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ADVANCES IN PARALLEL COMPUTING

Advances in Parallel Computing Technologies and Applications

Edited by
D. Jude Hemanth
Mohamed Elhosney
Tu N. Nguyen
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IOS Press

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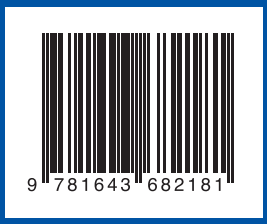
Advances in Parallel Computing Technologies and Applications

Recent developments in parallel computing mean that the use of machine learning techniques and intelligence to handle the huge volume of available data have brought the faster solutions offered by advanced technologies to various fields of application.

This book presents the proceedings of the Virtual International Conference on Advances in Parallel Computing Technologies and Applications (ICAPTA 2021), hosted in Justice Basheer Ahmed Sayeed College for women (formerly "S.I.E.T Women's College"), Chennai, India, and held online as a virtual event on 15 and 16 April 2021. The aim of the conference was to provide a forum for sharing knowledge in various aspects of parallel computing in communications systems and networking, including cloud and virtualization solutions, management technologies, and vertical application areas. It also provided a platform for scientists, researchers, practitioners and academicians to present and discuss the most recent innovations and trends, as well as the concerns and practical challenges encountered in this field. Included here are 52 full length papers, selected from over 100 submissions based on the reviews and comments of subject experts. Topics covered include parallel computing in communication, machine learning intelligence for parallel computing and parallel computing for software services in theoretical and practical aspects.

Providing an overview of the latest developments in the field, the book will be of interest to all those whose work involves the use of parallel computing technologies.



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Advances in Parallel Computing

Parallel processing is ubiquitous today, with applications ranging from mobile devices such as laptops, smart phones and in-car systems to creating Internet of Things (IoT) frameworks and High Performance and Large Scale Parallel Systems. The increasing expansion of the application domain of parallel computing, as well as the development and introduction of new technologies and methodologies are covered in the *Advances in Parallel Computing* book series. The series publishes research and development results on all aspects of parallel computing. Topics include one or more of the following:

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Preface

This book presents the proceedings of the Virtual International Conference on Advances in Parallel Computing Technologies and Applications (ICAPTA 2021), held on the 15th and 16th of April 2021 in Chennai, India, at Justice Basheer Ahmed Sayeed College for Women, jointly with KAS Innovative India.

The aim of the conference is to provide a forum for sharing knowledge in various aspects of parallel computing in communications systems and networking, including cloud and virtualisation solutions, management technologies, and vertical application areas. The recent developments of parallel computing in various fields of application are used to handle the huge volume of data to provide solutions in a faster manner. Furthermore, the newer and innovative ideas are well groomed with adequate technical support in computer communication to enhance the decisions in intellectual aspects. It also provides a premier platform for scientists, researchers, practitioners and academics to present and discuss about the most recent innovations, trends and concerns as well as practical challenges encountered in this field.

ICAPTA 2021, has recorded more than 100 submissions of which 52 full length papers were accepted based on the reviews and comments from subject experts. The topics include parallel computing in communication, machine learning intelligence for parallel computing and parallel computing for software services in theoretical and practical aspects. The main program of the two-day conference included a chief guest address, two invited talks, two keynote talks and four technical sessions for paper presentations.

We hope that all participants have taken the opportunity not only to exchange their knowledge, experiences and ideas but also to make contacts for their ongoing research in new directions.

Finally, we would like to thank all the authors as well as all the committee members, reviewer sand session chairs for their support, enthusiasm and time, which helped to make ICAPTA 2021 a successful conference during this time of the pandemic. We express our sincere thanks to the directors of KAS Innovative India for co-organizing this event. We also wish to thank IOS Press for their support and tireless efforts in preparation for the publication of the conference proceedings.

The Editors

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Intrusion Detection System Using Convolutional Neural Network on UNSW NB15 Dataset

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Abstract. Networks have an important role in our modern life. In the network, Cyber security plays a crucial role in Internet security. An Intrusion Detection System (IDS) acts as a cyber security system which monitors and detects any security threats for software and hardware running on the network. There we have many existing IDS but still we face challenges in improving accuracy in detecting security vulnerabilities, not enough methods to reduce the level of alertness and detecting intrusion attacks. Many researchers have tried to solve the above problems by focusing on developing IDSs by machine learning methods. Machine learning methods can detect datas from past experience and differentiate normal and abnormal data. In our work, the Convolutional Neural Network(CNN) deep learning method was developed in solving the problem of identifying intrusion in a network. Using the UNSW NB15 public dataset we trained the CNN algorithm. The Dataset contains binary types of '0' and '1' in general for normal and attack datas. The experimental results showed that the proposed model achieves maximum accuracy in detection and we also performed evaluation metrics to analyze the performance of the CNN algorithm.

Keywords. intrusion detection, anomaly detection, deep learning, convolution neural network, UNSW NB15.

1. Introduction

Networks play an important role in our current life, using the network we transfer datas easily while transferring datas we can face many security threats to avoid any vulnerabilities we use cyber security. Cyber security is a technique which prevents anonymous attacks in networks like anti-virus software, firewalls etc. But they are not strong enough to detect a new type of attack. To improve the network security Intrusion Detection System(IDS) is introduced. IDS used to detect, monitor and analyze any vulnerabilities for both software and hardware running during a network. The following Figure 1 shows the overview of intrusion detection: here the firewall acts as Intrusion Detector; it stands between networks and filters traffic that might be unhealthy. Network Security can be

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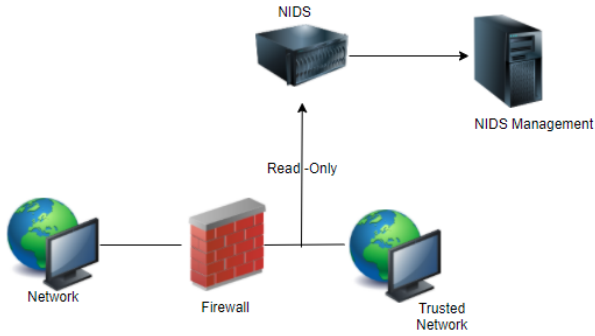

Figure 1. Overview of Intrusion Detection System.

monitored by administrators in network and security officers to provide a protected environment for user accounts, their online resources, personal details and passwords. IDS can be divided into two types by their approach:

1. Misuse Detection: It always uses signatures from previous data to detect intrusion; it may not be effective for new types of attacks.
2. Anomaly Detection: It uses an unusual pattern to detect attacks.

Here we use Anomaly detection for IDS. Attackers may act in two ways to try out their attacks in networks; 1) They create unavailability of network service for users. 2) Violating their personal information on the network. There are many types of attacks in networks. Denial of Service (DoS) is one among the frequent cases of attacks on network resources. It makes the network unavailable for users and creates traffic to crash their system. There are different sorts of DoS attacks, and each type has its own behaviour by intruding network resources of users for their own purpose which is to render the network unavailable for its users. Remote to Local (R2L) is one type of network attack, attackers send some type of files to gain unauthorized access to enter victim machines. User to Root (U2R) attacks are similar to r2l attacks; it enters the root machine illegally to crash the local machines. Probing is another type of attack in which intruders scan victim devices to find any weak spot in their machine to gain illegal access for their future attacks .There are many examples that represent probing over a network, like nmap, portsweep, ipsweep.

Table 1. Different Classes of Attacks

Attacks	Description
Denial of Service (DoS)	An attacker tries to shut down the victim's machine when they need to and create a traffic jam to crash the machine.
User to Root (U2R)	An attacker enters the local machine to crash the root privilege.
*R*emote to Local (R2L)	An Attacker tries to get unauthorized access to gain information into the victim machine.
Probe	An attacker attacks in which intruders scan victim devices to find any weak spot in their machine to gain illegal access for their future attacks mple port-scan and ping-sweep.

By using IDS we can prevent this type of attack. IDS uses classification techniques to form some sort of decision about every packet the network undergoes whether it's a

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traditional packet or an attack packet. Software to detect network intrusion and protect the network from unauthorized users. Intrusion learning models are used to create a predictive model to prevent attacks and it distinguishes the connection as "good" for normal and "bad" for intrusion.

2. Related Work

This chapter gives a survey of literature work done by other researchers. I've learned some existing techniques from their research work, few of them are discussed below.

Coelho et al, [1] used homogeneity of data cluster and label to form a semi-supervised data for feature selection. This method enhances the performance of the feature selection process. Mutual Information is employed during a Forward-Backward search process so as to gauge the relevance of every feature to info distribution and therefore the existent labels, during a context of few labeled and many unlabeled instances.

Gharaee and Hossein [2] proposed a genetic algorithm and SVM with a new feature selection technique to improve the IDS. The new feature selection method based on a genetic algorithm with innovative fitness function to increase the true positive rate and reduce the false positive simultaneously reduces the time taken for execution. They performed their work on KDD CUP 99 and UNSWNB 15 dataset.

Gul and Adali [3] proposed a feature selection process for Intrusion Detection. Feature selection is an important process before classification is performed. When selecting the important feature it will reduce the execution time and increase the accuracy of the model.

Zhang and Wang [4] proposed an effective wrapper based feature selection to increase the accuracy of the algorithm. The wrapper method feature selection is based on Bayesian Network classifier.

Moustafa et al, [5] compared the signature based network intrusion detection that Anomaly based detection is more efficient. Anomaly does not follow patterns like signature based detection. The Authors evaluate their classification algorithm with two benchmark datasets of Network Intrusion Detection System (NIDS) NSL-KDD and KDD99 and find out that the datasets may be lacking in accuracy because of poor recent attack types, so the author used UNSW NB15 dataset. The author shows that evaluation of UNSW NB15 is done in three aspects to find its complexity. Also the system designed by [6] offered higher accuracy based on optimiztion in real time.

Intruders use more enhanced techniques to break the security so enhancement in IDS is needed . Primartha and Tama [7] used three different (UNSW NB15, GPRS, and NSL-KDD) datasets to perform classification process using Random forest, Naive Bayes, and Neural Network to get high accuracy and low warning rate and K-cross validation is done.

Selvakumar et al, [8] proposed a novel intelligent intrusion detection for multi-class classification data. They have used the KDD CUP dataset. The dataset is preprocessed and FR algorithm is applied to get best features for classification. they get 99.7% accuracy for intrusion detection. Compared with existing models they achieved a high accuracy rate.

Belouch et al, [9] proposed a two-stage classifier supported RepTree algorithm and protocol subset for network intrusion detection systems. To gauge the performance of

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their approach, they used UNSW-NB15 and NSL KDD dataset. The feature technique is used to reduce the get best features here they get 20 best features out of 40. They have achieved detection accuracy of 88.95% and 89.85% on the UNSW-NB15 and NSL-KDD dataset.

Dhanabal and Shantharajah [10] used an NSL-KDD dataset and applied a different classification algorithm to detect the effectiveness of the classification algorithm in anomaly detection.

Tama et al [11] proposed hybrid feature selection and two-level classifier ensembles algorithm to improve the IDS. They have used NSL-KDD and UNSW NB15 dataset to perform their algorithm. In hybrid feature selection there are three methods(genetic algorithm, particle swarm optimization, ant colony algorithm) used to reduce the size of features in the datasets.

Selvakumar et al [12] proposed the FRNN approach to improve accuracy by reducing false positives in Wireless Sensor Network (WSN). They have used a traced dataset and applied Allen's interval algebra for preprocessing and selected important features using the Fuzzy algorithm. They have achieved 99.87% accuracy compared with existing models.

Vanthana et al, [13] proposed an optimal packet concept to increase the effectiveness in the intrusion detection. They introduce an indexing technique to reduce complexity and increase the accuracy in network intrusion detection. They use traced file datas.

Dahiya and Srivastava [14] proposed a framework during which a feature reduction algorithm is employed for reducing the smaller features than applied the supervised data processing techniques on UNSW-NB15 network dataset for fast, efficient and accurate detection of intrusion within the Netflow records using Spark.

Osama Faker [15] combined big data and IDS to create an efficient IDS for a large number of datas. Here, CICIDS2017 and UNSW NB15 datasets are used to perform the classification. homogenetic metrics are used to select the best feature for classification and there are three algorithms used for classification techniques are Deep Feed-Forward Neural Network (DNN), Random Forest and Gradient Boosting Tree. They get a high accuracy rate and 5-fold cross validation is done on Machine learning models.

3. Proposed Algorithm

In existing machine learning based IDS, always depending on the previous data may not be effective for newly generated attacks. The proposed deep learning model is dynamic and it can also be used for unusual patterns.

3.1. Convolution Neural Network (CNN)

In this proposed work Convolution Neural Network (CNN) used as a learning model for classification in IDS. Convolution Neural Networks (CNN) is designed to mimic the human visual system (HVS). It is made up of several neurons with learning weights and biases. CNN accepts a large number of inputs and takes the weighted sum of those inputs and sends them to the activation function to give output. A CNN is stacked with alternate convolution, activation pooling and fully connected layer. Figure 2 represent the CNN and their Layers like convolutional and pooling layer

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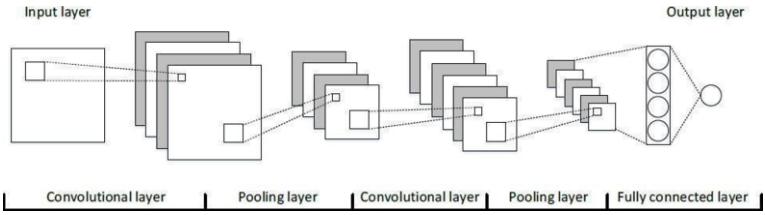

Figure 2. CNN Layout.

3.2. System Architecture

Figure 3 represents the system architecture. when the unsw nb15 dataset is given as an input and the given input splitted into trained and test data. CNN algorithm applied to the splitted data and we get a trained model. That trained model and test data are compared and we performed evaluation metrics for that data.

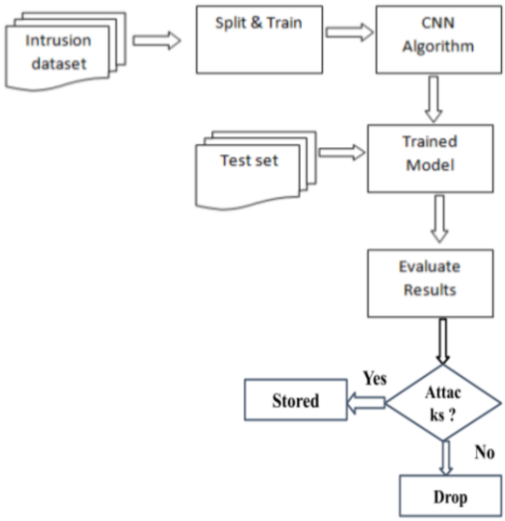

Figure 3. Architecture Diagram.

4. Implementation

Here the dataset is taken from kdd.ics.uci.edu.The downloaded dataset contains train and test data and the outputs are classified into different classes with binary value “0” and”1” for normal and attacked data. The train dataset is considered as the train set and the test dataset is considered as the test set. CNN is applied for the classification process in this work and evaluates the algorithm with performance metrics.

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4.1. Dataset Detail

The algorithm is trained using the UNSW NB15 public dataset. The dataset contains 1,75,341 recorded datas as training data and 82,332 recorded datas as testing data. It has 49 features and it is categorized into six groups like flow, time, content, etc. It recorded 9 different types of recent and common attacks like Dos, fuzzers,backdoors, worms, etc. the output categorized into binary values as “0” and “1” for attack and normal data.

4.2. Functional Requirement

4.2.1. Data Collection

The data collection is a process of collecting relevant data for their work. The job of this process is to collect and analyze the data whether the data needed for their work. Here we collected the unsw nb15 network intrusion dataset from uci.edu.

4.2.2. Data Visualization

The purpose of visualization is for easy understanding. visualization can be shown in graphs, diagrams, slides, etc. Here we represent the graph. It shows the intrusion accuracy of the learning model which we have used.

4.2.3. Data Preprocessing

The purpose of preprocessing is to convert the raw data into the form that fits for machine learning models. For data preprocessing the data will be normalized and categorical features converted into numerical form by data encoding method.

4.2.4. Dataset Splitting

After preprocessing the dataset will be splitted into training and testing data. Training data is modeled into a form of algorithm fit. Testing data is used to evaluate the training data.

4.2.5. Model Training

After preprocessing and data will be splitted into training and testing data. A deep learning model is applied to the training data and we will get a trained model.

4.2.6. Model Evaluation

We will compare the trained model with testing data and determine the accuracy of the deep learning model. Evaluation metrics will be evaluated to find the performance of the algorithm. Here we used MSE, MAE, R-Square, RMSE for evaluation metrics.

5. Result

The proposed work is done with a deep learning model to improve the Intrusion Detection System. Here, CNN deep learning model is used to find the accuracy of IDS from UNSW NB15 dataset. The proposed work is done in python 3.7 with libraries of

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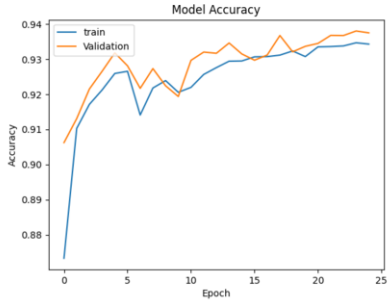

Figure 4. CNN Model Accuracy

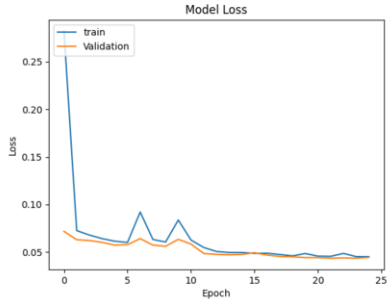

Figure 5. CNN Model Loss

keras, tensorflow, matplotlib and other mandatory files. Here we get 93.5% of algorithm accuracy using CNN and Evaluation metrics calculated to find the performance of the algorithm. The result shows that intrusion detection is efficient using CNN algorithm. The Figure 4 shows the model accuracy of training and validation datas by using CNN algorithm with 25 epoch. The Figure 5 shows the model loss accuracy of training and validation set using CNN algorithm with 25 epoch. The Figure 6 shows the evaluation metrics of CNN algorithm to analyze the performance of the model.

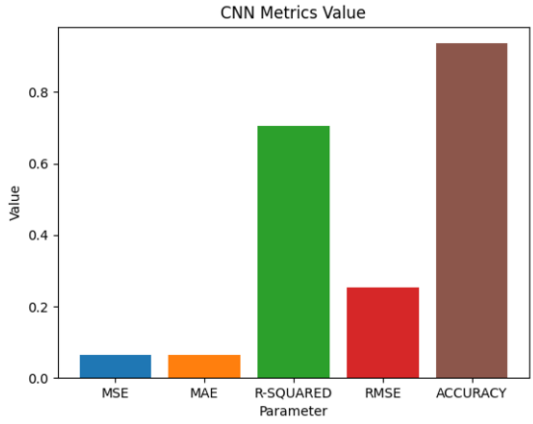

Figure 6. CNN Evaluation Metrics.

Evaluation metrics are used to survey the classification of the statistical learning model. Evaluating the learning models or algorithms is consequential for any project. There are many distinct types of evaluation metrics available to test a model. Mean Square Error (MSE) is a mean of Squared Error it is the difference between actual and predictive value. Mean Absolute Error (MAE) measures the difference between two variables and absolute error of each prediction error. R-Squared measures the goodness of fit of a regression model. Root Mean Square Error (RMSE) measures the square root of MSE value. Accuracy is the total number of predicted values by Total number of original value

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6. Conclusion

The proposed work is to improve intrusion detection efficiency though we have many existing IDS mostly developed in the Machine learning algorithm that fails to provide strong IDS to prevent from newly formed attacks because it mostly depends on previous data. Here, CNN deep learning model is used for developing the IDS. By using UNSW NB15 network intrusion public Dataset we perform the classification technique by applying CNN algorithm and we get 93.5% accuracy. The accuracy shows that CNN is efficient in Intrusion detection and evaluation metrics also performed to analyse the performance of the model.

References

[1] Coelho F, de Pádua Braga A, Verleysen M. Cluster homogeneity as a semi-supervised principle for feature selection using mutual information. In European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning 2012 (pp. 507-512).

[2] Gharaee H, Hosseinvand H. A new feature selection IDS based on genetic algorithm and SVM. In2016 8th International Symposium on Telecommunications (IST) 2016 Sep 27 (pp. 139-144). IEEE.

[3] Gül A, Adalı E. A feature selection algorithm for IDS. In2017 International Conference on Computer Science and Engineering (UBMK) 2017 Oct 5 (pp. 816-820). IEEE.

[4] Zhang F, Wang D. An effective feature selection approach for network intrusion detection. In2013 IEEE eighth international conference on networking, architecture and storage 2013 Jul 17 (pp. 307-311). IEEE.

[5] Moustafa N, Slay J. The evaluation of Network Anomaly Detection Systems: Statistical analysis of the UNSW-NB15 data set and the comparison with the KDD99 data set. Information Security Journal: A Global Perspective. 2016 Apr 4;25:18-31.

[6] Yang R. UAV landmark detection on fast region-based CNN. Arabian Journal of Geosciences. 2021 Jun;14(12):1-9.

[7] Primartha R, Tama BA. Anomaly detection using random forest: A performance revisited. In2017 International conference on data and software engineering (ICoDSE) 2017 Nov 1 (pp. 1-6). IEEE.

[8] Selvakumar K, Sairamesh L, Kannan A. Wise intrusion detection system using fuzzy rough set-based feature extraction and classification algorithms. International Journal of Operational Research. 2019;35(1):87-107.

[9] Belouch M, El Hadaj S, Idhammad M. A two-stage classifier approach using reptree algorithm for network intrusion detection. International Journal of Advanced Computer Science and Applications. 2017 Jul;8(6):389-94.

[10] Dhanabal L, Shantharajah SP. A study on NSL-KDD dataset for intrusion detection system based on classification algorithms. International journal of advanced research in computer and communication engineering. 2015 Jun 6;4(6):446-52.

[11] Tama BA, Comuzzi M, Rhee KH. TSE-IDS: A two-stage classifier ensemble for intelligent anomaly-based intrusion detection system. IEEE Access. 2019 Jul 11;7:94497-507.

[12] Selvakumar K, Karuppiah M, SaiRamesh L, Islam SH, Hassan MM, Fortino G, Choo KK. Intelligent temporal classification and fuzzy rough set-based feature selection algorithm for intrusion detection system in WSNs. Information Sciences. 2019 Sep 1;497:77-90.

[13] Vanthana G, Muthurajkumar S, Sairamesh L, Rakesh R, Kannan A. Optimal packet classification techniques for performance enhancement and intrusion detection. Advances in Natural and Applied Sciences. 2015 Jun 1;9(6 SE):311-6.

[14] Dahiya P, Srivastava DK. Network intrusion detection in big dataset using spark. Procedia computer science. 2018 Jan 1;132:253-62.

[15] Faker OM. Intrusion detection using big data and deep learning techniques (Master's thesis).

[16] Dhanalakshmi B, SaiRamesh L, Selvakumar K. Intelligent energy-aware and secured QoS routing protocol with dynamic mobility estimation for wireless sensor networks. Wireless Networks. 2021 Feb;27(2):1503-14.

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VANET: Trust Evaluation Using Artificial Neural Network

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Abstract. There is an increasing emphasis on enhancing the efficiency traffic management systems. Information is exchanged between the vehicular nodes to efficiently monitor and control huge volumes of vehicle. All existing applications in this area have focused on reliable data exchange and authentication process of vehicular nodes to forward messages. This study proposes a new entity centric trust framework using decision tree classification and artificial neural networks. Decision tree classification is used to derive rules for trust calculation and artificial neural networks are used to self-train the vehicular nodes, when expected value is not met. This model uses multifaceted role and distance based metrics like Euclidean distance to estimate the trust. The proposed entity centric trust model, uses a versatile new direct and recommended trust evaluation strategy to compute trust values. The suggested model is simple, reliable and efficient in comparison to the other popular entity centric trust models.

Keywords. Vehicular nodes, LDA, Artificial neural networks (ANN).

1. Introduction

There is an importance on enhancing the capability of traffic management systems. Road safety congestion control and security are three important components are considered. Traditional traffic control systems are slowly replaced by new vehicular networking technologies where each vehicular node is considered as a networking node. The vehicular nodes are information multifaceted, and they usually comprise of vehicles, Roadside units (RSU) and data centres. Information is exchanged between the vehicular nodes ability to manage monitor huge volume of vehicles. Moreover, the trustworthy between vehicles is important when messages are exchanged. The trustworthiness between the vehicles within the specified range, message interchange to maintain integrity is an important task. Information exchange between the vehicles is important. Moreover, data transmission between the vehicles directly affects the security in vehicular environments and the quality of service being provided largely depends on the trustworthiness of the date. Vehicular networks rapidly use wireless networking for data exchange. Traditional networking principles for data transfer and security measures cannot be apply in such

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environments directly changes the dynamic resulting from mobility. In real time applications, networks are broadly used in dynamic information exchange to ease vehicular applications.

Decision tree classification is used to derive trust rules and Artificial Neural Networks is implemented to self-train the vehicular nodes when expected trust value is not met. It improves the ability and reliability of the proposed model. Entity based trust model estimates trust between the participating vehicular nodes before exchange of information between them. The proposed approach effectively manages entity-oriented problems in vehicular networks and helps to maintain the integrity in vehicular environments.

The existing models use vehicular entities like vehicular nodes, RSUs, OBU and data centres to compute trust. Attributes of the message exchanged between the vehicular entities to estimates trust. However none of models follow a concrete model to take decision on the vehicular nodes depends on the valued trust. A vehicular node follows the decision either to forward or receive the messages due to dynamic changes of vehicular nodes some scenarios may not get hold on the recent study traffic based on their trust values and the message received from the vehicles entities. This study introduces the decision tree and ANN algorithm for the vehicular nodes to get the optimal trust value and forward the reliable the message to the vehicles if the vehicles does not get the trusted values it forward the untrustworthy information to the RSU.

2. Related Works

This gives the overview of literature surveys. It represents some of the relevant work done by the researchers. Many existing techniques have been studied by the researchers on trust evaluation; few of them are discussed below.

In the blooming era of the web of Things (IoT), trust has been accepted as an important factor for provisioning secure, reliable, seamless communications and services [1]. However, an outsized number of challenges still remain unsolved thanks to the anomaly of the concept of trust also because of the sort of divergent trust models in several contexts [2]. Vehicular Ad Hoc Networks (VANETs) are usually used to reduce the traffic accidents, improve traffic efficiency and safety, promote commercial or infotainment products etc. All the applications are based on the exchange of data among nodes, so not only reliable data delivery but also the authenticity and reliability of the data itself are prerequisite [3]. Vehicles to communicate on the roads, vehicular networks is improve the traffic safety. Trust management and privacy protection are play major role in vehicular environment. Existing work mainly on the two issues separately and have not provided a satisfactory solution. Thi Ngoc Diep Pham, et al., [4] proposed work manage the vehicles for trust and privacy. ALRS A secure linkability scheme to enable vehicles to identified the trust level of vehicle to protect privacy need to update the value in vehicles. The vehicular ad hoc networks (VANETs) aim basically to enhance the traffic safety performance, improve the traffic efficiency and achieve a comfortable driving experience. To reach these purposes, it is crucial to ensure the security of this network. Trust is one of the key challenges for VANET security enhancement. Trust management aims to investigate the relationship between the different entities in the network in order to ensure that only trustworthy messages are delivered to drivers. Solutions for trust evaluation are not self adaptively adjusted to discriminate between the requirements of

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each class of applications [5]. Intelligent Transportation systems constitute be vehicular ad hoc networks (VANETs) are key components contributing to the smart city based on the repeated exchange of periodic and event triggered messages while smart vehicles can enhance road safely and traffic system to provide support reliable trust information between the vehicles the drawback of the paper lots of dishonest information delivered to unwanted solution, chaker abdelaziz kerrache et al [6] proposed the two main components cryptography and trust .In vehicles environment the trust is forward the reliable message and then the cryptography is not mitigate all possible attacks so the existing models cannot handle trust together with some possible solutions. An optimized multilayer feed forward network (MLFN) is developed to construct a soft sensor for controlling naphtha dry point. To overcome the two main flaws in the structure and weight of MLFNs, which are trained by a back propagation learning algorithm, minimal redundancy maximal relevance partial mutual information clustering (mPMIc) integrated with least square regression (LSR) is proposed by Chen and Xuefeng yan [7] to optimize the MLFN. When the redundant nodes from the hidden layer are removed, the ideal MLFN structure can be obtained according to the test error results. In actual applications, the naphtha dry point must be controlled accurately because it strongly affects the production yield and the stability of subsequent operational processes. The mPMIc LSR MLFN with a simple network size performs better than other improved MLFN variants and existing efficient models. In [8] author judged the surface temperature using improved the neural network on satellite remote sensing data. The author also compared different models and further improved model parameters for better performance.

Traditional single hidden layer feedforward network (SLFN) is extended to novel generalized SLFN (GSLFN) by employing polynomial functions of inputs as output weights connecting randomly generated hidden units with corresponding output nodes. sequential ridge ELM(BR ELM and OSR ELM) learning algorithms, high performance of the proposed GSLFNs in terms of generalization and learning speed is guaranteed [9]. Vehicular Ad Hoc Network (VANET) is a class of mobile ad hoc network (MANET) support the vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communications. The features of VANET includes, self organization, distributed networking, and highly dynamic topology.. The transmission of messages in an access environment like VANET is most important and challenging security issues. Authentication, data confidentiality, data integrity, data availability, and non repudiation are components of security in VANET [10]. A hybrid SVM based decision tree to speed up SVMs in phase for binary classification. existing methods is aim to reduce the number of support vector. The central idea of Arun Kumar and Gopal [11] is to give the accuracy result the decision boundary of SVM using decision trees. The resulting tree is a hybrid tree in the sense that it has both 10 univariate and multivariate (SVM) nodes. Dhanalakshmi et al., [12] proposed a new protocol for sender-based responsive techniques on energy, mobility and routing for wireless sensor networks (WSNs). It improves the basic quality of service (QOS) metrics such as delay, Hop-count and energy level for each connection with multiple routes and predicts the optimal path to develop the efficient communication.

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3. System Design

3.1. Neural Networks

A neural network is a computing layered structure resembles the network structure with layers of connected nodes. A neural network can learn the data so it can be trained to recognize pattern and classify data. Common machine learning techniques for designing neural network applications include supervised and unsupervised learning, classification, regression, pattern recognition and clustering methods.

3.2. Design Methodologies

In existing system, a new entity centric trust framework using decision tree classification and artificial neural network. Decision tree classification is used derive rule for trust calculation and artificial neutral networks are used to self-train the vehicular nodes, which expected trust value or not. In proposed system, an efficient model that uses the self-trained network. In the proposed system, design of trust evaluation is implemented using the deep neural network model as part of improving the proposed trust evaluation better. Preprocessing the raw IOT data uses linear discriminant analysis (LDA).The neural network utilizes the self-organized mapping model with that decision making algorithm produces accurate trust evaluation

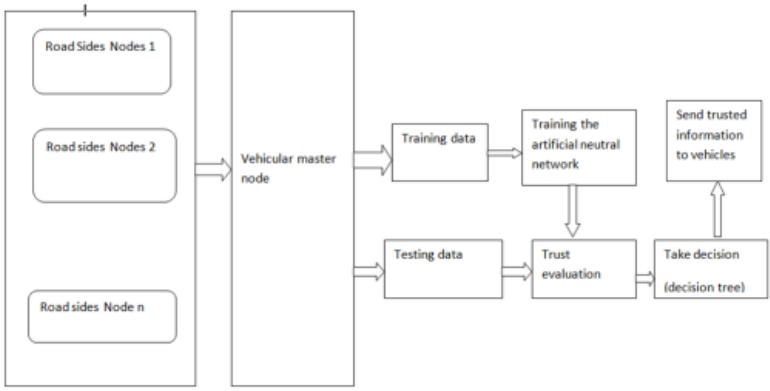

Figure 1. Architecture Diagram.

3.3. System Architecture

The existing system focused on implementing the trust evaluation model using artificial neural networks learning. The existing system uses a new entity centric trust framework using decision tree classification and artificial neural networks. Decision tree classification model is used to derive rules for trust calculation and artificial neural networks are used to self-train the vehicular nodes, when expected trust value is not met. This model

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uses multifaceted role and distance based metrics like Euclidean distance to estimate the trust. In the proposed system, design of trust evaluation is implemented using the deep

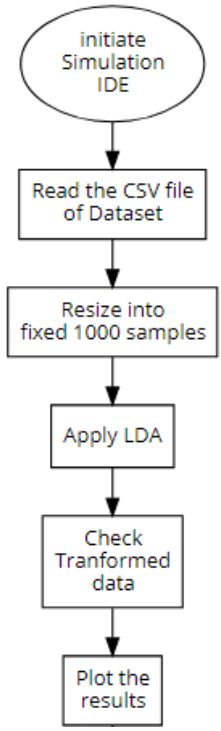

Figure 2. Dataflow Diagram.

neural network model as part of improving the proposed trust evaluation better. Preprocessing the raw IOT data uses linear discriminant analysis (LDA).The neural network utilizes the self-organized mapping model with that decision making algorithm produces accurate trust evaluation. The Vehicles network dataset is used for evaluation of vehicle count. The trust evaluation is based on information provided by the IOT sensor networks. The decision making considers the number of vehicles, type of vehicle, emergency vehicle information are the attributes.

4. Implementation Methodology

The neural network utilizes the self-organized mapping model with that decision making algorithm produces accurate trust evaluation. The Vehicles network dataset is used for evaluation of vehicle count. The trust evaluation is based on information provided by the IOT sensor networks. The decision making considers the number of vehicles, type of vehicle, emergency vehicle information are the attributes.

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4.1. Module Description

4.1.1. Data Set

The Vehicles network dataset are used for preprocessing it is used for evaluation of vehicle count. Dataset tells the attributes of vehicles which is consists of class of vehicles, radio, maximum distance.

4.1.2. Data Preprocessing

The purpose of Preprocessing the raw IOT data uses linear discriminant analysis (LDA) that fits machine learning Structured and clean data allows data to get more precise results from an applied machine learning model. The technique includes data formatting, cleaning, and sampling.

4.1.3. Dataset Splitting

A dataset used for machine learning should be partitioned into three subsets Training, test, and validation sets. Training set. A data scientist uses a training set to train a model and define its optimal parameters it has to learn from data Test set. A test set is needed for an evaluation of the trained model and its Capability for generalization.

4.1.4. Artificial Neural Network For Classification

Data has preprocessed the collected data and split it into train and test can proceed with model training. ANN allows vehicular nodes to self-train both message forwarding and message receiving vehicular nodes to get the expected trust values. ANN comprises input nodes, middle node, output node, activation function to initiate the functions of ANN and adjusting weights to adjust output values from the layers.

4.1.5. Trust Evaluation

The recommending vehicular nodes use these rules to take appropriate decision on message forwarding vehicular nodes.

Table 1. Trust Rule Table

R1: If Trust Value < 0.5 = Distrust
R2: If Trust Value > 0.5 And Trust Value ≤ 8 (Further evaluate the message forwarding vehicular nodes)
R3: If Trust Value > 0.8 And Trust Value ≤ 1 = Trust
R4: If Trust Value > 1 = Distrust

4.1.6. Direct trust computation

- Direct trust computation is a Role based strategy, priority based strategy and threading concepts are used to prioritize the vehicles and messages to calculate the trust value.
- Direct trust evaluation uses the attributes like time of message forwarded and message received to vehicular nodes, distance between the sender and receiver node to vehicles and packet loss between the sender and received to the vehicular nodes.

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4.1.7. Recommended trust computation

- Estimating the trust using recommended trust computing
- Euclidean distance or Euclidean metric is a measure of straight line distance between two points in Euclidean space. Euclidean distance between two attributes.

5. Simmulation Rrsults & Discussions

A simulation based analysis was administered to evaluate the performance of the trust model. The simulation environment was developed using MATLAB under Windows 64-bit platform. The result shows the every modules of the project

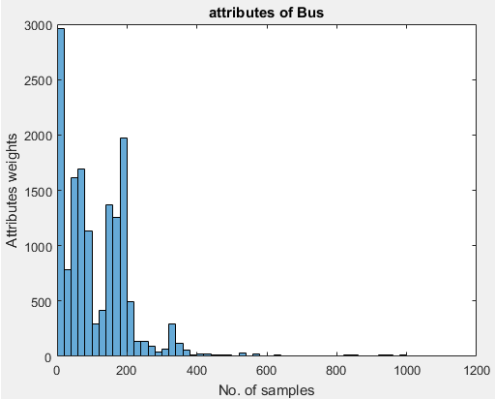

Figure 3. Input dataset of bus.

In Figure 3 shows the input data of vehicles from the graph x tell the number of samples and y tells the attributes

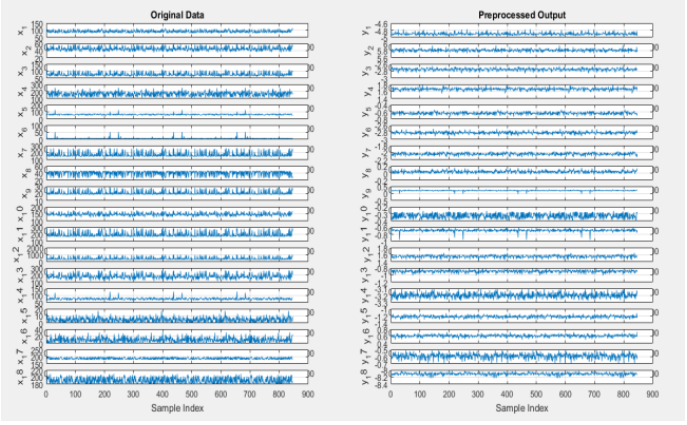

Figure 4. Preprocessing.

In Figure 5 shows the output of performance of algorithm x value tell the epochs and y tells the gradient value. Test, validation, train, best data are plotted. In Figure 6

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slows the ROC curve (receiver operating characteristic curve) is a graph showing the performance of a classification model at all classification thresholds. This curve plots two parameters: True Positive Rate and False Positive Rate. In Figure 7 slows the Error histogram is the histogram of the errors between target values and predicted values after training a feed forward neural network.

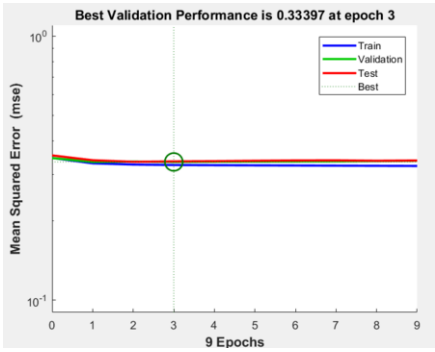

Figure 5. Performance of algorithm.

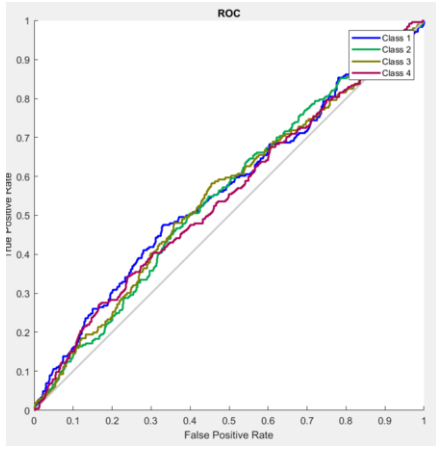

Figure 6. ROC Curve

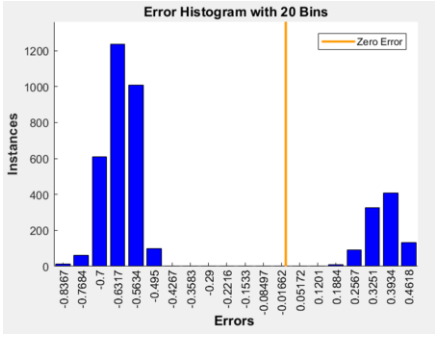

Figure 7. Error histogram

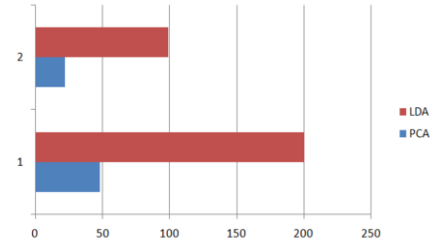

Figure 8. Algorithm Analysis Graph

Table 2. Algorithm Analysis Table

Algorithm	Sample class	Classification
PCA	48	22
LDA	200	99

6. Conclusion

Thus the evaluation of preprocessing module is completed successfully and results are tested using MATLAB IDE. The proposed work is further improved by developing a trust evaluation model using deep learning neural network in next phase.

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References

[1] Truong NB, Lee H, Askwith B, Lee GM. Toward a trust evaluation mechanism in the social internet of things. Sensors. 2017 Jun;17:1-18.

[2] Chen C, Yan X. Optimization of a multilayer neural network by using minimal redundancy maximal relevance-partial mutual information clustering with least square regression. IEEE transactions on neural networks and learning systems. 2014 Jul 17;26(6):1177-87.

[3] Kerrache CA, Calafate CT, Lagraa N, Cano JC, Manzoni P. RITA: RIsk-aware Trust-based Architecture for collaborative multi-hop vehicular communications. Security and Communication Networks. 2016 Nov 25;9(17):4428-42.

[4] Zheng K, Zheng Q, Chatzimisios P, Xiang W, Zhou Y. Heterogeneous vehicular networking: A survey on architecture, challenges, and solutions. IEEE communications surveys & tutorials. 2015 Jun 1;17(4):2377-96.

[5] Pham TN, Yeo CK. Adaptive trust and privacy management framework for vehicular networks. Vehicular Communications. 2018 Jul 1;13:1-2.

[6] Souissi I, Azzouna NB, Berradia T. Towards a Self-adaptive Trust Management Model for VANETs. In International Conference on Security and Cryptography 2017 Jul 24 (pp. 513-518).

[7] Kerrache CA, Lagraa N, Calafate CT, Cano JC, Manzoni P. T-VNets: A novel trust architecture for vehicular networks using the standardized messaging services of ETSI ITS. Computer Communications. 2016 Nov 1;93:68-83.

[8] Lap-fu Y. Environmental planning and economic efficiency of green cities based on improved neural network and satellite remote sensing. Arabian Journal of Geosciences. 2021 Jul;14(14):1-9.

[9] Wang N, Er MJ, Han M. Generalized single-hidden layer feedforward networks for regression problems. IEEE transactions on neural networks and learning systems. 2014 Jul 15;26(6):1161-76.

[10] Gazdar T, Belghith A, AlMogren AS. DTCF: A distributed trust computing framework for vehicular ad hoc networks. KSII Transactions on Internet and Information Systems (TIIS). 2017;11(3):1533-56.

[11] Manvi SS, Tangade S. A survey on authentication schemes in VANETs for secured communication. Vehicular Communications. 2017 Jul 1;9:19-30.

[12] Dhanalakshmi B, SaiRamesh L, Selvakumar K. Intelligent energy-aware and secured QoS routing protocol with dynamic mobility estimation for wireless sensor networks. Wireless Networks. 2021 Feb;27(2):1503-14.

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Auto Question Tagging for Health Care Using Machine Learning Technique

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Abstract. Tagging is a machine learning technique that provides tags to the information that the user can easily identify the related information. Manual tagging is widely used for constructing question banks; but, this approach is time-consuming and it would create pathway to consistency issues. Semi-manual tagging which is time-consuming and people must be experts in that domain have the ability to identify the question and tag them it is not possible in real-time and high in cost. The proposed associate degree automatic tagging exploitation information processing that mechanically tags automatic question tagging. In this paper, step up with a keywords-based model to automatically tag questions with information units. With regard to multiple-choice questions, the proposed models use mechanisms to capture helpful information from keywords to boost tagging performance. Automatic tagging method using NLP automatically tag questions where users can get information regarding to his search which overcomes earlier methods. In our experiments, the result shows that the model is credible and outperforms various existing models.

Keywords. Machine Learning, Natural Language Processing, Clustering, Prediction, E-Learning.

1. Introduction

With science of innovation, a modern computerised world has become multisource environment where one can get any information from www. While many applications were focus on extracting information from web, no technique has found to help user for identifying relevent information. The increased population of today young community might prefer to get most of the study material from open web for their academic purpose. While the usage of web increases for academic studies, finding or organizing relevant information become a mandate for medical too. But, the issue is that relying on web sources for medical treatment is invalid. Therefore, there has been a well structured methods has come to power to help user to get appropriate information from medical expert. Though the existing methods are efficient to retrieve accurate information from web, the integrated question answering approach requires to be integrated so that user can post any question and get right medicine from experts through online. Likewise, the well organised question bank with answers necessary to get aware of their field and raise relevant

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question to expert. Therefore, a well organized computerized adaptive testing method has proposed for providing right information to the user according to the individual user interest. This method facilitates a collection of questions stored in the system where tagging help to organize the resources. Since the tag has potential to organize knowledge units with required answer, the questions can be easily associated with relevant one. Thus, gives sophisticated CAT functions. Tagging is a machine learning technique which provides tags to the information that user can easily identify the related information user searching for. But there is flaw in that method, most technology uses manual tagging and semi-manual tagging which is time consuming and quiet difficult in real time and high in cost. An automatic tagging method by NLP automatically tag question where user can get information regarding to his search which overcome earlier methods.

2. Literature Survey

In variant from the article stated [1], dynamic model has been employed and secured best result over this existing model. The knowledge has been extracted from millions of questions from the stack overflow of Q&A site. The work was achieved by discriminative approach where there was no trial data set enforced. The work from [2], demonstrated by utilizing local mining and global study technique. The main issue in this approach is that it leads to data loss and low precision rate. The statistical model that was used [3] were trained on huge data particles graph to predict unknown labels. The observation on this existing article is that no text information is useful for developing knowledge in web. Similar work was carried out [4], by automatic labelling of textual data with knowledge base. The weakness is that the search queries were not found accurately as well as it generates irrelevant answers mostly. The idea from [5–7] tightly bonded and strengthened mutually. It does not carry the data dynamically since the idea is static and the approach is rudimentary and incompetent. The work [8,9] is mainly concentrated for schools where pretrained question were posted to school students. It lacks with automatic tagging semantically in the World Wide Web. The authors proposed [10], a system to focus only on context dependent matters so that it fails to adapt complicated Quiz and related sets. The work that was carried in our approach was novel and supports quiz related question and answering. The dropout approach [11] addresses on random bead piece on neural network platform during trial. Though this method was improving the performance on supervised learning and data modelling it generates huge noise which affects the overall performance. The work that has been reported from [12–16], is similar and our method was achieved very efficient for convolution implementation. The work in our approach reduces the overfitting issue that was mainly degrading the performance of the existing work.

3. Proposed Method

In this system, an automatic tagging of questions is performed by NLP-based machine learning (Natural language processing) technique. Machine Learning (ML) is applications of artificial intelligence (AI) that provide systems the ability to automatically learn. NLP analyzes to understand the human language in a smart and useful way. The Medical

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datasets are collected from the Medinet library. The data are stored in the CSV file formats for later use. CSV file contains the questions and answers from the medical health domain and then the automatic tagging takes place of the question and Answer than the user search the query in AWS(Amazon web service) and the query is forwarded to the Medinet library to extract the user queried related answer. Medinet library contains 700 medical domain files which are stored in tc2011 API if the requested file not found in Medinet it redirects to PDF box it will provide pdf files(contains information about domain or diseases) related to the question. The pdf files are extracted by using Lucene indexing which provide fast retrieval of files if the answer is not related to query or not clear. The question will be forwarded to the Expert (doctor) who can clear the doubts and replay for the query. Finally providing the quiz for the student who wants to know their knowledge in the medical field and providing them domain score and overall score and feedback for the student. The proposed methodology is applied in order to answer the medical related queries in order to reduce the confusion in medical field. It also avoids the user from getting distracted what they originally need. Thus, encourages people and students to gain valid information regarding the medical field. The system can be used in websites. It provides standard and consistent results. There are various modules that perform different task in our proposed methodologies.

3.1. Admin Pre-processing

First module Admin has to register first and then provide admin details (Name and password) valid admin enters the page. Admin is responsible for the whole operation admin work includes cleaning, adding the CSV files, analyzing resources, NLP (Natural language processing) and cleaning NLP.

3.2. Auto tagging Questions

This module helps user to register, authenticate and access relevant information from choosing the list of domains available in the database. The answer can be supplied by the expert for the question posted by the user if the relevant answer is not available from back end. If the user needs more clarification on this result can interact with expert and get details as much as needed.

3.3. Expert's Answering Process

This is expert module which can be accessed by only authorized or registered domain expert. The primary purpose of this module is to provide accurate answer for all the user queries while communication taken place between user and expert. The expert can interact or sophisticate the user by proving truly valid information over the chat or message. The expert answer is prepared after thorough analysis of user queries and involved two level authentications from the expert in order to validate the expert recommendation.

3.4. Student Assessment

In this module student registers initially, after that login page would forward to the quiz page the students were asked to write quiz in medical domain. Questions from medical

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domain would provide to student and they can answer it. Finally, the overall score of the test, domain score, and the feedback for the test would be provided, and then the student could improve knowledge in that domain.

4. Experimental Evaluation

Though some studies were focussed on this issue for some business agenda, question bank with knowledge tags present at the moment. In this circumstance, a well-executable method was applied to construct MCQ based question bank in our implementation. The question was crawled from a famous website such as koolearn3 and Tiku4, which returns expected results through search engine. In our initial process the questions that are similar to others are removed. The question that is collected from web is based on English subject on elementary and higher secondary school. The prototype was constructed with using English syllabus and curriculum in which knowledge map is coordinated by ontology based hierarchical knowledge system. To label the question tag leaf information is used. The trial experiment shows the consistency from the training sets. The F-1 score obtained from training is 0.8484 which shows that the pattern that has been extracted from this approach is not hard for the proposed language. The Kappa and F1-score are 0.4753 and 0.8996, respectively. The notable observation here is that a Kappa is iterative so we achieved 0.8197 in our final experimentation. This result obtained in our experiment is best compared to other metrices.

Table 1. Evaluation results of medical terminology assignment in terms of csv and expert answers.

Approach or Metric	S@1	S@2	S@3	S@4	P@1	P@2	P@3	P@4
CSV	72.0%	84.0%	91.0%	95.0%	72.0%	71%	69.7%	68.3%
EXPERT	83.0%	92.0%	98.0%	100.0%	83.0%	81.5%	80.3%	8.8%

Table 2. Comparative illustration of the representative question samples with csv and expert answers.

QA pairs	CSV ANSWERS	EXPERT ANSWERS
Do I suffer by hair colouring while pregnancy?	hair structure, dyed hair, feeling safe, patient currently pregnant, first trimester pregnancy...	Hair structure, coal tar allergy, hair disorder of endocrine system.
If I get an infection caused by gum disease, can that be transferred to my fetus?	Gingival disease, inflammation, periodontal disease...	Prematurity of fetus, gingival disease, periodontal disease low birth weight infant...

5. Conclusion and Future Work

This work achieves superior performance in indentifying relevant medical information through online. The advancement in search and querying methods checked out parametric conditions and necessities of user's needs accurately for today and tomorrow. Maintaining and keeping up accuracy to a standard is always tougher and troublesome with time. Some of the challenges can be anticipated, such as advances in algorithmic con-

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versions that are making it easier to provide accurate search results from the database. Here predictive algorithm is being utilized to work around the basic shortcomings in user search results. As the confirm mechanism for searching our view could be suitable and accurate. Similarly, we have also developed a system that does not allow any user from getting diverted from the search they wanted to perform.

References

[1] Al-Hmouz A, Shen J, Al-Hmouz R, Yan J. Modeling and simulation of an adaptive neuro-fuzzy inference system (ANFIS) for mobile learning. IEEE Transactions on Learning Technologies. 2011 Dec 13;5(3):226-37.

[2] Brusilovsky P. KnowledgeTree: A distributed architecture for adaptive e-learning. InProceedings of the 13th international World Wide Web conference on Alternate track papers & posters 2004 May 19 (pp. 104-113).

[3] Mendicino M, Razzaq L, Heffernan NT. A comparison of traditional homework to computer-supported homework. Journal of Research on Technology in Education. 2009 Mar 1;41(3):331-59.

[4] Forbey JD, Ben-Porath YS. Computerized adaptive personality testing: A review and illustration with the MMPI-2 computerized adaptive version. Psychological assessment. 2007 Mar;19(1):14-24.

[5] Nickel M, Murphy K, Tresp V, Gabrilovich E. A review of relational machine learning for knowledge graphs. Proceedings of the IEEE. 2015 Dec 17;104(1):11-33.

[6] Luo Y. Environmental cost control of coal industry based on cloud computing and machine learning. Arabian Journal of Geosciences. 2021 Jun;14(12):1-6.

[7] Xu X. Machine learning-based prediction of urban soil environment and corpus translation teaching. Arabian Journal of Geosciences. 2021 Jun;14(11):1-5.

[8] Kim HL, Passant A, Breslin JG, Scerri S, Decker S. Review and alignment of tag ontologies for semantically-linked data in collaborative tagging spaces. In2008 IEEE International Conference on Semantic Computing 2008 Aug 4 (pp. 315-322). IEEE.

[9] Brut M, Sedes F, Jucan T, Grigoras R, Charvillat V. An ontology-based modeling approach for developing a competencies-oriented collective intelligence. InIFIP World Computer Congress, TC 3 2008 Sep 7 (pp. 219-222). Springer, Boston, MA.

[10] Zhang ML, Zhou ZH. A review on multi-label learning algorithms. IEEE transactions on knowledge and data engineering. 2013 Mar 7;26(8):1819-37.

[11] Salton G, Wong A, Yang CS. A vector space model for automatic indexing. Communications of the ACM. 1975 Nov 1;18(11):613-20.

[12] Saha AK, Saha RK, Schneider KA. A discriminative model approach for suggesting tags automatically for stack overflow questions. In2013 10th Working Conference on Mining Software Repositories (MSR) 2013 May 18 (pp. 73-76). IEEE.

[13] Ambika M, Raghuraman G, SaiRamesh L. Enhanced decision support system to predict and prevent hypertension using computational intelligence techniques. Soft Computing. 2020 Feb 14:1-2.

[14] Saranya MS, Selvi M, Ganapathy S, Muthurajkumar S, Ramesh LS, Kannan A. Intelligent medical data storage system using machine learning approach. In2016 Eighth International Conference on Advanced Computing (ICoAC) 2017 Jan 19 (pp. 191-195). IEEE.

[15] Ambika M, Raghuraman G, SaiRamesh L, Ayyasamy A. Intelligence–based decision support system for diagnosing the incidence of hypertensive type. Journal of Intelligent & Fuzzy Systems. 2020 Jan 1;38(2):1811-25.

[16] Wang L. Urban land ecological evaluation and English translation model optimization based on machine learning. Arabian Journal of Geosciences. 2021 Jun;14(11):1-6.

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A Noninvasive Model to Detect Malaria Based on Symptoms Using Machine Learning

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Abstract. The impact of Artificial Intelligence in the domain of Healthcare has been growing, day by day. These applications bring a drastic change in the healthcare system and affects our lives based in the change it brings to the Patientcare system, transforming the traditional way of handling sicknesses and diseases. Machine Learning algorithms that use data, have a big role in the AI based applications that are used in the Healthcare. Hence the Data source and the nature of Data holds an important role in developing effective AI based solutions for many health issues in the society. Data is available in all the hospitals and medical care facilities for many years now. However, without transforming them into a format where Machine Learning algorithms work, it is impossible to use them to develop an AI based application. In this research paper, we briefly discuss the process of developing an AI based application to predict Malaria, which is one of the most common vector borne diseases in the coastal districts of Karnataka. This pioneer work was done over the data collected from the clinical notes of a 1500 bed hospital situated in Mangalore. Few machine learning algorithms like Logistic regression, Support vector machine XGB Booster classifier, CAT Booster Classifier and Random forest classifier were used over the dataset. Our experimental study revealed that, Random Forest classifier works efficiently for this data set, compared with the other algorithms that we used. It gave the best accuracy of 90.92.

Keywords. Artificial Intelligence, Support vector machine, machine learning, random forest, Logistic regression, Malaria, vector borne disease.

1. Introduction

The transforming power of Artificial Intelligence in the health care sector is very evident, in modern times [1]. As it is defined conventionally, AI is about developing machines with intelligence in contrast to the intelligence of human beings [2]. With more and more advances happening in the collection of data, processing and computing, intelligent systems are now aiding in these various tasks that once depended on human arbitration. From Finance to Medical care [2] scenarios are transforming drastically, in

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a way people never imagined before. One could say that machine learning is applied in variety of application such as [17] cost control, [18] soil environment preservation etc,. but, all these benefits do come with various limitations. The limitations ranges from the algorithms, hardware implementation, development of application etc. AI involves developing systems that exhibit cognitive aptitude that uses technologies such as Machine Learning [3]. Every instance of the role of AI that we hear about, and its applications [4] in Health care takes advantage of the Data. Despite the digital revolution, most of the medical data are still handwritten [5]. Problems arise when other stake holders are involved either for interpretation or study. Poor handwritten clinical notes poses a serious threat for researchers who are involved in data analysis. Dakshina kannada is one among the coastal districts of Karnataka, and reports many Malaria cases in a year. It is also named as one of the malaria endemic district [6] in the state and the country. Malaria is one of the important vector borne diseases globally [7] . Few studies have been done to analyze the trends of vector borne diseases [8]. Artificial Intelligence (AI) has been used as a surveillance and prediction tool to predict vector borne diseases [9]. The researchers of the above study came out with a system, that could predict the outbreak of dengue much earlier taking advantage of various data and parameters that were stored in different silos. Similar studies have also been done in other places as well [10]. Few such works are carried out in our country. [11–13]. However, in Indian scenario, there is hardly any study that is done in a deeper level involving clinical notes digitization. Many works take the demographic details and analyze. So an attempt was made to study the trends, symptoms, treatments of Malaria patients from the hospital records who were admitted in the span of four years (2015-2018) in a Medical College Hospital in Mangalore, India. The study was conducted after taking Ethics committee permission of the medical college. The data are maintained by the Hospital Medical Records Department (MRD). Section 2 elaborates the Framework that was used and the following sections narrates the results that we obtained from this study and is then followed by conclusion.

This experimental work results have helped to understand the dynamics of the Malaria fever in this region, and can serve as a tool to assist the doctors, for managing patients quickly and effectively.

2. Materials and Methods

2.1. Data Sources

The Real Time Data Collection was done primarily in two locations - the DHO office in Mangalore, and the Father Muller Medical College. The Data from the DHO Office were gathered from different records, files and also by visiting different primary Health centers (PHC) and National Urban Health Mission centers (NUMC) in and around Mangalore. The data that were gathered from the PHC and NUMC did not have detailed clinical notes but has only basic demographic details. Hence the Data related to Malaria from Father Muller Medical College was accessed after getting the approval from the scientific and Ethics committee of the Father Muller Medical College, Mangalore. We followed the CRISP-DM model, for our experimental study, understanding the data, transforming it into a format where the Model could be built and finally the evaluation.

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Figure 1. CRISP-DM Model.

2.2. Malaria Data

There are various symptoms for a patient to be identified as having Malaria. If a patient has fever with migraine, back pain, chills, rigors, sweating, nausea and puking [14]. A confirmed complicated/severe malaria is defined as a confirmed case with symptoms/signs of complicated/severe malaria (prostration, impaired consciousness, respiratory distress (acidotic breathing), multiple convulsions, circulatory collapse, abnormal bleeding, jaundice, hemoglobinuria, severe anemia, etc.) Confirmed Malaria cases that were treated in Father Muller Medical college hospital from the year 2014 to 2018 were considered for the study.

Fields	**Sample Data 1**	**Sample Data 2**	**Sample Data 3**
IP Number	54xxxx45	87xxxx41	46xxxx32
Patient Name	Xxxxxxx	Xxxxxxx	Xxxxxxx
Age	45	54	19
Sex	Male	Male	Female
City	Mangalore	Chickmangalur	Kasargod
DOA	20-11-2014 /09:15	10-11-2015 /10:15	02-11-2017/ 09:15
Discharge Date	25-11-2014 / 01:31	17-11-2015 / 02:31	10-11-2017/ 01:31
Primary Code	B54	B50.9	B50.9
Primary Code Description	Unspecified Malaria	Plasmodium vivax Malaria without complication.	Plasmodium vivax Malaria without complication

Figure 2. Sample of Malaria Data maintained in the Registration Department.

Few case sheets were reported as unspecified malaria. The individual patient medical records were accessed. The Data were available in two departments. The Registra-

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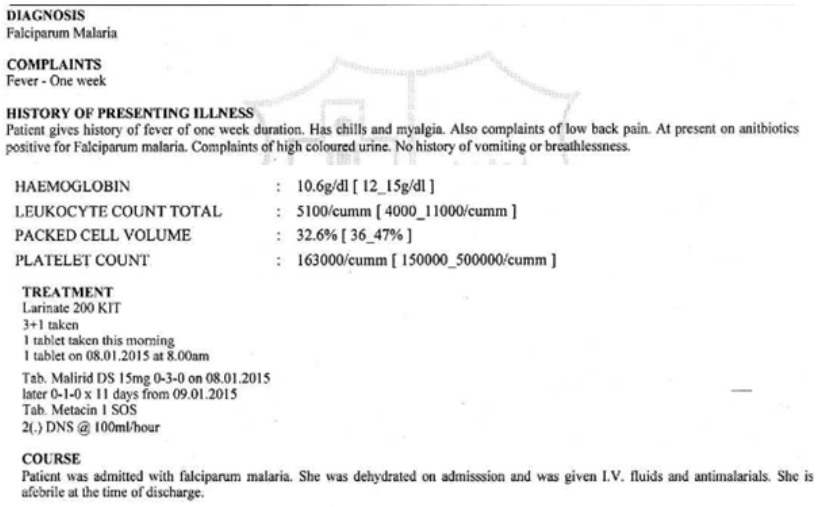
tion department maintains the details of the in-patients regarding their Inpatient number, Name, Sex, Age, City, Date of admission and Date of discharge.

2.3. Data Gathering from Medical Records Department

The Data related to Malaria from Father Muller Medical College was accessed after getting the required permission from scientific and Ethical committee of the Father Muller Medical College, Mangalore. The Data related to Malaria were stored as Electronic Medical Records (EMR). The case sheets were scanned and stored in the MRD repository. The corresponding patient history was accessed through the In-Patient number, is stored in the Medical Records Department and the data that is stored in the Registration department.



DIAGNOSIS
Falciparum Malaria

COMPLAINTS
Fever - One week

HISTORY OF PRESENTING ILLNESS
Patient gives history of fever of one week duration. Has chills and myalgia. Also complaints of low back pain. At present on anitbiotics positive for Falciparum malaria. Complaints of high coloured urine. No history of vomiting or breathlessness.

HAEMOGLOBIN	:	10.6g/dl [12_15g/dl]
LEUKOCYTE COUNT TOTAL	:	5100/cumm [4000_11000/cumm]
PACKED CELL VOLUME	:	32.6% [36_47%]
PLATELET COUNT	:	163000/cumm [150000_500000/cumm]

TREATMENT
Larinate 200 KIT
3+1 taken
1 tablet taken this morning
1 tablet on 08.01.2015 at 8.00am
Tab. Malirid DS 15mg 0-3-0 on 08.01.2015
later 0-1-0 x 11 days from 09.01.2015
Tab. Metacin 1 SOS
2(.) DNS @ 100ml/hour

COURSE
Patient was admitted with falciparum malaria. She was dehydrated on admisssion and was given I.V. fluids and antimalarials. She is afebrile at the time of discharge.

Figure 3. Sample Discharge summary in clinical notes.

2.4. Data Preprocessing

Major portion of the time in this research study was spend in this Data pre-processing step. All the health data thus collected go through Data pre-processing i.e., cleaning process where unnecessary information was removed. This phase consists of four primary sub steps: Data Cleaning, Data Integration, Data Transformation and Data Reduction.

- Data Cleaning: Data cleaning was done to sort our issues related to missing values, non-readable handwritings, and redundant data within the data that were available in the clinical notes.
- Data Integration: The Data were extracted from the Registration department which gave us the demographic information about the patient and other data from the medical records department which gives information about the treatment that was given. These data sources must be integrated, to a single data point which is uniform that can be analyzed.

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- Data Transformation: The data we collected was in formats that are not optimal for processing. For example, if dates are involved, the data must be formatted from text to date format. In this state, we convert raw data into a useful format that can be processed with mathematical libraries. In this project the date of admission and date of discharge fields are used to compute the number of days the patient was admitted.
- Data Reduction: Redundant data is identified and removed. Any unnecessary data is removed. This ensures that only valid data is used for processing.

2.5. Data Processing

The preliminary idea was to take screenshots of the patient discharge sheets and to extract text from those images. Each image which contained patient information from the day of his/her arrival to the day of discharge was recorded. In order to extract data from the images we used a python tool called Python-Tesseract. All the images were run through the modified python program and the image files were transformed into text files which contained all the textual information got from the images. Still there was a challenge with respect to the extracted files. Some of them were so distorted and blur, so the python program couldn't recognize the words in them and some of the extracted data was wrong. So, the only alternative was to store the data in the database by manually entering the patient information. For this we created a python script or program which takes the user input by using the input () function of python. Then the data was stored in Mongo DB using the python's pymongo package which allows us to set the database and the collections to store the data.

The next step is to create a prediction model. For this the entire data is split into train', 'test' and 'validation' set. Since the task involved in this model is classification, we created a supervised machine learning model [15, 16]. The model was created using the classification algorithm. In our case we used Logistic Regression, Support Vector Machine, XGB Booster classifier, CAT Booster Classifier and Random Forest. The model was then fed with input data i.e., the training data which is the set of input prepared from the clinical notes of the patients who were attended in the Medical College Hospital for Malaria. For the model to be trained or fit, few of the parameters were adjusted at regular intervals to get the best accuracy. Further, the model tunes its attributes based on the frequent evaluation results on the validation set. The working accuracy of the model is derived from the test set. The program was written using Python 3.7 using the following libraries and packages such as Numpy, Pandas, MatPlotlib, SKlearn, Dash, Spell Checker and nGram.

3. Results and Discussion

The Exploratory Data Analysis was performed over the data that were collected. Few of the results are presented below. From the Data that was collected from the Father Muller Medical College, Mangalore, the following insights were derived. The data has now been enabled to perform any machine learning tasks such as classification or prediction or regression based on the need. There are various algorithms for each of the tasks that are mentioned above. Since the task that we have been trying to solve is a classification

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related task, we tried to find out the different algorithms that can be used for building a model. We tried using Logistic Regression, Support Vector Machine, XGB Booster classifier, CAT Booster Classifier and Random Forest for training the model. The various values that were generated for different metrics such as Accuracy, Precision, Recall and F- Measure are displayed below.

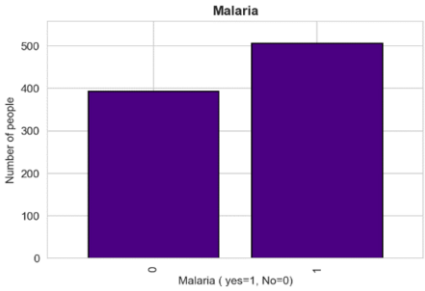

Figure 4. Malaria Cases

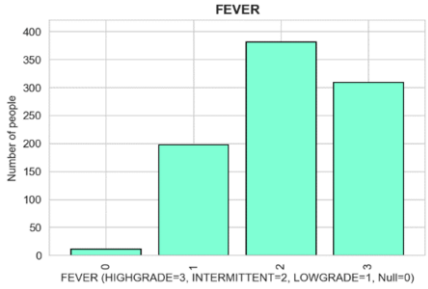

Figure 5. Malaria Cases with Symptoms of Fever

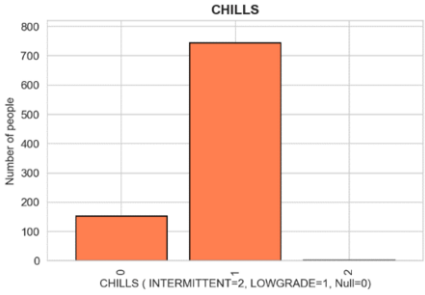

Figure 6. Malaria Cases with Symptoms of Chills

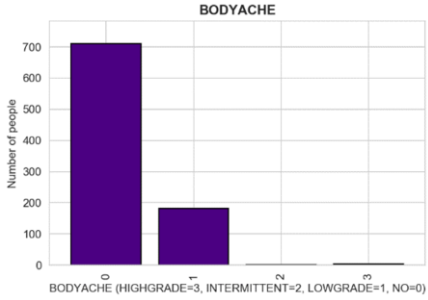

Figure 7. Malaria Cases with Symptoms of Body Ache

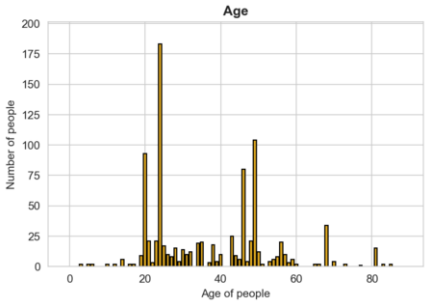

Figure 8. Malaria cases with Age classification

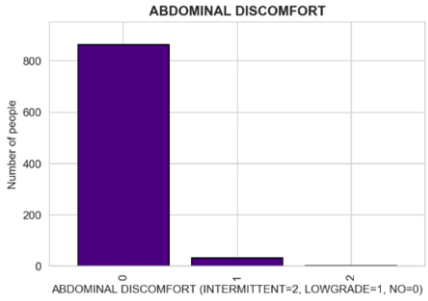

Figure 9. Malaria Cases with Abdominal Discomfort

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Table 1. Performance Comparison of Different Machine Learning Algorithms

Algorithm	Precision	Recall	F1-Score	Accuracy
Logistic Regression	0.59	0.72	0.65	62.63
Support Vector Machine	0.55	0.46	0.50	55
Random Forest Classifier	0.75	0.76	0.76	90.97
XGB Booster Classifier	0.74	0.79	0.77	86.25
CAT Booster Classifier	0.75	0.70	0.72	88.19

This Figure shows the results that we obtained from each classifiers. From this, we can understand that the model was effective as it gives the accuracy highest of 90.97 for the Random Forest classifier algorithm. From the results that is obtained from the test we can conclude that the Random Forest Classifier decision tree classifier gives the best result out of all the classifiers we used in the study. It gives higher accuracy than the other classifiers. Random Forest classifier algorithm is one of the best machine learning algorithms to examine the data categorically and continuously. Thus in conclusion we can say that if the dataset is larger in size the model will give more accurate result.

4. Conclusion

This research study based on clinical notes of the patient, treated for Malaria, provides an insight into the types of symptoms prior to hospital admission. It also explores the efficiency of diagnostic treatment for Malaria. The quicker a physician assesses based on the symptoms, more effective the treatment tends to be. This study was done with data collected from one specific location. More data from different hospital setting and different places would increase the efficiency of the System. We intend to add more real time data from different hospital settings. However, the same steps that were performed in the preprocessing stages can be repeated for any hospital setting to gather data and transform the raw clinical data into a meaningful data over which effective AI based model can be built.

5. Acknowlegement

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References

[1] Rong G, Mendez A, Assi EB, Zhao B, Sawan M. Artificial intelligence in healthcare: review and prediction case studies. Engineering. 2020 Mar 1;6(3):291-301.

[2] Weng J, McClelland J, Pentland A, Sporns O, Stockman I, Sur M, Thelen E. Autonomous mental development by robots and animals. Science. 2001 Jan 26;291(5504):599-600.

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[3] Priya, D. Top 5 Limitations of Artificial Intelligence. [Internet]. [updated 2019 March 17; cited 2020 September 27]. Available from: https://www.analyticsinsight.net/top-5-limitations-artificial-intelligence.
[4] Huang G, Huang GB, Song S, You K. Trends in extreme learning machines: A review. Neural Networks. 2015 Jan 1;61:32-48.
[5] Guo Y, Liu Y, Oerlemans A, Lao S, Wu S, Lew MS. Deep learning for visual understanding: A review. Neurocomputing. 2016 Apr 26;187:27-48.
[6] Rodríguez-Vera FJ, Marin Y, Sanchez A, Borrachero C, Pujol E. Illegible handwriting in medical records. Journal of the Royal Society of Medicine. 2002 Nov;95(11):545-6.
[7] Rajesh BV, Kumar A, Achari M, Deepa S, Vyas N. Malarial trend in Dakshina Kannada, Karnataka: an epidemiological assessment from 2004 to 2013. Indian Journal of Health Sciences and Biomedical Research (KLEU). 2015 Jul 1;8(2):91-4.
[8] Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL, Drake JM, Brownstein JS, Hoen AG, Sankoh O, Myers MF. The global distribution and burden of dengue. Nature. 2013 Apr;496(7446):504-7.
[9] George T, Jakribettu RP, Yesudas S, Thaliath A, Pais ML, Abraham S, Baliga MS. Trend analysis of dengue in greater Mangalore region of Karnataka India: Observations from a tertiary care hospital. International Journal of Advanced Research (IJAR). 2018;4(6):92-6.
[10] Sharma R. Epidemiological investigation of malaria outbreak in village Santej, district Gandhi Nagar (Gujarat). Indian Journal Preventive Social Medicine. 2006;37(3):125-32.
[11] Zacarias OP, Boström H. Predicting the incidence of malaria cases in mozambique using regression trees and forests. International Journal of Computer Science and Electronics Engineering (IJCSEE). 2013;1(1):50-4.
[12] Linder N, Turkki R, Walliander M, Mårtensson A, Diwan V, Rahtu E, Pietikäinen M, Lundin M, Lundin J. A malaria diagnostic tool based on computer vision screening and visualization of Plasmodium falciparum candidate areas in digitized blood smears. PLoS One. 2014 Aug 21;9(8):e104855.
[13] Devi SS, Sheikh SA, Talukdar A, Laskar RH. Malaria infected erythrocyte classification based on the histogram features using microscopic images of thin blood smear. Indian Journal of Science and Technology. 2016 Dec 20;9:1-10.
[14] Darla, B. Malaria: Causes, Symptoms, and Diagnosis. [Internet]. [updated 2019 March 7; cited 2020 September 24]. Available from: https://www.healthline.com/health/malaria#diagnosis.
[15] Sidey-Gibbons JA, Sidey-Gibbons CJ. Machine learning in medicine: a practical introduction. BMC medical research methodology. 2019 Dec;19(1):1-8.
[16] Beam AL, Kohane IS. Big data and machine learning in health care. Journal of the American Medical Association. 2018 Apr 3;319(13):1317-8.
[17] Xu X. Machine learning-based prediction of urban soil environment and corpus translation teaching. Arabian Journal of Geosciences. 2021 Jun;14(11):1-5.
[18] Luo Y. Environmental cost control of coal industry based on cloud computing and machine learning. Arabian Journal of Geosciences. 2021 Jun;14(12):1-6.

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A Contemporary Method on Feature Selection and Classification Using Multi-Model Deep Learning Technique for Identifying Diabetic Retinopathy

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Abstract. Diabetic retinopathy is one of the leading reason for preventable blindness in the world. 10 -18 % of diabetic people having diabetic retinopathy. The feature selection and classification is a vital task to find the seriousness of the diabetic retinopathy. The different researchers introduced different techniques to extract the features and classification of diabetic retinopathy images. The deep learning is one of the essential methods to extract the features. Most of the previous techniques are extracted information's with the help of texture and extracted the whole image feature data. Some feature missed and thereby the accuracy is significantly less. Hence a proposed new technique called FRCNN (Fast Region-based Convolution Network) and Nearest Neighbour (NN) algorithm used to extract the features and classifications. The proposed method yields better accuracy (96%), sensitivity (98%) and specificity (97%) compared to the previous methods. The implementations Messidor Dataset is used for training and testing

Keywords. Diabetic Retinopathy, Features, Classification, Nearest Neighbour, Deep Learning, FRCNN (Fast Region-based Convolutional Network).

1. Introduction

Diabetic retinopathy (DR) is one of the leading reason for preventable blindness in the world. As per the survey [1–3] 210 million people are having diabetics and around 10-18 % of people having diabetic retinopathy. The DR patients have affected the blood vessels of light sensitivity parts or tissue at the retina. Initially, the patents has no symptoms, but in the cases of type 1 and type 2 diabetics automatically affect the eye and eye diseases getting started simultaneously. The main symptoms of DR are blurred vision, impaired colour, fluctuating vision, dark vision, vision loss and empty areas in the vision etc. The DR occurred in the age of 25 to 74 years of ages. As per the clinical features,

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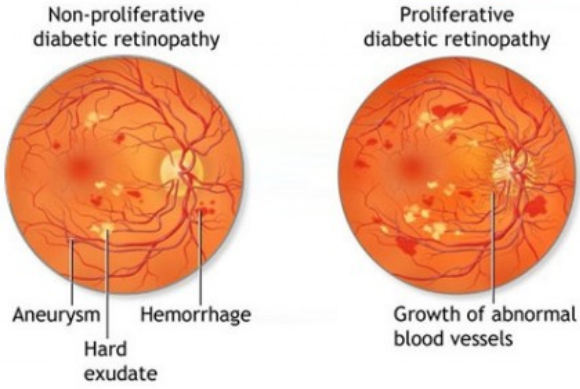

Figure 1. Representation of NPDR and PDR.

the DR is classified into three types such as [4] Non-proliferative diabetic retinopathy (NPDR), Proliferative diabetic retinopathy (PDR) and macular edema. The NPDR and PDR representation is shown in Figure 1, and sub-classification types shown in table

Table 1. Types, meaning and sub-classifications of DR

S.No	Types	Meaning	Sub- Classifications
1.	NPDR	The initial stage of diabetic retinopathy. it damages the blood vessels in the retina and begin to start fluid into the eye.	1. Mild NPDR. 2. Moderate NPDR 3. Severe NPDR 4. Very Severe NPDR.
2.	PDR	Close to blood vessels in the retina and stop the blood flow to retina. The blood vessels leak the blood and loss the eye site and time to time check needed.	1. PDR with neovascularisation 2. PDR with neovascularisation of the disc
3.	Macular Edema	Accumulation and abnormal leakage of fluid from damaged vessels in the retina.	—

The Table 1 shown the various types, meaning and sub- classifications of DR. This classifications and sub-classifications are identified based on the symptoms. The author of [5] presented the various classification based on the affecting status. Based on the affecting status, graded as R0, R1, R2 and R3. The R0 means not affected, R1 means mild affected (NPDR), R2 means severe affected (NPDR), R3 means most severe affected (PDR). So classification features of image is very important in DR. The different techniques, algorithms and methodologies are introduced to finding the features. The machine learning techniques are used to find the features of the images, one should note that Machine learning is applied in variety of application such as [6] cost control, soil environment preservation, Medical etc,. but, all these benefits do come with certain limitations. But the comparison parameters such as sensitivity (Sen), specificity (Spe) , accuracy (Acc) of the feature's predictions are not yet to the mark. So, features selection and classification methods are needed for further improvement in terms of all parameters. The previous works such as SVM (Sen-80%, Spe- 86% and Acc- 83%), SVM+BPSO (Sen-94%, Spe-98% and Acc-96%) [7] and another recent work [8] received very less accuracy compare to the SVM + BPSO model.

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New techniques and methodologies are required to improve the accuracy, sensitivity and specificity. In this work, planning new deep learning-based techniques to improve the prediction of features and increase the accuracy of prediction features. The deep learning is one of the main emerging techniques. The main advantages of deep learning over machine learning and artificial intelligence is, searching the features on its own and take multiple features that combine, correlate with other relevant features to fast learning. So, it, produce better results compared to the other methodologies. The main contribution of this work is

1. Introduced multi-model techniques to predict features with the help of deep learning
2. Used relevant and morphological are used to better predictions of features.
3. The accuracy, sensitivity and specificity are increased compared to the other recent methods such as SVM, SVM+BPSO [7] and colour histogram filter method [8].

2. Related Work

The different researchers introduced, different methods to predict the features of DR. In this section some of the works related to support for improving the features prediction. The authors of [9] presented automated detection of new vessels in the retina. This work is supported to dual classification techniques. The Local morphology features are used to measure the DR features. The authors of [10] presented a method for finding DR macular edema features with the help of deep learning technique. The FRCNN method with fuzzy k-means clustering used for features finding. The authors of [11] present particle swarm optimization method for finding the features of DR. In this work the selected features are again classified with the help of neural network. The accuracy of features prediction is 76.11%.

The authors of [12] introduced genetic algorithm with dual classification method for automated detection of PDR. The SVM classification is used with genetic algorithm for finding features. The authors of [13] presented conventional neural network method for screening various stages of DR. The different stages such as NPR and PDR in different stages are measured. The authors of [14] introduced deep learning techniques for features selection. This method used deep belief network for classification and MGS-ROA method is used for features selection. The authors of [7, 8] introduced multi-model or hybrid method for features in DR. These two methods given the better results compared to the other methods. The authors of [15–17] introduced various deep learning methods to select the features of DR. These deep learning methods are mostly supported to take the better decision. The authors of [18] present texture-based features extraction with the help of nearest pixel in the large areas. The authors of [19] present the morphological based features in the DR. With the help of morphological features easily find the relevant features also. The most of the previous work is the texture and morphological features are extracted separately and deep learning-based work given better results compared to the other artificial intelligence and machine learning.

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3. Materials and Metho

The MESSIDOR Dataset [20] used for features classification, training and testing. The MESSIDOR Dataset consists of total 1200 fundus colour images. The 300 images in the dataset are used for training and 100 images in the dataset are used for testing. The training data is used for validation of results and testing data is used for verifications of the images.

3.1. FRCNN + NN Method

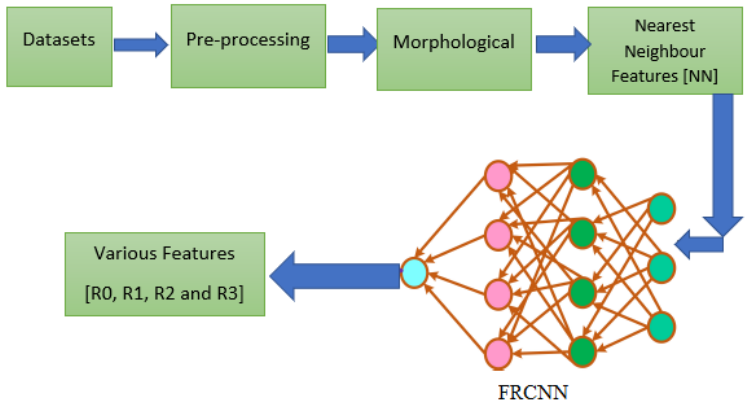

Figure 2. Proposed FRCNN + NN method.

The DR image finding FRCNN + NN method proposed for feature extraction and classification of the images. The proposed consists of four parts such as i. pre- processing ii. Morphological iii. Nearest Neighbour (NN)features extraction and iv. FRCNN learning. The pre-processing is used to check the quality of the images and extraction of useful images. The morphological features used to remove the imperfections and accounting of structure of features. The nearest neighbour features used to find the nearest features of images and classification. The FRCNN (Fast Region-based Convolutional Network) learning is used to find the extract features in the fastest way. The FRCNN method is used to give the output in fastest way.

3.1.1. Preprocessing of DR images

The pre-processing of DR images [21,22] having different steps such as color space, Spatial normalization, Region of Interest (ROI) extraction, Illumination correction, contrast enhancement and Vessels extraction etc. The entire process of preprocessing of images shown in the Figure 3. Using the pre-processing all the unwanted issues such as color, location and ROI extraction and vessels issues all are extracted.

3.1.2. Morphological Extraction

Morphological extraction is used to denoise the original images, identify the improper choice, length of the features, size and shape of the images to predict the features. The

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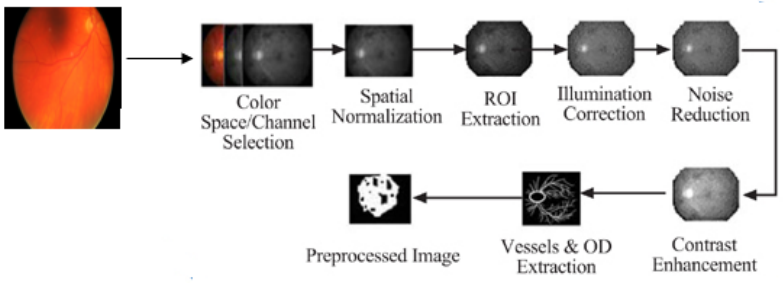

Figure 3. Pre-processing of DR images.

following function such as erosion Eq. (1), dilation Eq. (2), opening Eq. (3), closing Eq. (4) and differences Eq. (5) are used to extract the better resolutions of the images.

$$(f \ominus g)(n) = min[f(n+m) - g(m)) \tag{1}$$

Where m = 0,1,2,3,. . . ,M-1, n = 0,1,2,,..,N-1

$$(f \oplus g)(n) = min[f(n+m) + g(m)) \tag{2}$$

Where m = 0,1,2,3,. . . ,M-1, n = 0,1,2,,..,N-1

$$(f \circ g)(n) = (f \ominus g \oplus g)(n), n = 0,1,2,3 \ldots N-1 \tag{3}$$

$$(f \cdot g)(n) = (f \oplus g \ominus g)(n), n = 0,1,2,3 \ldots N-1 \tag{4}$$

$$((f \cdot g) - (f \circ g)(n)) = (f \oplus g \ominus g) - (f \ominus g \oplus g)(n) \tag{5}$$

f(n)- original function, f(m)- collected information's, $\ominus$- operation of erosion, $\oplus$- operation of dilation.

3.1.3. Nearest Neighbour (NN)

The NN features selection or classification method is a supervised algorithm. Using this NN, the nearest features of pixel, shape, structure, PDR blood vessels, NPDR blood vessels easily can classify and find the features. The Euclidian distance is used to find the distance between one pixel to another pixel. The distance metrics and equation shown in the Eq. (6).

$$D(L1, L2) = \sum_{n=1}^{\infty} (P \vee LP1 - LP2) \tag{6}$$

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The R-CNN is the base for faster R-CNN. It is used to find the selective features in the conventional network. This method combines all the similar pixels and morphological features. In this FRCNN the different rectangular areas feature also combined with multiple regions. In the proposed work FRCNN and NN features also used to getting the final output. At the time of computation of FRCNN the previous regions or previous steps also used to extract the features simultaneously. The pooled conventional neural networks filter and extract the selective features form the various features. So, the accuracy of the features also increased automatically. The overall process of features extraction combined with NN and morphological features shown in the Figure 2. The overall step by step process shown below:

1. Initialize the dataset
2. Perform the pre-processing steps
3. Find the morphological features with the help of equation 1-6
4. Nearest features are extracted using NN (Equation -7)
5. Training and testing performed using FRCNN.
6. Various features of grading performed using accuracy, sensitivity and specificity.

4. Results and Discussion

The experimental purpose MESSIDOR dataset is used [20]. The MESSIDOR datasets used for training and testing using FRCNN deep learning. The MESSIDOR dataset having 1200 images and the images are grouped into two categories such as DME and DR. In this work the image is used for only DR classification and features selection. The images were captured using high resolution images such as 1440*960, 2240*1488 and 2404 *1536.

Table 2. Comparison of proposed work with various other methods

S. No	Methods	Accuracy	Sensitivity	Specificity
1	SVM [9]	83%	80%	86%
2	SVM+BPSO [9], 2019	94%	98%	96%
3	MGS-ROA -DBN [16], 2020	93%	86%	95%
4	Proposed Work & FRCNN + NN	96%	98%	97%

The proposed work implementation, 300 images are used for training and 100 images are used for testing. The proposed work FRCNN+NN method used for training and testing. The proposed work implemented and performed in the different iterations. Each iterations the number of testing and training images are same. The proposed work evaluated with the help of three parameters such as accuracy, sensitivity and specificity. The previous methods such as SVM [7], SVM+BPSO [7], DT (J8) + K -NN [8] and MGS-ROA -DBN [14] also used same parameters for evaluations. These parameters are performed in various iterations, and results are consolidated. The proposed work consolidated data and comparison with various methods shown in the Table 2.

The Figure 4 shown the accuracy of proposed work and comparison with various other method. The proposed work produced better result such as 96% and compared with other methods it produces better results because two attributes are used to increase

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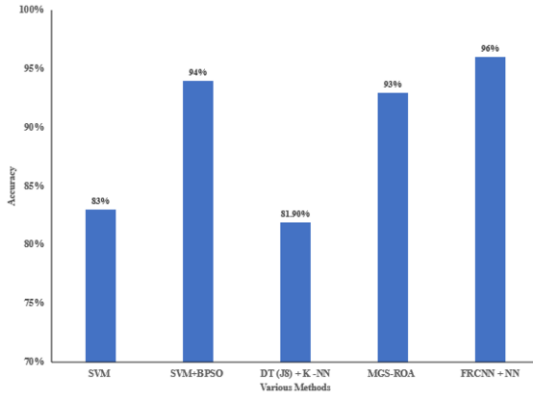

Figure 4. Accuracy of features selection.

the accuracy. The nearest features are selected using NN and FRCNN is increase the accuracy. The validation of accuracy is defined as shown in the Eq. (7).

$$Accuracy = \frac{TP+TN}{TN+TP+FN+FP} \tag{7}$$

Where TP -true positive, TN - true negative, TP – Ture positive and FP- False Positive. Similarly, the validation of sensitivity and specificity shown in the Eq. (8) and Eq. (9).

$$Sensitivity = \frac{TP}{FN+TP} \tag{8}$$

$$Specificity = \frac{TN}{FP+TN} \tag{9}$$

The sensitivity is used to find the correctly matched features from the datasets. The specificity is used to find the wrongly matched images from the datasets. The prediction of sensitivity shown in the Figure 5 and the experiment is performed in the different iterations and corresponding average values are plotted in the Figure 3 and Table 2.

Similarly, the specificity prediction in the Figure 6 and the average data mentioned in the Table 3. With the help of accuracy, sensitivity and specificity the four grading data is predicted such as R0, R1, R2, and R3. The predicted grading data shown in the Table 2. The grading data predicted from the 100 testing images.

Table 3. Comparison of proposed work with various other methods

Iterations/ Grading	R0 Not affected	R1 Mild affected	R2 Severe affected	R3 Most severe affected
Iteration -1	58	22	14	6
Iteration -2	55	24	16	5
Iteration -3	58	22	14	6
Iteration -4	58	22	14	6
Iteration -5	57	23	14	6

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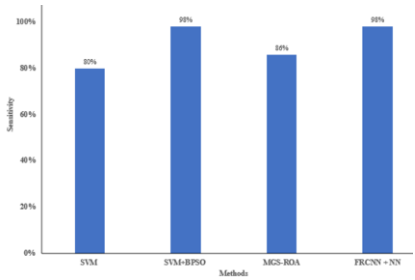

Figure 5. Sensitivity of features selection

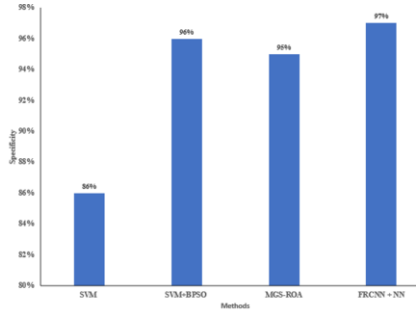

Figure 6. Specificity of features selection

5. Conclusion

Diabetic retinopathy is an important source of vision damage in the world. The different indications are used to identify the vision loss in the retina. In the DR computational features selection and classification is important to identify the symptoms. Based on the features and classifications the input images are categories into no DR, moderate DR, mild DR, and severe condition DR. In this work proposed multi-model technique FCNN + NN used for classifications and features selection. The FCNN+ NN method consists of pre-processing, morphological, NN and FCNN. The proposed work produces better results in the I age with the help of morphological features. The proposed work additionally used NN classification to find the nearest features in the retina. The FCNN is used to find the better accuracy compared to other methods. The proposed method yields better accuracy (96%), sensitivity (98%) and specificity (97%) compared to the previous methods. The future work, the performance can be improved in terms of features selection and prediction of the DR.

References

[1] Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes care. 2004 May 1;27(5):1047-53.

[2] Day C. The rising tide of type 2 diabetes. The British Journal of Diabetes & Vascular Disease. 2001 Aug;1(1):37-43.

[3] Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. Diabetes research and clinical practice. 2010 Jan 1;87(1):4-14.

[4] Fraser CE, D'Amico DJ, Trobe J. Diabetic retinopathy: Classification and clinical features. UpToDate. Waltham, MA: UpToDate Inc. 2014.

[5] Antal B, Hajdu A. An ensemble-based system for microaneurysm detection and diabetic retinopathy grading. IEEE Transactions on biomedical engineering. 2012 Apr 3;59(6):1720-6.

[6] Luo Y. Environmental cost control of coal industry based on cloud computing and machine learning. Arabian Journal of Geosciences. 2021 Jun;14(12):1-6.

[7] Chaurasiya RK, Khan MI, Karanjgaokar D, Prasanna BK. BPSO-based feature selection for precise class labeling of Diabetic Retinopathy images. In Advanced Engineering Optimization Through Intelligent Techniques 2020 (pp. 253-264). Springer, Singapore.

[8] Vijayan T, Sangeetha M, Kumaravel A, Karthik B. Feature Selection for Simple Color Histogram Filter based on Retinal Fundus Images for Diabetic Retinopathy Recognition. IETE Journal of Research. 2020 Nov 18:1-8.

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[9] Welikala RA, Fraz MM, Dehmeshki J, Hoppe A, Tah V, Mann S, Williamson TH, Barman SA. Genetic algorithm based feature selection combined with dual classification for the automated detection of proliferative diabetic retinopathy. Computerized Medical Imaging and Graphics. 2015 Jul 1;43:64-77.

[10] Nazir T, Irtaza A, Javed A, Malik H, Hussain D, Naqvi RA. Retinal image analysis for diabetes-based eye disease detection using deep learning. Applied Sciences. 2020 Jan;10(6185):1-21.

[11] Asti H, Toni A, Sari S, Hikmah AB. Feature Selection of Diabetic Retinopathy Disease Using Particle Swarm Optimization and Neural Network.In 2018 6th International Conference on Cyber and IT Service Management (CITSM) 2018 Aug 7 (pp. 1-4). IEEE.

[12] Welikala RA, Fraz MM, Dehmeshki J, Hoppe A, Tah V, Mann S, Williamson TH, Barman SA. Genetic algorithm based feature selection combined with dual classification for the automated detection of proliferative diabetic retinopathy. Computerized Medical Imaging and Graphics. 2015 Jul 1;43:64-77.

[13] Shaban M, Ogur Z, Mahmoud A, Switala A, Shalaby A, Abu Khalifeh H, Ghazal M, Fraiwan L, Giridharan G, Sandhu H, El-Baz AS. A convolutional neural network for the screening and staging of diabetic retinopathy. Plos one. 2020 Jun 22;15(6):1-13.

[14] Jadhav AS, Patil PB, Biradar S. Optimal feature selection-based diabetic retinopathy detection using improved rider optimization algorithm enabled with deep learning. Evolutionary Intelligence. 2020 Apr 9:1-8.

[15] Gulshan V, Peng L, Coram M, Stumpe MC, Wu D, Narayanaswamy A, Venugopalan S, Widner K, Madams T, Cuadros J, Kim R. Development and validation of a deep learning algorithm for detection of diabetic retinopathy in retinal fundus photographs. Jama. 2016 Dec 13;316(22):2402-10.

[16] Lu D, Heisler M, Lee S, Ding GW, Navajas E, Sarunic MV, Beg MF. Deep-learning based multiclass retinal fluid segmentation and detection in optical coherence tomography images using a fully convolutional neural network. Medical image analysis. 2019 May 1;54:100-10.

[17] Ting DS, Cheung CY, Lim G, Tan GS, Quang ND, Gan A, Hamzah H, Garcia-Franco R, San Yeo IY, Lee SY, Wong EY. Development and validation of a deep learning system for diabetic retinopathy and related eye diseases using retinal images from multiethnic populations with diabetes. Jama. 2017 Dec 12;318(22):2211-23.

[18] Du N, Li Y. Automated identification of diabetic retinopathy stages using support vector machine. In-Proceedings of the 32nd Chinese Control Conference 2013 Jul 26 (pp. 3882-3886). IEEE.

[19] Adhi M, Brewer E, Waheed NK, Duker JS. Analysis of morphological features and vascular layers of choroid in diabetic retinopathy using spectral-domain optical coherence tomography. JAMA ophthalmology. 2013 Oct 1;131(10):1267-74.

[20] Decencière E, Zhang X, Cazuguel G, Lay B, Cochener B, Trone C, Gain P, Ordonez R, Massin P, Erginay A, Charton B. Feedback on a publicly distributed image database: the Messidor database. Image Analysis & Stereology. 2014 Aug 26;33(3):231-4.

[21] Ramasubramanian B, Selvaperumal S. A comprehensive review on various preprocessing methods in detecting diabetic retinopathy. In2016 international conference on communication and signal processing (ICCSP) 2016 Apr 6 (pp. 0642-0646). IEEE.

[22] Ashraf MN, Hussain M, Habib Z. Review of Various Tasks Performed in the Preprocessing Phase of a Diabetic Retinopathy Diagnosis System. Current medical imaging. 2020 May 1;16(4):397-426.

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Multilevel Security Biometric Authentication Locking System Using Arduino UNO

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Abstract. The main aim of our project is to implement the door lock system using the fingerprint sensor. There are many modern locks that replace the regular locks due to the high security, while we use this we are able to both lock (or) unlock the door lock using the fingerprint sensor. You are not supposed to carry the bundle of keys wherever you go, so that we can implement this idea and for the high security too. The possibilities of threats occurring in regular locks is less compared to the wireless biometric lock (i.e.) modern lock. Only a particular person can open the door lock (or) unlock it. It is not like the regular lock means if X person opening the lock using a key means the lock will release on its own. In modern lock there is no possibility that only the developer will open it, if someone wants to access using smartphone we should get verification from the user by getting the OTP and login the app.

Keywords. Fingerprint sensor, Biometric Lock, Smartphone, Application.

1. Introduction

Security is a primary concern in today's busy world and humans cannot give security to their belongings each and every time. If the door can easily be opened then the belongings of an individual can easily be stolen. For the security purpose the humans invented modern technologies. At early stages, a door with a physical key to lock is used which is considered to provide less security and after the development of technology modern locks have been innovated. These locks can be locked or unlocked by the user without the use of a physical key. The most easy and secure system that is being used is the fingerprint recognition system in which a fingerprint of an individual cannot be matched with others. The system uses a microcontroller which is used to control other devices in the system. The HC-05 Bluetooth module is used for transparent wireless serial connection setup. The system has a multi level of security compared to other systems. At first the user must sign up by providing the required details and then their fingerprint must be enrolled to the database so that the system can grant access to the user to unlock the door. Among other available biometric traits fingerprint proves to be the best traits that provides high security, good mismatch ratio and reliability.

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2. Related Works

The literature review works help to generate and expose skills of searching for information from a variety of sources. These skills are very important to solve the problems encountered or will face in the future. IoT has been applied in various researches in smart home technology to remotely control and monitor various appliances [1]. Some research also focuses on efficiency to lower power consumption [2]. Some of the research, like the following, have been done about security systems. Agbo David.O proposed a smart home controller that uses the Bluetooth in an Android device to control the operation of an automated security door system [3]. Research conducted by Rahul Saikia, Malabika Sharma, Amlanjyoti Gogoi and Dibya Jyoti Bora describes a system which will control doors by using smartphones [4]. This system needs a camera, micro controller AT89S52, Bluetooth module HC-05, Arduino Uno and R305 fingerprint sensor. Whenever a person stands in front of the camera, it will detect and send image to the mobile device. User can control the door by using smartphone.

Piash Paul et al. proposed Smart Door Lock Using Fingerprint Sensor [5]. In this system, the user will enter a fingerprint in the fingerprint scanner which is connected to the door latch through the microcontroller. After scanning the print, the system runs its database and looks for a match. If any match is found, the latch opens and thus the door gets unlocked. The drawback in this project is that a person's finger changes sizes or form/pattern over time and the fingerprint scanner does not take this into consideration. Venkata Rao,et.al proposed Smart Door Unlock System using Fingerprint to detect intruder [6]. A micro controller is used to enable the door opening or closing if the matching between scanned data and the already existing data is correct. Comparison is done inside the fingerprint module itself and its output is given to the micro controller. Result is displayed in an LCD display whether the user is authorized or not. The limitations is that It doesn't take a lot for the thumb scanner door lock to not recognize your fingerprint due to reasons such as oily fingers, or a dirty fingerprint scanner.

A research conducted by Tennyson and Amuda describes a system which will control doors by fingerprint sensor [7]. A fingerprint locker system using a micro controller uses a fingerprint recognition system as a process of verifying the fingerprint image to open the electronic lock. This research highlights the development of fingerprint verification systems using Arduino 1.6.3. Verification is completed by comparing the data of authorized fingerprint image with incoming fingerprint image. The incoming fingerprint image will first go through the extraction and filtering processes through which the information about it is obtained. Then the information of the incoming fingerprint image will undergo the comparison process to compare it with the authorized fingerprint image.

Putluru Sravani and kannapan proposed a High security door lock system by using Android mobile with Bluetooth [8]. Once wireless communication between Smartphone Bluetooth and Bluetooth module is established through a pairing process, user's key selections are sent as radio frequency (RF) signal to the main controller board installed at home. Then the Arduino Uno controller is used to interpret key selections and determine whether to release or not the electromagnetic (EM) lock home door.

The limitation of this project is that Bluetooth has slower data transmission rate when compared to other hardware interfacing technologies. Its range of connectivity is very short so the user must remain close to the door to get accessed. Shruti Koza et.al proposed Password Based Door Lock System for home security [9]. Here an electronic

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code lock system is made using Arduino UNO, which provides control to the actuating load.

If you forget the password it is not possible to open the door because multiple attempts are not provided for the users to access the door. Md.Maksudur Rahman,M. Sowket Ali and Md. Shoaib Akther proposed Password Protected Electronic Lock System for Smart Home Security [10]. An electrical lock allows activation of an electrical appliance on entering the correct password. PIC18F452 micro controller plays the role of the processing unit. The MCU is interfaced with a 4*4 matrix keypad and a 16*2 LCD to the user interface. It does not provide a strong identity check because it is only based on a password. Ketan Rathod,et.al proposed Smart door security using Arduino and Bluetooth Application [11]. Arduino along with HC-05 and mobile Applications allows us to control door from anywhere in the home and constantly keep watch on it. R-Pi would exchange data or would communicate with the help of Bluetooth, Wi-Fi and Ethernet.

When the access is verified by the user the lock is opened. The limitation is that System implementing must requires WIFI/Ethernet for the data communication. It is not possible to place connected devices in a certain range to get access or else it results in failure. Hasem abdo Qasem Saeed Al-Nabhi proposed a Fingerprint based security system[12]. The limitation with the smart lock is that, if the battery drains off, you will have to face a lot of hassle to gain access to your premise.AkashSDevadiga,et.al proposed Smart Door Control System [13].

The system mainly consisting of micro controller, GSM and gear motor for controlling the door. A GSM modem provides the communication interface. The limitation of the project is that when there is no network available or poor network connectivity then the system cannot be accessed. Martin Magdin and Stefan Koprda proposed Biometric Authentication of Fingerprint with Using Fingerprint Reader and Micro controller Arduino [14]. The main part of this system is the micro controller Arduino Uno with an external interface to scan for the fingerprint with a name Adafruit R305. This microcontroller communicates with the external database, which ensures the exchange of data between Arduino uno and user application.

Adarsh V Patil,et.al proposed Android Based Smart Door Locking System [15]. The RFID card reader detects and checks the user accessibility. HC-05 module is an easy to use Bluetooth SPP module, designed for transparent wireless serial connection setup. The limitation related to smart locks regards a sudden blackout of the control unit or a fault of the recognition device. In both cases, the risk is that you cannot enter your house because the system is unable to authenticate you for accessing the premises.

From the literature review that has been discussed, there are few researchers that discuss the home security and remote door. Therefore we make a research that can control the door remotely, receive alerts and grant a door access to the people whose identification is stored on the database. The big difference between the related works and the system we proposed are that our system has multiple layer of security like OTP and user validation which provides the user feel secured. This makes smartphones a suitable platform for uses beyond making and receiving phone calls. Combined with the ability to perform short-range wireless communications via Bluetooth, the smartphone is like to like replacement for physical keys.

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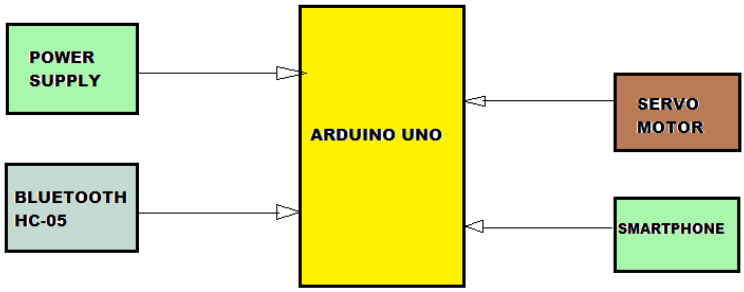

Figure 1. Block Diagram

3. System Architecture

The proposed system mainly consists of Arduino uno, Bluetooth HC-05 and Servo motor. Arduino uno acts as the micro controller in this system which operates the overall function. Bluetooth allows the user to connect the system with the application, so that the message can be passed to the system. Power supply is given to the system by means of USB connection or with external power supply so that the system works efficiently without any interruption. When the door wanted to be unlocked the user must login to the application and then an OTP will be shared to their registered mobile number. After the verification process the user need to place their finger on the fingerprint button. And then the door gets unlocked.

3.1. System Modules

Bluetooth wireless module is utilized in a master/slave management. In our wireless biometric lock, the HC05 module plays a important role by pairing with mobile fingerprint. By the use of HC05 module only the lock opens. By default, the processing plan setting is slave. The role of the module can be designed distinctly by at commands. The slave modules cant start an association with another Bluetooth gadget, yet can knowledge connections. Master module can establish connection with different gadgets.

Arduino Uno is an open source micro controller based on the micro chip AT mega 328P micro controller and developed by Arduino.cc. via USB cable it can be given connections with Jumper wires to unlock the wireless biometric lock. It accepts voltages between 7 and 20 volts. It is similar to the Arduino nano and leonardo. Layout and production files for some versions of the hardware are also available.

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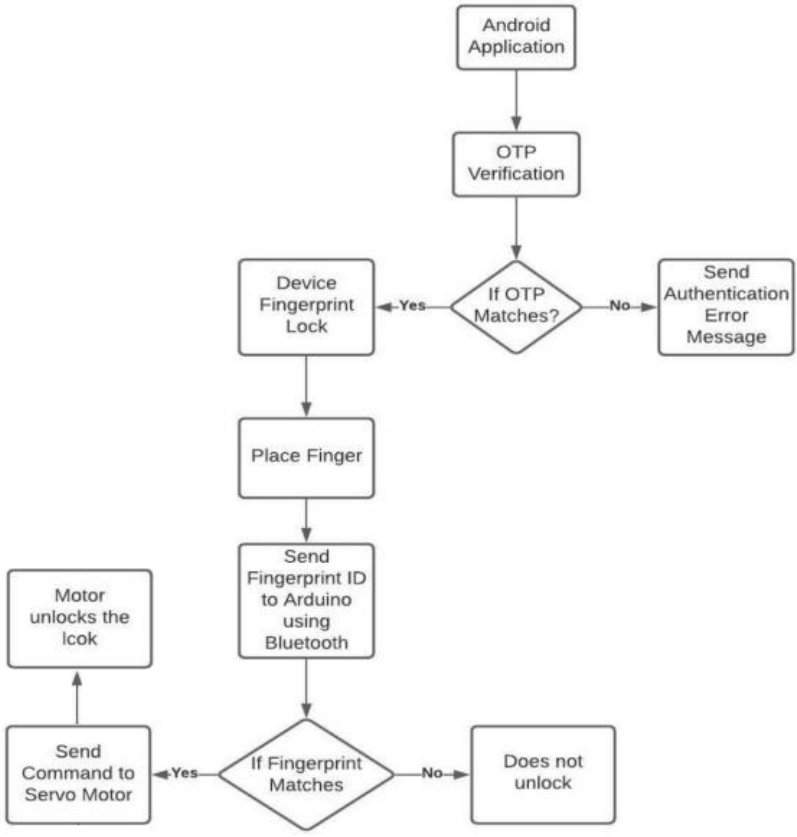

Figure 2. Data Flow Diagram

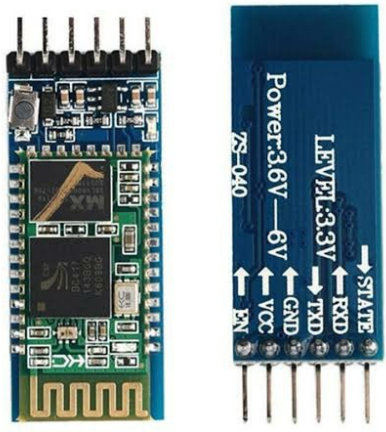

Figure 3. Bluetooth HC-05 module

Servo motors are utilized in application, For example, mechanical technology, CNC apparatus or mechanized assembling. They are commonly utilized as a superior option in

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Figure 4. Arduino UNO Module

Figure 5. Servo Motar Module

contract of the stopper engine. They have inherent yield steps. The encoder and regulator of a servo motor are an extra expense, yet they advanced the presentation of the general frame work. This can be seen when turning on an ink jet printer.

4. Implementation

Use of Firebase in this project adds an extra security layer to the system. The user of the system can view who are the persons and their mobile numbers that are logged in the application. When an unauthorized person tries to access the door they will get a notification. The user has the power to disable the unauthorized person mobile number. Therefore the unauthorized persons cannot be granted access to the system. The initial step

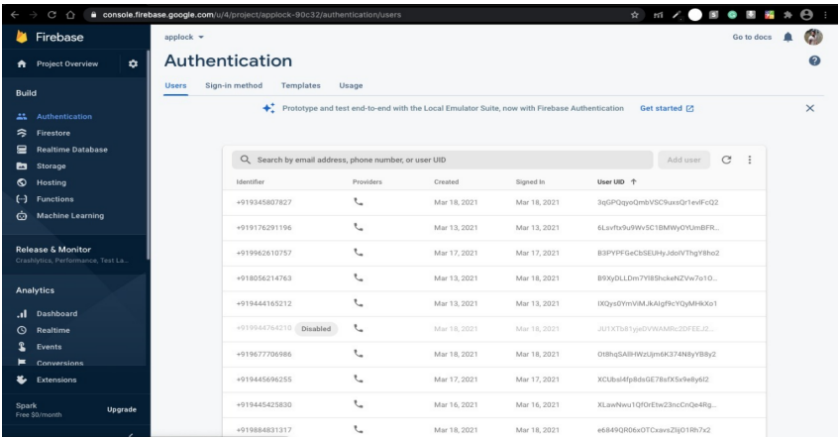

Figure 6. Monitoring of User Access

is to create a program using Arduino IDE and uploading it into the Arduino Uno. This program creates communication between the Arduino and the smartphone via bluetooth. Next step is to create a string variable which stores the unique device ID for the lock. To receive the data sent by the phone we use bluetooth HC-05 module. Next is to create

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a Loop function that stores the device ID .Then an if condition is used for verifying the sent ID by the bluetooth. When the fingerprint of the user is scanned by the smartphone it initially authenticates with the one present in the application. After the authentication, the application sends the device ID to the Arduino board. In the event this ID matches with the one set in Arduino, at that point the servo motor moves the lock to open position.

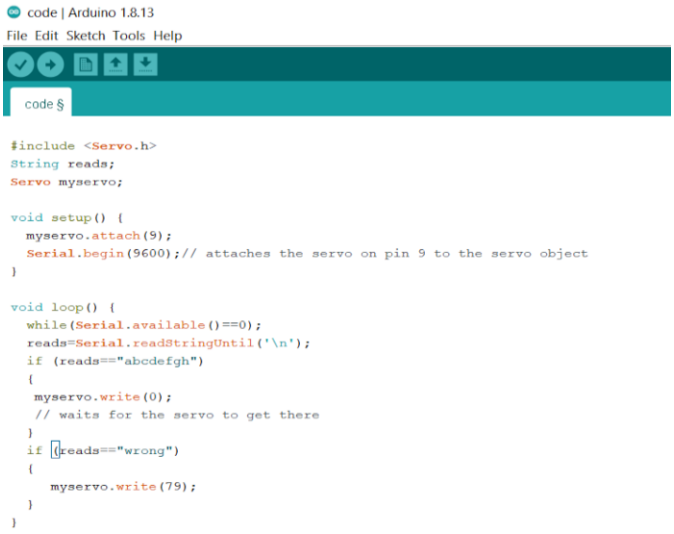

Figure 7. Arduino IDE Interface.

5. Result and Analysis

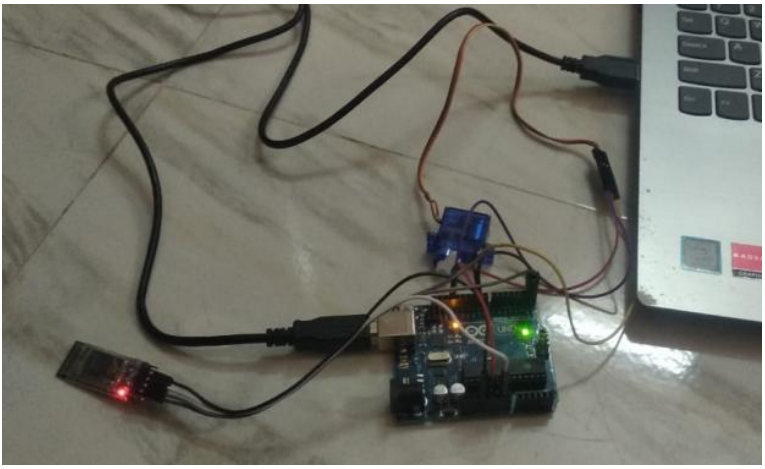

Figure 8. Working Model.

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Initially we need to connect our phones with the system by the application which we created on Kodular. Once we get connected we will be able to lock or unlock the door using the scroll button in the application. If we place our fingerprint on the unlock position then the application will send a particular value to the Bluetooth module and then the servo motor will rotate with a certain degree so that the door will be opened. When the person wants to access the door first they have to pair their smartphone to the system. Then the application collects information like a mobile number and then it sends the message to the person who wants to access the door. Once the OTP is verified the door will be unlocked for the user. The user can view the unauthorized person who tried to access the door and can stop them by disabling the unauthorized users. Compared to other systems our system has another layer of security in the form of Bluetooth password.

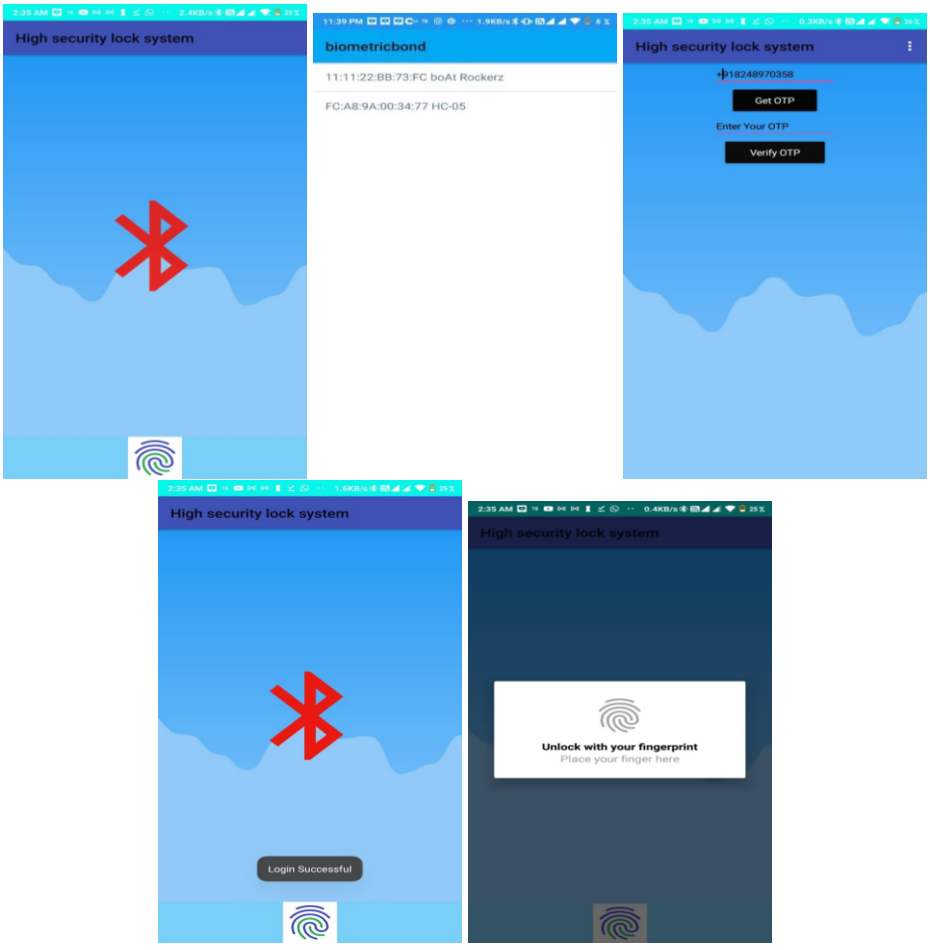

Figure 9. Auth Control Interface.

The user can view who are all the persons that have logged in the system by using Firebase. If we place our fingerprint again on the position then the value is fetched and sent to Arduino via Bluetooth module HC-05 and then the servo motor is rotated with the

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value and then the door gets unlocked. The result efficiency of the proposed system has a higher result rate compared to other existing systems mainly due to the whole system works under a simple algorithm called matching algorithm,which is used to compare previously-stored templates of fingerprints against user's fingerprints for authentication purposes.

6. Conclusion

The proposed system helps in implementing a design for home security using Arduino Uno and Bluetooth module. Our system is cost effective compared to the available lock systems on the market. Our fingerprint lock system has a high accuracy rate and seamless integration with the users and provides maximum security. It is designed in a modern way that a normal person can use. It is very compact in size and easy to integrate. The mobile application used here is also very simple and easy to use interfaces where they can easily interact with application to use the wireless biometric lock.

References

[1] Patil KA, Vittalkar N, Hiremath P, Murthy MA. Smart door locking system using IoT. Int Res J EngTechnol (IRJET). 2020;7(5):3090-4.
[2] Firdosh S, Shikha PK, Durgam B, Begum N, Singh SK. Password based door locking system using microcontroller. International Journal of Scientific Research in Computer Science, Engineering and Information Technology, IJSRCSEIT. 2017;2:1-5.
[3] David OA, Chinaza M, Jotham O. Design and implementation of a door locking system using android app. International Journal of Scientific & Technology Research. 2017;6(8):198-203.
[4] Varughese SE, George M, Anand J. Content Based Image Retrieval Technique on Texture and Shape Analysis using Wavelet Feature and Clustering Model. International Journal of Enhanced Research in Science Technology & Engineering. 2014 Aug;3(8):224-9.
[5] Paul P, Al Achib MA, Hossain HS, Hossain MK. Smart Door Lock Using Fingerprint Sensor. BRAC University. 2019:1-13.
[6] Rao BV, Chaitanya PA, ruchitha Reddy A. Smart Door Unlock System using Fingerprint. Pramana Research Journal. 2019;9(3):756-61.
[7] Baidya J, Saha T, Moyashir R, Palit R. Design and implementation of a fingerprint based lock system for shared access. In2017 IEEE 7th Annual Computing and Communication Workshop and Conference (CCWC) 2017 Jan 9 (pp. 1-6). IEEE.
[8] Sravani P, Knnappan S. High Security Door Lock System by Using Android Mobile with Bluetooth.
[9] Prabhakar AY, Oza SK, Shrivastava N, Srivastava P, Wadhwa G. Password Based Door Lock System. International Research Journal of Engineering and Technology (IRJET). 2019 Feb;6(2):1154-7.
[10] Rahman MM, Ali MS, Akther MS. Password Protected Electronic Lock System for Smart Home Security. International Journal of Engineering Research and Technology. 2018;7(4):541-4.
[11] Rathod K, Vatti R, Nandre M, Yenare S. Smart door security using Arduino and Bluetooth application. International Journal of Current Engineering and Scientific Research (IJCESR). 2017 Nov;4(11):73-7.
[12] Anand J, Flora TA, Philip AS. Finger-vein based biometric security system. International Journal of Research in Engineering and Technology eISSN. 2013 Dec;2(12):197-200.
[13] Anand KJ, Sivachandar K. An edge vector and edge map based boundary detection in medical images. International Journal of Innovative Research in Computer and Communication Engineering. 2013 Jun;1(4):191-3.
[14] Martin M, Štefan K, L'ubor F. Biometrics Authentication of Fingerprint with Using Fingerprint Reader and Microcontroller Arduino. Telkomnika. 2018 Apr 1;16(2):755-65.
[15] Patil AV, Akshay S, Patgar C, Prakash S, AJ SK. Android Based Smart Door Locking System. International Journal of Engineering Research & Technology (IJERT). 2018;6(13):1-4.

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Footstep Power Generating System

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Abstract. The power is generated by human motion while walking on the piezoelectric sensor, which is pressed and produces kinetic energy, which is then converted into electrical energy. The generated energy is stored in the battery. The energy in the battery is used to turn on the street lights using the LDR Sensor when the sun's beam becomes dull, and to pass water to the grass using the motor with the help of the soil moisture Sensor when the soil becomes moisture. And also used for charge the mobile phones using the charging port which is installed in the park and to be used for other purposes in the park. All the data is get tracked and stored in the IOT for continuously monitoring and for future purpose.

Keywords. piezoelectric sensor, IoT, LDR sensor, soil moisture sensor.

1. Introduction

India is a developing country that has been ranked as Asia's second largest energy user since 2008. India's energy demand will continue to rise as the country develops, but the country's power generation capacity will be inadequate.

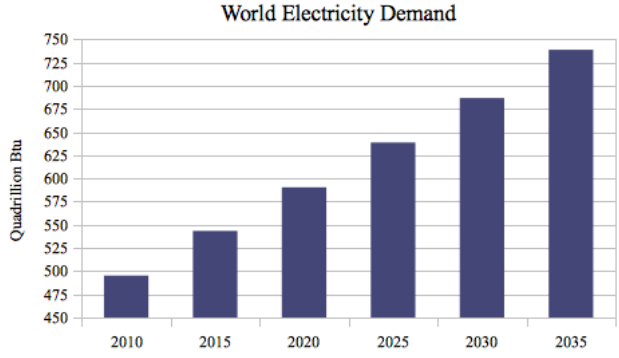

Figure 1. World Electricity Demand

Walking is the most popular human activity. Every day, humans walk for a short time, and the energy they lose by walking is tapped and converted into electrical energy. For densely populated countries like India, implementing waste energy produced by hu-

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man motion is critical. Many villages in India also lack access to electricity. Rather than focusing on conventional oil, we are now focusing on non-conventional energy. Conventional energy consumption is roughly equivalent to non-conventional energy usage. As a result, we will reduce waste that is detrimental to the atmosphere while still saving money. It is highly recommended because it is a one-time investment. In this project, we primarily aim to capture power produced by human motion using a piezoelectric sensor, then move the power to a battery, which then applies the power to street lights and motors. As a result, the footstep power generating system would aid in the development of the nation's economy.

2. Related Study

Sensor enabled Internet of Things for smart cities [1,2] reflects the fact that the world's population is increasingly increasing, putting pressure on cities. As a result, many government and private sector organisations are working to identify long-term solutions to these complex issues. In the last few years, IoT has drawn never-before-seen interest. In this paper, we look at the concepts of sensor-enabled Internet of Things, which links billions of sensors, and discuss their potential in the construction of smart cities. The main goal of this paper is to correct the flaw and review the current system's latest trends in order to recognise some of the major issues with sensor-enabled IoT. The author of [3] provided an overview of China's IoT growth, including policies, R&D plans, applications, and Standardisation. This paper is written from China's Points of view, To address the architecture challenge, the report portrays certain challenges in terms of technology, applications, and Standardisation, as well as proposing an open and general IoT architecture comprised of three platforms [3]. The main goal of [4] is to create a renewable electric energy source that can be used to charge a cell phone. This paper was generated in order to generate renewable electricity and reduce energy waste. A greater number of pedestrians use the subway, stairs, and highways, causing vibrations under the floors. IoT connected to piezoelectric material monitors energy generation and is linked to a multicontrol device for wireless network communication with a computer or cell phone. The system proposed by [5] describes the electrical energy is generated by walking in treadmill which is rotating in the circular motion the electricity is produced and that energy is stored in the battery and used for future purpose.

This system by [6] described the mechanical energy is converted into electrical energy by using the piezo electric sensor and then it is stored in the battery. RFID is the sensor used for phone charging purpose. RFID card is used to charge the mobile phones. The prototype design and testing of a hybrid power management system for a wireless sensor mote is designed by [7]. The sensor mote, which is installed on the outside of a high voltage transformer, generates electricity from the transformer tank vibration using a piezoelectric cantilever. The authors of [8] proposed a decision-making procedure to assist a city energy manager in evaluating the most cost-effective energy retrofit plan for an existing public street lighting system across a large metropolitan area. The proposed decision model aims to maximise energy consumption reduction while also achieving an optimal allocation of retrofit actions among street lighting subsystems, all while making efficient use of the available budget. A quadratic knapsack problem is used to express the resulting optimization problem.

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3. Existing System

In the current scheme, human labour is needed to maintain park zones for watering purposes. We will deal with new techniques in order to provide an effective and automated process.

4. Block Diagram

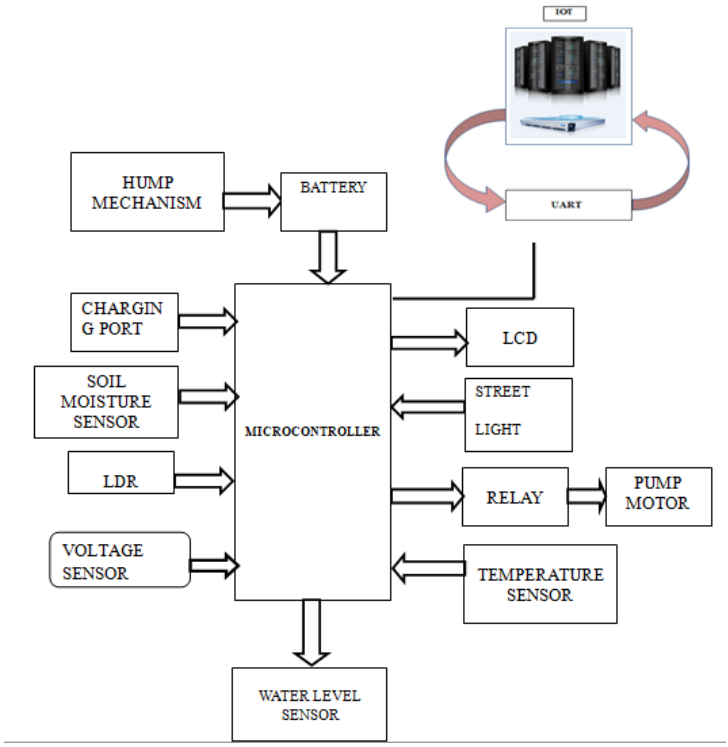

Figure 2. Block Diagram for Footstep Power Generating System

In Block diagram, Electrical energy is produced by people walking over the ground surface. Using a special arrangement known as a Hump Mechanism (Figure 3) , this electrical energy can be used to generate electricity. By allowing the people to walk over the piezo electric sensor it undergone some of pressure and here the kinetic energy is converted into electrical energy by the way the electrical energy is stored to the battery. The energy produced is stored in a battery and used in a variety of ways using Arm Microcontroller which is shown in the Figure 2. We also use the Internet of Things (IoT) to constantly track soil moisture in park zones. We can power the pump motor automatically via IOT and for watering purposes in the park zones with the water supply present within the parks whenever the soil moisture is dry.

The electricity that is used is often used to switch on street lights. Just when the sun's rays become dull are the street lights switched on. This improves battery life and

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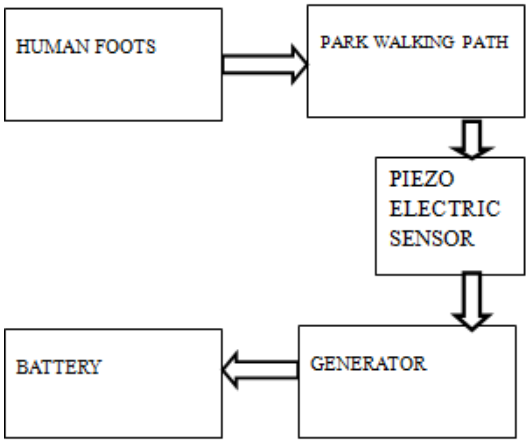

Figure 3. Block diagram for Hump Mechanism

the efficient use of renewable energy. IOT is constantly track temperature in the park and the temperature degree is stored in IOT server. We can also charge our Mobile phones through charging port which is in the park. Those who haven't have charge in their mobile during emergency situation, they can charge their phones in the park. The water source in the park can be monitored using a water level sensor. The information from the various sensors is shown on the LCD and saved on the web server.

5. Result and Analysis

Figure 4. Hump Mechanism

We used a 22 Piezoelectric sensor in 1 Square ft.

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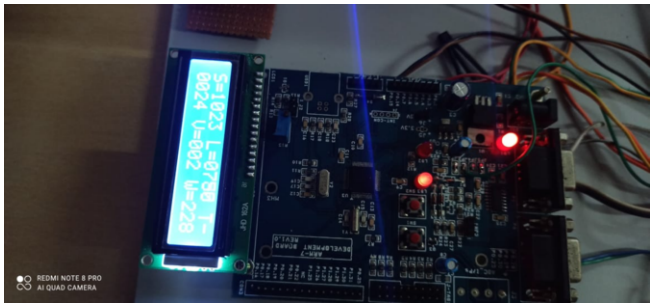

Figure 5. Sensors Values

As Piezoelectric Sensors power generating varies with different steps, we obtain
Minimum voltage = 1V per step
Maximum voltage = 5.2V per step
We took an average of 50kg weight pressure from a single person
Considering the steps of a 50kg weighted single person, the average calculation is:
It takes 800 steps to increase the battery's 1V charge. So, total steps required to increase 12V in battery is,

= (22*800)
= 17600 steps

We took an average of two steps in one second because we will be implementing our project in a populated area where footstep as a source will be available. Time required for 17600 steps is,

= 17600/(60*2)
= 17600/120
= 146.6 minutes (Approximately)

6. Conclusion and Future Works

We overcome the flaws in the current system with the footstep power generation system presented in this project, and every phase is automated, reducing man-made interference. We successfully implemented a new park automation model based on renewable energy. In the future, we can improve our project by installing piezoelectric sensors in public areas like streets, while people walking on the street and energy is generated. With this energy, we can turn on street lights that are useful to the public. In addition, by placing this piezoelectric sensor in tiles placed throughout the house, electric energy is produced every time someone steps on the tiles. We can use this energy for a variety of purposes, such as turning on a fan or lights etc.

References

[1] Sumi L, Ranga V. Sensor enabled Internet of Things for smart cities. In2016 fourth international conference on parallel, distributed and grid computing (PDGC) 2016 Dec 22 (pp. 295-300). IEEE.
[2] Li Z. Mountain environment detection and power transformer fault diagnosis based on edge computing. Arabian Journal of Geosciences. 2021 Jun;14(11):1-3.

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[3] Chen S, Xu H, Liu D, Hu B, Wang H. A vision of IoT: Applications, challenges, and opportunities with china perspective. IEEE Internet of Things journal. 2014 Jul 9;1(4):349-59.

[4] Ambrish R, Ashwini S, Dharun Surya MK, Karthick M, Kalaikumar T. Piezoelectric Based Automatic Generation Using IOT. In2019 Second International confrence on Nextgen Technologies. 2019 Mar (pp. 179-185).

[5] Gopinath R, Lavanya M, Arivalagan M. Power Generating using Human Foot Step With Piezo Electric Sensor and Treadmill. International Journal of Pure and Applied Mathematics. 2018;119(16):3171-82.

[6] Shradha P, Pratik B, Hemant C. "Advanced Foot Step Power Generation System using RFID for Charging". International Research Journal of Engineering and Technology. 2020 Feb;07(02):2408-12.

[7] de Villiers DJ, Kaplan S, Wilkinson RH. Energy harvesting for a condition monitoring mote. In2008 34th Annual Conference of IEEE Industrial Electronics 2008 Nov 10 (pp. 2161-2166). IEEE.

[8] Carli R, Dotoli M. A dynamic programming approach for the decentralized control of energy retrofit in large-scale street lighting systems. IEEE Transactions on Automation Science and Engineering. 2020 Feb 21;17(3):1140-57.

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Advances in Parallel Computing Technologies and Applications
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Secure and Privacy Based Home Patient Monitoring Internet of Things (HPMIoT)

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Abstract. The Internet of Things (IoT) refers to a network of physical objects that are embedded with sensors are able to collect and transfer information over a wireless network with human conciliation. In confined Home Patient Observation system light-weight wearable/embedded sensing element devices connected to record the patient health conditions. Adopting looming technologies like 5G and Mobile Edge Computing (MEC) a multi-staged journey builds ultra-low latency. The health care sector is drowning in information. An overflow of clinical records, patient history, complicated billing information, medical analysis and lot builds it very troublesome to manage such information at intervals the health care sector in a systematized approach. Escorted by IoT, since data mobility occurs, hackers gain access to clinical IoT device, acquire management and revamp data which oblige health partitioners take actions which will injury the health of their client. i) To overthrow security issues introduces Optimized blockchain with hyperledger fabric in edge-cloud computing is proposed. Since data stored in blockchain are immutable, the permission granted patients can only access their records using hash value. Thus, blockchains will provide an immutable audit trail of health facts. ii) Software Defined Network (SDN) deliver Quality of Service (QoS) steer further from network congestion.

Keywords. Mobile Edge Computing, Optimized Blockchain, Hyperledger, Software Defined Network, Audit trail.

1. Introduction

The health care sector is drenching in information. An overabundance of medical record, patient history, complicated billing information, medical analysis and lot of build it terribly strenuous to cope such data amid the health care sector in an organized way. According to research, Americans see an estimated nineteen distinct doctors in his or her life. Within the interim, the U.S. Government lacks a novel patient symbol code system, thereby creating it nearly unfeasible to rack up & supervise absolutely the information of every patient.

Electronic health records have assisted practices convert paper information into digital kind. But whereas this innovation has blessed physicians with an excelling proposal to carry on the data of their patients, electronic health records far and away not shared blatantly between systems. So, there's not a single source obtainable where all sole patient

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information resides. Presently, physicians use any of the three given models to access info.

- Push: Anamnesis is forward from one health professional to a different.
- Pull: One client requests information from determiner
- View: Clients with prerogative can view data inside another client's record

This is the time to figure out a contemporary technique to ameliorate the data care in the health care sector. Need a secure place where to save a patient's complete anamnesis and apposite information exhaustively for future utilize and analysis.

2. Home Patient Observing System

Unlike side patient observing systems, remote patient observing systems (sometimes referred to as "home patient observing systems") are used to monitor patients outside of the hospital ("remotely"). A smartwatch that sends knowledge about a couple of patient's heart activity to a doctor whereas the patient is at the food market is an associate example of a distinct version of the said electrocardiogram machine.

As remote patient observing [1,2] is an exigency field, new edges are regularly being found. So, for the sake of brevity, we'll target the 3 that appear to be driving growth within the field: reduced time in the hospital, shriveled admission and increased hindrance of medical exigency among older patients, and increased prerogative for patients.

Postoperative observing will be a time-intensive method for each physicians and patients alike. Though care suppliers are perpetually trying to find ways in which to cut back the time patients pay within the hospital, the emergence of the COVID-19 pandemic has placed extra-pressure on clinicians to mitigate potential infective agent exposure by decreasing contact time even more. Remote patient observing is one among the ways in which healthcare suppliers are grappling this drawback. By facultative physicians to observe their patients outside of the hospital or doctor's workplace, they scale back the time patients pay in either of these places while not risking patient health

As we age, we tend to become prone to healthcare issues we didn't ought to worry concerning once we were younger. For this reason, older patients tend to want a lot of care and a spotlight than younger patients. Remote patient observing is one methodology care suppliers are victimization to stay up with the wants of older patients. In fact, new proof is rising that even basic forms of remote patient observing (like telemedicine) will facilitate decrease admission and forestall medical emergencies among older patients.

Spending time during a hospital means suggests that golf shot your traditional life on hold. A patient being monitored in a hospital doesn't have the power to perform daily activities. On the surface, this could not appear as necessary because the different edges, however it's importance for each the patient and also the doctor. For the patient, this limitation suggests that less freedom—they can't pay time doing chores round the house, working, serving to their white-haired ones, etc. For doctors, having the ability to observe patients who are living their "everyday" lives can deprive them of insight that will be valuable for diagnosing or treatment. However, with remote patient observance devices like smartwatches, patients have the liberty to perform their daily activities and doctors have the power to pull together information from these activities which will improve the patient's health.

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2.1. Remote Patient Use Cases

Though there are several potential modlities where remote patient observance is used, there are 3 specific use cases wherever it shows potential to form the long run of diagnosing and treatment: polygenic disease care, chronic hindering pneumonic illness ("COPD") observance, and serous membrane qualitative analysis.

More than thirty-four million individuals within the United States have polygenic disease, consistent with the middle for illness management. Due to the tremendous value of polygenic disease on each patient and tending suppliers, the sphere of polygenic disease care has been a hotbed for remote patient observance innovation. Among the polygenic disease care realm, remote patient observance is being employed to enhance detection of glucose issues and different indicators of health deterioration which will result in hospitalization.

According to WHO, COPD is accountable for associate degree calculable five-hitter of all world deaths. It's calculable that "more than seventieth of COPD-related tending prices are consequences of emergency and hospital stays for the treatment of exacerbations." Though still within the early phases, continuous remote patient observance of COPD patients' physiological vital organ is showing promise in predicting potential exacerbations, up the standard of patient care, and lowering overall tending prices.

If a urinary organ fails, it will now no longer perform its job of removing waste from the blood. For a few patients with nephropathy, serous membrane dialysis associate qualitative analysis is a possibility that permits them to administer qualitative analysis reception comes with the danger that patients might not adhere to or accommodates their prescription. Remote patient observance of serous membrane qualitative analysis patients is showing promise in lowering hospitalization rates and reducing the quality of your time hospitalized patients keep within the hospital. The challenge of developing remote patient observance devices live at the intersection of the many technical disciplines. At a high level, they usually need advanced sensors, newest wireless technology, progressive cybersecurity systems, and sophisticated interconnect solutions[3,4]. The online of complexness that comes with developing a far-off patient monitor is very troublesome to navigate.

3. Literature review

Blockchain could be a distributed ledger that keeps records of transactions and/or information that participate during a network. Everyone seems to be able to be part of the network, have access to the information, verify transactions and communicate with the opposite members of it. Due to the suburbanized and distributed nature of Blockchain, the records of the ledger are maintained across totally different systems, devices, and locations within the network [5]. Finally, the outturn of blockchain systems is outlined because the variety of transactions that are hold on within the ledger per second. Typical Blockchain systems have restricted outturn, like Bitcoin that's restricted to seven transactions per second, due to the complexness of the Proof of labor accord mechanism that it uses [6]. Huh et al. [7] proposed a completely unique blockchain PKI management system victimization Ethereum and sensible contracts. The protection answer uses RSA public key cryptosystems wherever public keys are hold on in Ethereum and personal

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keys are saved on individual devices. Reyna et al. [8] study IoT and blockchain connectivity and its disputes. The survey work summarizes and discusses IoT devices which will be used as blockchain components, very important blockchain technologies and up thus far IoT Blockchain applications. IoT is gradually is becoming ready to use solutions in multitude of fields [9,10,11]. Dorri et al. [12] gifted a light-weight illustration of a blockchain throughout a home automation setting. The solution defines native blockchain doesn't use PoW and is controlled by the owner. The native blockchain is managed by a region miner in each home automation. The unicast communication between devices is secured with a shared key but these keys are generated by the native miner. The similar general framework supported blockchain for broader IoT applications is projected in by Dorri et al. in [13].

4. HPMIoT security challenges

1. Data security & privacy
2. Integration: multiple devices & protocols
3. Data overload & accuracy
4. Cost

5. 5G Edge

The advent of 5G has created edge computing even extra compelling, sanctionative significantly improved network capability, lower latency, higher speeds, and enlarged efficiency. 5G guarantees information speeds in additional than twenty Gbps and further the flexibleness to connect over 1,000,000 devices per sq. km. Communication service provider's (CSPs) can use edge computing and 5G to be able to route user traffic to rock bottom latency edge nodes throughout a rather safer secure and economical manner.[14,15] With 5G, CSPs may cater to amount of your time communications for next-generation applications like autonomous vehicles, drones, or remote patient observance. Information intensive applications that need giant amounts of data to be uploaded to the cloud will run many effectively by employing a combination of 5G and edge computing. With 5G and edge computing, developers can get to still specialize in creating native cloud applications even plenty of economical. The continual addition of newer and smaller edge devices would require changes to existing applications so enterprises will absolutely leverage the capabilities of 5G and edge computing. In some cases, applications can get to be containerized and run on an awfully tiny device. in numerous cases, the virtualized network parts should be compelled to be redesigned to require full advantage of the 5G network. Several different cases exist that need analysis as a part of the appliance development roadmap and future state design.

5.1. Advantages of Edge Computing

- No delays in information processing. The information stays on the "edges" of the IoT network and may be acted on straightaway.
- Real-time information analysis. Works nice once giant amounts of information ought to be processed and straightaway.

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- Low network traffic. The info is 1st processed domestically, and solely then sent to the most storage.
- Reduced operational prices. Information management takes less time and computing power as a result of the operation features a single destination, rather than circling from the middle to native drives.

IoT edge computing is an optimum answer for tiny immediate operations that ought to be processed with time unit rates. Once several tiny operations are happening at the same time, playing them domestically is quicker and cheaper. To address these security challenges, the infrastructure upstream within the native edge might need further security issues to deal with. Additionally, with multiple edges, the safety is currently distributed and a lot of advance to handle.

5.2. Benefits of Edge Computing over Cloud Computing

Edge computing may be a cluster of native small information centers that take a number of the burden off the cloud, a form of "regional office" that handles native computing tasks rather than causing it to a central information center one thousand miles away.

It's not one thing which will replace cloud services, however rather a complement to that. The main advantages of edge computing over cloud computing are, better information management, lower property prices and higher security practices, reliable, uninterrupted network, lower connectedness costs and greater security practices. Edge computing permits you to filter sensitive information at the supply instead of send it to the central information center. Less transfer of sensitive info between devices and therefore the cloud suggests that greater security for you and your customers. And by reducing information transport and storage needs through tradition ways, most IoT comes may be achieved at way less price. Blockchain is suburbanized, whereas Private Blockchain is centralized

6. Block Chain

Blockchain database does exist.A block chain is a kind of database because it is a ledger that stores information in datastructures called blocks.On the other hand, a traditional database is a data structure used for strong information. A blockchain is actually a dig-

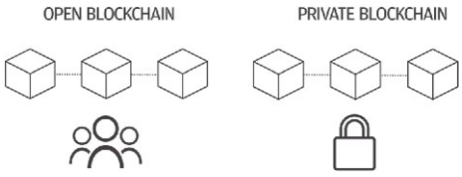

Figure 1. Block Chain Classification

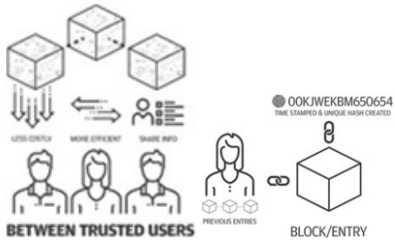

Figure 2. Block chain Security

ital ledger of that's duplicated and distributed across the complete network of pc systems on the blockchain. Figure 1. illustrates the categories of Blockchain Open or Public

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and personal Blockchain. Hashing, as in Figure 2, may be a unidirectional perform that scrambles plain text to engender a novel message digest. With a properly designed algorithmic rule, there is no process to reverse the hashing method to reveal the aboriginal passcode. An intruder who steals a file of hashed passcode should then guess the passcode. Here's however it works: A user enters a passcode and an ID in a very browser and sends it (preferably over a secure link) to the authentication server. The server uses the ID to seem up the associated message digest. The passcode submitted by the user is then hashed with the similar algorithmic rule, and if the resultant message digest matches the one cached on the server, it is authorized. During this citation the server doesn't store or got to see plain-text passwords. Stealing hashed files will the intruder very little smart as a result of the intruder cannot reverse the hashing citation.

7. Blockchain, a Distributed Ledger Technology (DLT)

Block chain, a Distributed Ledger Technology (DLT), is concentrated on making trust in associate suspicious scheme, creating it a probably strong cybersecurity technology. The ledger system is localized; however, data is transparently out there to members of the particular blockchain. Hyperledger material is associate open, proven, enterprise-grade, distributed ledger platform. It's advanced privacy controls thus solely the info need gets shared among the "permissioned" (known) network participants. Like banking, the healthcare sector endures a continuing barrage of cyber-attacks. In fact, health care experiences double the quantity of phishing emails and malware attacks of the other sector. The distribution of solely bound data to documented health care professionals ensures that cybercriminals cannot access all acknowledgeable aspects of an individual's health record. Edge computing/a distributed compute architecture can provide an infrastructure for blockchain nodes to store and verify records. Stores information in a chain shaped data structures called blocks. Hyperledger is a permissioned blockchain platform, which means that it is highly secured. Hash function turns text into a set of numbers and letters. Hash value contains hash generated from the record+last hash and Nonce at end. The advantages of Hyper ledger fabrics are permissioned network, confidential transactions, pluggable architecture and easy to urge started

8. Auditing distributing ledgers and blockchains

A distributed ledger, or distributed ledger technology, is usually termed to as blockchain technology. It's an agreement of replicated, shared and synchronous digital information, that is geographically unfold across multiple sites, countries or establishment with no administrator or centralized information storage. A distributed ledger is actually an immutable info maintained among a collection of nodes or computing devices.

8.1. Auditors

The technological advantage of utilizing a distributed ledger, whether or not public or non-public, within the auditing method include:

- Decentralization — the peer-to-peer style of blockchain eliminates the utilization of a sure central third party

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- Encryption — preservation of consumer privacy through encrypted communication
- Immutability — virtually fraud-proof database of information

Auditing features a distinctive need for distributed ledgers and blockchain technology distinct from alternative industries since this new technology will greatly increase audit potency. Is it necessary for accounting corporations that potency is managed to assist with audit rating, the quantity of purchasers managed and overall client satisfaction. An audit is often extraordinarily meticulous, with auditors achieving supporting documentation to verify transactions. Audit groups can get to adapt to utilize this new technology in an efficient manner.

9. Architecture

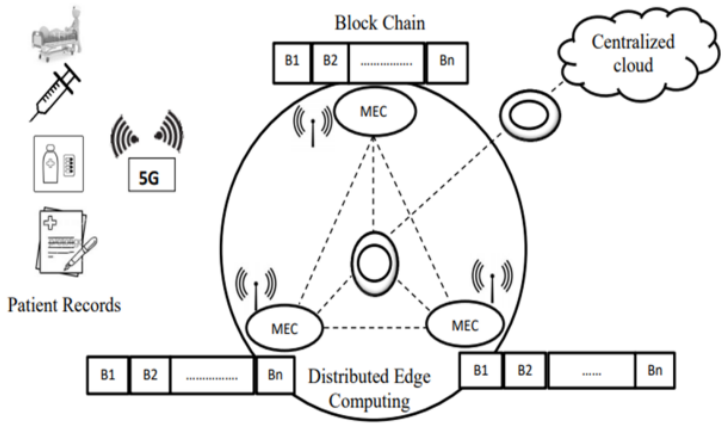

Figure 3. Architecture of HPMIoT

In the architecture of HPMIoT, Figure 3. the health records of a home monitoring patient's were transferred the distributed edge computing framework through 5G network. In edge computing data processed at the edge of the network which is close to the originating source and filters sensitive data at the source. It transfers only a few sensitive information between device and the cloud which provides better security. Edge computing reduces transport and storage requirement .Edge computing is mainly preferred in remote locations, where there is limited or no connectivity to a centralied location. Records are distributed over the distributed blockchain. Block chain consists of blocks and each blocks have more than 5,000 nodes, where the nodes checks validity of the records which is requested to access. Each nodes checks validity. If majority of nodes approves the request as valid, then it will be written into a block, changing one entry will not be allowed since all the nodes will not be allowed since all the nodes will have the original hash. Each block refers to the previous block and together make the block chain. If hackers wants to alter data he need to change the previous hash too. Nounce is the number used only once, added with this entry will make more complicated for hacking those hashed records. Block chain updates itself every 10 minutes.

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10. Conclusion

In future smart healthcare, machines are expected to take decisions and response according to the task. Real-time processed data is essential. Edge computing plays an important role in decision time which is more important, especially in 5G based network. Distributed ledgers have taken central stage in technology innovation within the business world as this technology will disrupt current best practices. Utilizing distributed ledgers and blockchains among accounting, specifically auditing, will improve audit potency and audit quality. Since data stored in blockchain are immutable, the permission granted patients can only access their records using hash value this gives security to the system.

References

[1] Darwish A, Hassanien AE. Wearable and implantable wireless sensor network solutions for healthcare monitoring. Sensors. 2011 Jun;11(6):5561-95.

[2] Aditya RR, Ajay H, Balavanan M, Lalit R, Anand J. A Novel Cardiac Arrest Alerting System using IoT. International Journal of Science Technology & Engineering. 2017 April;3(10):78-83.

[3] Anand J, Dhanalakshmi M, and Perinpam J. Smart Indication System for Spinal Cord Stress Detection. International Journal of Recent Technology and Engineering. 2019 Sep;8(3):6164-6168.

[4] Conoscenti M, Vetro A, De Martin JC. Blockchain for the Internet of Things: A systematic literature review. In2016 IEEE/ACS 13th International Conference of Computer Systems and Applications (AICCSA) 2016 Nov 29 (pp. 1-6). IEEE.

[5] Zheng Z, Xie S, Dai HN, Chen X, Wang H. Blockchain challenges and opportunities: A survey. International Journal of Web and Grid Services. 2018;14(4):352-75.

[6] Zheng Z, Xie S, Dai H, Chen X, Wang H. An overview of blockchain technology: Architecture, consensus, and future trends. In2017 IEEE international congress on big data (BigData congress) 2017 Jun 25 (pp. 557-564). IEEE.

[7] Huh S, Cho S, Kim S. Managing IoT devices using blockchain platform. In2017 19th international conference on advanced communication technology (ICACT) 2017 Feb 19 (pp. 464-467). IEEE.

[8] Reyna A, Martín C, Chen J, Soler E, Díaz M. On blockchain and its integration with IoT. Challenges and opportunities. Future generation computer systems. 2018 Nov 1;88:173-90.

[9] Lee I, Lee K. The Internet of Things (IoT): Applications, investments, and challenges for enterprises. Business Horizons. 2015 Jul 1;58(4):431-40.

[10] Dimitrov DV. Medical internet of things and big data in healthcare. Healthcare informatics research. 2016 Jul 1;22(3):156-63.

[11] Sai Ramesh L, Sundar SS, Selvakumar K, Sabena S. Tracking of Wearable IoT Devices Through WAP Using Intelligent Rule-Based Location Aware Approach. Journal of Information & Knowledge Management. 2021 Feb 29;20(supp01):2140005.

[12] Dorri A, Kanhere SS, Jurdak R, Gauravaram P. Blockchain for IoT security and privacy: The case study of a smart home. In2017 IEEE international conference on pervasive computing and communications workshops (PerCom workshops) 2017 Mar 13 (pp. 618-623). IEEE.

[13] Dorri A, Kanhere SS, Jurdak R. Towards an optimized blockchain for IoT. In2017 IEEE/ACM Second International Conference on Internet-of-Things Design and Implementation (IoTDI) 2017 Apr 18 (pp. 173-178). IEEE.

[14] Wang Y. Structural strength of loess in mountainous areas and optimization of rural public management services based on 5G Internet of Things. Arabian Journal of Geosciences. 2021 Aug;14(15):1-2.

[15] Wu F. Monitoring of ocean surface circulation and swimming athletes' physical training data based on IoT perception. Arabian Journal of Geosciences. 2021 Aug;14(15):1-8.

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An Efficient Algorithm for Movie Recommendation System

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Abstract. Now a day's recommendation system has changed the fashion of looking the items of our interest. OTT Movie Application Recommendation for mobile users is crucial. It performs a complete aggregation of user preferences, reviews and emotions to help you make suitable movies. It needs every precision and timeliness, however,this can be info filtering approach that's accustomed predict the preference of that user. Recommender System may be a system that seeks to predict or filter preferences in keeping with the user's selections. The very common purpose where recommender system is applied are OTT platforms, search engines, articles, music, videos etc During this work we tend to propose a Collaborative approach-based Movie Recommendation system. it is supported collaborative filtering approach that creates use of the knowledge provided by users, analyzes them so recommends the flicks that's best suited to the user at that point. The suggested motion picture list is sorted in keeping with the ratings given to those movies by previous users. It conjointly helps users to search out of their selections supported the movie expertise of alternative users in economical and effective manner while not wasting a lot of time in useless browsing [1]. Therefore, we tend to offer the item-oriented methodology of the analysis of social network as the steering force of this method to further improve accuracy within the recommendation system. We tend to propose economic healthcare associates during this paper The algorithmic rule of the Film Recommendation supported improved KNN strategy that measures simpler advisory system accuracy. However, to evaluate performance, the k closest victimized neighbors, the maximum inner circles, as well as the basic inner strategies are used [2]. The exception to this is the projected results, which use algorithms to check for (supposedly) involvement.The performance results show that the projected strategies improve additional accuracy of the Movie recommendation system than the other strategies employed in this experiment.

Keywords. Movie Recommendation, KNN, Correlation, IMDB, Search by keywords.

1. Introduction

Individuals' everyday lives are getting progressively reliant on portable administrations as cell phones become more common. Shrewd gadgets furnish individuals with organization subtleties, item data, advertising data, and proposal data. Quite possibly the main employments of versatile administrations is film suggestion. A film recommender frame-

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work has end up being a successful instrument for giving clients important film suggestions. The proposals are given to help clients in managing data over-burden by helping them in rapidly and effectively finding appropriate films. In contrast to the market for PCs (computers), portable administrations place a more prominent spotlight on idealness, requiring specialist organizations to measure and quantify information quickly. Subsequently, film proposals in portable administrations should be stressed regarding both guidance precision and, therefore, practicality. Recommender Frameworks produce proposals; the purchaser can favor them dependent on their inclinations, and ought to likewise give certain or unequivocal info, either quickly or later [3]. Clients' practices and ideas are routinely saved in the recommender data set and can be utilized to make new suggestions during ensuing client framework connections. Film proposal can be a complex and tedious cycle that requires an assortment of client inclinations, film types, etc. Accordingly, an assortment of idea strategies has been recommended to determine the issues [4]. customized ideas of the greatest quality give the client experience another measurement. Customized online suggestion frameworks have as of late been utilized to give different types of custom-made data to their clients. These frameworks are generally utilized in an assortment of utilizations and are getting more mainstream continuously. The recommender frameworks will be partitioned into two classifications:

1. Collaborative sifting approach
2. Content-based sifting approach

Things are suggested by a common sifting structure zeroed in on client as well as article closeness measures. The framework suggests things that are regular among comparable clients. There are a few advantages of Collaborative sifting. (i) It is content-free, depending exclusively on associations. (ii) Because individuals in CF give clear appraisals, genuine quality assessments of things should be possible. (iii) Since proposals depend on client likeness instead of thing closeness, it submits fortunate suggestions.

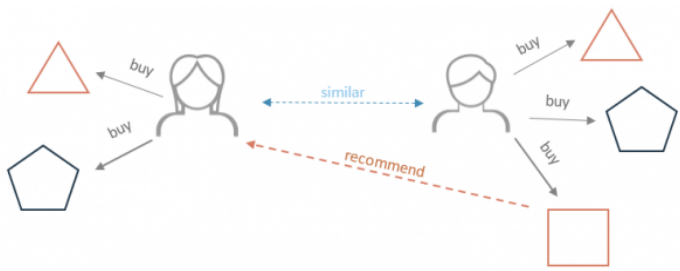

Figure 1. Collaborative filtering block diagram

Besides, clients' absence of cognizance of slant is a significant issue in film suggestion. Individuals are progressively ready to post their own audits online nowadays. Clients will communicate their assumptions and sentiments about motion pictures in their audits . As a result, the assessments passed on in these audits affect the decisions made by different clients [5]. Clients can peruse the audits, assess their own encounters, pick the most important surveys, erase those that are negative or possibly inconvenient, and settle on their own decisions and choices. As an outcome, the sound of audits can be a huge thought to consider while assessing a film. Likewise, watchers are destined

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to pick the movies that most of individuals like and overlook the movies that most of individuals' disdain. System extracts keywords from the search statement for various film descriptions, mines the keyword in the database and recommends a film based on a similar user view.We use a feelings database based on the keywords, together with the weight of the positivity or negativity in the database. We then classify it according to those feelings.

This is dependent on a suggestion process that gives clients different recommendations [6]. Clients would be prescribed movies using this system. When compared to existing systems, this system can yield more accurate results. The current system eats away at individual clients' evaluations. This system also has newly added features such as searching for recommendations [7] using keywords that matches with description. As every shopper could have completely different preferences, it should be pointless for shoppers World Health Organization have distinct tastes from the concepts given by the system. This method calculates the likenesses of shoppers so recommend films to them supported the ratings provided by different shoppers of comparable tastes. This will offer the client with a particular recommendation.

2. Methodology

The existing system works on individual users' rating and on the genre of the show. this could be someday useless, the users World Health Organization have completely differentcompletely different style from the recommendations shown by the system as each user might have different tastes. This technique calculates the similarities between completely different users then suggest show to them as per the ratings given by the various users of comparable tastes. The planned system may be a higher system than the other

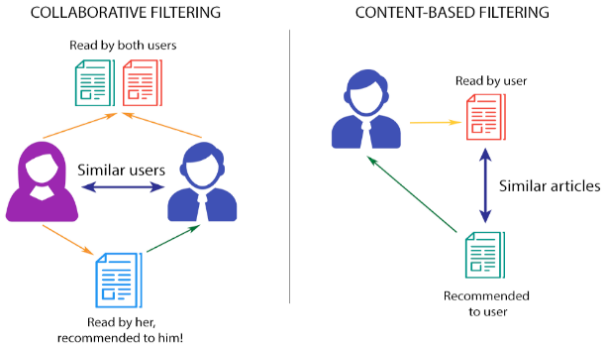

Figure 2. Difference between collaborative and content-based filtering

existing systems. this technique has accessorial the positive options of existing systems and has overcome the drawbacks of existing systems. The system uses item-based cooperative based mostly algorithms. within the existing system picture shows solely will be searched mistreatment picture show title however within the planned system they will be searched through key words that matched with description of the movie [8,9]. There are 3 main types in movie recommendation system as following:

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- Content Based: the advice system recommends different moving-picture shows that area unit just like that elite movie.

$$\text{"f(movie)} \rightarrow \text{"movie}$$

- Collaborative: the advice system recommends movies that area unit rated extremely by the similar users.

$$\text{f(movies, user)} \rightarrow \text{movie}$$

- This method combines previous approaches (that is, Approach 1 and Approach 2). most likely, most organizations use a hybrid approach to production recommender systems

In this paper we have executed the two methods namely Correlation Coefficient effect and K nearest neighbors. We have taken the dataset from the IMDB website where all the movies gets registered. We have implemented the program in a way that the movies will be recommended based on the similar user whose watching of movies will be similar.

2.1. Correlation coefficient

Correlation coefficients is a accustomed measure however sturdy a relationship is between 2 variables. There are many kinds of coefficient of correlation, however the foremost widespread is Pearson's. Pearson's correlation (also known as Pearson's R) could be a coefficient of correlation unremarkably utilized in statistical regression. If you're beginning get into statistics, you'll in all probability find out about Pearson's R initial. In fact, once anyone refers to the coefficient of correlation, they're typically talking concerning Pearson's.

The main element of our moving picture recommendation system depends on a learning conception known as cooperative filtering. cooperative filtering bases its suggestions solely on users' past knowledge and preferences, largely within the style of reviews (albeit their area unit alternative strategies of gathering user preferences). To understand this, I'll illustrate associate example of user-user cooperative filtering that utilizes the closest neighborhood rule. Say I enjoyed looking at moving picture A, movie B, and moving picture C, and my friend enjoyed looking at moving picture A, movie B, and moving picture D. The cooperative filtering rule can possibly counsel that I'll get pleasure from looking at moving picture D, and my friend can get pleasure from looking at moving picture C supported our previous positive preferences. It is smart on behalf of me and my friend to get pleasure from our moving picture recommendations as a result of we have a tendency to share similar preferences. Of course, this isn't continually the case, however the percentages become more and more in our favor once we begin analyzing larger datasets of user reviews.

2.2. KNN Nearest Neighbors

In this section, as a method to recommend movies based on collaborative approach, we present the KNN classification algorithm [10]. The KNN contribution is two-fold. Next, it computes a special K value ideal for that patient for each unknown patient u0. Second, precise measurements of distance are employed. A normalization function is used for the set N$\subset$A to scale the numerical characteristics to the interval[0,1] to prevent wide range

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characteristics from outweighing those with narrower ranges, given a set U of patients defined by a set of characteristics.

$$\widehat{V_{u_i a_j}} = \frac{V_{u_i a_j} - \min_{u_n}(v_n.a_j)}{\max_{u_n}(v_n.a_j) - \min_{u_n}(v_n.a_j)} \tag{1}$$

As we have conveyed above, for both supervised and unsupervised issues[11], the above algorithm can be used. To forecast any latest data values, the above algorithm uses 'function similarity' [12]. This proposes that a rating relying on coordinates of the training set values is applied to the new phase. Computing the interval between the initial point and each point taken from the training dataset is the initial step. There are different ways to measure this distance, including different kind of distance such as Euclidean distance, Manhattan Distance and Hamming Distance. The three mentioned distance calculated using below equations.

$$EuclideanDistance = \sum_{i=1}^{k}(x_i - y_i)^2 \tag{2}$$

$$ManhattanDistance = \sum_{i=1}^{k}|x_i - y_i|^2 \tag{3}$$

$$HammingDistance(D_H) = \sum_{i=1}^{k}|x_i - y_i| \tag{4}$$

$$x=y \Rightarrow D=0 \mid x \neq y \Rightarrow D=1$$

At an incredibly low approximation of k, the model overfits the training results, resulting in a high error rate on the range accepted. If closely observed, the validation error curve reaches a minimal value of k=9. This value of k is the optimal calculation of the model. This curve is known as the 'elbow curve' that can be used to determine the value of k.

3. Results and Discussion

As in the above discussed methods and operations. we are able to build the recommender system for recommending movies by user-based collaborative approach and an additional feature which is helpful to get recommendation of movies, based on keywords in search phrase. The movies are recommended when the keywords have similar words in the description of the movies. Both the correlation and KNN methods executed successfully, and they give accurate and timeliness result. This recommendation system recommends movies based on what similar users watch and genre the user usually watch. The execution of additional feature that is getting recommendations through searching keywords is successful. A test case was executed for finding recommendation of movies based on searching keywords. For the input "Football player trains a woman team" the

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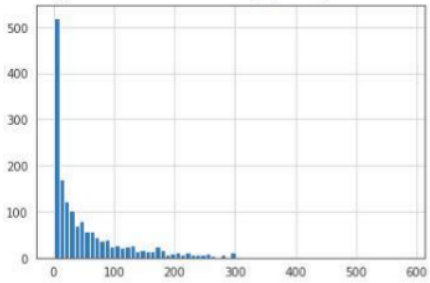

Figure 3. Histogram for movie Ratings

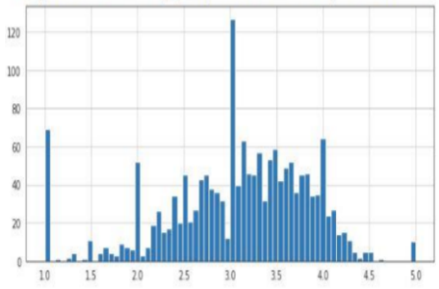

Figure 4. Number of movie ratings in the data set

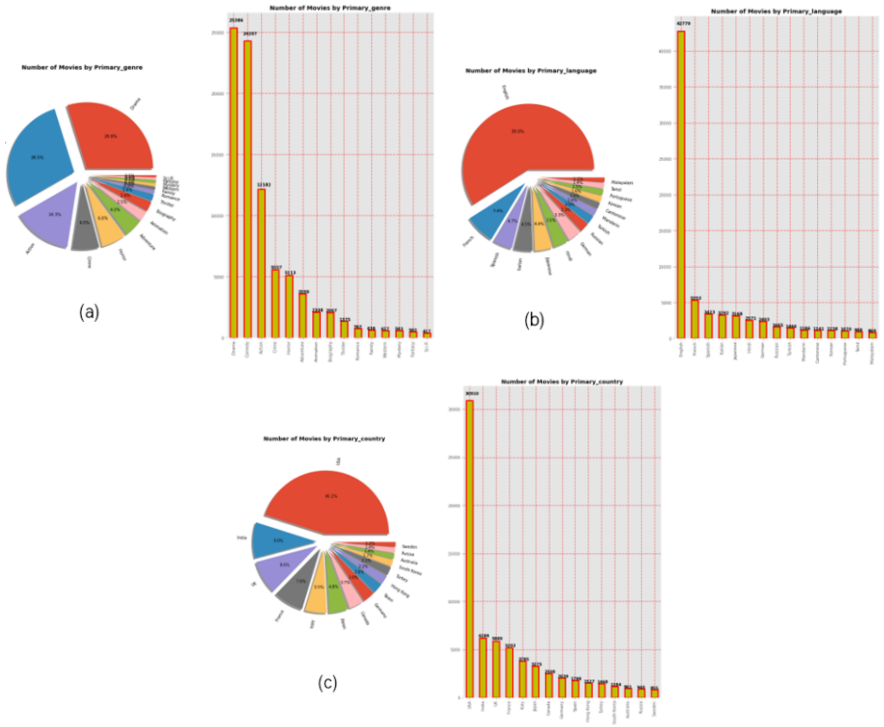

Figure 5. Data visualization.

output returned is “Bigil, What Men Want, The Sensei, Quan li Kou Sha Etc..”. The other test case for the input “Plane crashes immortal Amazonian war” the output returned is “Kosmos Anna 2000, Wonder Woman, Airport ‘80, Last Flight to Abuja Etc..”. This shows that this feature’s result is successful.The code implementation was done with the help of google colabs.Google colab is a software tool by Google Research which allow anyone to create and work the python code on a web-browser. It is very well suited to Data Analysis, Machine Learning(ML) and education. It is a free Jupyter notebook service and does not require a setup for use, also provides free access to computing resources along with GPUs. For the input “Bigil” output was successful. The Recommender sys-

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tem recommended “Sarkar, Their, Pailwaan, Viswasam...etc.” for the input “Bigil”. For the input “Wonder Woman” output was successful. The Recommender system recommended “Black Panther, IT, A Quiet Place, Herediatery...etc.” for the input “Wonder Woman”. Importing the packages and reading the dataset was done. The required dataset

```
get_recommendations_for('Wonder Woman')
| Movie Name: Black Panther
| Director: Ryan Coogler
| Cast: Chadwick Boseman, Michael B. Jordan, Lupita Nyong'o, Danai Gurira, Martin Freeman, Daniel Kaluuya, Let
e, Sterling K. Brown, Angela Bassett, Forest Whitaker, Andy Serkis, Florence Kasumba, John Kani, David S. Lee
| Language: English, Swahili, Nama, Xhosa, Korean
| Genre: Action, Adventure, Sci-Fi
| Year: 2018
| Country: USA
| Description: T'Challa, heir to the hidden but advanced kingdom of Wakanda, must step forward to lead his peo
d must confront a challenger from his country's past.
| Rating: 7.3
| Total Votes: 597058
```

Figure 6. The Recommender system output for “Wonder Woman”.

was loaded. Operations like view head() of data, info of data were done. Importing the required datasets and analyzing the datasetdone was used to find recommendations for movies based on keywords search. .Thevisualization of data based on primary genre of the movie is done. The pie graph shows amount of movie each genre has. From the chart drama and comedy has highest with 29.8% and 28.5%.The Figure 4 is represents the visualization techniques to show ratings and number of ratings for the movies in the data set Figure 5 help us visualize the dataset effectively. The first plot tells us how the movies are segregated according to genre i.e drama, action, romance etc. The second plot tells us how the movies are segregated according to language i.e English, hindi, Spanish etc. The third figure tells us how the movies are segregated according to where the movie is released i.e US, UK, India etc. The correlation score tells us how close the movies above are related to the movie we provided as an input. Closer its value to 1, the more chances the user may like the movie recommended by our recommender. The Recommender system recommended “Black Panther, IT, A Quiet Place, Herediatery...etc.” for the input “Wonder Woman” can be verified in Figure 6. Movie recommendation for given key-

```
[29]: query="football player trains a woman team"
search_result=searchFAISSIndex(imdb_movies,"id",query,index,nprobe=10,model=model,topk=20)
search_result=search_result[['id','description','title','cosine_sim','L2_score']]
search_result
#expected bigil
```

```
Batches: 100% 1/1 [00:00<00:00, 22.04it/s]
```

Out[29]:

	id	description	title	cosine_sim	L2_score
19	83217	A former football player struggles to train a ...	Bigil	0.567901	0.929622
17	80897	A woman is boxed out by the male sports agents...	What Men Want	0.547876	0.950919
9	46296	In 1985 Colorado, a long-absent woman, profici...	The Sensei	0.539643	0.959538
13	70509	A young woman trains to become a badminton cha...	Quan li kou sha	0.517158	0.982692
16	77080	A female recording artist encounters the misog...	Stadium Anthems	0.511985	0.987942
14	70644	A self-help seminar inspires a sixty-something...	Hello, My Name Is Doris	0.502626	0.997371
12	63611	A neuron-transfer scientist experiments with t...	Aurora	0.494476	1.005509
5	30229	A female Senator succeeds in enrolling a woman...	Soldato Jane	0.490444	1.009511
8	44292	A determined woman works with a hardened boxin...	Million Dollar Baby	0.486515	1.013396
6	43651	A single mom plays in the local ice hockey tea...	Chicks with Sticks	0.483045	1.016813

Figure 7. Movie Recommendation keyword ”Football player trains a woman team” Output

words. For the input “Football player trains a woman team” the output returned is “Bigil, What Men Want, The Sensei, Quan li Kou Sha Etc..”. This shows that this feature’s result is successful.

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4. Conclusion and Future Scope

In this project, a better movie recommendation system was built successfully and new features such as searching movies through description were added. When user searches using keywords, the system will recommend movies which have similar keywords in its description. We studied what a recommender system is and how we can create it in Python using only the Pandas library. The algorithm we used is good but real time system use a very complex algorithm. This algorithm can be embedded into a movie streaming app. That way users can get the best out of the application. This algorithm can also be used just for viewing a movie details just by letting it know a part the story of story that will happen. Latest movies are given preference over older ones for better user experience. This project can be forked and can be given better features according to requirements.

References

[1] Sadhana SA, SaiRamesh L, Sabena S, Ganapathy S, Kannan A. Mining target opinions from online reviews using semi-supervised word alignment model. In2017 Second International Conference on Recent Trends and Challenges in Computational Models (ICRTCCM) 2017 Feb 3 (pp. 196-200). IEEE.

[2] Sulthana AR, Jaithunbi AK, Ramesh LS. Sentiment analysis in twitter data using data analytic techniques for predictive modelling. InJournal of Physics: Conference Series 2018 Apr 1 (Vol. 1000, No. 1, p. 012130). IOP Publishing.

[3] Zhao ZD, Shang MS. User-based collaborative-filtering recommendation algorithms on hadoop. In 2010 third international conference on knowledge discovery and data mining 2010 Jan 9 (pp. 478-481). IEEE.

[4] Jain A, Vishwakarma SK. Collaborative filtering for movie recommendation using RapidMiner. International Journal of Computer Applications. 2017 Jul;169(6):29-33.

[5] Kumar M, Yadav DK, Singh A, Gupta VK. A movie recommender system: Movrec. International Journal of Computer Applications. 2015 Jan 1;124(3):7-11.

[6] Bagci H, Karagoz P. Context-aware location recommendation by using a random walk-based approach. Knowledge and Information Systems. 2016 May 1;47(2):241-60.

[7] Desrosiers C, Karypis G. A comprehensive survey of neighborhood-based recommendation methods. Recommender systems handbook. 2011:107-44.

[8] Jeong WH, Kim SJ, Park DS, Kwak J. Performance improvement of a movie recommendation system based on personal propensity and secure collaborative filtering. Journal of Information Processing Systems. 2013;9(1):157-72.

[9] Inan E, Tekbacak F, Ozturk C. Moreopt: A goal programming based movie recommender system. Journal of computational science. 2018 Sep 1;28:43-50.

[10] Hamed A, Sobhy A, Nassar H. Accurate Classification of COVID-19 Based on Incomplete Heterogeneous Data using a K NN Variant Algorithm. Arabian Journal for Science and Engineering. 2021 Mar 4:1-12.

[11] Selvakumar K, Ramesh LS, Kannan A. Enhanced K-means clustering algorithm for evolving user groups. Indian Journal of Science and Technology. 2015 Sep 1;8(24):1-8.

[12] Dev AV, Mohan A. Recommendation system for big data applications based on set similarity of user preferences. In2016 International Conference on Next Generation Intelligent Systems (ICNGIS) 2016 Sep 1 (pp. 1-6). IEEE.

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Person Identification Using Face and Speech Recognition for Visually Challenged with Mask Detection

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Abstract. A system and method for facilitating a visually impaired person for identifying a person. The method includes the step of storing a plurality of instructions for facilitating the visually impaired person identify the person in front of them by their face and/or voice characteristics by updating our project with Mask Detection using OpenCv and keras. It includes the step of receiving voice signals from the person present in surrounding of the visually impaired person and includes the step of capturing the pictures of a particular person and their surroundings of the visually impaired person and storing the processed data into the database or any storage devices. The data will be processed to AWS server or any local storage for processing and determining the person with the help of the database we already have. After processing and identifying the person with the help of face and voice recognition modules the name is sent to the visually impaired user's phone in the form of a text message which will be read aloud by his phone's virtual assistant.

Keywords. Visually impaired, Voice signals, Database, Voice recognition, Virtual assistant, Mask Detection.

1. Introduction

This Structure goes likely an Briliant specialist which helps in carrying the earth nearer and nearer to the environment a supported spot over living for Visually obstructed individuals. The Person is seen, and the personality of the individual is gotten the message out about for the customer, which is another case that would be an issue to recognize and there is a probability of getting cheated and this ensures security and prosperity by alerting the user. The face acknowledgment (also simply called as face Recognition) [1, 2] is the one able to recognize and see a person by their facial characteristics. The face is multidimensional and consequently requires a ton of mathematical computations. Face affirmation system is essential and huge for giving security, mug shot planning, law approval applications, customer affirmation, customer access control, etc., and is commonly used for affirmation for various applications. These all applications require a compelling Face affirmation system.

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Figure 1. Face Recognition System (Courtesy from google)

1.1. Face Recognition

In Face recognition system, a predictable picture is given to the machine or framework, and through component extraction measure that image is checked against the information or simply the database as of late put to the side in the construction. Later the highlighted pictures will be taken out from the database existed.

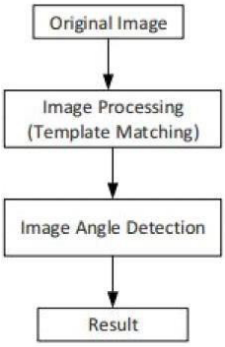

Figure 2. Workflow of Face-Recognition

In Face detection [3], a computerized picture is given to the system and through extraction in view of the highlights, that image is looked against the information base which is now put away in the framework. Features of the test picture will at that point be compared with the highlights of the information base. The least variation in the highlights will help in distinctive the profile of an individual in the test picture. Face identification was finished by utilizing "**Haar cascade classifiers**", that distinguished the appearances, and afterward the recognized countenances were being put away by utilizing python orders in an information base. Preparing was done so the photographs inside the information base were changed over to yml record for additional utilization in attestation measure. At last, assertion measure was finished by utilizing LBPH while keeping be cautious with a yml report made during setting up this cycle, if the picture of the individual before the camera created with the information base records, which construed that the capability between of two pictures didn't gather quite far, the entryway lock would open or, point of fact alert would begin.

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1.2. Speech Recognition

Discourse acknowledgment has two primary factors that influence the exhibition for example voice acknowledgment and order acknowledgment. At the point when the framework was prepared with the voice of individual A, it was difficult for the framework to look at the voice orders [4–6]. In offline system development of framework v3 module was utilized for SST which means transferred from discourse to text and TTS which means text is transferred to discourse which in addition offers an inherit port for the receiver. It can basically store 80 requests, so it isn't inside and out ideal to anticipate comparative requests with various voices, so a refreshing was made through setting up the framework with standard highlight and a customary tone. To avoid disillusionment as a result of much disturbances and contortion in the ecological variables, planning is done into some degree disorderly temperament to evade dissatisfactions while working with bad quality progressing tone orders and a substandard standard mic is used to get most extreme tone.

1.3. Mask Detection

This Face Mask Detection uses Artificial Networking to identify whether the person who came near to the person wears a mask or not. The Machine can be associated with any current or new mask recognition cameras to identify individuals with or without a cover. This Mask Detection has some special properties of detecting a person whether he/she wears a mask or not in a single or Group Environment. As a further process we are going to say for visually impaired person that the person who came near to him/her wears a mask or not.

2. Literature Survey

Throughout the most recent ten years, security of a Home and computerization frameworks is been picking up fame due to the improvement towards science field and the associative dangers of breaking in the framework. This thing imagines a sharp secretly masterminded on the two free and arising progressions through face affirmation, for the rationale of safety, and talk certification, for the robotization purposes. Likewise, the furthest down the line work done is examined quickly and why a withdrew structure was a pressing need to fill the opening in the constant progression shows presented in the related field [3, 7].

The related study presents an acknowledgment structure, will be useful for a visually challenged individual. The hand motion recognition framework and face acknowledgment framework has been prepared by specific calculations. In the Hand signal system, Skin concealing disclosure was completed in an YCbCr concealing space, in order to identified hand lifted distortion character motivation behind the hand was used where different features which is similar as fingertips, the point in the middle of fingers are being isolated. As indicated by banner Recognized, different undertakings can be performed like turning off lights and fans. The hand signal was seen with an exactness of 95.2% was refined certification was finished with an accuracy of 92%.

Expecting cover examination doesn't particularly think about, it can change the display truly the vast majority of the refined face acknowledgment techniques. Less amounts

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of facial highlights in the masked face cause challenges than other ordinary face acknowledgment procedures. In this way, the exactness pace of acknowledgment is diminishing. That is the reason the veiled face is being one of the majors concerned elements inside the space of face acknowledgment. Then again, the use of a profound learning network is more difficult on the grounds that the amount of preparing information isn't adequate to prepare the profound learning networks [8] for this application which powers to utilization of move learning. Lastly, this check cycle is solidified to perceive up-and-comers face by playing out the arrangement task inside a brought together Support Vector Machine (SVM) [9–12].

3. Existing Technologies

3.1. Be My Eyes

It is a mobile application which doesn't cost the user on installation. It associates outwardly weakened people with a volunteer through video talk for help with regular day-to-day activities. These volunteers can assist the needy people with checking the date of

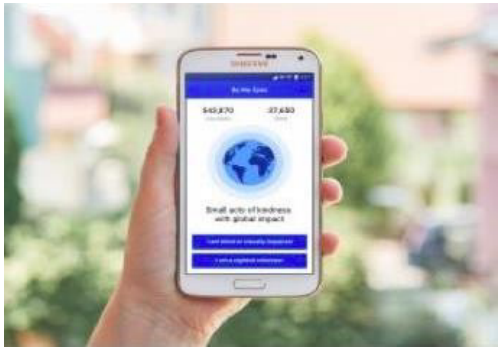

Figure 3. Be my Eyes application (Courtesy from google)

expiry on a container of milk or sort out what outfits to wear. It's an ideal method to associate the two completely different worlds and exchange knowledge from one another.

3.2. Brain Port

Brain Port uses electro-tactile method to assist blind people with direction, portability, and object identification. Accessible by solution, Brain Port involves a couple of camera-equipped shades that can be connected to a gadget that is set in the person's mouth. The gadget makes moving impressions or designs on the person's tongue that helps them in understanding or identifying the entity before them.

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Figure 4. Brain Port application (Courtesy from google)

3.3. The Eye See

This was developed by undergrads, the Eye See is a protective cap model intended to help the blind people to ”see” the surroundings. Also, it not only helps the users to describe the entities and people but also produces an alarming sound when the user is excessively nearer to an obstruction, making life safe and more secure.

Figure 5. The Eye see application (Courtesy from google)

4. Methodology

4.1. Speech Recognition

Talk affirmation, or talk to-message, is the limit with respect to a program or machine to recognize words communicated so anybody may hear and change over them into intelli-

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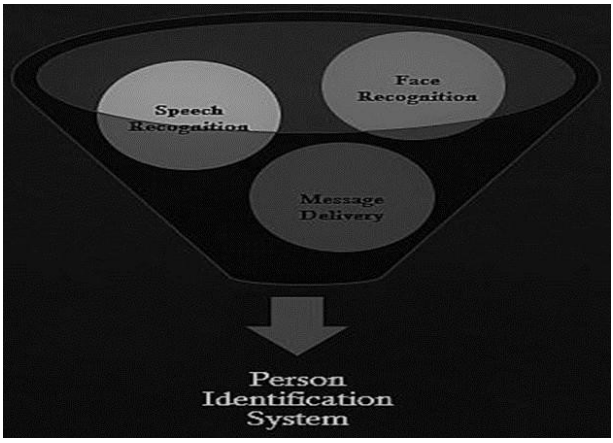

Figure 6. Design of Proposed System

gible substance. Basic talk affirmation programming has a limited language of words and articulations, and it may perhaps recognize these if they are spoken unmistakably. More unpredictable programming can recognize basic talk, different accents, and vernaculars. Talk affirmation works using figuring's through acoustic and language showing. Acoustic exhibiting addresses the association between semantic units of talk and sound signs; language showing matches sounds with word progressions to help perceive words that sound similar

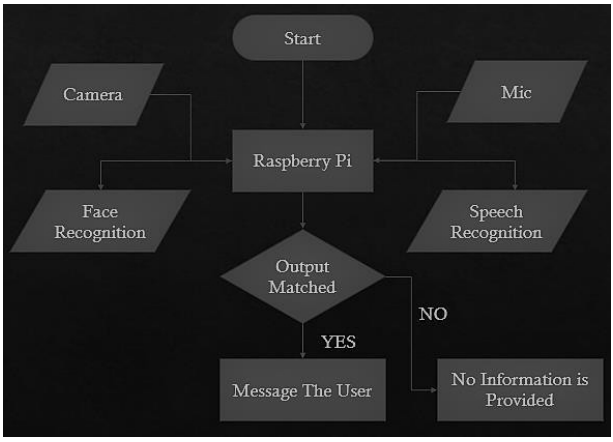

Figure 7. Workflow of Proposed System

4.2. Face Recognition System

This segment manages PCA and LDA for face acknowledgment. To begin with, we need a lot of Databases of pictures using which the figuring will be attempted. AT&T dataset pictures will be utilized. The underlying advance is to scrutinize all the dataset pictures that will be used for setting up the explanation [13]. In this section, we plate all the

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mathematical advances that will be executed on the microcontroller called as Raspberry Pi 3 embedded system board to realize the face affirmation structure on it. This portion is isolated into two segments for instance Preparing stage and the Recognition stage.

4.3. Mask Detection

In this part, we will examine Face discovery or detection which has different modules that go inseparably to make the structure run suitably. The underlying stage contains snapping the photo and Detecting the face in it. Pictures can be gotten dynamically from a USB webcam related to Processor or Machine .The duty of the face acknowledgment module is to recognize whether a face is available during the continuous application. The face recognition is finished by looking at an image and finding some example that proclaims if a face is available in the picture. We built up the face cover identifier model for identifying if individual is wearing a veil. We have prepared the model utilizing Keras with network design. This Mask Detection module has some special properties of detecting a person whether he/she weared a mask or not in a single or Group Environment. As a further process we are going to say for visually impaired person that the person who came near to him/her weared a mask or not. This Machine Works efficiently when you develop mask/no mask dataset. This dataset is required to train the machine for accurate detection and Recognition.

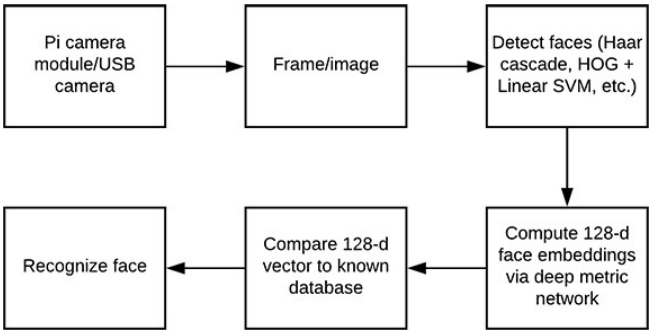

Figure 8. Design of Mask Detection.

5. Result an Analysis

Distance from the camera method is utilized to check whether an individual is moving toward the camera or disappearing. As demonstrated in the figure, decreasing distance shows the individual is moving toward the camera, and face detection can be set off. Eye line detection finds out the valley in level histogram projection. In the event that the eye line is distinguished, face detection can be applied to check whether the individual is wearing a mask or not. As it tends to be seen, in the situations where the individual isn't wearing a cover, face detection and facial part location occur appropriately. At the point when an individual is wearing a mask or face is covered with a hand or fabric, location of the face probably won't happen in specific cases, or face recognition will occur however either nose or mouth won't be recognized showing it is a cover. Eye discovery discov-

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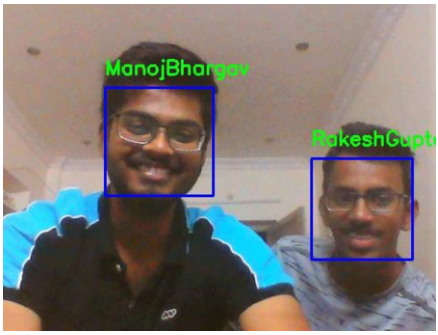

Figure 9. Sample output of Machine Recognizing two or more people

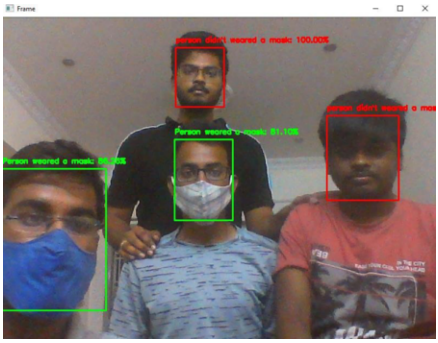

Figure 10. Mask Detection for multiple People Simultaneously

ers eyes and afterward triggers face identification. At the point when an individual isn't wearing a veil, eyes will be distinguished and face discovery can be applied as demonstrated in Figure. In the cases, when an individual is wearing a cover, eye location returns valid yet face identification returns bogus demonstrating it is a mask. The false identi-

Figure 11. Accuracy of a Machine

fication [13] rate is greatest in the eye line recognition calculation and afterward in eye discovery. This is on the grounds that eye recognition and eye line discovery recognize little parts in the picture and for pictures with helpless goals; this location won't be precise promoting bogus identifications. The execution season of facial part recognition is greatest contrasted with any remaining strides as it manages face identification followed by face parts location which is an unpredictable calculation. To examine the exhibition of these four stages, four recordings were tried; with veil and without cover, and precision was determined as (Number of True identifications/Expected detection) and % of exact-

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ness was determined. For distance from the camera step, the precision of the individual moving toward the camera is registered

6. Conclusion

Hence, by using the IOT and implementing its use cases like Security, Media and Automation, we can provide a physically challenged person with identifying a person who is standing Infront of him. Meanwhile in the process of updating our process it is also going to find whether a person is wears a mask or not which plays a major role in every days life. This helps in his security and helps him make sure that he is not cheated on by some random people and this would make a lot of change to people who are challenged and also helps in social distancing.

References

[1] Sahani M, Nanda C, Sahu AK, Pattnaik B. Web-based online embedded door access control and home security system based on face recognition. In2015 International Conference on Circuits, Power and Computing Technologies (ICCPCT) 2015 Mar 19 (pp. 1-6). IEEE.

[2] Zhang H, Qu Z, Yuan L, Li G. A face recognition method based on LBP feature for CNN. In2017 IEEE 2nd Advanced Information Technology, Electronic and Automation Control Conference (IAEAC) 2017 Mar 25 (pp. 544-547). IEEE.

[3] Berbar MA, Kelash HM, Kandeel AA. Faces and facial features detection in color images. InGeometric Modeling and Imaging–New Trends (GMAI'06) 2006 Jul 5 (pp. 209-214). IEEE.

[4] Michaely AH, Zhang X, Simko G, Parada C, Aleksic P. Keyword spotting for Google assistant using contextual speech recognition. In2017 IEEE Automatic Speech Recognition and Understanding Workshop (ASRU) 2017 Dec 16 (pp. 272-278). IEEE.

[5] Kumar M, Shimi SL. Voice recognition based home automation system for paralyzed people. International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE). 2015 Oct;4(10):2508-15.

[6] Kannan K, Selvakumar J. Arduino based voice controlled robot. International Research Journal of Engineering and Technology (IRJET). 2015 Mar;2(01):49-55.

[7] Cuimei L, Zhiliang Q, Nan J, Jianhua W. Human face detection algorithm via Haar cascade classifier combined with three additional classifiers. In2017 13th IEEE International Conference on Electronic Measurement & Instruments (ICEMI) 2017 Oct 20 (pp. 483-487). IEEE.

[8] Wang M. Research on artificial intelligence-based mountain mineral composition detection and big data chemistry education. Arabian Journal of Geosciences. 2021 Aug;14(15):1-9.

[9] Naveena M, HemanthaKumar G, Prakasha M, Nagabhushan P. Partial face recognition by template matching. In2015 International Conference on Emerging Research in Electronics, Computer Science and Technology (ICERECT) 2015 Dec 17 (pp. 319-323). IEEE.

[10] Raut PP, Borkar NR, Student ME, Gawai SK. Techniques and Implementation of Face Spoof Recognition: Perspectives and Prospects. International Journal of Engineering Science and Computing. 2018 Jan;8(1):345-9.

[11] Kumar T, Singh KV, Malik S. Artificial neural network in face detection. International Journal of Computer Applications. 2011 Jan;14(3):5-7.

[12] Kim T, Park H, Hong SH, Chung Y. Integrated system of face recognition and sound localization for a smart door phone. IEEE Transactions on consumer Electronics. 2013 Oct 15;59(3):598-603.

[13] Xu N. Application of remote sensing image classification based on adaptive Gaussian mixture model in analysis of mountain environment features. Arabian Journal of Geosciences. 2021 Aug;14(15):1-4.

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Framework for Authentication 802.1X Security Protocol of WNAS as RFC Access Management Device Associated with RFC Authentication Management Technique

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Abstract. IEEE 802 is used in LAN networks that expose or provide sensitive data to complex applications or services. These are protocols for accessing, managing and controlling access to network-based services and applications in general. Port-controlled network access controls network access and prevents the transmission and reception of nameless or unauthorized persons, leading to network interruption, service theft and data loss. This paper introduces a new approach to investigate whether a data packets in wired networks transferred to a management device is authenticated packet. The data packets are sent to the SDN from RAR and share the information associated with each packet with a limited rate for the access management and are received by the RFC. Here it detects whether the data packet arrived is accepted or restricted. The speed at the authentication start packet is restricted to manage the number of terminals that enter later authentication, and it avoids avalanche impact of wireless authentication which may cause faults to lots of terminals which enter later authentication at the same time.

Keywords. Authentication, RFC (Request For Comments), Network security, SDN (Software Defined Networks).

1. Introduction

The IEEE 802.1X specifies a standard method for port-based network access with the aim of providing optimal authentication PSK, authentication and cryptographic key acquisition methods to enable secure communication between devices connected to the local network (LAN). IEEE Class 802.1 AE (TMS) outlines the principles for establishing MAC security firms. Radius assists in the implementation of industry standardization and accreditation processes network virtualization to generally (Figure 1) separate physical infrastructure and "topology" from "logical" topologies or infrastructure by cre-

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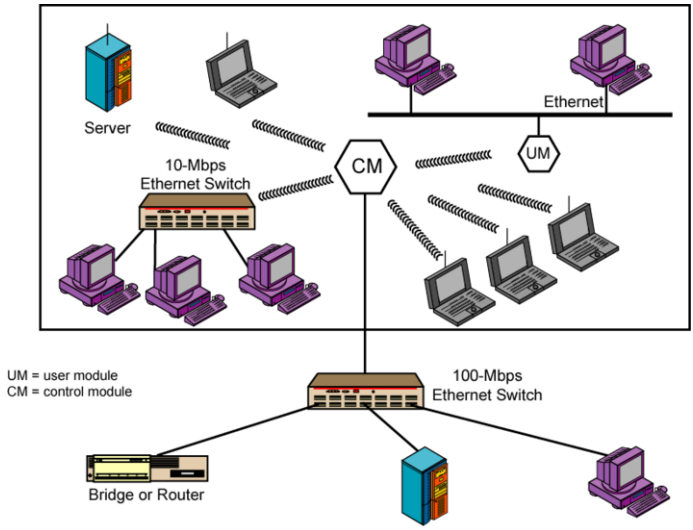

Figure 1. Physical Infrastructure.

ating RFC overlay network. Network Coverage physical networks support a variety of applications across infrastructure and areas, transforming them into cloud-based multi-tenancy physical infrastructure and "topology" from "logical" topologies or infrastructure by creating RFC overlay network. and scalable networks . It basically distinguishes physical infrastructure tops and topologies from "logical" topologies by (Figure 1) creating RFC overlay network, and the ability to collect and disconnect as a whole. Network overlays physical networks can support applications from infrastructure and scales and fields, transforming them into cloud-based multi-tenancy and scalable networks . In IEEE802.1X [1], 802.15 and 802.3 are nodes connected to IAE 802 Technology, PSK [2] coordinator and intermediate register. LAN's new wiring is SDN connected to protocol RFC is an upgraded variant of SDN that incorporates the features of a remote cross stock.

2. Related Work

Security is the top challenge for every wired and Wi-Fi neighborhood location community in an organization setting [3, 4]. These days' agencies like government, non-public [5], and public sectors construct their workplaces with Wi-Fi neighborhood place networks imparting entire safety to their beneficial facts belongings and safety from unauthorized user which should be a difficult task. The findings of the literature exhibits that the existing protection fashions tackle completely RFC genuine extent of protection troubles and all have their own limitations. Therefore, in this paper, a company new safety layout is developed referred to as a multi-layered [6] protection layout for any organizations' WLAN [7].

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3. Research Methodology

Authentication Protocol (EAP) is used inside the wired and wi-fi community that helps more than one authentication techniques like secret digital certificates and public key infrastructure. PSK typically consists of three entities especially supplicant, authenticator, and authentication server. A supplicant is CCMP (Counter Mode with CBC-MAC) entity that wants to use the provider provided through the managed port on the TKIP (Temporal Key Integrity Protocol) has the administration over a crew of ports, and a community will have a couple of authenticators. In IEEE 802.11, the administration port represents to PAC (Protected Access Credential) affiliation between supplicant and authenticator. The former authenticates by the critic to a [8] central authentication server. The 802.1X makes use of Remote Authentication Dial-in User Ser-vice (RADIUS) as RFC authentication server, that directs the CTR (user Counter Mode) to produce an entry for productive authentication. 802.1X usually gives for centralized authentication and dynamic key distribution in 802.11 designs and for using 802.1X [9] with RADIUS. 802.1X is employed for conversation between the Wi-Fi buyers and AP's, where as RADIUS operates between AP and authentication server. The authentication approach between authentication server SDN supplicants is carried over protocol (EAP). The key protocol in 802.1X is termed EAP over a laptop community (EAPOL) [10].

4. Framework of Components

The distance between the EAP cable and the Ethernet cable is not long: the cable is still limited to a maximum length of 100 meters (328 feet) limits cable to 90 meters in length, at both ends. Historically, this medium was coaxial copper cable MIC, but today it is usually twisted pair or fiber optic cable. Most industrial control components in current production (Figure 2) run at 10 / 100BaseT. Industrial networks should only use 5E Shielded Trusted Pair (STP) cables and cables with Shielded RJ-45 connectors only. Optical fiber conversation entails sending indicators to skinny wires of glass or plastic fibers. The mild is directed towards the core of the fiber known as the core. The core is surrounded by means of RFC [8] optical object known as RFC "envelope", which makes use of RFC optical method known as "total interior reflection" to seize the mild in the center. The core and sleeve are generally made of ultra-clear glass, even though some fibers are all plastic, or the identical is proper for cores and plastic sleeves. The center of a single-mode fiber is so small that light can only travel through a beam. This increases bandwidth to almost infinity - but actually limits it to about 100,000 GHz and more. The extension distance of single-mode fiber optic cable can be extended up to 80 km or more, while the range of multi-mode fiber optic cable can reach up to 2 Km. Fiber optic cable is very expensive, but it is also important in terms of concerns about electronic radiation and environmental hazards. Because it does not conduct electricity, it is useful in areas with severe electromagnetic interference (such as fiber optic cable factory sites). The Ethernet standard allows fiber optic cable sections from 2 km to 80 km. Fiber optic cables are commonly used in indoor equipment to protect network equipment from electrical damage caused by lightning storms.

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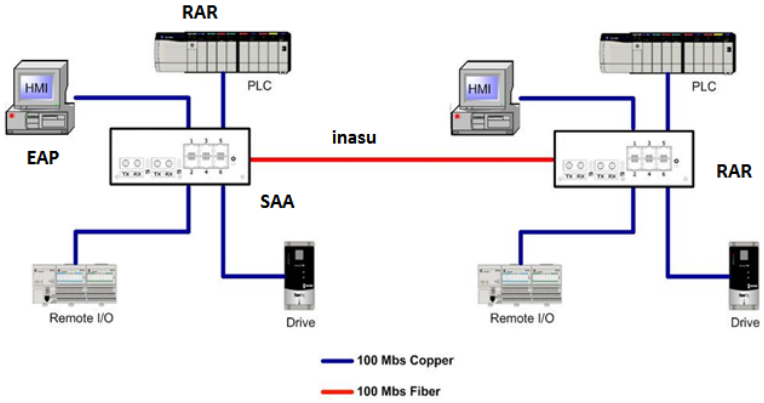

Figure 2. Framework tracking function Execution of SAA

4.1. Simulation Setup

4.1.1. New Simulation

Use this menu to simulate exclusive kinds of networks in RAR. SDN can simulate the following the sorts of networks: Internetworks, Legacy Networks, Mobile Adhoc networks, Cellular Networks, Wireless Sensor Networks [11], Internet of Things, Cognitive Radio Networks, LTE/LTE-A Networks (LTE/LTE-A, LTE femtocell, LTE D2D, LTE Vanet), 5G NR mmWave (newly delivered aspect in v12), and VANETs.

4.1.2. Open Simulation

Use this menu to load saved configuration archives from the current workspace. SDN can view, regulate or re-run current simulations. Along with this IEEE802.1X, users can additionally export the saved documents from the modern-day workspace to their desired location on their PC's.

4.1.3. This lookup setup

Use this menu to operate simulations of extraordinary types categorized technology-wise. Users can select any community which they prefer to work and further go down with the aid of the use of a double LAN on it or via a LAN on on the arrow pointer which will take SDN to the subsequent level. By a LAN on any simulation file will open a pre-existing simulation file which User can run and analyze the results. Users can LAN on the 802.1X server present in the right-hand facet of every community which opens the corresponding packet data file files.

Similarly, on the different side, User can discover experiments area which has various experiments masking all the applied sciences in RAR. Users can select their experiment via either a double LAN on it or with the aid of a LAN on the pointer arrow which will take SDN the samples. LAN on the pattern to open the specific scan in RAR. All the settings to lift out a specific scan are already done. Users can LAN on the 802.1X Server current in the right-hand aspect of every experiment. This will open the corresponding packet data file for the test which consists of distinctive description of that particular

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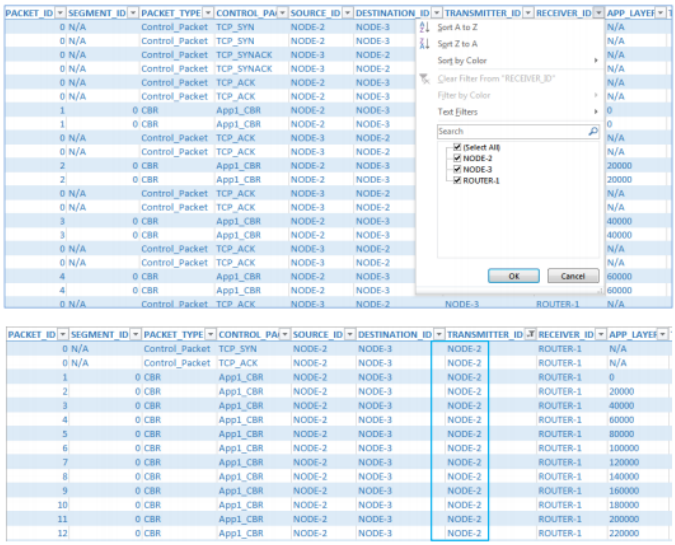


PACKET_ID	SEGMENT_ID	PACKET_TYPE	CONTROL_PAI	SOURCE_ID	DESTINATION_ID	TRANSMITTER_ID	RECEIVER_ID	APP_LAYEF
0	N/A	Control_Packet	TCP_SYN	NODE-2	NODE-3			N/A
0	N/A	Control_Packet	TCP_SYN	NODE-2	NODE-3			N/A
0	N/A	Control_Packet	TCP_SYNACK	NODE-3	NODE-2			N/A
0	N/A	Control_Packet	TCP_SYNACK	NODE-3	NODE-2			N/A
0	N/A	Control_Packet	TCP_ACK	NODE-2	NODE-3			N/A
0	N/A	Control_Packet	TCP_ACK	NODE-2	NODE-3			N/A
1	0	CBR	App1_CBR	NODE-2	NODE-3			0
1	0	CBR	App1_CBR	NODE-2	NODE-3			0
0	N/A	Control_Packet	TCP_ACK	NODE-3	NODE-2			N/A
0	N/A	Control_Packet	TCP_ACK	NODE-3	NODE-2			N/A
2	0	CBR	App1_CBR	NODE-2	NODE-3			20000
2	0	CBR	App1_CBR	NODE-2	NODE-3			20000
0	N/A	Control_Packet	TCP_ACK	NODE-3	NODE-2			N/A
0	N/A	Control_Packet	TCP_ACK	NODE-3	NODE-2			N/A
3	0	CBR	App1_CBR	NODE-2	NODE-3			40000
3	0	CBR	App1_CBR	NODE-2	NODE-3			40000
0	N/A	Control_Packet	TCP_ACK	NODE-3	NODE-2			N/A
0	N/A	Control_Packet	TCP_ACK	NODE-3	NODE-2			N/A
4	0	CBR	App1_CBR	NODE-2	NODE-3			60000
4	0	CBR	App1_CBR	NODE-2	NODE-3			60000
0	N/A	Control_Packet	TCP_ACK	NODE-3	NODE-2	NODE-3	ROUTER-1	N/A

Sort A to Z
Sort Z to A
Sort by Color
Clear Filter From "RECEIVER_ID"
Filter by Color
Text Filters
Search
(Select All)
NODE-2
NODE-3
ROUTER-1
OK
Cancel

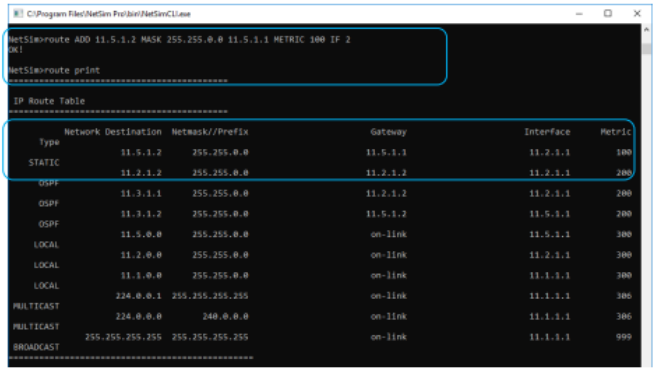
PACKET_ID	SEGMENT_ID	PACKET_TYPE	CONTROL_PAI	SOURCE_ID	DESTINATION_ID	TRANSMITTER_ID	RECEIVER_ID	APP_LAYEF
0	N/A	Control_Packet	TCP_SYN	NODE-2	NODE-3	NODE-2	ROUTER-1	N/A
0	N/A	Control_Packet	TCP_ACK	NODE-2	NODE-3	NODE-2	ROUTER-1	N/A
1	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	0
2	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	20000
3	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	40000
4	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	60000
5	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	80000
6	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	100000
7	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	120000
8	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	140000
9	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	160000
10	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	180000
11	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	200000
12	0	CBR	App1_CBR	NODE-2	NODE-3	NODE-2	ROUTER-1	220000

Figure 3. RFC discover experiments 802.1X authentication management technique

experiment. (Figure 4) shows the routing desk entries with community locations and the gateways to which packets are forwarded when they are headed to that destination.

5. Implementation

Traffic evaluation is extraordinarily the equal as the invention of wi-fi community devices. Here, the perpetrator analyzes the visitors between the user and consequently the community machine employs a wi-fi card and code that acts as someone. Unless SDN



```
C:\Program Files\NetSim Pro\bin\NetSimCLI.exe

NetSim>route ADD 11.5.1.2 MASK 255.255.0.0 11.5.1.1 METRIC 100 IF 2
OK!

NetSim>route print
-------------------------------------------

IP Route Table
-------------------------------------------

        Network Destination  Netmask//Prefix          Gateway          Interface     Metric
Type
STATIC          11.5.1.2        255.255.0.0        11.5.1.1          11.2.1.1        100
                11.2.1.2        255.255.0.0        11.2.1.2          11.2.1.1        200
OSPF            11.3.1.1        255.255.0.0        11.2.1.2          11.2.1.1        200
OSPF            11.3.1.2        255.255.0.0        11.5.1.2          11.5.1.1        200
OSPF            11.5.0.0        255.255.0.0         on-link          11.5.1.1        300
LOCAL           11.2.0.0        255.255.0.0         on-link          11.2.1.1        300
LOCAL           11.1.0.0        255.255.0.0         on-link          11.1.1.1        300
LOCAL         224.0.0.1   255.255.255.255         on-link          11.1.1.1        306
MULTICAST       224.0.0.0         240.0.0.0         on-link          11.1.1.1        306
MULTICAST 255.255.255.255   255.255.255.255         on-link          11.1.1.1        999
BROADCAST
-------------------------------------------
```

Figure 4. Framework Authorization RAR Communication SAA

already brought static routes to the table, the whole thing SDN see right here will be dynamically generated RAR Protocol. The perpetrator determines the load on the conversation medium through the volume and measurement of the packets being transmit-

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ted. The sniffers like the Ethereal location unit helps to analyze the traffic. By examining the traffic, the perpetrator will get records related to get admission are settled and consequently the varieties of protocols employed in transmission generally get right of entry to factors broadcast their Service Set image (SSID), that successively is employed through the customer to perceive the entry purpose. This SSID ought to be a parameter that has to be designed inside the Wi-Fi card's driver SDN for any wi-fi station desiring get admission to a Wi-Fi LAN. Data Packet to RFC→ Transfer (Input)

$$\begin{gathered}\frac{\partial E(D)}{\partial w_i(D)} = \sum_{j=1}^{N} e_j(n) G(||x_j - t_i(D)||_{C_i}) \\ w_i(D+one) = w_i(D) - \eta_1 \frac{\partial E(D)}{\partial w_i(D)}, i = 1,2,...M\end{gathered} \tag{1}$$

Packet moving Network data(PMDA)

$$\begin{gathered}\frac{\partial E(D)}{\partial t_i(D)} = 2w_i(n) \sum_{j=1}^{N} e_j(D) G'(\|x_j - t_i(D)\|_{C_i}) \sum_i^{-1} [x_j - t_i(n)] \\ t_i(D+one) = t_i(D) - \eta_2 \frac{\partial E(D)}{\partial t_i(D)}, i = 1,2,...M\end{gathered} \tag{2}$$

$$\begin{gathered}\frac{\partial E(D)}{\partial \sum_i^{-1}(D)} = -w_i(D) \sum_{j=1}^{N} e_j(D) G'(\|x_j - t_i(D)\|_{C_i}) Q_{ji}(D) \\ Q_{ji}(D) = [x_j - t_i(D)][x_j - t_i(D)]^T \\ \sum_i^{-1}(D+1) = \sum_i^{-1}(D) - \eta_3 \frac{\partial E(D)}{\partial \sum_i^{-1}(D)}\end{gathered} \tag{3}$$

RAR protocol contains the EAP packets over air between the critic and additionally the supplicant. In 802.1X identification, a supplicant continuously trusts the critic and the supplicant alternatively no longer vice versa. There's no EAP request message originating from the supplicant and it responds to the requests dispatched by using the critic. This unidirectional authentication of the supplicant to the AP will expose the supplicant to practicable "Man-In-Middle attack" with assailant performing as a patron to RAR [8-9] as RFC AP to supplicant. The EAP-success message dispatched from the critic to the supplicant consists of no integrity conserving information. SDN assailant will forge this packet to commence the attack. There is free consistency between 802.Ix and 802.11 nation machines and additionally the community falls at chance of the session hijacking. With IEEE 802.IX and RSN (Robust Security Network), affiliation has to make certain earlier than greater layer authentication. One is basic 802.11 and additionally the choice is 802.1X especially based totally RSN [12] status machine. Their mixed motion ought to dictate the status of authentication. However, thanks to the dearth of clear conversation between these two status machines and message credibleness, "Session Hijacking Attack" [13] turns possible. First, the supplicant and the critic have interplay inside the authentication approach that effects in the supplicant being genuine. RFC assailant then sends a wired message with wi-fi the AP's MAC address. The legitimate supplicant can disassociate as soon as receiving the MAC-disassociate message. This reasons the RAA state computing device to switch to the un-associated state.

However, considering this disjoint message which used to dispatch with the aid of the assailant, the essential entry to cause would not fathom it, so the 802.1X status laptop stays in a authentic state for that consumer inside the actual AP. The attacker then improves its admission to EAP and the SAA address of the real supplicant. In 802.1X,

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Table 1. Overall execution of result

	1 Mbit/sec		2 Mbit/sec	
PMNDA	**Data Sender**	**File Header**	**Data Sender**	**File Header (400ms hop time)**
128	0.346	0.346	0.507	0.454
512	0.684	0.659	1.163	1.088
512 (frag size = 28)	0.503	0.502	0.761	0.759

Table 2. Comparative study

Author	**Methods**	**Use**
Selvakumar [18]	IEASAR	Packet Distance
Sathiyavathi [19]	QOS	Packet Dynamic Keys
Sabena [20]	STGG	Packet protocol
Proposed *	RAR	Packet ASTR

the conversation of cellular shoppers starts off evolved with EAPOL-start and terminates [14] the session with EAPOL-Logoff frame.

As these frames don't seem to be true via the authentication server, the RFC assailant will spoof the EAPOL-Logoff body and work off actual user from AP [14, 15] so the assailant will regularly ship spoofed EAPOL-Logoff [16–19] body to the AP to be positive on this attack. The use of ASTR (Accuracy, speed, Time, Reliability) is a new approach in RFC. Complicated network packets might attain a router from many directions. Priority scheduling inasu algorithm will permit the router to repair precedence tiers for special SDN sources from extraordinary directions. Higher precedence packets are processed first 802.1X and dispatched out to RAR.

6. Conclusion

Network-based network access control allows network operators to control the use of IEEE 802 LAN (port) access pointers to prevent communication between unauthorized and authorized devices. This standard specifies a standard framework of objects and supports authentication across single-lane connected port clients and is used to establish and deploy security between ports and independent media access system processes organizations using IEEE 802.1 AE MAC security.

References

[1] Röpke C, Holz T. Sdn rootkits: Subverting network operating systems of software-defined networks. In International Symposium on Recent Advances in Intrusion Detection 2015 Nov 2 (pp. 339-356). Springer, Cham.

[2] Tatang D, Quinkert F, Frank J, Röpke C, Holz T. SDN-Guard: Protecting SDN controllers against SDN rootkits. In 2017 IEEE Conference on Network Function Virtualization and Software Defined Networks (NFV-SDN) 2017 Nov 6 (pp. 297-302). IEEE.

[3] Selvakumar K, Sairamesh L, Kannan A. An intelligent energy aware secured algorithm for routing in wireless sensor networks. Wireless Personal Communications. 2017 Oct;96(3):4781-98.

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[4] Sathiyavathi V, Reshma R, Parvin SS, SaiRamesh L, Ayyasamy A. Dynamic trust based secure multipath routing for mobile ad-hoc networks. In Intelligent Communication Technologies and Virtual Mobile Networks 2019 Feb 14 (pp. 618-625). Springer, Cham.

[5] IEEE Standard for Local and Metropolitan Area Networks-Port-Based Network Access Control. In: IEEE Std 802.1X-2020 (Revision of IEEE Std 802.1X-2010 Incorporating IEEE Std 802.1Xbx-2014 and IEEE Std 802.1Xck-2018). 2020 Feb 28.

[6] Shin S, Xu L, Hong S, Gu G. Enhancing network security through software defined networking (SDN). In 2016 25th international conference on computer communication and networks (ICCCN) 2016 Aug 1 (pp. 1-9). IEEE.

[7] Sabena S, Sureshkumar C, Ramesh LS, Ayyasamy A. Secure Trust-Based Group Key Generation Algorithm for Heterogeneous Mobile Wireless Sensor Networks. In Inventive Computation and Information Technologies 2021 (pp. 127-141). Springer, Singapore.

[8] Li C, Lu R, Li H, Chen L, Li X. Comment on "A Novel Homomorphic MAC Scheme for Authentication in Network Coding". IEEE Communications Letters. 2014 Oct 8;18(12):2129-32.

[9] Ruixuan P, Chao N, Yingjie Y, Qiang L, Bowen L. Research on the Network Access Authentication Technology of Sdn Based on 802.1 X. In 2020 12th International Conference on Measuring Technology and Mechatronics Automation (ICMTMA) 2020 Feb 28 (pp. 780-786). IEEE.

[10] Li Z. Liu M. Wei Z. Design and implementation of software-defined network trusted connection. Journal of Computer Applications. 2019;182(03):1-9.

[11] Zhang B, Liang H, Qiong Y. Prediction of mountain green vegetation coverage based on wireless sensor network and regional industrial economic convergence. Arabian Journal of Geosciences. 2021 Jun;14(12):1-8.

[12] Yakasai ST, Guy CG. FlowIdentity: Software-defined network access control. In 2015 IEEE Conference on Network Function Virtualization and Software Defined Network (NFV-SDN) 2015 Nov 18 (pp. 115-120). IEEE.

[13] Mattos DM, Duarte OC. AuthFlow: authentication and access control mechanism for software defined networking. annals of telecommunications. 2016 Dec;71(11):607-15.

[14] Kuliesius F, Dangovas V. SDN enhanced campus network authentication and access control system. In 2016 Eighth International Conference on Ubiquitous and Future Networks (ICUFN) 2016 Jul 5 (pp. 894-899). IEEE.

[15] Cao Z, Fitschen J, Papadimitrio P. FreeSurf: Application-centric wireless access. In 2016 IEEE 17th International Conference on High Performance Switching and Routing (HPSR) 2016 Jun 14 (pp. 206-212). IEEE.

[16] Vaishnavi R, Anand J, Janarthanan R. Efficient security for Desktop Data Grid using cryptographic protocol. In 2009 International Conference on Control, Automation, Communication and Energy Conservation 2009 Jun 4 (pp. 1-6). IEEE.

[17] Samuel H, Kaul S, Anand J. A Secured Routing Technique for Wireless Sensor Networks. International Journal of Engineering Research. 2014 Mar;3(3):275-9.

[18] Divya R, Vijayalakshmi V. Analysis of multimodal biometric fusion based authentication techniques for network security. International Journal of Security and Its Applications. 2015;9(4):239-46.

[19] Sundaramoorthy R, Rajapandiyan K, Palanivelayudham V, Muthukrishnan U. Interoperability Solution for Ieee 802.1 x Based Authentication Unsupported Customer Premises Equipment. In 2019 IEEE International Conference on Electrical, Computer and Communication Technologies (ICECCT) 2019 Feb 20 (pp. 1-5). IEEE.

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Fog Enabled Cloud Based Heart Rate Monitoring System

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Abstract. The world has seen a substantial growth in the number of senior citizens who often endure from heart disease in recent times and has seen a major spread of the viral disease (COVID-19) in recent months, resulting in thousands of deaths, particularly among the elderly and people suffering from heart disease. Among the most promising health care that seek to relieve the suffering of patients, particularly the elderly, by eliminating the trouble of going to hospital centers for treatment and enabling them to obtain medical attention in their homes. The IoT has been depended on and its use has seen broad adoption in health care, where it is commonly used remotely to track patient health. Fog computing expands the computational capabilities of the cloud to the edge devices of the IoT, enabling many smart devices in healthcare to provide services such as storing and retrieving information to their users. However in the traditional cloud-based system, there is a timing delay in providing a reliable and secure heart monitoring system. The main objective of this work is to develop a fog-enabled cloud-based (FECB) heart rate monitoring unit that allows better network use and energy consumption. In terms of performance metrics, such as latency and delay, the proposed system also outperforms the existing system.

Keywords. Cloud Computing, Fog Computing, Healthcare, IoT, Patient monitoring.

1. Introduction

Medical care now plays an important role in people's personal well-being, with healthcare professionals, distributors, patients, and corporations massively pushing and adopting these services. Patients have to be taken to a hospital or health centers in the conventional healthcare setup to monitor and track their health issues locally. Healthcare services have recently been implemented with cloud computing services on data centers with front-end smart healthcare to regulate, analyze and visualize data captured in real-time from IoT devices. Remote patient health surveillance helps to reduce hospitalizations by 50 per cent, emergency room visits by 73 per cent, and patient costs by 51 per cent. In order to draw certain assumptions that are useful in maintaining a healthier lifestyle, there are many health applications such as Microsoft Health, Apple Health Kit, Samsung S Health and Google Fit to gather patient health data by tracking their everyday activities (e.g. sleeping practices, exercise routines and food choices) [1]. As patients are

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forced to stay in the hospital for the duration of their treatment due to the lack of technology capable of delivering patient health information remotely to approved health practitioners, healthcare facilities are becoming more and more expensive. Remote patient monitoring provides tremendous opportunities to reduce the cost of patient health care and to improve the quality of healthcare services by detecting and avoiding illnesses. By allowing remote patient monitoring in hospitals and even at home, IoT will bring tremendous opportunities to revolutionize healthcare in the near future. IoT systems directly gather health information from patients and send it to healthcare professionals in real time. This would not only reduce the expense of healthcare services for patients, but also encourage health conditions to be dealt with before they become serious [2].

By the year 2020, the present hospital-centered healthcare practice is projected to be balanced by its home base equivalent in the next decade. The average growth in health data will also be around 48 percent a year and the amount of health data will grow to 1018 bytes by 2020. It takes some time to allocate vast volumes of data to cloud computing for processing and storage, which is inappropriate in life or death circumstances. Architecture with a middle computing layer is becoming the more commonly used technology to improve the quality of healthcare services to support this data development because of the growing sensing devices used for healthcare. This intermediary computing layer is known as fog computing or Edge computing, which offers unique IoT device services to improve the processing chance to react to patient requests from e-Health customers. E-Health information must be applicable in real time to medical professionals by adding this second tier between IoT body-sensor sensors and cloud computing [3].

In support of IoT-enabled clinical services offering solutions for scalability, data processing and consistency, cloud computing services have been broadly approved. The geographical centralization of cloud data centers, however, allows data obtained from sensors to be distributed for processing over a multi-hop range, adversely affecting the latency tolerance of the solutions. In addition, cloud resource management in heterogeneous healthcare environments requires complex strategy implementation in order to avoid constant revision of the distribution of resources in response to unequal and unpredictable loads of data from healthcare solutions [4–6]. By investigating lightweight and customizable additional computing tools closer to the IoT database in healthcare solutions, Fog computing is a promising option in this scenario. Conventional edge computing devices such as switches, routers, low-profile computing devices, etc. are fitted with computer infrastructure, utilities and management models for local lean technologies to be applied in this approach. As a consequence, some data processing can be carried out closer to the data source, resource demands can be dispersed, the need for multi-hop data exchange can be minimized, latency reduced and service flexibility encouraged [7]. Providing an easy sensor-to-cloud architecture is not feasible for many healthcare applications especially because most hospitals will not prefer outside storage of patient data. There is also often the grim case of a packet loss or a failure of the data centre which puts the health of patients at risk. Fog computing helps healthcare solutions in this field. Fog computing is a decentralized computer architecture that processes and stores information between the source of origin and the resources of the cloud. This contributes to the minimization of overhead data transfer and ultimately increases computational efficiency on cloud networks by reducing the need to process and store large quantities of illumination [8].

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The Fog computing framework is largely driven by a massive rise in Internet of Things (IoT) devices, where an ever growing amount of data is created from an already array of devices (in terms of volume, variety, and velocity). The Fog model aims to provide problems with a flexible, decentralised approach. This is accomplished through the development, as shown in Figure 1, of a new hierarchically dispersed and local network between the Cloud system and end-user devices. This platform is capable of sorting, consolidating, sorting, analyzing and sharing information and will save time and energy for interaction [9]. Although the resources and computing resources of fog resources are limited, they are versatile enough to adjust according to the context of performance. The challenge of managing and running distributed computing scenarios is addressed by the convergence of variable requirements and restricted computing resources, ensuring performance, reliability and protection. During the transition of data from the sensors to the cloud and the cloud to hospitals or personal clinicians, the use of only the cloud can cause delays. In healthcare, we have emergency service systems that involve real-time operations that play an important role in productivity and time; this can suffer as a result of cloud delays. Therefore, not only because of latency problems, but also because of protection, the transfer of such enormous quantities of data back and forth is not an effective option. The risks associated here are not only data breaches, but also risks to patients' health [10]. Therefore, in this paper a fog-enabled cloud-based (FECB) heart rate monitoring unit that allows better network use and energy consumption. This approach also reduces latency. Along with this detailed study of cloud and fog computing contribution in Section 2 provides the related work. Section 3 describes the proposed health

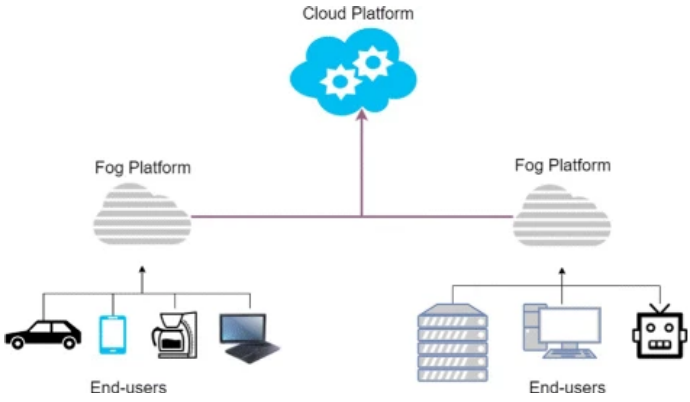

Figure 1. Fog enabled cloud platform healthcare

care monitoring unit and results and discussions are provided in Section 4 followed by conclusion in Section 5.

2. Background Study

Fog computing enables organizations, especially in large environments where devices need to communicate with each other and the data centre, to use cloud computing to support IoT [11]. This makes it possible for devices that access similar data to communicate through a sub-cloud network called a fog layer. Fog computing enhances opera-

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tional performance by providing end users to access smaller, more specific information rather than obtaining information from users in a centralised, cloud-based infrastructure together with information they would never need to access. Hence, in this section, fog computing in healthcare related works is discussed.

IoT-Fog-Cloud [12] presented study, models, and demonstrates how to lower the cost of computational power while maintaining performance limitations for health requests-particularly response time of obtaining medical data stored in a fog-cloud environment. This work presented a queuing model to forecast the minimum necessary amount of computing resources (both fog and cloud nodes) to satisfy the Service Level Agreement (SLA) for responsiveness in order to address this problem. Via nonlinear models, we check and cross check our analytical model. The conclusions drawn from our analytical models indicate that in order to obtain the required responsiveness under various workload conditions, the proposed model is able to properly and effectively estimate the number of computational resources needed for health data services.

A Fog-based IoT-Healthcare technology framework [13] and the incorporation of Cloud-Fog services into the conventional Cloud-based framework of interoperable clinical services. Via simulations using the iFogSim simulator, the scenarios are tested and the outcomes analysed in relation to numerical computation, latency reduction, data transmission optimization and energy consumption. In terms of cost, network delay and energy use the empirical setup point to enhancement. Integrated IoT and Fog to deliver health data [14] presented the move from the cloud to the edge network of computing knowledge. Fog computing functions closer to the customer, on the edge of the network, allowing precise service delivery with low response time to prevent delays and network failures that may disrupt or delay the decision process and delivery of healthcare services. A design framework is designed and the advantages of the IoT and fog computing integration are demonstrated by a series of use cases.

A design that focuses on healthcare systems [15], in addition to a system implementing this architecture, an architecture comprising three layers; objects (i.e., sensors), fog nodes and a cloud data centre is proposed. This arrangement provides coordination between fog nodes with efficient resource management and job allocation, which is capable of achieving a high QoS (i.e. low latency) in a healthcare service scenario. Smart devices are not capable of handling IoT-produced data as elements of IoT-driven health systems, nor is data uploading to the Cloud the required solution.

The paradigm shift, known as Fog computing, has seemed to solve the limitations of smart devices and the cloud, where an extra element collects the message and transmits the results to the cloud. Leading proponents brought into IoT-based environments by Fog computing, privacy and security concerns remain the primary challenge for its deployment. This paper presents the reasons for the convergence of the IoT-based healthcare system and Fog computing, advantages and challenges, as well as the proposal of a simple low-cost system [16].

Healthcare companies have become more open to cloud computing over the past year as a common technology for health IT infrastructure. Firms recognize that the cloud facilitates even more intelligent collaboration between health information systems, enabling smarter interaction between mission-critical platforms for end users. The need for end-to-end visibility of the cloud environment is acknowledged by organizations. However, for the sake of improved visibility, as cloud ecosystems expand, healthcare organizations are faced with adapting to the volume of data. Fog computing enables such data

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to be separated by IT administrators and users, making it easier to access and handle. The implementation of a fog layer into the architecture of cloud computing eliminates the security risk whenever it comes to patient data not being lost due to a data centre failure. But at the same time, in the cloud, the data is processed. This raises the threat to patient information privacy and also takes huge delay in accessing the information. Health monitoring system for people who are old and disabled [15] was proposed to monitor their health regularly. Heart beat rate is monitored at regular time period and collected. The collected value is compared with prescribed doctor value whether it is normal or not. If there is critical in heart beat rate then alarm is emerged and message sent to patient doctor and family member. The message is passed which contains collected heart beat rate at period of time along with patient location.

3. System model

Although the number of medical devices is rising day by day, most of them use preconfigured applications based on artificial intelligence to handle medical data. This suggests however that practically all of the care and evaluation decisions are taken based on the description of the common patient. In addition, due to the fact that all data analysis takes place on a central server, as more and more medical devices are linked to the system, networks also struggle from network latency issues. To build and incorporate a monitoring system for the heart beat that would allow the medical data of the patient to be processed on a Fog node using algorithm to minimize the alert delay while not exceeding the communication overhead of the server.

3.1. Basic components

1. A database server which preserves and manages sensed information for the patient.
2. A smartphone to provide a 2-way data stream with the sensor and the database server.
3. A lightweight, wearable body sensor that is connected to the patient with a lot of computing power.

3.2. Algorithm

- Uploading sensed information.
- Storing basic information about smartphone users.
- Validating input data.
- Display the heart rate is critical or not

3.3. Responsibility of fog node

1. Using an encrypted key, reading heart rate from the sensor.
2. Downloading corresponding user information, sending a proper notification.
3. Sending the SMS to the caretaker when the heart rate is critical.
4. Displaying collection of recent heart rates.

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3.4. Communication with fog nodes

Using cloud connectivity, the contact from the database server to a fog node is finished. Cloud connectivity is an effective way for a battery to connect a database server to a computer, allowing you to send messages and updates to your device from your server. The

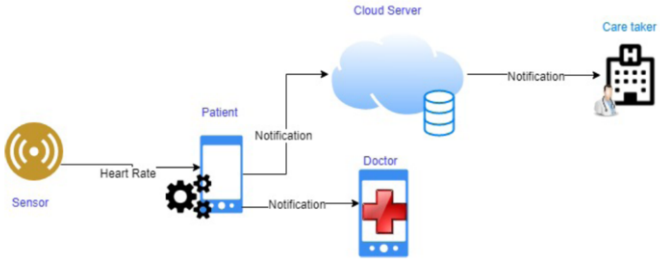

Figure 2. FECB heart rate monitoring architecture

advantage of cloud messages is that they are very simple to set up and have constructed features to handle circumstances when network issues on the side of the fog node are present. In order to send a message to the Fog node, cloud connectivity is used. The message includes information about the user that is automatically downloaded to the device after the message is sent. On the server side, there is currently no help to ensure that the message was actually received by the fog node, which allows for potential opportunities for growth.

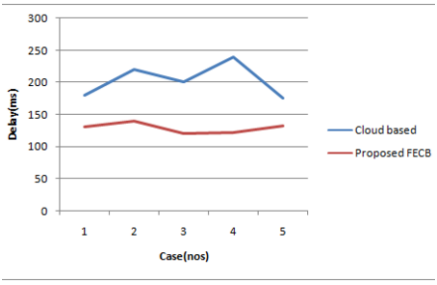

Figure 3. Comparison analysis for delay

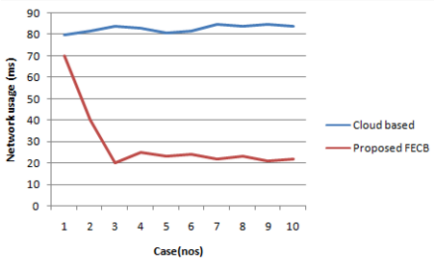

Figure 4. Comparison analysis for network usage

From Figure 2, the patient's phone transmits the heart rate to the cloud server, where the server runs the algorithm to determine whether to give the doctor a notification. If it has changed, the heart rate status is still stored in the database, so the patient's status is updated to alert the hospital caretaker. The key issue with a conventional tracking system based on cloud computing is that the extra time it takes for the data to be transmitted to the server from the patient's phone may be critical in a life and death situation. But in the proposed system the delay can be reduced using fog node installation. Figure 3 demonstrates the delay comparison analysis between conventional cloud-based heart rate monitoring and the proposed FECB monitoring unit. In this case, we consider homogeneous workloads for body sensors, which are uniformly distributed and each body

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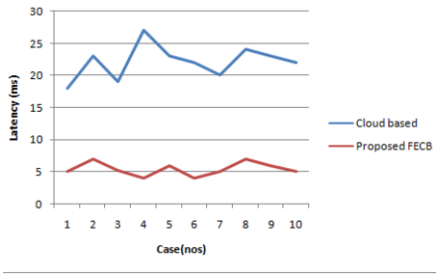

Figure 5. Comparison analysis for latency delay

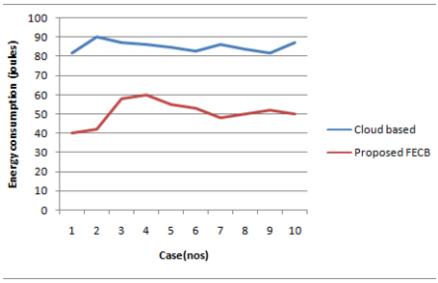

Figure 6. Comparison analysis for energy consumption

sensor generates a rate of 500 requests per second. We see the delay rises as the number of cases increases. Similarly, Figure 5 depicts the comparison analysis for latency delay and Figure 6 shows the energy consumption between traditional clouds based and proposed FECB monitoring units. We suggest that if the healthcare workload increases the response time increases with a fixed number of computing resources, and inversely, if the healthcare workload decreases the response time decreases. As a result, as a function of the forthcoming healthcare workload status, it is vital to scale up and down computing resources. In addition, the cloud computing-based approach reveals that the delayed update will reach two seconds, compared to the FECB fog-based device unit where only half of it is delayed. In addition, since this experiment was performed using a powerful high-bandwidth network signal, this delay will exponentially increasing in areas where the signal intensity or network bandwidth is smaller.

4. Conclusion

As a result, the FECB system for heart rate monitoring was established, providing a way for doctors and caregivers to monitor their patients. The device consists of a doctor's database server, a patient's smartphone and a sensor that supplies the application with the heart rate. In this type of environment, the use of cloud storage will only make sense if the algorithm is extremely hungry for resources and the fog node would not be capable of processing the data on a regular basis. The biggest advantage here is that all intervals are kept as short as possible as the processing happens very close to the sensor itself. In addition, since the two alerts are sent as different requests, there is a fair probability that the other one will stay untouched and the message will not be lost even though either the physician or hospital network connection breaks.

References

[1] Kraemer FA, Braten AE, Tamkittikhun N, Palma D. Fog computing in healthcare–a review and discussion. IEEE Access. 2017 May 15;5:9206-22.

[2] Malik BH, Mahmood F, Shahzad S, Arif MB, Khan WU, Ilyas S, Hassan M. From cloud computing to fog computing in Healthcare big data. InMATEC Web of Conferences 2018 (Vol. 189, p. 03011). EDP Sciences.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[3] Priyadarshini R, Panda MR, Mishra BK. Security in healthcare applications based on fog and cloud computing. Cyber Security in Parallel and Distributed Computing: Concepts, Techniques, Applications and Case Studies. 2019 Mar 25:231-43.

[4] Shi Y, Ding G, Wang H, Roman HE, Lu S. The fog computing service for healthcare. In2015 2nd International Symposium on Future Information and Communication Technologies for Ubiquitous HealthCare (Ubi-HealthTech) 2015 May 28 (pp. 1-5). IEEE.

[5] Nandyala CS, Kim HK. From cloud to fog and IoT-based real-time U-healthcare monitoring for smart homes and hospitals. International Journal of Smart Home. 2016 Feb;10(2):187-96.

[6] Ajay H, Rao AR, Balavanan M, Lalit R. A Novel Cardiac Arrest Alerting System using IoT. International Journal of Science Technology & Engineering. 2017;3(10):78-83.

[7] Bharati S. CLOUD AND FOG COMPUTING IN HEALTHCARE INDUSTRY 4.0. Journal of the International Academy for Case Studies. 2020 Aug 20;26(6):1-2.

[8] Abdelmoneem RM, Benslimane A, Shaaban E, Abdelhamid S, Ghoneim S. A cloud-fog based architecture for iot applications dedicated to healthcare. InICC 2019-2019 IEEE International Conference on Communications (ICC) 2019 May 20 (pp. 1-6). IEEE.

[9] Dash S, Biswas S, Banerjee D, Rahman AU. Edge and fog computing in healthcare–A review. Scalable Computing: Practice and Experience. 2019 May 2;20(2):191-206.

[10] Gill SS, Arya RC, Wander GS, Buyya R. Fog-based smart healthcare as a big data and cloud service for heart patients using IoT. InInternational Conference on Intelligent Data Communication Technologies and Internet of Things 2018 Aug 7 (pp. 1376-1383). Springer, Cham.

[11] Luo Y. Environmental cost control of coal industry based on cloud computing and machine learning. Arabian Journal of Geosciences. 2021 Jun;14(12):1-6.

[12] El Kafhali S, Salah K, Alla SB. Performance evaluation of IoT-fog-cloud deployment for healthcare services. In2018 4th international conference on cloud computing technologies and applications (Cloudtech) 2018 Nov 26 (pp. 1-6). IEEE.

[13] Mahmud R, Koch FL, Buyya R. Cloud-fog interoperability in IoT-enabled healthcare solutions. InProceedings of the 19th international conference on distributed computing and networking 2018 Jan 4 (pp. 1-10).

[14] Andriopoulou F, Dagiuklas T, Orphanoudakis T. Integrating IoT and fog computing for healthcare service delivery. InComponents and services for IoT platforms 2017 (pp. 213-232). Springer, Cham.

[15] Al-Khafajiy M, Webster L, Baker T, Waraich A. Towards fog driven IoT healthcare: challenges and framework of fog computing in healthcare. InProceedings of the 2nd international conference on future networks and distributed systems 2018 Jun 26 (pp. 1-7).

[16] Maksimović M. Implementation of Fog computing in IoT-based healthcare system. Jita-Journal Of Information Technology And Aplications. 2017;14(2):100-7.

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COVID-19: Role of Deep Learning and Cloud Through Identification of Kidney, Pancreas and Intestine

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Abstract. Worldwide human health and economic has been affected due to the ongoing pandemic of corona virus (COVID-19). The major COVID-19 challenges are prevention, monitoring and FDA approved vaccines. IOT and cloud computing play vital role in epidemic prevention and blocking COVID-19 transmission. Mostly lungs and hearts are affected. Other than lungs many parts are affected which are not considered as prominent conversational cue. In this paper, we have proposed smart system that is effective through detection of pancreas, kidney and intestine. It detects acute pancreatitis, protein leak, microscopic blood leak, post infectious dysmotility and gastrointestinal bleeding. The data from the edge devices are collected and mapped into the cloud layer. The cloud consists of COVID-19 patients medical records which compare the user data with the existing patient records. Once the data matches it sends warning message to the user regarding the result of affected parts. Based on the result from KPI system, it analyzes with all data and using deep Convolutional Neural Network (CNN) it classifies whether the pancreas, kidney and intestine are affected or not due to COVID-19.

Keywords. Cloud Computing, KPI, Convolutional Neural Network, Acute Pancreatitis, Dysmotility.

1. Introduction

The COVID-19 is an ongoing pandemic of coronavirus disease 2019 caused by the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), first identified in December 2019 in Wuhan, china. More than 43.9 million cases were recorded with more than 1.16 million deaths. It easily spreads through the respiratory route of infected person when they are physically close and spread through airborne. Though fever and cough are common symptoms; fatigue, difficulty in breathing and loss of smell and taste are other symptoms to identify the corona virus infection. Due to COVID-19 many complications may arises which includes pneumonia and respiratory problem. The life period of corona virus is around five days for moderate cases but ranges from 1 to 14 days. The global death-to-case ratio is 2.7 percent till October which is increasing day-by-day.

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The metric used to assess the death rate is Infection Fatality Rate (IFR) which is calculated by taking deaths attribute to disease divided by infected individuals till date. COVID-19 spreads easily from one person to another through the respiratory path of an infected person while coughing, sneezing or breathing. Infected people remain in incubation period for 7-12 days in case of moderate and for severe cases it takes up to two weeks. In October 2020, it is clear that it can reinfect the patient with the same or different symptoms which were proved by scientists since the symptoms of COVID-19 are non-specific. Fever and dry cough are the common symptoms of corona virus.

Based on symptoms, COVID-19 can be diagnosed and confirmed using reverse polymerase chain reaction (RT-PCR) by taking the infected region or chest X-ray. Vaccine for corona virus is based on the knowledge about the structure and function which leads to development of vaccine in early 2020 through various technologies around the world. There were 321 candidates who developed vaccine to cure and prevent the virus infection, but the vaccines are under trail and testing regarding safety and efficiency. Other than lungs many organs are affected due to COVID-19. The organs such as kidney, pancreas and intestine are affected due to COVID-19. A research report shows that there is serious risk of Acute Kidney Injury (AKI) for people affected by COVID-19. It is the artifact to COVID-19 infection because it may lead to serious illness, dialysis and death rate is high for these patients. Various COVID-19 related effects lead to AKI which result in infection of the kidney. Even after discharged from hospital most of the COVID-19 patients have low kidney function.

COVID-19 cause acute pancreatitis. It may cause organ paralysis, failure of respiratory organ with high impermanence. Patients admitted with COVID-19 symptoms have upper abdominal pain. On analysis they had mild cough and unfiltered in chest X-ray on the day 3 of illness but no fever. There was no history of intake of alcohol, trauma or drug predisposing to AP. The patients were diagnosed as moderate COVID-19 and mild acute pancreatitis.

The Corona virus not only affects the lungs: in advanced cases of COVID-19 it causes gastrointestinal infection. Imaging scan reports of hospitalized COVID-19 patients reported with abnormalities in bowel region. Most of the effects were severe and leads to clots and blood flow impairment. Autopsy and biopsy are used to verify the intestinal damage caused by corona virus infection. 3% of COVID-19 patients have gastrointestinal infection without respiratory infection.

A machine learning method has the ability to determine whether the COVID-19 patients will recover from complications or to be admitted in hospital based on the available data. The large dataset helped to ensure that the machine learning tool was able to read many different images and data available to predict the complications occurred due to COVID-19. It has also achieved in predicting hospitalization, illness and death. Machine learning tool potentially helps the providers and users to determine automatically and rapidly which patients are to develop complications from the virus infection.

The API machine learning tool helps to determine the acute pancreatitis, protein leak, microscopic blood leak, post infectious dysmotility and gastrointestinal bleeding based on the test report. It determines whether the patient organ is affected or not and store the data in the cloud. It helps to analyze the various patients and give advance alert rate about the complications.

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2. Related Work

The structure, diagnosis and vaccine of COVID-19 are discussed. The importance of deep learning, AI, IoT and blockchain in managing the severe effect of corona virus like false reports and wrong information [1]. Due to COVID-19 many organs are affected which are not in conversational cue. One of the organs is Kidney, a new automated sensing technique is introduced to detect the kidney disease by monitoring the urea level in saliva samples. And for further analysis of signals generated by sensor, the CNN is induced with SVM to classify [2].

Chronic Kidney Disease (CKD) has high death rate and causes other disease. In early stage, there are no symptoms to notice so the patients are not aware of disease. Corona patients are affected by chronic kidney disease which leads injury and function becomes slow. The unified model with perceptron; compared to other models it achieves high accuracy due to combination both logistic regression and random forest is proposed [3]. Corona virus causes pneumonia lesions and segmentation of lesions from CT images is important for accurate diagnosis [4]. Deep learning methods have the ability to automate the diagnosis and detection of disease which requires high quality data. The noise-robust framework called COPLE-Net helps to segment the lesions from the images automatically [5].

Wireless Capsule Endoscope (WCE) is used to detect the lesions in small intestine incorporated with YOLOv3 is proposed [6]. By comparing the hash values, the superfluous images are filtered. This computer-aided application with WCE detects the lesions accurately than manual detection. CKD results in high death rate, therefore it is necessary to detect the disease during early stage. Varieties of DL algorithm are proposed to classify the disease automatically [7]. But there is no work in comparing the DL algorithms which achieves more accuracy in CKD. The major issues of COVID-19 which includes geographical issues, high-risk patient and recognition have been reviewed [8]. For detecting and finding location of lesions in the kidney, the CT scan image plays a major role as it provides useful information in many applications. Traditional detection of lesions in kidney needs more labor and time. The proposed IOU based kidney lesion detection is based on cascade CNN to improve the tiny lesions and stability [9]. Other than CNN, FPN and RCNN are used in CT.

The diagnostic models for corona virus with multiple feature decision-making are not easy process. The TOPSIS is incorporated in MCDM method in order to standard the technique is to calculate weight of the multiple feature [10]. By analyzing various machine learning techniques, computer vision-based diagnosis of chronic Kidney Disease is proposed [11] and comparisons are made. In Weka software, cross-validation of K-fold method is compared with J48 decision tree and random forest but still there is problem arising in predicting the accurate result.

For predicting the corona virus outbreak, ML-based prediction system has been proposed and the forecasting is achieved, results are proved [12]. To predict the death rate and for confirming the cases the LR and LASSO techniques are used. The main focus of deep learning techniques in this pandemic situation is to real time monitoring. To prevent virus spread and limit the clinical resources in the rapid evaluation of COVID-19, the CXR is used to diagnosis and managing patient [13]. Patch-based framework with neural network train the data more stable and mapped to local neural network for finding the radiation which is compared with the trained and proposed SOTA method.

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Dual-KA was developed [14] by correlating the two kidneys with multiple feature approach in the human body is to stimulate and predict the kidney function. In each iteration of multiple feature approach, the GHR is checked in the dual-KA. The proposed method is used for many problems like benchmark classification, prediction of time series and water in real world. Detection of cancer is also tested by the proposed method with flexibility in detecting and tracking the symptoms of corona virus in low cost. Using headset, the respiratory problems are detected which is simple in configuration [15]. The principle behind the detecting respiratory problem with simple configuration can be extended to predict heart rate, temperature and oxygen saturation with the help of sensors which can be one of the solutions in predicting the symptoms and detection of corona virus.

The structure of kidney with renal changes is correlated in dynamic time series [16] and the images are registered. It should be developed as a tool for measuring the arteriosclerosis. In biopsy, the arteriosclerosis is detected by correlating the deformed images, normalized volume with pressure gradients. To learn the specific features of CXR, the diverted data distribution is used which is modality specific transfer by collecting CXR in large-scale [17]. In CXR classification, the proposed model is compared to pertained weights of ImageNet. Further, the model is improved and fine-tuned while transferring the images during classification.

On the spatial neural network, the kidney is detected with 3D ultrasound images by changing the image shape to volume [18]. To increase the accuracy in detecting the kidney function, the modelling of shape and classification of voxel was introduced and it validates texshape-based method superiority. To monitor the protein leak in urine, the POCT model was developed which is reliable. It is designed and developed with low cost economically portable. The protein leak is based on the total protein concentrate and creatinine in urine. It is color intensity change method with sensors. The detection of kidney disease is tool kit [19] which monitors the creatinine, protein concentrate of urine and display immediately which helps to cure in early stages. The model is designed in such a way that is user friendly which monitors and display amount of protein leaked in urine.

The ventilator is highly required for corona patients in case of severe where the capacity of airflow is expanded. So, the smart system was developed where the ventilator can be separated and used for two patients at a time [20]. The shortage of ventilator is raised as major problem in this pandemic situation. To avoid this problem the parallel model that supports the ventilator shortages was developed. The VSRS system was designed with user interface to avoid the potential error with effort. The hybrid CNN is used in internet of medical platform to predict the kidney disease [21] was developed to detect the small lesions in the renal.

To address the corona virus detection and prediction using deep learning methods there is war between the contents in online. The LDA algorithm [22] is used to collect the related information from the available sources regarding vaccines and development. To handle the large dataset the statistical methods are developed which are potential in labelling the disease. To classify the CT images, the weakly supervised deep learning [23] was developed to reduce the time delay of decision taking and treatment for the kidney is recommended. The deep learning framework is designed which extracts the CT images from different sources which includes scanners and centers. It is faster than established model and automatically classifies the images accurately. It helps the patients

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by providing warning messages regarding the severity of the disease and treatment. The crossbar-net [24] is the segmentation model mainly focused on size and of patches. Various image patches are trained in cascaded network to learn about the structure of renal with and without abnormality. This achieves the fast, accurate diagnosis and treatment of various kidney tumors with varying size and shape.

3. Proposed Framework

The solution for COVID-19 is a challenging task. The experiments on vaccines are still going on but the effects related to corona virus infection are increasing day by day. Early stage of corona virus caused infection only in respiratory organ and heart. But other organs are affected which is found later once the corona infection is cured. Many applications and wearable gadgets are introduced to detect the corona virus manually in home. Also, the smart devices are invented to detect the damage or infection in the lungs and heart due to COVID-19. Other than lungs many organs are affected which is not considered as conversational cue. Researchers found that it affects the kidney, pancreas and intestine in various ways. The proposed work is about the detection of kidney protein leak, microscopic blood leak, Acute Pancreatitis (AP), gastrointestinal bleeding and post infectious dysmotility. Deep learning techniques have the ability to predict the disease

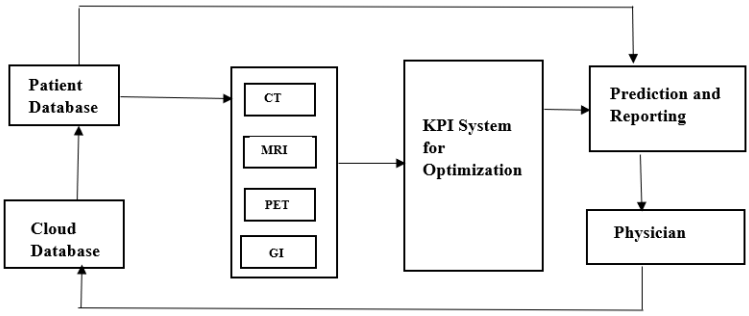

Figure 1. Architecture of KPI System

rapidly with the help of large dataset. It classifies the labels of disease which is helpful in diagnosing and treatment in the early stage. Deep learning works based on the neural networks; prediction is accurate if the network is deeper. It takes the input data without defining features and predicts the output more accurately. Various deep learning algorithm are used to predict the health diagnostics, here the Convolutional Neural Network (CNN) is used to predict the kidney, pancreas and intestine infection with the help of large data. Cloud computing provides security to the data which are highly confidential. Cloud plays a vital role in the healthcare system. After the prediction of health, the data are stored in the cloud securely for future use. Two databases are maintained namely patient database and cloud database as shown in Figure 1. Both the database holds the patient details and reports generated by the imaging system. Only the authorized user accesses the database to update, replace and delete the patient records. Imaging system holds the various scan reports which includes MRI, CT, PET and GI reports. Magnetic Resource Imaging (MRI) is used to take pictures of various tissues of pancreas, Com-

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puted Tomography (CT) is usually for diagnose disease or injury in the kidney, Positron Emission Tomography (PET) is for detecting cancer in the pancreas and Gastrointestinal Test (GI) is to detect the infection or injury in the small intestine and large intestine. These reports are used to optimize and improve the output of imaging system. The scan reports are used for tumor detection, chronic kidney disease and infections. Deep learning methods has the potential to detect the lesions in the kidney as in training phase, the CT images are trained with varying size and shape. It helps to learn the structure and function of kidneys and suggest treatment to physician which reduce the time, man power and cost. AI-based methods are incorporated in existing deep learning methods to overcome the outbreak of pandemic. Many kidney problems have no symptoms in early stage in such cases AI-based method helps to understand the function and structure of abnormalities in organs. This reduces the death rate and increases the life span of patients by detecting the disease in the early stage. The patient database holds the COVID-19 results and scan reports. The CT is combination of both X-rays and computer technology to take images horizontal or axial. CT scan of kidney is for prediction of tumors, chronic kidney disease and kidney stones. It detects the amount of protein and microscopic blood leak in urine. MRI is for confirming diagnosis and complications due to acute pancreatitis. PET measures the blood flow, oxygen use and functioning of pancreas. GI is for detecting the gastrointestinal bleeding and post infectious dysmotility. After fetching the scan reports it is optimized to improve the output of images to predict the affected parts using CNN. Images are improved and optimized by the CNN. Once the input images

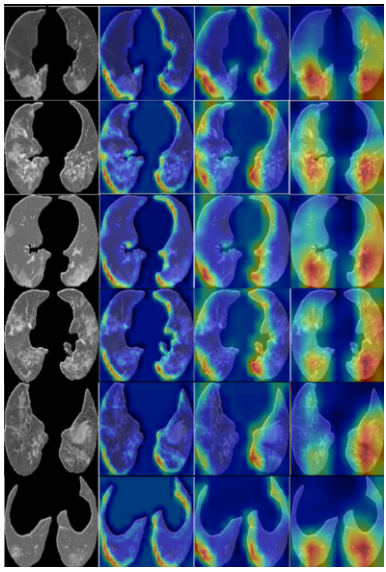

Figure 2. Optimization Results of CT images

are loaded in the CNN, it generates its own feature by extracting from the input images. The feature is extracted to predict the health diagnostics as shown in Figure 2. The CNN is one of the top deep learning technologies which predict the output rapidly and accurate compared to other technique. The input image file is not directly taken by the CNN, rather than it converts the images into pixel values and passed to the input layer. First the

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input image pixel values are feature mapped by preserving the important features, then max pooling is applied in order to recognize the image and to predict the output as the input files vary in size and shape. Finally, the input values are given to the input layer, it undergoes through the layers to predict the output. Then it calculates the error rate in the output layer to check whether the predicted output matches the actual output. Again, it calculates the error rate by adjusting the weights. It processes until the CNN predicts the accurate output. Once the output is predicted, the report is generated whether the COVID-19 patients is affected with kidney infection, acute pancreatitis, gastrointestinal bleeding and post infectious dysmotility. Once the report is generated it is directed to the physician for cross checking and for treatment. The reports are stored in the cloud database for further use. The reports are accessed by the patients and physician to further treatment. It can be restored in the same cloud after the diagnosis which helps the other patients to predict the affected parts due to COVID-19. The proposed method is compared with other existing methods as shown in Table 1. The accuracy, sensitivity, specificity and F1 score are calculated it shows the proposed CNN methods achieves maximum accuracy than Support Vector Machine (SVM), Decision Tree, K-nearest neighbor (KNN) and Random Forest (RF).

Table 1. Comparison of Performance between proposed and other methods

Classifier	Accuracy	Sensitivity	Specificity	F1 score
SVM	85.79	86.00	86.56	-
Decision Tree	87.98	87.88	86.23	87.80
KNN	90.02	93.20	95.14	90.56
Random Forest	97.36	98.98	98.74	97.43
Proposed Method	99.86	100	99.80	99.78

4. Discussion

Targeting on the feasibility of the CNN application for diagnosing COVID-19 related problems in organs, such as lungs, heart, kidney, liver, pancreas and intestine, CNN and cloud are used to suggest several DL-based methods. Other problems like high-risk patients, preventing from outbreak are recognized by DL methods. Advanced Deep Learning algorithms are integrated and analyzed the large data related to corona patients to understand the structure, function of virus, improving the speed and accuracy of detecting the organ dysfunction. It has been criticized that only some users are collecting the data, storing, managing and accessing. To avoid this, cloud computing is proposed in order to collect the huge corona patient data and maintained securely. It is used to predict and analyze the data more efficiently. However, AI-based methods are used to diagnosis the health condition because it monitors and collects data from several sources [25]. Various information regarding the COVID-19 from the articles and publications are concealed by suggested methods. While variety of inputs available publicly, clinical health data are shared as input for almost all AI and DL techniques. When people are surrounded by group they are characterized to be in high risk, so it is important to monitor the patients throughout the disease life period. The proposed method focused on kidney, pancreas and intestine of corona patients. These ideas are also extended to other high-risk

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patients because DL techniques are accurate in estimating the data and prediction. It is important that COVID-19 is spreading rapidly and affects the organs in second week of infection; therefore, the patients cannot be guarantee if they are recovered from the infection [25]. This clearly shows the importance of integrating the effective CNN-based method in understanding and detecting COVID-19. When data is given to this technique, it creates new data and feature as the training data. However, there are many techniques are available which predict and detect the disease by reducing the dependency in input. Though the proposed method has not been utilized earlier in case of diagnosing kidney, pancreas and intestine for effectiveness, there are several reports and source proved that speed, accuracy and efficiency is achieved by this method for similar kind of diseases. It is generalized that these methods are important for prediction in case of corona virus.

5. Conclusion

In this paper, based on ML and Cloud-based techniques with introduced concepts and platforms are proposed to deal with COVID-19. Incorporating COVID-19 diagnostic system such as RNN and CNN, many techniques have been developed. The main issues with COVID-19 like high-risk, geographical issues and recognizing have been discussed and studied in this work. The number of clinical and non-clinical datasets are used for prediction have been showed along with their mechanism for selecting models. By considering these platforms, it helps the experts and physician to analyze huge dataset, train machine, algorithms or optimize the analyzed data with more speed and accuracy. We discussed that they are suitable for creating workspace while experts and physician to work side by side. For this level of complexity, novel approaches have to be developed and real experiments should be conducted because advantages and limitations of ML methods for COVID-19 is yet to be achieved. The tools that developed to achieve sought goals and realize saving more lives from death.

References

[1] Chamola V, Hassija V, Gupta V, Guizani M. A comprehensive review of the COVID-19 pandemic and the role of IoT, drones, AI, blockchain, and 5G in managing its impact. Ieee access. 2020 May 4;8:90225-65.

[2] Bhaskar N, Manikandan S. A deep-learning-based system for automated sensing of chronic kidney disease. IEEE Sensors Letters. 2019 Sep 18;3(10):1-4.

[3] Qin J, Chen L, Liu Y, Liu C, Feng C, Chen B. A machine learning methodology for diagnosing chronic kidney disease. IEEE Access. 2019 Dec 30;39(8):20991-1002.

[4] Xiao Z, Feng LN. A Study on Wireless Capsule Endoscopy for Small Intestinal Lesions Detection Based on Deep Learning Target Detection. IEEE Access. 2020 Aug 27;8:159017-26.

[5] Neumann K, Steil JJ. Optimizing extreme learning machines via ridge regression and batch intrinsic plasticity. Neurocomputing. 2013 Feb 15;102:23-30.

[6] Khan B, Naseem R, Muhammad F, Abbas G, Kim S. An empirical evaluation of machine learning techniques for chronic kidney disease prophecy. IEEE Access. 2020 Mar 18;8:55012-22.

[7] Jamshidi M, Lalbakhsh A, Talla J, Peroutka Z, Hadjilooei F, Lalbakhsh P, Jamshidi M, La Spada L, Mirmozafari M, Dehghani M, Sabet A. Artificial intelligence and COVID-19: deep learning approaches for diagnosis and treatment. Ieee Access. 2020 Jun 12;8:109581-95.

[8] Zhang H, Chen Y, Song Y, Xiong Z, Yang Y, Wu QJ. Automatic kidney lesion detection for CT images using morphological cascade convolutional neural networks. IEEE Access. 2019 Jun 20;7:83001-11.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[9] Mohammed MA, Abdulkareem KH, Al-Waisy AS, Mostafa SA, Al-Fahdawi S, Dinar AM, Alhakami W, Abdullah BA, Al-Mhiqani MN, Alhakami H, Arbaiy N. Benchmarking methodology for selection of optimal COVID-19 diagnostic model based on entropy and TOPSIS methods. Ieee Access. 2020 May 19;8:99115-31.

[10] Sobrinho A, Queiroz AC, Da Silva LD, Costa ED, Pinheiro ME, Perkusich A. Computer-aided diagnosis of chronic kidney disease in developing countries: A comparative analysis of machine learning techniques. IEEE Access. 2020 Feb 3;8:25407-19.

[11] Rustam F, Reshi AA, Mehmood A, Ullah S, On BW, Aslam W, Choi GS. COVID-19 future forecasting using supervised machine learning models. IEEE access. 2020 May 25;8:101489-99.

[12] Oh Y, Park S, Ye JC. Deep learning covid-19 features on cxr using limited training data sets. IEEE transactions on medical imaging. 2020 May 8;39(8):2688-700.

[13] Abdullah S, Jaddi NS. Dual kidney-inspired algorithm for water quality prediction and cancer detection. IEEE Access. 2020 Jun 11;8:109807-20.

[14] Stojanović R, Škraba A, Lutovac B. A headset like wearable device to track COVID-19 symptoms. In2020 9th Mediterranean Conference on Embedded Computing (MECO) 2020 Jun 8 (pp. 1-4). IEEE.

[15] Hodneland E, Keilegavlen E, Hanson EA, Andersen E, Monssen JA, Rørvik J, Leh S, Marti HP, Lundervold A, Svarstad E, Nordbotten JM. In vivo detection of chronic kidney disease using tissue deformation fields from dynamic MR imaging. IEEE Transactions on Biomedical Engineering. 2018 Nov 2;66(6):1779-90.

[16] Rajaraman S, Siegelman J, Alderson PO, Folio LS, Folio LR, Antani SK. Iteratively pruned deep learning ensembles for COVID-19 detection in chest X-rays. IEEE Access. 2020 Jun 19;8:115041-50.

[17] Marsousi M, Plataniotis KN, Stergiopoulos S. Kidney Detection in 3-D Ultrasound Imagery via Shape-to-Volume Registration Based on Spatially Aligned Neural Network. IEEE journal of biomedical and health informatics. 2018 Feb 13;23(1):227-42.

[18] Mandal N, Dutta S, Gupta A, Bandyopadhyay D. Based Sensors for Point-of-Care Kidney Function Monitoring. IEEE Sensors Journal. 2020 Apr 24;20(17):9644-51.

[19] Kaplan M, Kneifel C, Orlikowski V, Dorff J, Newton M, Howard A, Shinn D, Bishawi M, Chidyagwai S, Balogh P, Randles A. Cloud computing for covid-19: lessons learned from massively parallel models of ventilator splitting. Computing in Science & Engineering. 2020 Sep 21;22(6):37-47.

[20] Chen G, Ding C, Li Y, Hu X, Li X, Ren L, Ding X, Tian P, Xue W. Prediction of chronic kidney disease using adaptive hybridized deep convolutional neural network on the internet of medical things platform. IEEE Access. 2020 May 18;8:100497-508.

[21] Sear RF, Velásquez N, Leahy R, Restrepo NJ, El Oud S, Gabriel N, Lupu Y, Johnson NF. Quantifying COVID-19 content in the online health opinion war using machine learning. Ieee Access. 2020 May 11;8:91886-93.

[22] Hu S, Gao Y, Niu Z, Jiang Y, Li L, Xiao X, Wang M, Fang EF, Menpes-Smith W, Xia J, Ye H. Weakly supervised deep learning for covid-19 infection detection and classification from ct images. IEEE Access. 2020 Jun 29;8:118869-83.

[23] Yu Q, Shi Y, Sun J, Gao Y, Zhu J, Dai Y. Crossbar-net: A novel convolutional neural network for kidney tumor segmentation in ct images. IEEE transactions on image processing. 2019 Mar 18;28(8):4060-74.

[24] McCall B. COVID-19 and artificial intelligence: protecting health-care workers and curbing the spread. The Lancet Digital Health. 2020 Apr 1;2(4):166-7.

[25] Greenhalgh T, Koh GC, Car J. Covid-19: a remote assessment in primary care. Journal of Biomedical. 2020 Mar 25;368:1-5.

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Energy Efficient Clustering Technique for VANET

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Abstract. Vehicular ad-hoc networks (VANET) are listed as an extension of mobile ad-hoc networks (MANETs) which can improve road safety and provide the Intelligent Transportation Systems (ITS). In addition to its advantages, VANET faces many obstacles ranging from high-energy consumption to instability induced by high changes in topology. The main goal of designing an optimum route algorithm is to decrease the probability of contact failure and reduce the energy consumption of nodes within the network. Clustering is thus a method to combine nodes and make the network more robust. With no node consciousness, it is often shorter on resources, which causes network execution problems and changes in topology. At that point, a primary energy issue emerges in the AODV routing protocol that aims to improve the energy efficiency of the V2V communication in nodes lifetime and to connection lifetime problems in the network. This article proposed a clustering-based optimization technique called Energy Efficient Clustering Technique (EECT) with the AODV protocol's K-Medoids clustering algorithm in order to cluster vehicle nodes and find nodes that are convincing to interact in a defined secured and reliable path, which detailed in previous works. Efficient nodes are recognized from each cluster with the goal of energy-efficient communication, to optimize the parameter as minimum energy consumption in VANET.

Keywords. VANET, AODV, Energy Efficient Routing, K-Medoid Clustering, Minimum Energy Consumption.

1. Introduction

Electronic road signs were visible throughout the mid-19th century, traffic officers used colored lights, hand signals, semaphores to track and monitor farmer movements in the 1930s. The 1940s saw widespread use of vehicle indicators, and in the 1960s various types of warning signals were introduced to alert drivers to current events [1]. Countries like the United States, Japan and Europe have recently launched measures to create a safer and more efficient driving situation. It has led researchers to engage in vehicle technology or intelligent transport systems and to exchange vast amounts of information, such as traffic information and direction, through wireless network protocols. This led

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to the development of an ad hoc vehicle network called the Vehicular Ad-hoc Network (VANET). VANET is a mobile ad-hoc network that tackles all issues related to the messaging of wireless test vehicles. An ad-hoc network is a set of mobile nodes that usually have wireless connectivity without any current or centralized connection point [2]. VANET allows the creation of wireless vehicles as necessary. Comprehensive path must begin to allow efficient communication of the packet to its destination through reasonable routing protocol architecture. As a result, transceivers and computerized vehicle control modules enables communication [3]. The aim of VANET is to ensure comfort and protection in fuel stations, weather, parking, traffic blocks and emergency alerts. Abundant energy is wasted in the node during transmission and battery life in order to provide this information. The VANET architecture is detailed in Figure 1.

The vehicle data is handled by computers, sensors, automobile foundations and equipment. VANET, no network provider, provides road (vehicle) and roadside (RSU) connectivity to customers [4]. V2I, V2V and VRC [5] have been found in Intelligent Transportation Systems (ITS) areas to resolve some of the different issues.

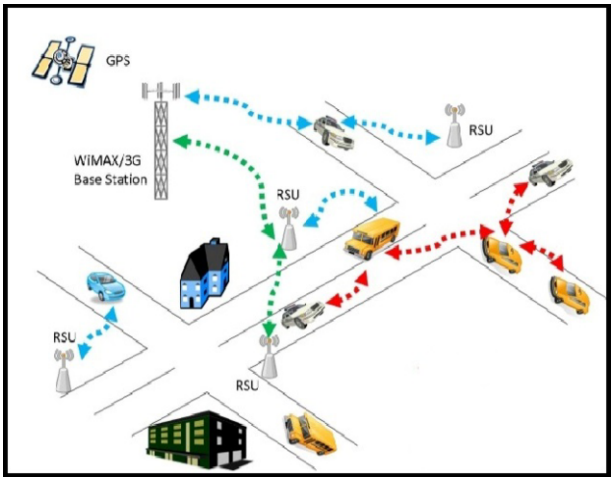

Figure 1. VANET Architecture.

Over the years Green Technology has taken the growing use of electricity in remote technologies into consideration. The complex technical collection includes factor in transmission power and transmission probability. Every round, nodes will send traffic and use their energy; nodes will refresh the chances of sending them on prior conviction. The supplementary protocol improves energy efficiency and reduces dead nodes in the Wireless Network. The algorithm is used in critical physical inactivity and energy efficiency network [3,5,6], which is often missing. The Energy-Efficiency Protocol reduces the WSN's energy consumption and thus expands its operating range, leading to the use of the shortest possible routes. Once, it is attempting to change the use of certain power to predict network clustering. Therefore VANET, incorporates dynamic topology as well as some arbitrary and variable network forecasts for vehicle speed. The best way to move data from the source node to the target node is to analysis to determine the proper moving of vehicles to transmit information related to traffic, between the source node and the destination node. Interestingly, various governments, companies and aca-

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demic institutions around the world have taken over numerous VANET companies in the last decade.

2. Related Works

The study was inspired by some work on the VANET energy supply. Here are some of the major inquiries. Lochert et al. [7] suggested that they use a genetic algorithm to approach a traffic information system (RSU). Good RSU sites are chosen from the initially defined list of possible positions to assess the extremely fragmented nature of VANET during the early deployment phase. The choice of the best set of RSUs, however, strongly depends on the simulated transport situation in the studies.

In the road scenario, the study of VANET support location routing (LAR) using metrics such as packet delivery ratio (PDR), network performance, average delay and overhead routing was presented by Husain et al. [8]. The LAR for various node density metrics is calculated. The test was performed at 100 km / h at some very high speed. The protocol demonstrated good communication efficiency in vehicle, showing that, at a fair number of nodes, the PDR increases and although decreases the higher network density.

Zhang et al. proposed energy efficient routing Protocol (ERBA) [9] that uses vehicle activity and classification of VANET motion patterns. Changing patterns are introduced, considering current and future trends. ERBA allows packet transmission with a proactive routing protocol to choose appropriate paths for applications that require delays. ERBA analysis and correlation in Shanghai with AODV real urban scenarios, considering such performance metrics as performance levels, probability density, reliable neighborhood connection and end-to-end delay.

Deshmukh and Sonekan [10] proposed an improved AODV protocol to improve the performance of the standard AODV protocol, in order to improve the route discovery process , improve the road detection process and reduce energy utilization during message distribution by a two-tier method. Similarly, the improved protocol used reduces the overhead gap and is adaptable to different traffic conditions.

In order to select the correct route from source to destination for energy transmission from a vehicle, Laroiia and Lekhi [11] implemented of the root and leaf node concept using the Location-Aided Routing (LAR) protocol, which defined root nodes. Data can be flowing from the leaf nodes to the root node, usually to the sink. The simulation of 35 nodes and 50 nodes reveals an increase in energy consumption of 56.7% and 38% and a decrease of 64% in 8 seconds, respectively.

The WSN test is comparatively about the limited node energy resources, as Ghaffari relies heavily on WSNs during their lifetime [12]. Therefore, this study explores the effect on transmission decisions in an effective location-based routing protocol and focuses on estimated data transmission for specific service quality (QoS) parameters. While VANET is considered to be a MANET subclass, Samira Harrabi et al. [13] presented VANET can use the high flexibility of the vehicle which ensures successive changes in network topology, including road change and fluctuating node thickness of existing vehicles along the route.

Sharma et al. [14] looked at the methods of integrating the DCF-MAC protocol with an ad hoc power-efficient network of OFDM radio network interfaces. Agarwal et al. [15] proposed a new load-adjusted routing approach to increase grid resilience and battery

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life at each node. Nearly load-adjusted routing study sets these upper limits on two RSUs in rear-to-back for the variable energy transfer dimensions of any vehicle. The problem of a straight net with a uniform distribution of vehicles was identified with more than 1-D lane.

3. AODV & K-MEDOID Clustering

3.1. AODV Protocol

The aim of the AODV protocol was to pick an appropriate route from source to destination. AODV [16] starts route scanning when a source node sends data to a destination node. A route request packet (RREQ) is transmitted to the source node during the course of this method. Neighboring nodes clueless of the active route for the corresponding destination node forwards the packet to their neighbors until they locate the active route or hit the maximum hops. Through Unicast mode route reply (RREP) packet is sends back to the source node where the intermediate node knows the path to the target node. Finally, the RREP packet is given to the source node, and the route opens.

Route Discovery-AODV sends RREQs to nearby nodes to investigate the route. The RREQ broadcast includes source address, location of sequence number, broadcast Id, and counter that count the number of times RREQ has been created for a particular node. By increasing the number of hop nodes to minimize RREQ retrieval, it receives RREP from its neighbors or transmits the RREQ from source. Whereas, the RREQ is also conveyed from neighbours. Using the AODV route tab to prevent node entries that do not exist in the source-to-target direction. Route table monitoring is achieved using aim sequence numbers. When a node detects a non-valid communication path, all relevant entries for these invalid routes are removed from the routing table. This then transfers the RREP to neighbouring nodes, no longer true.

3.2. K-Medoid Clustering

This cluster model uses information pieces ”k” to classify k clusters as the initial medoids. Similar residual nodes are positioned in a closest cluster. Until then the Medoid was resolved and could help characterize a cluster, K clusters focusing on medoids are built, and each individual is placed in the related cluster focusing on the nearest medoid.

K-Medoids [17] or PAM clustering algorithm that is similar to the K-means algorithm. Algorithms are split between K-means and k-medoids (group breaking data). Both would be attempting to reduce the gap between cluster points and center point of the cluster. In comparison to k-means, k-Medoids use data points as a center (medoids or examples) and can be used for arbitrarily defined distances, whereas k-means do not usually use cluster data center (average cluster). In 1987, regular and other remote functions were introduced with PAM. Initialization: Chooses the n data points value ‘K’ as the medoids. Selection of Medoids: Medoid value is determined by measuring distance from each of the two data points for any object considered. Here, the distance measure is calculated by Eq. (1).

$$D_{dist} = \left(\sum_{k=1}^{N} |v_{ik} - v_{jk}|^{nd} \right)^{\frac{1}{nd}} \tag{1}$$

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When nd = 1, it is the L1 norm distance metric, when nd = 2 it is L2 norm distance metric,and so on. The L1 norm represents the absolute difference between two vehicle attributes. The standard L1 is flexible, robust, and outliers-resistant. Additionally, due to the inherent sparsity, it is computationally efficient in high-dimensional data. To find the distance between vi and vj a co-occurrence based approach is specified in Eq. (2).

$$D_{dist} = \frac{1}{K} \sum_{j=1}^{k} max_{j \neq 1} dist_{i,j} \tag{2}$$

Where $D_{ij}$is when the vehicle vi and vjwithin the same cluster. When vehicle vi and vjare in a different cluster then the Eq. (3) is processed.

$$D_{i,j} = \frac{(\overline{dist_i} - \overline{dist_j})}{dist_{ij}} \tag{3}$$

Where $\overline{dist_i}$ is the average distance from each point of the ith cluster to the centroid of the ith cluster.$\overline{dist_j}$ is the average distance from each point of the i^{th} cluster to the centroid of the j^{th} cluster. is the distance between the centroids of the i^{th} and j^{th} clusters. The maximum value of represents the worst case between the cluster ratio i. Some of the key points to be noted.

1. The initial cluster is created by assigning the closest medoid value to each individual.
2. In each cluster, the role of calculating the new medoid is to minimize the total distance between objects in the cluster.
3. The clustering effects are accomplished by allocating each client to the shortest medoid. Execution of the clustering algorithm may end if the number is equal to something like the previous one. Additionally, the Medoid cycle rehash the K-medoid algorithm for distance calculation of a K-medoid algorithm gets 200 knots initially.

3.3. Energy Efficient Clustering technique

This section proposed a K-medoid algorithm involving initialization, iterative detection, and outer detection. DBI-measuring is the basis of assessment cluster algorithms, and the distribution of points is centred on each medoid-like dataset.

A city map can be viewed as a subset of topology for the network, and road transport conditions are limited to vehicle development. Here 200 nodes were used, ordinary nodes showed without a GPS in grey data trading. Conversely, despite the output impedance of the jammers, a few reference nodes must be fitted at once with accurate GPS and poorly controlled communications to provide fair knowledge of the position data for the entire network. There are two routes to this road. All sides of the road have separate source node and destination node; the proposed K-Medoid algorithm is exhibited in Figure 2.

The findings revealed several methods for VANET clustering. Cluster utilises and uses VANET cluster systems for frame clusters, without taking into account a comparison of VANET size. Outside, experts use a model for the K-Medoid clustering that included clustering 200 vehicle nodes, rejecting a lower-individual group of vehicles, and joining with its head of the neighboring group.

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Algorithm 1 Proposed EE- Clustering Technique

Input

K: Number of Clusters, D: Set of Data Points A: A Constant Value, B: A small constant value

Output Clusters $C_1, C_2, C_3, \ldots C_K$

BEGIN
{1.Initialization Phase}
S = random sample of size A.K
{M = Set of potential medoids of size B.K m_1, m_2 , . . .
computed from S by a greedy strategy}
M = Greedy(S , B.K)
{2. Iterative Phase}
BestObjective = ∞
$M_{current}$ =Choose randomly m_1 , m_2 , m_k ⊂M based on the similarity measure}
repeat
{Assign each datapoint to a medoid in ∈ $M_{current}$ based on similarity measure
C=AssignPoints($M_{current}$,D)
where C=$C_1, C_2, \ldots C_K$ is the set of clusters.
ObjectiveFunction=EvaluateClusters($C_1, C_2, \ldots C_K$)
if objectivefunction¡Bestobjective **then**
    Bestobjective=objectivefunction
    $M_{Best} = M_{current}$
    compute Bad MedoidsεM_{best}
    if objectivefunction≥ threshold **then**
        $M_{current} = M_{Best} \cup m$
        where m ∈ M and m ∉ $M_{current}$

4. Experimental Evaluation

Figure 2. Simulation area

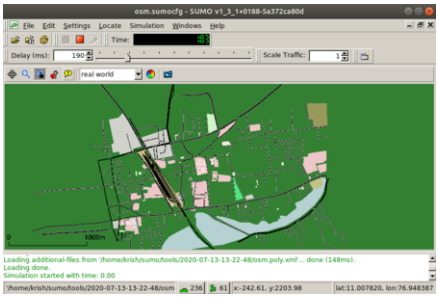

Figure 3. SUMO running environment

The performance of the K-medoid clustering and optimization model is evaluated in terms of energy consumption, packet delivery rate, network throughput, by evaluating the network parameters. To check the efficiency of the study, a Network simulation tool version 3.25 (NS 3.25) is used. With openstreet.org simulation surface was chosen to select the map location and simulated using the SUMO Traffic Simulator. Figure 2 shows

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Table 1. Simulation and traffic specification

Parameter	Value
Protocol	AODV
Connection Type	UDP
Packet Sizes	500 Bytes
Number of Connections	10 % of connections
CBR rate	128 KB/s
Number of simulation run	10
I-5s length L	12 Km
Number of lanes	4
Junctions	20
Maximum number of vehicles	1250
Mobility traces duration	400s
Road length L	2 Km
Traffic lights	2
Traffic status	continues arrival

selected simulation area. SUMO is a microscopic, open-source road traffic simulator, GPL. The German Aerospace Centre (DLR) and ZAIK are launching SUMO (Institute for Applied Informatic Technology). Table 1 lists simulation and traffic detail.

1. **Throughput:** Network performance can be described as executing accepted packets via a channel.
2. **Packet to the Delivery ratio (PDR):** The number of packets delivered via communications can be specified as having successfully transmitted a number of packets.
3. **Energy Consumption:** The overall energy consumption of the packet is called energy consumption from source to destination.

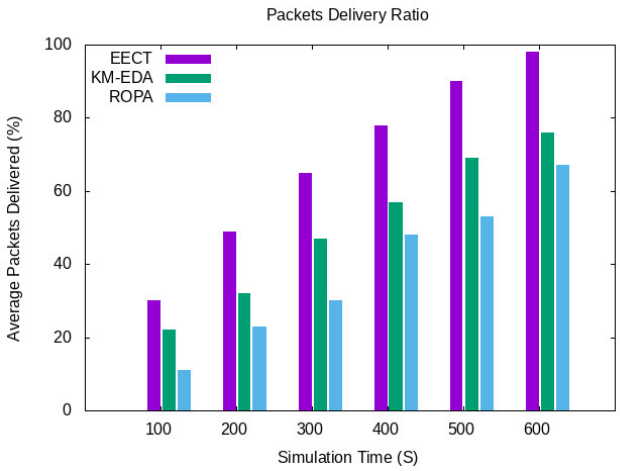

Figure 4. Average PDR

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The running environment of SUMO is presented in Figure 3. Figure 4 presents the PDR between the proposed EECT and existing KM-EDA and ROPA models. EECT maintains better PDR than the existing schemes. It achieves 30% of better performance in PDR than the others.

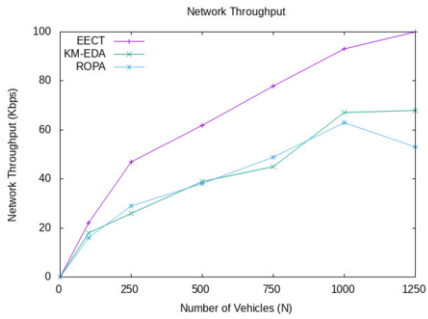

Figure 5. Network Throughput

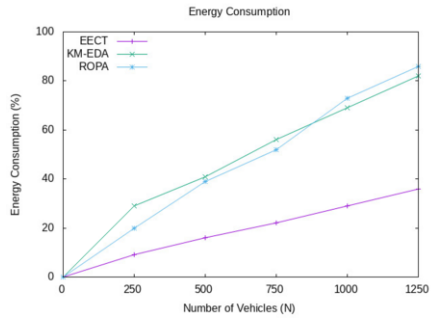

Figure 6. Energy Consumption

Figure 5 shows the network throughput between the EECT and other models. The proposed model attains 40% or better performance results in throughput compared to the existing. Figure 4 and 5 shows improvements, which in turn results in minimal energy consumption for the proposed model. Therefore, Figure 6 shows the energy consumption model. The proposed EECT retains less energy consumption than the existing systems. The proposed model achieves an energy-saving improvement of 45% relative to all of the others. Overall, the proposed study achieves an increase of 40 percent in clustering, lifetime and network maintenance compared with the other existing systems. The proposed work thus proved to enhance the VANET strategy for implementing it in Indian road conditions.

5. Conclusion

This paper represents VANETs to efficiently classify nodes, taking into consideration as the minimum energy usage. For example, the clustering algorithm, the K-medoid algorithm combined together with optimisation to achieve this goal. It groups the vehicle nodes in different conditions and selects a few other nodes as cluster heads in all other rounds. It will decrease the amount of messages sent from each node to various nodes and base station, saving more energy in the network. By using the EECT algorithm to advance the clustering and the energy-efficient route for V2V communication was obtained. In comparison to the k-medoid approach, the proposed algorithm k-medoid gives the minimum energy consumption resulting from the simulation experiment. This paper concludes the three iteration process that are, i) identifying the stable and secured routing, ii) identifying the reliable path selection for VANET and encompassing it with the stable and secured routing and finally, iii) identifying energy efficient clustering in the above merged work in claiming better model to implement VANET. In future, extend this work by enhancing energy efficiency and optimizing QoS by proposing eventually successful clustering and optimization strategies in Indian regions.

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References

[1] Tomar R, Prateek M, Sastry GH. Vehicular adhoc network (vanet)-an introduction. International Journal of Control Theory and Applications. 2016;9(18):8883-8.

[2] Omar HA, Zhuang W. Introduction. Springer; 2014 Sep 2.

[3] Hartenstein H, Laberteaux K, editors. VANET: vehicular applications and inter-networking technologies. John Wiley & Sons; 2009 Nov 4.

[4] Bakshi P, Nandi S. Secure, Privacy Enhanced and Anonymous Communication between Vehicle and Infrastructure. In 2019 Second International Conference on Advanced Computational and Communication Paradigms (ICACCP) 2019 Feb 25 (pp. 1-10). IEEE.

[5] Iswarya B, Radha B. Detailed Survey on VANET Environment. International Journal of Creative Research Thoughts. 2018;6 (1):16-20.

[6] Chaudhary B, Singh S. An Insight Analysis of Economic and Legal Challenges in VANET. International Journal of Applied Engineering Research. 2018;13(17):12991-4.

[7] Lochert C, Scheuermann B, Wewetzer C, Luebke A, Mauve M. Data aggregation and roadside unit placement for a vanet traffic information system. In Proceedings of the fifth ACM international workshop on VehiculAr Inter-NETworking 2008 Sep 15 (pp. 58-65).

[8] Husain A, Kumar B, Doegar A. A study of Location Aided Routing (LAR) protocol for vehicular ad hoc networks in highway scenario. International Journal of Engineering and Information Technology. 2010;2(2):118-24.

[9] Zhang D, Yang Z, Raychoudhury V, Chen Z, Lloret J. An energy-efficient routing protocol using movement trends in vehicular ad hoc networks. The Computer Journal. 2013 Aug 1;56(8):938-46.

[10] Deshmukh P, Sonekar S. Improving Energy and Efficiency in cluster based VANETs through AODV Protocol. IJCSIT) International Journal of Computer Science and Information Technologies. 2014;5(3):4788-92.

[11] Laroiya N, Lekhi S. Energy efficient routing protocols in vanets. Advances in Computational Sciences and Technology. 2017;10(5):1371-90.

[12] Ghaffari A. Hybrid opportunistic and position-based routing protocol in vehicular ad hoc networks. Journal of Ambient Intelligence and Humanized Computing. 2020 Apr;11(4):1593-603.

[13] Harrabi S, Jaafar IB, Ghedira K. Message dissemination in vehicular networks on the basis of agent technology. Wireless Personal Communications. 2017 Oct;96(4):6129-46.

[14] Sharma R, Malhotra J. Performance Evaluation of AODV and GOD for Qos Aware Applications through Realistic Conditions in VANET. International Journal of Computer Network and Information Security. 2015;7(11):64-71.

[15] Agarwal Y, Jain K, Karabasoglu O. Smart vehicle monitoring and assistance using cloud computing in vehicular Ad Hoc networks. International Journal of Transportation Science and Technology. 2018 Mar 1;7(1):60-73.

[16] Kumar A, Sinha M. Design and analysis of an improved AODV protocol for black hole and flooding attack in vehicular ad-hoc network (VANET). Journal of Discrete Mathematical Sciences and Cryptography. 2019 May 19;22(4):453-63.

[17] Elhoseny M, Shankar K. Energy efficient optimal routing for communication in VANETs via clustering model. In Emerging Technologies for Connected Internet of Vehicles and Intelligent Transportation System Networks 2020 (pp. 1-14). Springer, Cham.

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Trust-Based Public Key Management for Data Distribution in Wireless Networks

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Abstract. A packet has to be delivered within a distinct time limit as data delivery is a critical issue in a wireless network. In emergency situations, real-time data distribution of multimedia file is addressed using wireless network. The real-time data examined here are image and audio files and these files are broken into sequence of packets and forwarded to the destination peer node based on a Priority algorithm. Prioritized data dissemination processes the sequence of packets to be forwarded based on permanent priority scheduling. The packets are encrypted based on Trust-based Public key management using public key generated in key generation phase and decrypted at the receiver end. The simulation results prove that the proposed technique has the enhanced and secured data transmission. The design of the network requirements and detailed experimental results are presented.

Keywords. Trust, Public key, private key, key management, data distribution, wireless networks.

1. Introduction

A network is a collection of mobile devices that must have the communication into the wireless medium that could not generate the common infrastructure [1]. The devices have been facilitated an enhanced communication with the internet according to the latest capability and minimized cost to permit the utilization of sever network type without any fixed framework [2]. The wireless network has the independent framework that is fixed and the mobile nodes should communication through adjacent nodes within the transmission range [3]. The resources are shared among the interconnected nodes without the use of centralized administration is a benefit of wireless network. Many application domains use wireless networks and the technologies used in wireless networking include GPRS, Bluetooth, and WLAN etc [4]. In order to sustain a permanent connection even when the nodes are mobile, it is an important task to analyze the wireless technology usability and handover experienced [5]. In wireless network each node is referred as node and it follows a fully decentralized architecture. Requests can be initiated by a main node to another adjacent node, likewise the main node could respond to requests incoming from other nodes connected in the wireless network [6]. Wireless networks are of great use for efficient file sharing, data sharing and downloading. To avoid any leakage

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of sensitive data or personal information security adequate security measures must be implemented [7].

2. Related works

In RSA Algorithm [8], a key utilized for encryption shouldn't be used for other purpose, because if the key is cooperated the entire information disclosed is exposed to risks. Moreover if the single key is compromised, then the information cannot be decrypted at receiver side. An enhanced method related to the public key enabled security [9], the similar format is utilized to secure the useful files. The procedure for implementing the authentication process should be achieved through the signature enabled methods. The security related problems have been solved through the complexity function to reflect higher execution period. The RSA enabled methodology [10] has been implemented the security through the increment of the security side; the execution period has been reduced compared with related techniques [8]. Whenever the execution period of the RSA technique has been solved the issue of bottleneck while performing in real-time application that the minimization of the execution period needed to utilize the technique for several purposes [11,12]. The decryption process has been utilized the time reduction which has the private components of modular computation. The multi-prime related technique [13] has been used the key generation process to generate the prime values. The other cryptographic techniques are implemented for providing security as dynamic trust routing [14,12], intelligent secured mobility estimation [15], group key generation [16], and threshold multi-authority access [17].

3. Typographical style and layout

Data distribution is used in dissimilar keys that are utilized for encryption and decryption in public key cryptography hence the process is called as an asymmetric system. Combining the public key with its certification by means of digital signatures protocols enhances the authentication and integrity of data. Network with high bandwidth and low cost allows users to exchange multimedia content which may be image data, video, audio etc. Thus the necessity for encryption and decryption comes into picture. Transmission of real-time data includes multimedia communication hence huge amounts of audio, video, image must be transmitted in a secure manner. The multimedia content needs to be transmitted in timely manner as well as the quality of the communication must be guaranteed. The content is streamed directly to the receiver by active sender and the nodes which are capable to stream the same content anytime are standby senders. Based on the active sender's availability and congestion in network path the scheduling is commenced. A standby sender replaces the active sender when congestion raises overmuch or an active sender fails. The limitation of the above scheme is that there is need for particular network layout in the case of mobile environment. A folder is created for all the mobile nodes in wireless network involved in the data dissemination process. Each folder corresponding to the node contains data files such as image or audio. Folder represents storage space to store data specific to a device. The file transfer is demonstrated in Figure 1.

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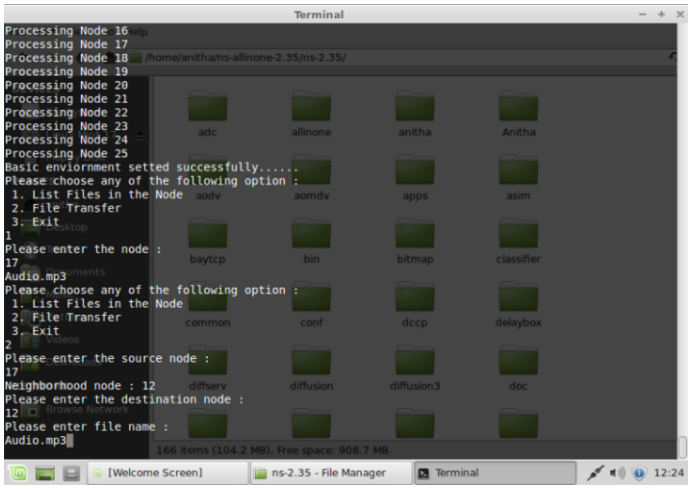

Figure 1. File transfer

3.1. Trust-based Public key management

Each node requires generating a certification with valid key pair where the public key must be delivered frequently. The digital signature technique is implemented to calculate the key pairs. The NTC based key pairs have been generated randomly whenever a node discovers its equivalent NTC, the node needs that NTC to perform the certification process and the public key has been generated. According to the availability of the trust value from the profile, the NTC performs the delivery of the certificate for the key pair to the node due to the condition. For assumption if there are 25 nodes connected in MANET environment, there is folder created for each node. Each folder corresponding to the nodes represents the storage space for the files involved in transfer.

3.2. List Files

The List File method lists all the files in the folder of the respective node. The pseudocode for listing files in a node is given below: The certificate package demonstrates the node

Algorithm 1 File Listing

```
1: set f [gets stdin]
2: if f <=n then
3:     set dir "$envName/$f/"
```

public key certificate that is delivered through the digital signature of NTC within the execution period. Whenever the termination time is reached, the node needs to upgrade the key value for providing the security. The trust threshold value maintains the enhanced performance for implementing the security as each node generates its key pair which is normally a huge random value and it is securely managed. The unique key has been generated for each node with the certificate confirms the generated valid keys, the entire process is demonstrated in Figure 2.

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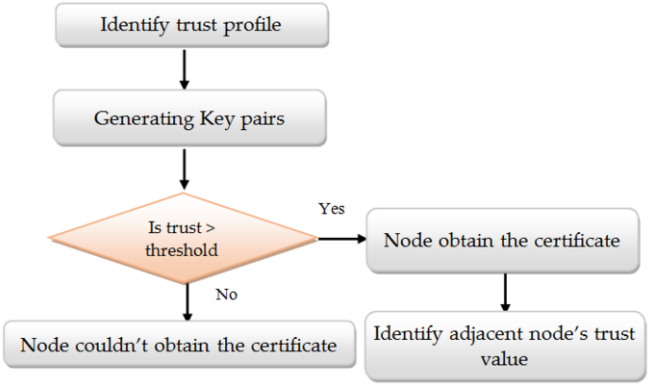

Figure 2. Process of Trust-based key management

3.3. File Transfer

The File transfer method gets the user choice of which file has to be transferred. If the file does not exist then file transfer operation could not take place and if file to be transferred exists then the file could be transferred if and only if the sender node has the receiver node's public key. Moreover if the nodes are untrustworthy any kind of operation could not take place. The pseudocode for file transfer is given below:

Algorithm 2 File Transfer

```
1: set fn [gets stdin]
2: set ff [glob -path $dir $fn]
3: set fName [file tail $item]
4: set fsize [file size $item]
5: puts "file Sixe : $fsize"
6: set chunk [expr $fsize/10]
```

The file to be transferred is first converted to binary file. The binary file is encrypted using RSA encryption function and converted to cipher message and then transmitted to the receiver side. To convert to binary format the code is as follows:

fconfigure $fp -translation binary
fconfigure $fo -translation binary.

4. Fine tuning

The performance of trust based public key management for real-time data distribution is evaluated for varying metrics namely Information Risk, Throughput and Transfer Speed. The performance evaluation is implemented through the simulation environment of NS2. The encryption time is calculated by Input file size divided by Encryption execution time. Likewise the decryption time is calculated by Encrypted file divided by Decryption execution time. The unit for transfer speed in KB/Sec. The average of Encryption and Decryption time gives the Transfer speed.

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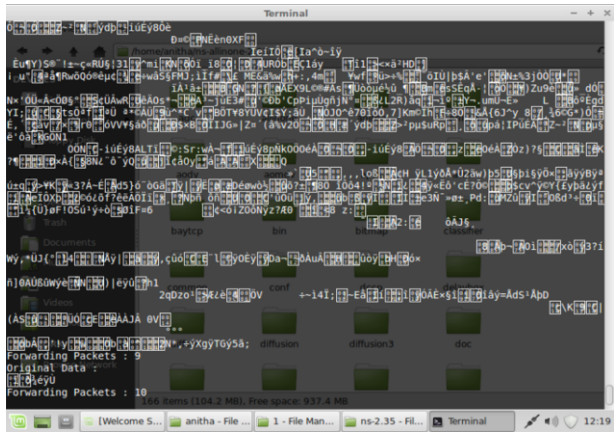

Figure 3. Encryption Process

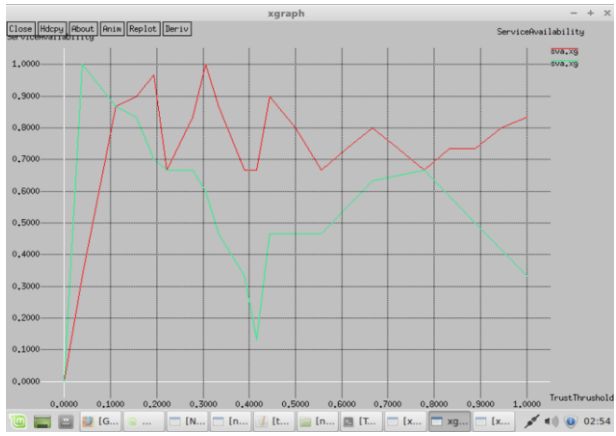

Figure 4. Information Risk

The public key is reserved in every transmission for delivering messages to the recipient node. The image encrypted at the sender side should be exactly decrypted at the receiver end. Trust-based Key Management algorithm encrypts the image/audio files with good accuracy. The throughput is the quantity of information transmitted effectively from source place to recipient place in a given time duration. The input file is partitioned into chunks of packets and each data packet has to be transferred within the limited bandwidth. Throughput is defined by Number packets partitioned from Input File size divided by Total number of Packets. Figure 3 demonstrates the encryption process of the image and audio files for transfer. Figure 4 illustrates the Information risk in every parameter related to the security. Trust bias demonstrates the dissimilarity within the node's average trust value and generated values which is demonstrated in Figure 5.

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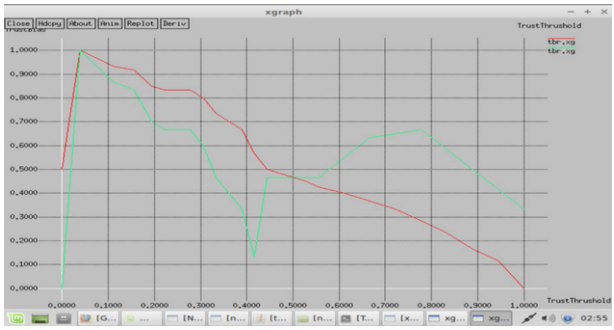

Figure 5. Trust bias

5. Conclusion

The problem of data distribution of multimedia files in wireless networks has been addressed in this paper. Data distribution of both image and audio files has been examined. Priority scheduling algorithm works based on the precedence of data packets to be implemented thus exhibiting prioritized data distribution. Its major objective is to present firm prioritization using priority as a scheduling aspect. Data is distributed and encrypted using the Trust-based public key management algorithm. Thereby wireless networks for distributing data have been calculated and evaluated.

References

[1] Cho JH, Chen R, Chan KS. Trust threshold based public key management in mobile ad hoc networks. Ad Hoc Networks. 2016 Jul 1;44:58-75.

[2] Bui BD, Pellizzoni R, Caccamo M, Cheah CF, Tzakis A. Soft real-time chains for multi-hop wireless ad-hoc networks. In13th IEEE Real Time and Embedded Technology and Applications Symposium (RTAS'07) 2007 Apr 3 (pp. 69-80). IEEE.

[3] Rao GR, Lakshmi PV, Shankar NR. A novel modular multiplication algorithm and its application to RSA decryption. International Journal of Computer Science Issues (IJCSI). 2012 Nov 1;9(6):303-9.

[4] Dhakar RS, Gupta AK, Sharma P. Modified RSA encryption algorithm (MREA). In2012 second international conference on advanced computing & communication technologies 2012 Jan 7 (pp. 426-429). IEEE.

[5] Thangavel M, Varalakshmi P, Murrali M, Nithya K. An enhanced and secured RSA key generation scheme (ESRKGS). Journal of information security and applications. 2015 Feb 1;20:3-10.

[6] Li Y, Liu Q, Li T. Design and implementation of an improved RSA algorithm. In2010 International Conference on E-Health Networking Digital Ecosystems and Technologies (EDT) 2010 Apr 17 (Vol. 1, pp. 390-393). IEEE.

[7] Ali ZU, Ahmed JM. New computation technique for encryption and decryption based on RSA and ElGamal cryptosystems. Journal of Theoretical and Applied Information Technology. 2013 Jan 10;47(1):73-9.

[8] Noh J, Baccichet P, Hartung F, Mavlankar A, Girod B. Stanford peer-to-peer multicast (SPPM)-overview and recent extensions. In2009 Picture Coding Symposium 2009 May 6 (pp. 1-4). IEEE.

[9] Nagar SA, Alshamma S. High speed implementation of RSA algorithm with modified keys exchange. In2012 6th International Conference on Sciences of Electronics, Technologies of Information and Telecommunications (SETIT) 2012 Mar 21 (pp. 639-642). IEEE.

[10] Peltotalo J, Harju J, Saukko M, Vaatamoinen L, Bouazizi I, Curcio ID, van Gassel J. A real-time peer-to-peer streaming system for mobile networking environment. InIEEE INFOCOM Workshops 2009 2009 Apr 19 (pp. 1-7). IEEE.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[11] Hwang RJ, Su FF, Yeh YS, Chen CY. An efficient decryption method for RSA cryptosystem. In19th International Conference on Advanced Information Networking and Applications 2005 Mar 28 (Vol. 1, pp. 585-590). IEEE.

[12] Zhou X, Han S, Liang Z, Yang X. Wireless sensor-based prediction of debris flow in mountainous areas and improvement of power business environment. Arabian Journal of Geosciences. 2021 Aug;14(15):1-7.

[13] Ding G, Bhargava B. Peer-to-peer file-sharing over mobile ad hoc networks. InIEEE Annual Conference on Pervasive Computing and Communications Workshops, 2004. Proceedings of the Second 2004 Mar 14 (pp. 104-108). IEEE.

[14] Sathiyavathi V, Reshma R, Parvin SS, SaiRamesh L, Ayyasamy A. Dynamic trust based secure multi-path routing for mobile ad-hoc networks. InIntelligent Communication Technologies and Virtual Mobile Networks 2019 Feb 14 (pp. 618-625). Springer, Cham.

[15] Dhanalakshmi B, SaiRamesh L, Selvakumar K. Intelligent energy-aware and secured QoS routing protocol with dynamic mobility estimation for wireless sensor networks. Wireless Networks. 2021 Feb;27(2):1503-14.

[16] Sabena S, Sureshkumar C, Ramesh LS, Ayyasamy A. Secure Trust-Based Group Key Generation Algorithm for Heterogeneous Mobile Wireless Sensor Networks. InInventive Computation and Information Technologies 2021 (pp. 127-141). Springer, Singapore.

[17] Selvakumar K, SaiRamesh L, Sabena S, Kannayaram G. CLOUD COMPUTING-TMACS: a robust and verifiable threshold multi-authority access control system in public cloud storage. InSmart Intelligent Computing and Applications 2019 (pp. 365-373). Springer, Singapore.

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Enhanced Handwritten Document Recognition Using Confusion Matrix Analysis

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Abstract. The handwritten Multilanguage phase is the preprocessing phase that improves the image quality for better identification in the system. The main goals of preprocessing are diodes, noise suppression and line cancellation. After word processing, various attribute extraction techniques are used to process attribute properties for the identification process. Smoothing plays an important role in character recognition. The partitioning process in the word distribution strategy can be divided into global and local texts. The writer does not use this header line to write the text which creates a problem for skew correction, classification and recognition. The dataset used are HWSC and TST1. The tensor flow method is used to estimate the consistency of confusion matrix for the enhancement of the text recognition .The accuracy of the proposed method is 98%.

Keywords. Handwritten, Morphological, tensor flow, Optical Character Recognizer, angular directions.

1. Introduction

Automatic document processing helps conversion of paper document into digital text form. Many OCR algorithms has been developed by the researchers for different scripts. But the performance of OCR algorithm becomes unsatisfactory. The challenges associated with the processing of handwritten [1,2] document image are due to the irregular handwriting.

When two characters touch each other, a large space set is formed between the numbers .This is very important for separation, as the points of contact are often close. First, the size and shape of the text is analyzed and detected when touched. Finally, depending on the touching position of the text and the morphology of the contact area with the incision site are new algorithm also formed [3]. It has been observed that the identification of manuscripts with structured functions based on preprocessing documents is effi-

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cient. Therefore, word-level structural features [4,5] are used for text identification. First, the words in the document image are sorted into text boxes [6,7]. In the final process, sometimes two areas of text form the words. These text correction rules are divided into words. Coherence analysis is performed to allow the possibility of general conditions in the pixel pairs of the altered image [8,9]. Based on the calculated design characteristics, visuals were defined using the K-Nearest Neighbor (K-NN) classification. These design features define the script without knowing its composition. The advantage lies in the design features, not the design features.

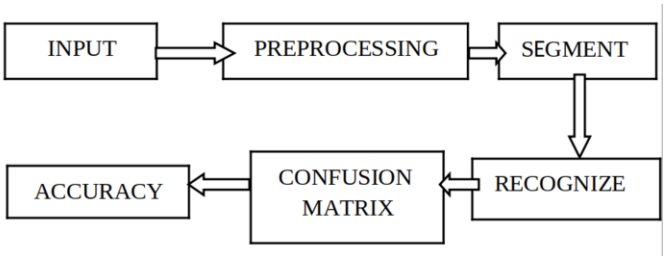

Figure 1. Flow of work

2. Literature Review

Wenyu Zhang et al. [10] introduced a new anti-mission learning (AML) paradigm to improve HCR performance. Data in limited training, includes prior knowledge of printed data and is independent of the author features of semantics. Of the available manual methods, the AML method offers a different one authors use independent semantic functions automatically as knowledge prior to standard print data does realistic research. To address issues of speed and memory capacity, Xiao et al. [11,12] introduced Globalization Controlled range extension method and optimal weight loss Tensor flow method . The proposed method is evaluated in a database dedicated to a publicly available database .

3. The Proposed Recognition System

3.1. Preprocessing

This step includes document digitization, followed by binarization. We have used a HP flat bed scanner for digitizing the collected documents in 300 dpi. Initially all the images are stored at 256 intensity level or as grey level. During binarization procedure the grey (256 level) images are converted to binary (2 level) image or binary image. Preprocessing helps us to improve the character recognition system [13]. Preprocessing is essential in order to have a higher recognition rate. There is certain constraints in hand written document. The handwriting should be legible and uniform. No decorative or cursive style letter should be written. Letters should remain specific beyond every mean of system. Thickness over the line about the slip must be specific.

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3.2. Algorithm Classification For Handwritten

This research work have used different steps in the classification process belief-level fission techniques is used in which each classifier use new methods of tensor flow .This is unlikely to be a style course, a confidence score of 1 indicates that the test sample format is the maximum perhaps the corresponding script is a trust score results of the individual classifiers are collected and validated [14]. The highest scoring script is marked as an internal category. In our experiment, the research work collected results from SVM, KNN (K = 5), and neural network classification [15,16] for SVM classification [17], Belief is built on personal level works. It is calculated as a percentage of losses. The output value of a node belonging to a particular class that assigns a belief value to the nervous system. Classified build-in classification can achieve accuracy 98% of 5x cross valid data is standard deviation. Algorithm

4. Implementation

The character recognition system of a handwritten includes steps such as digitization, pre-validation process and classification. Handwriting recognition system is widely adopted. It depends on the functions to be removed. The removed attributes must be able to classify the character habit [18,19]. In this application, the research work have provided a great advantage by using a horizontal cover there is also a maximum limit for functions. This research work also compared the results of evaluating the proposed system with new systems. Electronic translation is done using a process that contains symbols image is scanned and is an electronic representation of the real image of the character in TIFF format. The image has been created. Digitization creates a digital image that is provided during image preprocessing. The grayscale image is simplified in a 360 x 360 window using the nearest neighbor Interpolation Algorithm (IA). After simplifying, the research work creates a bitmap for the entire image. Now, the bitmap was converted into a thinner image using the parallel attenuation algorithm proposed by Zhang. To determine the style displayed in each image, the research work used the vertical, stroke and shadow functions features of functions and basic functions.

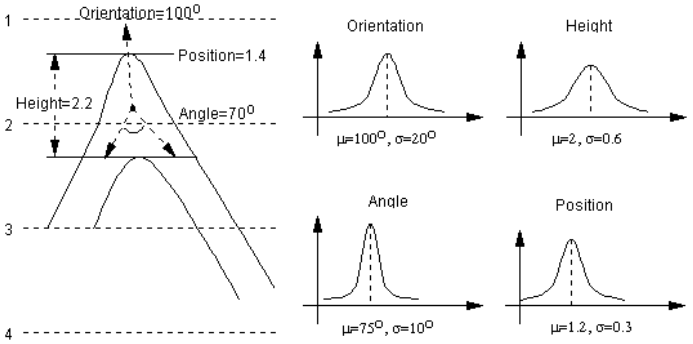

Figure 2. Angle of Character

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Algorithm 1 Classification Handwritten Algorithm

procedure IMAGE DOCUMENT(Model S, Dataset P)
    Sheet = create a knot ()
    $pixel.test_condition = findbestsplit(s, f)$
    $V = v|Possibleresultofvroot.test_condition$
    VεP for any value=0 to 360 degree
    HW+ Image document = Image document (HW, P)
    Handwritten. current = head
    while $current \neq null$ **do**
        current = current. Next
        new Dataset= new Handwritten.(o)
    N.next = head→head = new.dataset;
    if tail == null) **then**
        tail = head;
        head=new Handwritten.(element)
    else if size == 1 **then**
        Handwritten. temp = head
    Handwritten. current = head;
    return temp.element (Filter)
procedure REMOVE(index)
    if $index < 0 || index >= size$ **then**
        return null
    else if index == 0 **then**
        return remove First(HCAR)
    else if index == size - 1 **then**
        return remove Last(character)
    Handwritten. previous = head;
    for int i = 1; i < index; i++ **do**
        previous = previous. Next(TST1);
        Handwritten. current = previous. Next;
        previous. Next = current. Next;
    if element value < the value in current. Element **then**
        parent = current. Left
    return true(value)

5. Result and Evaluation

To train tattoo network we used the datasets of HWSC and TST1 databases. The number of eligible classes is 3755.

$$P(V;W) = \sum_H \frac{1}{Z} exp - E(V,H;W)$$
$$E(V,H;W) = \sum_k E(V,H_k;W_k)$$
$$E(V,H_k;W_k) = -H_k \otimes Filter(V,W_k)$$

This research work is implemented our scheme on 12,000 numbers collected by different people from different of schools, colleges, universities, teachers, banks and post employees, traders etc. The data set includes the writing style. Note that the accuracy

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of the definition scheme is 92.8%.It is not enough to know works number. There are two types of businesses based on this nervous system. Numerical identification using the proposed identification scheme are represented by dotted lines. (X1, y1) and (x2, y2) are integers the first and third rolls of the dataset collection in the dataset have 98% accuracy MLP based project proposed by Bhattacharya et al. accuracy is 39.83% was tested using 3,330 points. Therefore, our proposed scheme gives better results than tensor flow based classifiers. During the experiment, the research work found that a high definition rate of (eight) is 97.8%. That is the reason, confusion rates are calculated depends on the post-thinning groups can be fraught with difficulties [8]. They were also in the queue due to the different styles of writing; the following method does not work as expected there is a moving number divided into the figure thinning and uniform morphology method (σ) .Ours the identification method accurately identifies the number of this part without any change System. The disadvantage of the proposed method is that it does not give results if there is a discrepancy in the small part used as an outline collection range. However, if these faulty points are properly connected, performance can be improved received. To eliminate some of these conditions when using the size of the stopping area.

$$P(H_k|V) = \sigma(Filter(V, H_k))$$
$$P(V|H) = \sigma(\sum_k Filter(H_k, W_k))$$
$$\sigma(x) = \frac{1}{1+exp-x}$$

The data HCAR is in the standard Tier 1 kit and has hundreds of samples of each track. All test roles are in training Time, which is the identity of the closed group. However, there are about 7000 characters in the group organization for modern travel.

Table 1. Confusion matrix data analysis of handwritten predictions

Measure	Formula	Percentage
Sensitivity	TPR = $\frac{TP}{TP+FN}$	88%
Specificity	SPC = $\frac{TN}{FP+TN}$	82%
Positive Predictive Value (Precision)	PPV = $\frac{TP}{TP+FP}$	78%
Negative Predictive Value	NPV = $\frac{TN}{TN+FN}$	84%
False Positive Rate	FPR = $\frac{FP}{FP+TN}$	66%
False Discovery Rate	FDR = $\frac{FP}{FP+TP}$	56%
False Negative Rate	FNR = $\frac{FN}{FN+TP}$	44%
Accuracy	ACC = $\frac{TP+TN}{TP+TN+FP+FN}$	97.88%
F1 Score	F1 = $\frac{2TP}{2TP+FP+FN}$	91.22%
Matthews Correlation Coefficient	MCC = $\frac{TPxTN-FPxFN}{\sqrt{(TP+FP)x(TP+FN)x(TN+FP)x(TN+FN))}}$	89.1%

6. Conclusion

In this paper, an approach to distinguish machine printed and handwritten text from document image is proposed. Text separation helps better processing of real life documents by applying separate OCR on separate type of text images. Simple and easy to compute

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feature vector is constructed for the same. The present work is focused on English, Chinese and Arabic. Experimentation is done on these three scripts individually script wise and in collectively combining all three scripts. The system requires a table processing program that provides a complete alphabet of printed or handwritten letters by scanning of new n algorithms using tensor flow given 98% better results.

References

[1] Gupta D, Bag S. CNN-based multilingual handwritten numeral recognition: A fusion-free approach. Expert Systems with Applications. 2021 Mar 1;165:113784.

[2] Pal U, Chaudhuri BB. Automatic separation of machine-printed and hand-written text lines. InProceedings of the Fifth International Conference on Document Analysis and Recognition. ICDAR'99 (Cat. No. PR00318) 1999 Sep 22 (pp. 645-648). IEEE.

[3] Kavallieratou E, Stamatatos S. Discrimination of machine-printed from handwritten text using simple structural characteristics. InProceedings of the 17th International Conference on Pattern Recognition, 2004. ICPR 2004. 2004 Aug 26 (Vol. 1, pp. 437-440). IEEE.

[4] Jang SI, Jeong SH, Nam YS. Classification of machine-printed and handwritten addresses on korean mail piece images using geometric features. InProceedings of the 17th International Conference on Pattern Recognition, 2004. ICPR 2004. 2004 Aug 26 (Vol. 2, pp. 383-386). IEEE.

[5] Zheng Y, Li H, Doermann D. Machine printed text and handwriting identification in noisy document images. IEEE transactions on pattern analysis and machine intelligence. 2004 Jun 28;26(3):337-53.

[6] Raghuraman G, Sabena S, Sairamesh L. Image retrieval using relative location of multiple ROIS. Asian Journal of Information Technology. 2016;15(4):772-5.

[7] Sharieff AH, Sabena S, Sathiyavathi V, SaiRamesh L. Intelligent framework for joint data hiding and compression using SMVQ and fast local image in-painting. Int. J. Sci Technol. Res. 2020;9(2):2267-71.

[8] Imade S, Tatsuta S, Wada T. Segmentation and classification for mixed text/image documents using neural network. InProceedings of 2nd International Conference on Document Analysis and Recognition (ICDAR'93) 1993 Oct 20 (pp. 930-934). IEEE.

[9] Kumar A, Awasthi N. An efficient algorithm for text localization and extraction in complex video text images. In2013 2nd International Conference on Information Management in the Knowledge Economy 2013 Dec 19 (pp. 14-19). IEEE.

[10] Zhang W, Yang D, Zhang S, Ablanedo-Rosas JH, Wu X, Lou Y. A novel multi-stage ensemble model with enhanced outlier adaptation for credit scoring. Expert Systems with Applications. 2021 Mar 1;165:113-123.

[11] Li Z, Wu Q, Xiao Y, Jin M, Lu H. Deep matching network for handwritten Chinese character recognition. Pattern Recognition. 2020 Nov 1;107:107-17.

[12] Li Z, Wu Q, Xiao Y, Jin M, Lu H. Deep matching network for handwritten Chinese character recognition. Pattern Recognition. 2020 Nov 1;107:107471.

[13] Kuhnke K, Simoncini L, Kovacs-V ZM. A system for machine-written and hand-written character distinction. InProceedings of 3rd International Conference on Document Analysis and Recognition 1995 Aug 14 (Vol. 2, pp. 811-814). IEEE.

[14] Anand J, Sivachandar K. An edge vector and edge map based boundary detection in medical images. International Journal of Innovative Research in Computer and Communication Engineering. 2013 Jun;1(4):1050-1055.

[15] Simard PY, Steinkraus D, Platt JC. Best practices for convolutional neural networks applied to visual document analysis. InIcdar 2003 Aug 6 (Vol. 3, No. 2003).

[16] Kunte RS, Samuel RS. On-line character recognition for handwritten kannada characters using wavelet features and neural classifier. IETE Journal of Research. 2000 Sep 1;46(5):387-93.

[17] Ramteke SP, Gurjar AA, Deshmukh DS. A novel weighted SVM classifier based on SCA for handwritten marathi character recognition. IETE Journal of Research. 2019 Jun 20:1-3.

[18] Sahare P, Chaudhari RE, Dhok SB. Word level multi-script identification using curvelet transform in log-polar domain. IETE Journal of Research. 2019 May 4;65(3):410-32.

[19] Cao Z, Lu J, Cui S, Zhang C. Zero-shot Handwritten Chinese Character Recognition with hierarchical decomposition embedding. Pattern Recognition. 2020 Nov 1;107:107488.

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The Role of AI in Battling Against Covid-19 Crisis in India

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Abstract. The impact of Covid-19 outbreak has become a matter of grave concern in India. The scarcity of resources to endure the epidemic outbreak combined with the fear of overburdened health care systems had forced many Indian states to go for a partial or complete lockdown. Stimulated by the need for employing Artificial Intelligence (AI) in battling Covid-19 crisis, this paper highlights the importance of AI in responding to the Covid-19 outbreak and curtail the severity of the disease. Artificial Intelligence (AI) aim is to open the door for human in the prediction of the novel Corona Virus disease. Researchers are in process of using AI in finding new drugs and medicines for Covid cure and focusing on detection and analysis of infectious patients, through AI based Machine learning (ML) Algorithms and Expert Systems. Owing to huge number of cases, Covid-19 remains a global health problem, Al could take individual conditions into account, produce suitable decisions and promise to make great strides in managing Corona Virus. We begin with an outline of AI, identify the various applications aimed at fighting the disease, then highlight the challenges and issues associated with the cutting edge solutions finally arriving on the recommendations for the communication to effectively control the Covid-19 crisis.

Keywords. Artificial Intelligence, Covid-19, Detection and Analysis, Machine learning, Expert Systems.

1. Introduction

Artificial intelligence (AI) and Expert Systems that mimic human beings, has not only peeked in business and society but has also given a deep footprint in the field of healthcare. These technologies have proven to give an upper mark of support to transform many aspects of patient care, as well as administrative processes within healthcare organization [1]. AI is never tired, it does not get frustrated even during the pressurized situations, which are some of the most critical benefits while working with a problem of such complexity. There are already a number of research studies in process which suggest that AI can perform better than humans at key healthcare tasks such as disease diagnosis, appropriate medicinal support etc. AI has also tagged an impression in battling against the recent global crisis of Covid-19 [2,3]. In this baffling battle, AI is playing a vital role in fighting against the disease in various ways like facial recognition cameras to track the

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infected patients with travel history, robots to deliver food and medicines, drones to disinfect public places, to patrol and broadcast audio messages to public encouraging them to stay at home etc. Many researches using AI are also in progress to find new drugs and medicines for the Covid cure.

Government of India has taken various initiatives in the field of AI. Some of the notable Innovative Initiatives are - Implementation of Artificial Intelligence Task Force, Establishment of NITI Aayog's National Strategy for Artificial Intelligence under #AIFORALL, setting up of four Committees for AI under Ministry of Electronics and Information technology(MEITY) [4]. Some of State Governments of India have also taken enormous initiatives, such as establishment of Centre of Excellence for Data Science and Artificial Intelligence (CoE-DS&AI) by Karnataka, Safe and Ethical Artificial Intelligence Policy 2020 and Face Recognition Attendance System by Tamil Nadu, AI-Powered System for monitoring driving behaviour by West Bengal, AI System to fight agricultural risks by Maharashtra etc [5,6]. As with any other technology, AI brings with it a span of opportunities and challenges. Artificial Intelligence is not a One-Technology mechanism. But instead it is collection of constructs like Machine Learning , Natural Language Processing , Rule Based Expert Systems, Physical Robots and Robotic Process Automation. In this paper, we describe the potential that AI offers by elaborating on the various AI constructs which automate to ease aspects of health care and help to break the barriers to overcome the pandemic in the near future [7].

2. Types of AI Constructs that support healthcare

2.1. Machine Learning

Machine learning is a technique helps the machine to learn with algorithm to analyze the data based on the representation given by the end user. The action takes place in the machine learning approach based on the mathematical models and data set used in that. The approach which give more accuracy as the human wish is considered as the efficient approach. Some approaches will take more time to give an output but most of the end user need the accurate result with irrespective of time especially in medical fields.

2.2. Medical imaging of Infected patient

Machine Learning Algorithms were used in radiological imaging for detecting the disease symptoms. A new automatic model to detect COVID-19 symptoms made a deep impact to predict Covid patients using a chest X-ray image.

2.3. Intelligent E-Platform to fight Covid

Many Intelligent E-Platforms were implemented in India to detect and prevent the spread of the disease. For example, Dozee, a device created by Turtle Shell Technologies, India which produced this device and make it accessible by common people to monitor their health status in a continuous manner. If the person going to hospital they have to undergone many lab test for diagnosing the diseases which reduced by this simple device. We can place these device under their mattresses and monitor the individual health condition based on their heart rates, stress, oxygen and others. It provide an analysis report based

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on the received metrics to the smart phone which was linked with the devices and help to early detection of diseases before it reaches the severity. In COVID early detection of symptoms helps to achieve the highest rate of curable from the diseases. The decision making is the pure machine learning approach which makes this device far better than other monitoring device. One other important product helpful in this pandemic situation is the Milagrow Seagull. It is the robot used for vacuum cleaning process which includes anti-bacterial and anti-viral properties in their vacuum machine which reduce the spread of disease or hospitals where the patients are admitted. The cleaning process include the wet cleaning process but the machine itself make them dry in few minutes. This device shows the display in real time the progress of cleaning process.

In the pandemic period everyone want their belongings to be very clean and make themselves to live in a protective manner. CoronaOven is the device developed by Bengaluru based organization to clean the objects or equipment's which ever you bring with yourself or bought from outside using the ultra violet rays. The UV rays having the wavelength of 253.7 nm which is not harmful for the human and it available in different size which is easily available for any kind of individual house or organization. Apps like COVID locator, Medical Teleconsultation app, Call DOC, Well being volunteer, Test Yourself and Cobot-19 app are some of the notable Applications used Nationwide to fight the pandemic. Aarogya Setu is the smartphone app especially for tracking the spread of covid around India [8]. This was launched by the Government of India which available in eleven Indian languages to make this app usable by all peoples of India. The app provides the detail of affected patients around you in the specific area which you mentioned is helpful for the people to avoid from moving between the locations. It also provides the details of active cases and helps for the data analyst to predict the spread of disease which support the administrators take precautions to reduce the spread.

Staqu is the another AI based application developed by a start-up from Gurgaon has responded the people queries regarding the COVID. This start-up owned a video-based tracking setup to identify the spread of COVID and provide the contagion through the application which helps the needy peoples through remote monitoring and provide the solution for their current situation regarding their health condition. They provide an alert to the users for their daily hygiene activities to keep them safe against COVID. Another organization in India designed a remotely operable ventilator system which is inexpensive. The Big Bang Boom is the company which produced that and deliver around the primary health centers where there is no specific conditions not available to maintain the oxygen cylinder ventilator systems. This product really helpful for many remote locations in India where the frequent transport facilities was not feasible. The Defence Institute of Advanced Technology (DIAT) in Pune, Maharashtra has developed an AI based COVID-19 detection tool(Press Trust of India 2020g). The tool uses the chest X-rays of patients to identify COVID-19 infection. It will be particularly helpful for radiologists and also in telemedicine.

An IIT-Roorkee Professor has also developed similar software which can detect COVID-19 and measure its severity using X-ray scan of the suspected patient(Press Trust of India 2020e). An AI based voice tool has also been developed and designed by a professor and her students in Mumbai(Press Trust of India 2020d). This tool is able to detect COVID-19 through voice-based diagnosis using a smartphone app. The tool will detect COVID-19 based on the fact that the voice of COVID-19 patient is different from the healthy person as COVID-19 severely compromises the lungs and airways. Artificial

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Intelligence is able to detect these differences which a normal ear cannot. When a person speaks to the microphone on the app, this voice tool breaks down the voice in multiple parameters like frequency, noise distortion etc. The values of these parameters are then compared to normal person's values which help to detect COVID-19. This tool is being pilot tested by University of Tor Vergata in Rome and has yielded 98% accurate results. The Norway India Partnership Initiative (NIPI) in collaboration with the Wadhwani Institute of Artificial Intelligence has developed an artificial intelligence (AI)-powered tool which enables identification of COVID-19 through cough sound analysis [6]. The tool will detect COVID-19 based on the fact that the cough of a COVID-19 patient is different from other coughs. Based on the reference coughing pattern, this AI powered tool will be able to detect COVID-19 as soon as the person coughs in front of the machine.

2.4. Natural Language Processing

With the rapid increase in the use of the Internet, sentiment analysis has become one of the most popular fields of Natural Language Processing (NLP). Using sentiment analysis, the implied emotion in the text can be mined effectively for different occasions. People are using social media to receive and communicate different types of information on a massive scale during COVID-19 outburst [9,10]. Mining such content to evaluate people's sentiments can play a critical role in making decisions to keep the situation under control. The sentiment analysis of tweets posted by Indian citizens has been performed using NLP and machine learning classifiers. From April 5, 2020 to April 17, 2020, a total of 12,741 tweets having the keywords "Indialockdown" were extracted. Data have been extracted from Twitter using Tweepy API, annotated using TextBlob and VADER lexicons, and preprocessed using the Natural Language Tool kit provided by the Python. Eight different classifiers have been used to classify the data. The experiment achieved the highest accuracy of 84.4% with LinearSVC classifier and unigrams.

2.5. Expert Systems

Artificial Intelligence-based Expert System models have emerged as one of the powerful weapons to fight against COVID-19 in India. Decision makers have used Computer Simulators to understand how COVID-19 situation will evolve over time. Many scientists and companies from India has contributed with very useful Innovations during this pandemic. Some noted among them are

- TCS(Tata Consultancy Services), has developed Machine-Learning Expert Models to predict the severity of the disease and identify at-risk populations across the country(KPMG 2020; Ghosh, Ghosh, and Chakraborty 2020; Shinjini 2020). For instance, TCS(Tata Consultancy Services) in collaboration with Pune-based Prayas Health Group has developed 'Digital twin' which is a Virtual Computerized Based Model to forecast the spread of COVID-19 in Urban districts in India.
- MyGov, world's largest citizen engagement platform launched by the Government of India, partnered with Amplify.ai, a company which deals in conversational AI technology with the aim to make people aware of COVID-19 and provide them real-time updates(Das 2020). The virtual assistant or chatbot also allows citizens to ask relevant questions and clear their doubts related to COVID-19.

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- The Indian Council of Medical Research (ICMR) in collaboration with the tech giant IBM has implemented the Watson Assistant, an AI-based query answering system, on its portal. The Watson Assistant responds to the queries on COVID-19 raised by front-line workers and also general public. The Watson Assistant works 24*7 and responds both in English and Hindi(The Economic Times 2020) [11].

2.6. Physical Robots and Robotic Process Automation

AI based Robotic Technologies has also put its maximum efforts to fight against the deadly pandamic in the recent times. India, known for its outstanding brains in the field of Technology has proved its mark with remarkable development in Robotic Process Automation to fight the Virus. Some of the Innovative Technologies developed were as follows:

- 'Milagrow iMap 9', a robot designed for floor disinfection purposes which can navigate and sanitize floors without any human involvement was launched by Milagrow HumanTech(Press Trust of India 2020f).
- Garuda Aerospace, a Chennai based start-up, has developed an automated disinfecting Unmanned Aerial Vehicle (UAV) called "Corona-Killer 100" (a disinfectant spraying drone) . Garuda Aerospace has deployed 300 "Corona-Killer 100" drones for disinfection purposes across 26 cities in India.
- AI based tools such as drones and mobile applications have also helped in enforcing quarantine and maintaining social distancing. Drones are being used to monitor the movement of COVID-19 suspects in quarantine centers. They are being leveraged for video surveillance and enforcing social distancing purposes. These are particularly helpful in the red alert and containment zones and in public places where people gather in large numbers like banks, ration shops etc.
- The Kerala Government has initiated the use of robots 'KARMI-Bot' and 'Nightingale19'(Bhatia 2020; Zachariah 2020). These robots serve food and medicines to the COVID-19 patients, collect trash used by the patients, enable video call between patients and doctors or relatives and perform disinfection of the isolation ward. Other states like Tamil Nadu and Jaipur have also explored the use of robots. From monitoring temperature and sanitizing spaces to enabling video conferencing with doctors, these robots by Indian startups are helping minimize human intervention and paving the way for the use of technology in our fight against COVID-19.
- The autonomous mobile robot Invento C-Astra has come to use in April 2020 for sanitizing the common areas like hospitals, living rooms and infected hallways. It avoid the human interception in moving into the infected areas which greatly helpful for the frontline peoples.
- Another robot-based monitoring device called Mitra scans the patients who enters the hospital regarding their body temperature and pressure with the system to enter their personal details. This avoid the doctors and others to make a direct contact without knowing that what they really need or by which they are affected.
- Invento Robotics has come up with another robot called RoboDoc which was used to reduce the risk of contracting with the virus. This is virtual reality-based software which takes the doctor virtually to the patient environment and they can avoid the unwanted physical movement for monitoring purpose. It also get the details of patients including their temperature, and their food intaking information.

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3. Conclusion

Artificial intelligence has put in a great impact in medical field specially during the pandemic in the present times. It is a reality which has instantly come true to fight the disaster that we should face and encourage its progress and appearance. In this paper, we discuss various AI techniques that help in speeding up researches and assisting in the current COVID-19 crisis. Also, various expert, innovative techniques in introduced in a diverse country like India were emphasized. The various Artificial Intelligence constructs has helped in creating appropriate treatment regimens, counteraction methodologies, and medication and immunization advancement. Likewise, the NLP paved is way in sentiment analysis thereby mining such content to evaluate people's sentiments that can play a vital role in making decisions to keep the situation under control . Computer-based Artificial Intelligence is not only useful in the treatment of COVID-19, but additionally, for their appropriate medical check-ups. Further work will along these times need to address their desires with the goal that the improvement of AI is to serve patients to overcome the disaster.

References

[1] Kolker E, Özdemir V, Kolker E. How healthcare can refocus on its super-customers (patients, n= 1) and customers (doctors and nurses) by leveraging lessons from amazon, uber, and watson. Omics: a journal of integrative biology. 2016 Jun 1;20(6):329-33.

[2] Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The lancet. 2020 Feb 15;395(10223):497-506.

[3] Xu X, Chen P, Wang J, Feng J, Zhou H, Li X, Zhong W, Hao P. Evolution of the novel coronavirus from the ongoing Wuhan outbreak and modeling of its spike protein for risk of human transmission. Science China Life Sciences. 2020 Mar;63(3):457-60.

[4] NITI A. Government of India. National Strategy for Artificial Intelligence AIFORALL [Internet]. 2020 [updated 2020 Apr 23; cited 2020 Aug 20]. Available from: "https://niti.gov.in/.

[5] Tamil Nadu e-Governance Agency (TNeGA). TNeGA Announces with Pride That the 'Face Recognition Based Attendance System' Has Arrived. We Have Been Running. [Internet]. 2020 [updated 2019 Sep 3; cited 2020 July 3]. Available from: https://tnega.tn.gov.in/latestnews/29. .

[6] Kumar R. Bihar Nod to NIPI to Develop AI-Powered Tool to Track Covid-19 Suspects. Bihar Nod to NIPI to Develop AI-Powered Tool to Track Covid-19 Suspects [Internet]. 2020 [updated 2020 Apr 17; cited 2020 Sep 20]. Available from: https://www.hindustantimes.com/patna/bihar-nod-to-nipi-to-develop-aipowered-tool-to-track-covid-19-suspects/story-YDXNp1x8jLpfOrKup4Uh6K.html.

[7] Kulkarni, Viraj. 2020. "How India Is Using Artificial Intelligence to Combat COVID-19" [Internet]. 2020 [cited 2020 Sep 5]. Available from: https://www.theweek.in/news/sci-tech/2020/07/31/how-india-is-using- artificialintelligence-to-combat-covid-19.html.

[8] National Informatics Centre, Ministry of Electronics & Information Technology, Government of India. 2020. "Aarogya Setu Mobile App." Aarogya Setu Mobile App [Internet]. 2020 [updated 2020 Jan 15; cited 2020 May 5]. https://www.mygov.in/aarogya-setu-app/.

[9] Murdoch TB, Detsky AS. The inevitable application of big data to health care. Jama. 2013 Apr 3;309(13):1351-2.

[10] Dilsizian SE, Siegel EL. Artificial intelligence in medicine and cardiac imaging: harnessing big data and advanced computing to provide personalized medical diagnosis and treatment. Current cardiology reports. 2014 Jan 1;16(1):441.

[11] The Economic Times. 2020. ICMR Deploys IBM Watson Assistant to Empower Frontline Testing Facilities [Internet]. 2020 [updated 2019 Oct 20; cited 2020 July 23]. Available from: https://cio.economictimes.indiatimes.com/news/next- gentechnologies/icmr-deploys-ibm-watson-assistant-to-empower-frontline-testing facilities/75532811.

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Deep Learning Based Static Analysis of Malwares in Android Applications

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Abstract. Android is a widely distributed mobile operating system developed especially for mobile devices with touch screens. It is an open source, Google-distributed Linux-based mobile operating system. Since Android is open source, it enables Android devices to be targeted effectively by malware developers. Third-party markets do not search for malicious applications in their databases, so installing Android Application Packages (APKs) from these uncontrolled market places is often risky. Without user's notice, these malware infected applications gain access to private user data, send text messages that costs the user, or hide malware apk file inside another application. The total number of new samples of Android malware amounted to 482,579 per month as of March 2020. In this paper deep learning approach that focuses on malware detection in android apps to protect data on user devices. We use different static features that are present in an Android application for the implementation of the proposed system. The system extracts various static features and gives them to the classifier for deep learning and shows the results. This proposed system will assist users in checking applications that are not downloaded from the official market.

Keywords. Android, APKs, Malware Detection, Third-party markets, Deep Learning.

1. Introduction

In smartphones and tablets, Android is the world's best-selling Operating System. The presence of number of markets present in Android like Google Play Store and other third-party markets also encourages the malware developers to develop a malicious application. The number of malware samples targeting Android has risen over the last few years. The reason is because there are a lot of third-party markets that are not monitored and regulated properly. The open architecture of Android enables users to install apps that do not inherently come from the Google Play Store. We can estimate that over 20,000 new apps are released every month, with over 1 million apps available for download from Google's official market, and probably another million distributed across third-party app stores. An attacker can pick up and change any benign application and upload its code to third-party markets, making users think it is not a malicious application. Android is known for its free, ready-made, low-cost and open source license, which was developed

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by Google. Application support is the main drawback in Android, given its capabilities. It usually takes months before it reaches the user if a new version of the Android operating system or a security patch is issued [1]. They don't really reach out at all. This is due to the large range of Android device manufacturers and hardware. In the machine learning community, Deep Learning (DL) is gaining more and more attention. In the field of Image detection, Natural Language Processing and Speech Recognition, Deep Learning Classifiers have inspired a great number of successful approaches. In order to improve detection accuracy, DL classifiers have also been used recently for malware analysis. Since Deep Learning models are trained by feature learning rather than task-specific algorithms, they can recognize more characteristics than traditional machine learning techniques.

2. Related work

Static analysis detects malware based on the information that is present in an APK file. The static analysis features and techniques for detecting android malware is widely explored in this section.

Hota et al. [2] explained static analysis as the analysis of software without actually executing the program. Static analysis is one of the malware detection techniques that uses less computation. They read the bytes that are present in the dex file as input and they one hot encoded those bytes and then fed them to a Long Short Term Memory Network (LSTM). The final output is used to classify a particular application as malware or benign. They were able to achieve 95.3% accuracy. Also Naway et al. [3] provides a detailed explanation about the static features and their role in the detection of malware in android. The authors of [4,5] discussed permission misuse by android apps using a static analysis tool of identification stating that it is possible to obtain all the manifest file permission. In order to gain understanding of the purpose of the study, they review and give the reader the required preliminary information on android and static analysis. They explain the concept of static program analysis, permissions and analysis technique. The findings of this job can help encourage Android malware detection studies based on techniques of deep learning. Also [6,7] designed a more simplified instruction set since there are a lot of Dalvik opcodes to process. They analysed multiple smali files and discovered that there certain instructions have multiple opcodes because of parameters. For example, the same opcode will be used different operands, since operands maybe 8-bit or 16-bit. Based on the frequency of occurrence and core semantics they have identified 107 Dalvik opcodes. Then, group the similar instructions together using a single character. For example G for all the branch statements goto16, goto/32 since they do the same job. Then they use apk tool to get the smali files from the apk file. They then extract all the opcodes from the reduced instruction set and they map the opcodes to their corresponding characters.

3. Problem description

The architecture of android malware detection using static analysis is given in Figure 1. Two static analysis models are developed for detecting android malware.

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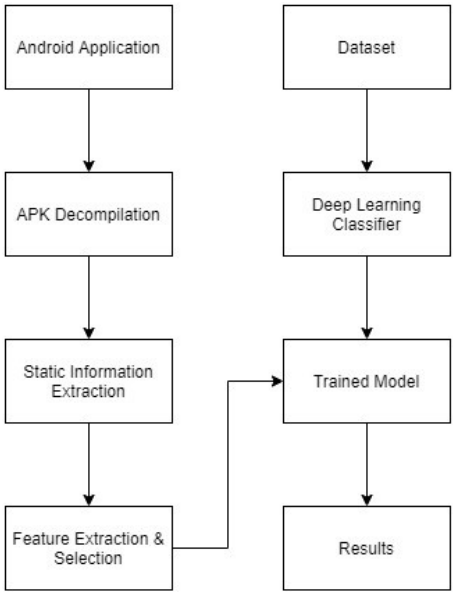

Figure 1. Android malware detection using static analysis

For training the first model, DREBIN dataset is used. It is a popular dataset used for static analysis of android malware detection. The dataset contains 5,560 applications from 179 different malware families. The samples were collected between August 2010 and October 2012, and the MobileSandbox project made them available to DREBIN. For training the second model, a 3gram opcode dataset is used for detecting android malwares.

Deep Neural Network algorithm is used to train both the models. The first one to detect android malwares using the static features Intents, API calls and permissions [8]. The second one to detect android malwares using the static feature opcodes [9,10]. The models are saved once it is trained with good accuracy. If an application has to classified as either benign or malware, the apk file of that particular application is decompiled and features are extracted from the application, then the saved model is loaded and provided with the feature set for prediction [11].

We decompile the APK file using tools such as Androguard and Apktool to extract static information about a specific android application. After decompilation, we will be able to get the manifest file, smali files (baksmali disassembler is used on dex file to obtain smali files) consisting of dalvik opcodes, the methods and classes used for the development of the application from the dex file.

After decompilation, we extract static information such as intents from the manifest file, API calls , permissions using the androguard tool and smali files for opcodes using apktool.

- Permissions: Applications use permissions in order to access the system resources.
- Intents: Intents are messaging objects that transfer data from one activity to another.
- APIs: APIs are the libraries and methods present inside the source code of an APK file.

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- Opcodes: The Opcodes are instructions that an application executes.

We convert the information to features after static information is extracted. Once the features are extracted, by comparing the dataset, we select the important features from them. The Table 1 and 2 consist of feature set and number of features for building the first model and second model.

Table 1. Feature set for model building the first model

Feature Set	Number of Features
Permissions	113
Intents	23
API calls	71

Table 2. Feature set for model building the second model

Feature Set	Number of Features
3 gram opcodes	343

4. Methodology

4.1. First Model

Drebin dataset [12] was used for this model. It consists of 9476 benign applications and 5560 malware applications. It consists of 215 features. 5 malware apps had null values in some columns so those 5 apps were removed and 5555 malware applications. 6 commands feature was removed from the dataset because it was difficult to extract the commands using androguard. Some of the APIs in the dataset contains classname and method name so the classname is removed and the method name alone is taken as a feature. 2 API features HttpPost.init and HttpGet.init were removed because both of them have the same method name so if class name is removed there will be two features with the same name. Finally a total of 208 features was used for training the model.

Using the androguard tool, we decompile a given apk file and extract all the permissions present in the apk file using a method in androguard and take only the important permission keywords. Then we extract all the classes in the apk file, take only the relevant keywords, and API calls are classes in androguard that are marked as EXTERNAL, so we only take the classes marked as EXTERNAL. Next, using the Androguard tool, we get all the methods present in the APK file. We then read the contents of the manifest file using androguard and extract only the strings that are present within double quotes using regex. After that, using the intent keyword, we extract only the intents present from those values. Lastly, we select only a few of them from all the extracted features by comparing the dataset. Then we give the feature set to the deep learning model for prediction.

The model is trained using the Deep Neural Network algorithm (DNN). The model consists of an input layer with 207 neurons, one hidden layer with 100 neurons with ReLU activation function. As it is a binary classification, the output layer consists of one neuron and it uses the sigmoid activation function. The model is tested with 20 percent of the dataset split before the training of model.

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Algorithm 1 Feature Extraction (First Model)

1: Decompile the given apk using the androguard tool.
2: Extract the permissions using androguard.
3: Remove ”android.permission.” string from all permissions and store it (Permissions).
4: Extract all the classes using androguard.
5: Split the classes using the separator and store only those classes that are marked as EXTERNAL (APIs)
6: Extract all the methods using androguard (APIs)
7: Get the contents of the manifest file using androguard
8: Using regex get only the strings that are present inside double quotes
9: Store all the strings that has ”intent.action” string in it (Intents)

4.2. Second Model

A 3gram opcode dataset downloaded from [13] was used for this model. It consists of data for 334 applications out of which 180 applications are malware and 154 applications are benign. All the 343 features are used for training the model.

Apktool is used for decompiling the apk file. After decompilation, we will get a classes.dex file so when we read a particular method in that dex file the opcodes will be in hexadecimal sequences, so in order to convert them into human readble form apktool uses a disassembler called baksmali which further decompiles classes.dex into several smali files. We read all the files inside the smali folder and store them word by word in an array. Then we read the opcode sequences that are present inside methods. A method starts with a ”.method” opcode and ends with ”end” opcode. Since each opcode have multiple versions we group them together and denote using a single character. Select only the 3gram opcode sequences that are present inside the methods.

Algorithm 2 Feature Extraction (Second Model)

1: Decompile the given apk using the androguard tool.
2: Read all the smali files line by line inside the smali folder.
3: Split the line based on blank space and store all the opcodes in an array
4: Read the opcode sequences present in between ”.method” and ”end” opcode.
5: **if** opcode is a move instruction **then**
6: denote them as ”M”,
7: goto instruction as ”G”,
8: **if** condition instruction as ”I”, getter instruction as ”T”, setter instruction as ”S” and method **then**
9: invoke instruction as ”V”, else ignore the opcode and read the next one.
10: Store the opcode sequence only if the length is 3.

The model is trained using the Deep Neural Network algorithm. The model consists of an input layer with 343 neurons, three hidden layers, one with 300 neurons and ReLU activation function and the other 2 hidden layers uses sigmoid activation function and consists of 150 and 100 neurons respectively. As it is a binary classification, the output layer consists of one neuron and it uses the sigmoid activation function. The model is tested with different benign apps obtained from Google Play Store and malware apps obtained from GitHub repository.

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5. Results

In this paper, we implemented android malware detection using static analysis where we classify any android application to be malware or benign. Deep Neural Network has been used as the classifier in both the models The first model is trained with a training data set that contains approximately 12,000 applications and tested with 3000 apps. The first model was able to achieve an accuracy of 99.37 percent while tested with the 3000 applications. The second model is trained with a 3 gram opcode dataset that contains around 300 applications and tested with around 30 applications. The second model was able to achieve an accuracy of 97 percent. But since different combination of layers and neurons produced the same accuracy we evaluated the model using applications downloaded from Google Play Store and malware apps downloaded from GitHub repository.

5.1. Performance Analysis of First Model

This section discusses about the performance metrics of the proposed first android malware detection model and states about the confusion matrix, false positives(apps that are not malware but predicted as malware) and false negatives(apps that are not benign but predicted as benign) are explained.

A confusion matrix is one of the important classification metric that provides summary of prediction results. For each class, the number of predictions is given along with the correct and incorrect ones.

$$Confusion = \begin{bmatrix} 1921 & 9 \\ 10 & 1067 \end{bmatrix}$$

False Malware - Predicted Malware but Benign = 9
False Benign - Predicted Benign but Malware = 10
True Malware - Predicted Malware and it is true = 1067
True Benign – Predicted Benign and it is true = 1921

$$FalsePositiveRate(FPR) = \frac{FalseMalware}{FalseMalware+Truebenign} = 0.0047$$

$$FalseNegativeRate(FNR) = \frac{FalseBenign}{FalseBenign+TrueMalware} = 0.0093$$

$$\text{Accuracy}=\frac{TrueMalware+TrueBenign}{Totalno.Offsetsamples} = 0.9937$$

$$\text{Precision}=\frac{TrueMalware}{TrueMalware+FalseMalware} = 0.9937$$

$$\text{Recall}=\frac{TrueMalware}{TrueMalware+FalseBenign} = 0.9937$$

$$\text{F1 Score}=\frac{2*(Precision*Recall)}{Pecision+Recall} = 0.9912$$

By using the machine learning classifiers, we classify any android application to be benign or malware. With the help of confusion matrix we can predict false malware, true malware, false benign and true benign. According to this classification metrics like False Positive Rate (FPR), False Negative Rate (FNR), Accuracy, Precision, Recall and F1 Score has been calculated and compared with the proposed and existing machine learning classifiers. The proposed DL classifiers has better results when compared with existing classifies and is shown in Table 3.

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Table 3. Comparison of DL classifier Vs other machine learning classifiers

ML classifiers / Metrics	FPR	FNR	Accuracy	Precision	Recall	F1
Logistic Regression	0.0109	0.0418	0.9781	0.9781	0.9582	0.9690
Decision Tree	0.0238	0.0251	0.9757	0.9757	0.9749	0.9664
Naive Bayes	0.4285	0.0186	0.7183	0.7183	0.9814	0.7139
Random Forest	0.0036	0.0176	0.9914	0.9914	0.9824	0.9879
SVM	0.0095	0.0321	0.9820	0.9820	0.9679	0.9757
DL Classifier (proposed model)	0.0047	0.0093	0.9937	0.9937	0.9907	0.9912

Table 4. Deep learning results with different combinations of hidden layers

No of layers	No of neurons	FPR	FNR	Accuracy	Precision	Recall	F1
1	50	0.0067	0.0121	0.9914	0.9914	0.9879	0.9879
1	100	0.0047	0.0093	0.9937	0.9937	0.9907	0.9912
1	150	0.0067	0.0121	0.9914	0.9914	0.9879	0.9879
1	200	0.0047	0.0139	0.9920	0.9920	0.9861	0.9888
2	100,50	0.0052	0.0111	0.9927	0.9927	0.9889	0.9898
2	100,100	0.0062	0.0149	0.9907	0.9907	0.9851	0.9870
2	200,50	0.0057	0.0102	0.9927	0.9927	0.9898	0.9898
2	200,100	0.0073	0.0121	0.9910	0.9910	0.9879	0.9875
2	200,200	0.0057	0.0139	0.9914	0.9914	0.9861	0.9879
3	100,100,50	0.0031	0.0204	0.9907	0.9907	0.9796	0.9869
3	100,100,100	0.0062	0.0176	0.9897	0.9897	0.9824	0.9856
3	200,100,100	0.0041	0.0186	0.9907	0.9907	0.9814	0.9869
3	200,200,200	0.0052	0.0111	0.9927	0.9927	0.9889	0.9898

The proposed model DL classifier is evaluated with different combination of layers and neurons using classification metrics FPR, FNR, Accuracy, recall and F1. Layer is the collection of nodes operating within a neural network. Input layer has raw data. The hidden layer in which computation is done and in output layer will have single output with multiple nodes in it. By adding more hidden layer or more neurons per layer will add more parameter to the model. In Table 4 number of neuron is increased in each layer and it is evaluated using classification metrics to know the efficiency of the proposed model.

In order to highlight the significance of the results, we compared the proposed work with other static analysis based works using the classification metrics accuracy, precision, recall and f1 score. [14] used a total of 179 static features with mixed feature set and was able to achieve an accuracy of 97.5%. [15] also uses a mixed feature set along with certificate verification and was able to achieve an accuracy of 95.31%. [16] used all the samples in Android malware genome project and was able to achieve an accuracy of 99.3% by introducing the principle of similarity to Gated Recurrent Unit. The proposed model uses DNN algorithm with total of static features Intent, API calls and permission was able to achieve an accuracy of 99.37% which is way better than other existing works and is shown in Table 5.

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Table 5. Comparison of the proposed model with existing works

Related work	No of Malware/ Benign samples	Accuracy	Precision	Recall	F1
Ensemble learning [14]	2925/3938	0.9750	-	0.9730	-
DNN [15]	600/600	0.9531	0.9535	0.9531	0.9531
GRU [16]	5560/123453	0.9930	0.9879	0.9950	0.9912
DL Classifier (proposed model)	5560/9476	0.9937	0.9937	0.9907	0.9912

5.2. Performance Analysis of Second Model

The model using the static feature Dalvik Opcodes is tested with 40 applications obtained from Google Play Store and 60 applications obtained from GitHub repository. This model scrutinize the downloaded application and predicts each application whether it is benign or malware and the predictions are shown in Table 6.

Table 6. Evaluation of Models

Number of layers	Number of neurons	Benign Prediction	Malware Prediction
1	100	26/40	57/60
1	200	33/40	57/60
1	300	26/40	59/60
2	200,150	27/40	60/60
2	300,150	25/40	59/60
3	200,150,100	0/40	60/60
3	300,150,100	31/40	59/60

6. Conclusion and future work

The aim is to identify malicious functions present in an apk file of an android application and classify them as benign or malware. Two different static analysis models was trained to accomplish this task. One model classifies applications using the static features intents, API calls and permissions and the other model classifies applications using the static feature Dalvik opcodes. The future work of this paper include classifying android applications using dynamic analysis. We run the application in an emulator and classify the applications based on its behaviour. After that we will combine both static and dynamic analysis which further improves the detection accuracy. Then we will build an android application that allows the user to scan any specific application for malware by moving the apk file of the chosen application from the mobile to the system and then sending the results back to the mobile after classification. In future we will manually prepare the dataset for static analysis by installing different benign and malware applications and extracting the static features to boost the accuracy of the existing system.

References

[1] Alzaylaee MK, Yerima SY, Sezer S. DL-Droid: Deep learning based android malware detection using real devices. Computers & Security. 2020 Feb 1;89:1-25.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[2] Hota A, Irolla P. Deep Neural Networks for Android Malware Detection. InICISSP 2019 (pp. 657-663).
[3] Naway A, Li Y. Android malware detection using autoencoder. International Journal of Computer Engineering and Applications. 2019 Jan;12:1-9.
[4] Lubuva H, Huang Q, Msonde GC. A review of static malware detection for Android apps permission based on deep learning. International Journal of Computer Networks and Applications. 2019 Sep;6(5):80-91.
[5] Pan Y, Ge X, Fang C, Fan Y. A systematic literature review of android malware detection using static analysis. IEEE Access. 2020 Jun 16;8:116363-79.
[6] Chen T, Mao Q, Yang Y, Lv M, Zhu J. TinyDroid: a lightweight and efficient model for Android malware detection and classification. Mobile information systems. 2018 Oct 17;2018.
[7] SaiRamesh L, Ashok E, Sabena S, Ayyasamy A. Credit Card Fraud Detectıon in Retaıl Shopping Using Reinforcement Learning. InInternational Conference On Computational Vision and Bio Inspired Computing 2018 Nov 29 (pp. 1541-1549). Springer, Cham.
[8] Kang H, Jang JW, Mohaisen A, Kim HK. Detecting and classifying android malware using static analysis along with creator information. International Journal of Distributed Sensor Networks. 2015 Jun 3;11(6):1-9.
[9] Kang B, Yerima SY, Sezer S, McLaughlin K. N-gram opcode analysis for android malware detection. International Journal on cyber situational Awareness. 2016 Dec 5;1:231-55.
[10] Sandeep HR. Static analysis of android malware detection using deep learning. In 2019 International Conference on Intelligent Computing and Control Systems (ICCS) 2019 May 15 (pp. 841-845). IEEE.
[11] Sirisha P, Anuradha T. Detection of Permission Driven Malware in Android Using Deep Learning Techniques. In2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA) 2019 Jun 12 (pp. 941-945). IEEE.
[12] Derbin [Internet]. [cited 2020 Oct 23]. Available from: https://www.sec.cs.tu-bs.de/danarp/derbin/
[13] Android malicious code detection based on machine learning, n-gram opcode + RandomForest [Internet]. Available from: https://github.com/kassadinsw/AndroidMalware-ngram-RF
[14] Yerima SY, Sezer S, Muttik I. High accuracy android malware detection using ensemble learning. IET Information Security. 2015 Oct 12;9(6):313-20.
[15] Naway A, Li Y. Using deep neural network for Android malware detection. International Journal of advanced studies in Computer Science and Engineering (IJASCSE). 2019 Jan 16;7(12):1-9.
[16] Zhou H, Yang X, Pan H, Guo W. An Android Malware Detection Approach Based on SIMGRU. IEEE Access. 2020 Jul 29;8:148404-10.

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A Comparative Study of Detection and Classification of Emotions on Social Media Using SVM and Näive Bayes Techniques

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Abstract. The rapid rate of innovations and dynamics of technology has made humans life more dependent on them. In today's synopsis Microblogging and Social networking sites like Twitter, Facebook are a part of our lives that cannot be detached from anyone. Through these social media each one of them carry their emotions and fix their opinions based on a particular situations or circumstances. This paper presents a brief comparison about Detection and Classification of Emotions on Social Media using SVM and Naïve Bayesian classifier. Twitter messages has been used as input dataset because they contain a broad, varied, and freely accessible set of emotions. The approach uses hash-tags as labels to train supervised classifiers to detect multiple classes of emotion on potentially large data sets without the need for manual intervention. We look into the usefulness of a number of features for detecting emotions, including unigrams, unigram symbol, negations and punctuations using SVM and Naïve Bayesian Classifiers.

Keywords. Emotions, Microblog, Twitter, SVM, Naïve Bayes.

1. Introduction

Social media are interactive digitally mediated technologies that facilitate the creation or sharing or exchange of information, ideas, career interests, product reviews, and other forms of expression via virtual communities and networks. The word "emotion" was coined in the early 1800s by Thomas Brown and it is around the 1830s that the modern concept of emotion first emerged for the English language. With the advent of social networking platforms, communication has shifted from face-to-face to online with instant messaging, a means of communication that involves a lot of communication using unigram symbols and short text types. In texts, text-based representations of emotions are used. The opinion of other person is an important information for decision making. It also needs multi-label classification [1]. The information from Social Medial is used to organize, explore and analyse for better decision making. Even though the study of

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emotion dates back to the 1980s, emotion computation is a relatively new field. With so much data available from social media, the role of classification is complicated by issues such as the lack of a common dataset for lexical analysis of the data. Annotating the data has its own set of problems, such as the possibility of bias if a human expert is used, and the difficulty of gathering annotated data from online resources. Emotion analysis on Twitter data has a duration issue because it articulates the emotions in a short amount of time, and the increasing amount of slang content increases the amount of preprocessing needed. Automating machines to detect emotions will help many organizations to understand their consumers effectively and to make more appropriate decisions. This study exhibits the trends in the emotion recognition in different perspectives. Even there is many techniques are there to exhibit the emotion recognition still the machines need some efficient learning algorithm to provide the result thinking as human. An overview of how the emotions is detected can be seen in Figure 1.

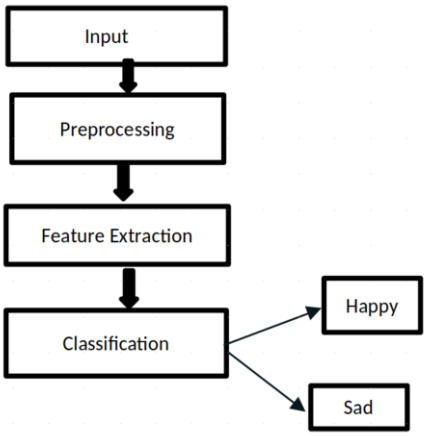

Figure 1. Flow diagram for emotion detection

1.1. Social Media: Twitter

Emotion is a combinatorial result of a person's evaluation of a situation along with the physiological arousal. One of the earliest studies suggests 'anger', 'fear', 'enjoyment', 'sadness', 'disgust', 'surprise' as the basic emotions [2]. Individuals can share their views, emotions, and thoughts on a variety of topics in the form of short text messages using social networks and microblogging tools like Twitter. These are brief texts (commonly known as tweets) where individuals mental states (such as pleasure, anxiety, confusion, depression) as well as the feelings of a wider group reflecting various forms of emotions (such as opinions of people in a certain country or affiliation). In reality, Twitter can be thought of as a vast repository containing a diverse range of emotions, feelings, and moods [3]. For example, the tweet "Happy birthday brother, wish u all the health, happiness, success. Stay blessed Stay safe." Expresses Happiness. "I am lost. My life is broken" expresses sadness as shown in Table 1.

The role of emotion analysis and classification using machine learning techniques [4] (SVM and Naïve Bayes) is the subject of this paper. The information used came from

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Twitter. The data was collected automatically using emotion hashtags for two emotion types which includes Happy and Sad whereas Fear, Stressed, Depressed comes in the indirect state of Sad and Relaxed comes in the indirect state of Happy as given in Table 2.

Table 1. Examples for emotion

Happy	Weekend is coming!
Sad	RIP! Grandfather passed away.
Fear	Everybody dies in theirNightmare.
Relaxed	I feel so at peace right now. The sound of rain always puts me to Sleep.
Stressed	Seriously! Stressed over this final Presentation?
Depressed	My cat is lost. I 'm totally depressed.

1.2. Inducement

The study demonstrates a method for automatically detecting and classifying the emotions conveyed in Twitter messages. A framework based on this approach could be used in a wide range of applications, including Politics, Entertainment, Health-Care, Transportation, Communications Industry to detect the emotions of group of people and their stature of mind. Self-reports and surveys are commonly used to assess quality of life. People are asked to complete questionnaires about their daily lives and emotions. It takes a long time, is repetitive, and is prone to errors to collect these questionnaires. The framework developed based on studied method, on the other hand, would be able to automatically detect how people feel about their lives from tweets.

2. Data Pre-Processing

There will always be noisy, outdated, and meaningless data in any dataset that needs to be cleaned up. Failure to do so makes the training process extremely difficult, resulting in poor classifier results. Data pre-processing is a crucial step in achieving high precision from the noisy data to the best possible data used for training. Pre-processing a typical political reviews tweet dataset. involves a number of techniques. This involves maintaining a consistent letter case, stripping special symbols typically used in tweets like "$@, \#, etc.$," eliminating extra whitespace and redundant terms, and many such steps [5].

2.1. Detection of Emotions

Detection of emotions can be done by Supervised Machine Learning to identify emotions in text messages such as tweets to classify short texts automatically according to the category of the text defined [3,6].

2.2. Collection of Data

To pre-process the Twitter message the following rules are taken into consideration.

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1. Tweets often contain usernames which start with the @ symbol before the username (e.g. @Fathima). All words that start with the @ symbol are replaced by"USERID" [5].
2. Many tweets have multiple hash tags, and some even have hash tags from two different classes. For example, the tweet "Iam Employed.. #nervous #sohappy." Contains the hash-tag #nervous from the Sad class and the tag #sohappy from the Happy class. If there are two subjects in a tweet, it may be omitted because such tweets will add ambiguity as given in Table 2.

2.3. Feature preferences

2.3.1. Unigrams

Unigrams define single word that are widely used in expressing emotions directly. The appearance of affect terms such as "disgusted" and "happy" in text messages can be used to classify them into emotion groups as sad class and happy class. Identifying an acceptable emoticon will also solve the problem of detection.

2.3.2. Unigram Symbols

Unigram Symbols are textual representations of a writer's emotion in the form of symbols, which are useful features for emotion classification in text messages. In emotion analysis, these features are often used. The western style emoticons were used by Go et al [7] and A. Pak et al [8], to collect labelled data. There are a variety of emoticons that can represent joyful, sad, irritated, or sleepy emotions listed in Table 3.

Table 2. Unigram Emoticons

Category	Unigram Emoticons
Happy	=), ☺, ☺, ^-^, ^.^, (:,:-},!_!,U, 8D, (^_^),8^),☺)), ^¿^,* * |___|
Sad	=(, ☹, ☹, T.T, =[, :c, D:, D=, Y_Y, v.v, ;~;,< >-, \8^1, X-(,X(,:-@, >☹ ,:@,>☹ ,-_-+,:-t, >-(

2.3.3. Punctuations

Punctuations are another function that may be useful in detecting emotions. When users want to convey their intense emotions, they often use exclamation marks. For example, the tweet "I lost 4lb in 3 days!!!!!" conveys great joy, while the tweet "we're in December, which means. . . ONE MONTH IS THERE TO GET SALARY!!!" conveys a high level of anxiety. The exclamation mark can be used in a variety of situations.

2.3.4. Negation

Negation are the final function to correct errors caused by tweets that contain negated phrases such as "not sad" or "not happy." For example the tweet, "Finally Exams are over .Long wait !.Not happy. Even though it has a cheerful unigram, "Not happy" should be considered a sad tweet. We define negation as a distinct function to address this problem.

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3. Data Classification

Machine Learning model learns from the past input data and makes future predictions as output. Classification is a supervised machine learning model that learns data from a classified trained set and predicts the test set without knowing the actual class labels. Decision Trees, Naïve Bayes, Support Vector Machines, k-Nearest Neighbors, Rule based classifier and many more other classification models are among the options. A study on two well-known supervised learning classifiers such as Nave Bayes and Support Vector Machines were demonstrated.

Table 3. Hash Tags Emotions

Class	Hash-Tags
Happy	#elated, #overjoyed, #enjoy, #excited, #proud, #joyful, #feelhappy,#sohappy, #veryhappy, #happy, #superhappy, #happytweet, #feelblessed,#blessed, #amazing, #wonderful, #excelent, #delighted, #enthusiastic, #calm,#calming, #peaceful, #quiet, #silent, #serene, #convinced, #consent,#contented, #contentment, #satisfied, #relax, #relaxed, #relaxing, #sleepy,#sleepyhead, #asleep, #resting, #restful, #placid
Sad	#nervous, #anxious, #tension, #afraid, #fearful, #angry, #annoyed,#annoying, #stress, #distressed, #distress, #stressful, #stressed, #worried,#tense, #bothered, #disturbed, #irritated, #mad, #furious #sad,#ifeelsad,#feelsad, #sosad, #verysad, #sorrow, #disappointed, #supersad, #miserable,#hopeless, #depress, #depressed, #depression, #fatigued, #gloomy, #nothappy, #unhappy, #suicidal, #downhearted, #hapless, #dispirited

Naïve Bayes is a probabilistic classifier based on Bayes theorem, with the naïve assumption of independence between every pair of features. This model works well on text classification that are based on posterior probabilities generated with the presence of different classes of words in text form from Twitter. Naive Bayes has been widely used for classifying text because it is simple and fast [9]. A Support Vector Machine (SVM) is a discriminative classifier defined by a separating hyper plane as shown in Figure 3. From the given labeled training data SVM finds a hyper-plane that creates a boundary between the types of data. The two results of a binary classifier will be

- The data point belongs to that class OR
- The data point does not belong to that class.

The best hyper plane is the one that represents the largest separation or margin between the two classes. Text classification using SVMs is very robust to outliers and does not require any parameter tuning [10].

4. Experimental Results

4.1. Identification of Emotion Hash-tags

The collected labeled data are identified from the list of hash-tags corresponding to each class of emotions. Two classes of emotions namely Happy and Sad are defined. We selected those keywords which are very distinct and distinguishable from other classes. We ignored the keywords that are located close to the boundary of two dimensions. we extended the list by adding hash-tags from Twitter, namely emotion-specific tags such as the tag ”#ifeelsad”. Using the extended list of keywords, we obtained a set of unique

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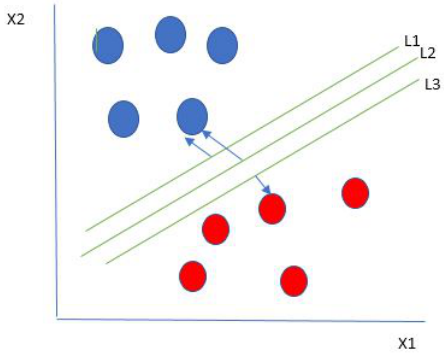

Figure 2. SVM binary classifier

emotion hash-tags for each class. Table 2 presents the final list of hash-tags used for collecting labeled data for each class. Table 4 represents the number of collected labeled tweets before and after pre-processing. As it shows the number of tweets decreased by 19% by removing noisy tweets during preprocessing.

Table 4. Collected Labelled tweets

Emotions	No.of Tweets before Preprocessing	No.of Tweets before Preprocessing
Happy	80600	63200
Sad	84700	70900
Total	165300	134100

Once the pre-processing is performed, each classifier is trained after which the classifiers are individually evaluated on the test samples. Evaluation metrics are used to measure the quality of the statistical or machine learning model. There are many different types of evaluation metrics available to test a model. These include classification accuracy, logarithmic loss, confusion matrix, and others. The test set is a set of observations used to evaluate the performance of the model using some performance metric. In our study three metrics (precision, recall and f-measure) are used to evaluate the performance for both happy and sad tweets.

Precision is also called positive predicted value is the fraction of relevant instances among the retrieved instances. An algorithm with high precision returns more pertinent results as compared to irrelevant results. Recall is a measure that tells us how great our model is when all the actual values are positive. If Recall = 0, this means that the model is broken. If Recall = 1, this means that the model is good enough to correctly make a prediction. It is a quantity measure to check how many relevant results are being returned by the algorithm while precision checks from the selected items, how many of them were relevant. F-Measure: F-Measure is a metric that combines recall and precision by taking their harmonic mean.

4.2. Results of Classification

In our study we found that 75% of collected data is labeled data which is used to train a classifier and 25% for testing. The accuracy of classifiers is measured based on F-

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measure precision and recall. Table 5 present F-measure, precision and recall of SVM and Naive Bayes techniques using different kinds of features. From the table it is understood the accuracy is higher for Naive Bayes for all the features. However SVM achieved the highest accuracy by using unigrams and negations. The accuracy of Naive Bayesian

Table 5. Measures of SVM, Naive Bayes Classifier for different features

Features	F-Measure		Precision		Recall	
	Naïve Bayes	SVM	Naïve Bayes	SVM	Naïve Bayes	SVM
Unigram	86.2	90	87.7	90.3	86.4	89.7
unigram symbols	86.4	89	87.5	89.5	86.3	88.8
Punctuations	86.2	89.8	87.2	90.4	86.6	89.4
Negations	86.9	89	87.9	89.4	86.9	88.7
Total	86.43	89.45	87.58	89.9	86.55	89.15

Classification and SVM classification and are presented in Figure 3 and 4. For the class sad the highest accuracy can be achieved by using all the features. However for other classes the highest accuracy can be achieved by using unigrams. Interestingly, using punctuation features across these two classes increased the accuracy.

In this paper, we have studied how to classify Twitter messages into distinct emotional classes based on the Twitter hash-tags. Our results suggest that hash-tags and other conventional markers of tweets are useful features for emotion classification. In the field

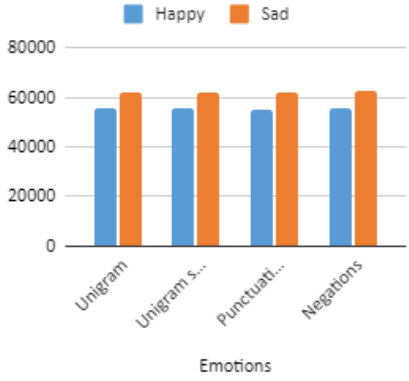

Figure 3. Emotion classification using Naïve Bayes

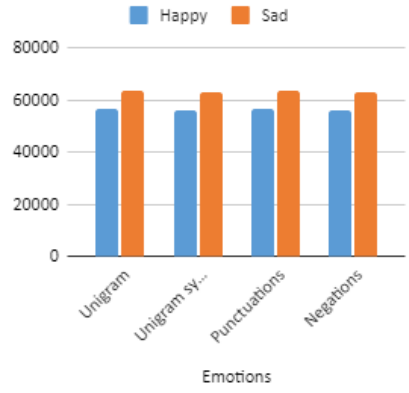

Figure 4. Emotion classification using SVM

of emotion identification, database choice played a pivotal role where feature extraction is the second step for good exactness in the result. From our study, we found that the Naïve Bayes Classification and Support Vector Machines are the most widely used ML algorithms for solving Emotion Classification. Support Vector Machines Classification algorithm is widely used in most of the paper because it is fast and performs better than the other technique [11,12] . Still, there are many open issues that need to be solved like diversity in emotion, recognize spontaneous emotion and speaker recognition in case of simultaneous conversation. Tools for Downloading and Analyzing Twitter Data [13], Twitter's official archive download, BirdSong Analytics, Cyfe, NodeXL and TWChat.

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5. Conclusion and Future Work

This paper gives a summarized review of the thorough comparison and performance analysis of the salient classification algorithms used in supervised learning namely Naïve Bayes, Support vector machine. We have considered only SVM and Bayesian Classifier because they achieved more accuracy in many studies and even though few other classifiers provide high accuracy, it is very slow and therefore not practical for big datasets. From our standard reviews on tweet dataset, we can say that SVM run fast than Naïve Bayes where the accuracy is 90% when the accuracy of Naïve Bayes is 87%. As a future work, based on data accessibility, we have a plan to propose method that can be implemented on social media data like Twitter, Facebook etc., Also the proposed method can be used to analyze the emotions on political reviews, disaster management and scholastic review on higher education. Probabilistic, non-probabilistic, and ensemble classifiers are popular in machine learning.

References

[1] Sabena S, Kalaiselvi S, Anusha B, Ramesh LS. An Multi-Label Classification with Label Correlation. Asian Journal of Research in Social Sciences and Humanities. 2016;6(9):373-86.

[2] Bollen J, Mao H, Pepe A. Modeling public mood and emotion: Twitter sentiment and socio-economic phenomena. In Proceedings of the international AAAI conference on web and social media 2011 Jul 5 (Vol. 5, No. 1).

[3] Sadhana SA, SaiRamesh L, Sabena S, Ganapathy S, Kannan A. Mining target opinions from online reviews using semi-supervised word alignment model. In 2017 Second International Conference on Recent Trends and Challenges in Computational Models (ICRTCCM) 2017 Feb 3 (pp. 196-200). IEEE.

[4] Liu M. Optimization of marine biological sediment and aerobics training mode based on SVM. Arabian Journal of Geosciences. 2021 Aug;14(15):1-7.

[5] Sahu S, Rout SK, Mohanty D. Twitter sentiment analysis–a more enhanced way of classification and scoring. In 2015 IEEE international symposium on nanoelectronic and information systems 2015 Dec 21 (pp. 67-72). IEEE.

[6] Sulthana AR, Jaithunbi AK, Ramesh LS. Sentiment analysis in twitter data using data analytic techniques for predictive modelling. In Journal of Physics: Conference Series 2018 Apr 1 (Vol. 1000, No. 1, p. 012130). IOP Publishing.

[7] Go A, Bhayani R, Huang L. Twitter sentiment classification using distant supervision. CS224N project report, Stanford. 2009 Dec;1(12):1-6.

[8] Pak A, Paroubek P. Twitter as a corpus for sentiment analysis and opinion mining. In LREc 2010 May 17 (Vol. 10, No. 2010, pp. 1320-1326).

[9] Krishnan H, Elayidom MS, Santhanakrishnan T. Emotion detection of tweets using naive bayes classifier. Emotion. 2017 Nov;4(11):457-62.

[10] Joachims T. Text categorization with support vector machines: Learning with many relevant features. In European conference on machine learning 1998 Apr 21 (pp. 137-142). Springer, Berlin, Heidelberg.

[11] Jin Q, Li C, Chen S, Wu H. Speech emotion recognition with acoustic and lexical features. In 2015 IEEE international conference on acoustics, speech and signal processing (ICASSP) 2015 Apr 19 (pp. 4749-4753). IEEE.

[12] Zheng WQ, Yu JS, Zou YX. An experimental study of speech emotion recognition based on deep convolutional neural networks. In 2015 international conference on affective computing and intelligent interaction (ACII) 2015 Sep 21 (pp. 827-831). IEEE.

[13] Ann S. Five Tools for Downloading and Analyzing Twitter Data [Internet]. [updated 2015 Feb 17; cited 2020 Sep 12]. Available from: https://www.entrepreneur.com/article/242830.

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Survey on Erythema Migrans, and Basal Cell Carcinoma in Computer-Aided Diagnosis

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Abstract. Lyme disease appears by various means one of the causes is infection from a bite of a black-legged tick which leads to the formation of a rash called Erythema Migrans (EM). This Lyme disease is the direct root of skin cancer and the primary phase is known as Basal Cell Carcinoma (BCC). Skin cancer causes pathological situations it integument the body's surfaces, including skin, hair, nails, and associated glands. Identifying EM and BCC in biomedical representation is a common platform known as biopsies and many works are done in the traditional methodology. But early detection of EM and BCC in the field of medical imaging using computer-aided diagnosis provides more accuracy and rapidity. This survey is classified under two categories; the first is EM detection and the second is the segmentation of BCC. The circumstances of this review are under the base of different algorithms, various methods used by the non-medicals appliance are discussed and compared by the several measures taken by increasing the parameters to improve the accuracy levels.

Keywords. Lyme disease, Erythema Migrans, Basal Cell Carcinoma.

1. Introduction

Medical image processing [1] is a vast field, researching in this area is a challenging task. Providing accuracy and time consumption are the keystone in image processing. Diseases identification, detection [2, 3], classification, and clustering in this field are still not optimal. Various diseases (such as Tumors, Cancer, Skin, Retina, etc.) are still under evolution, and identifying them by computer-aided diagnosis is not ample. According to various reviews and studies on natural human calamities, the World Health Organization (WHO) gives an alert that skin disease is one of the most communal and stimulating sources of human illness. Very commonly, [4] it is known that the cause of cancer is not known for many cases but once it is identified at the beginning it can be cured. It is

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vulnerable to people and it appears through blood, bones, lungs, skin, and many other means. From numerous research and studies [5–7], it is come to know that the cause of cancer through the skin occurs primarily on areas of sun-exposed skin, involves all layers of the skin, and through many mediums (like the scalp, face, lips, ears, neck, chest, arms and hands, and on the legs too) and has several etiology (such as infections, tumors, or inflammation UV radiations, exposure of sunlight). Skin cancer [7, 8] through infections also ensues by insect bites. From the regions of northern Midwest and eastern coasts of the United States as well as in southeastern Canada insects so-called black-legged tick or deer tick bites trigger the bacteria Borrelia Mayonii and so engenders Lyme disease. The very foremost stage of Lyme disease [9] is a rash appearance recognized as [10, 11] Erythema Migrans (EM). Approximately 70 to 80 percent of people with Lyme disease have this kind of rash. Very often the rash looks like a bulls-eye and for some individual guises like a solid circle. And it is stated by doctors and many research specialists that Lyme disease is the direct cause of skin cancer. The very preliminary step of Lyme disease is [12–14] Basal cell carcinoma or Basal cell cancer (BCC) is an early category of skin cancer. This nature of cancer transpires by the formation of new cells inside the skin as old ones perish off. BCC often appears as a fairly transparent bump on the skin, though it can take other forms. Aspects that are stated and executed as previous work through various image acquisition techniques so-called noise reduction, implementation of various segmentation algorithms, feature extractions process (like Color Features: Min, Max, Mean, SD, and Entropy; and Textures Features: contrast, correlation, and energy), and classification of diseases have resulted in many downsides [15, 16].

2. Surveys

The review work in this field is categorized into two: detection of Erythema Migrans and feature extraction, and segmentation methods of Basal Cell Carcinoma to detect skin cancer.

2.1. Erythema Migrans

Based on the work of Philippe M. Burlina et al. [17], from various experimental analyses, it is proved that machine-based testing outcome better results than manual testing called biopsies. The work was implemented by the operations mean and rescale applied to the raw image to obtain pre-processed image through Image Net [18] and with various Deep Learning Techniques [12, 19–23]. Data augmentation functions flip, blur, color contrast, saturate, sharpen, and color balance are performed. [24] ResNet 50 a Deep Convolutional Neural Network model was implemented in the platform Keras and Tensor flow. In the training model, Stochastic Gradient Descent was used to improve the training speed and accuracy. The categorical cross-entropy loss function also named softmax loss function was used to train the Convolutional Neural Network model ResNet 50 to produce the probability-based classes. But entropy loss function stopped at every 10 epochs. So, the dynamic learning rate schedule was given as a constant. This training was held for four classes EM (Erythema Migrans), Normal, Tinea Corporis(TC), and Herpes Zoster(HZ). And later it was reduced to two class classifiers EM and Non-EM classes (Normal, TC, HZ). [25, 26] The training model of four class and two class classifiers was measured

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using the metrics accuracy, F1, sensitivity, specificity, positive predictive value, negative predictive value, kappa score, ROC. Implementation, training, and metric measurement were done with the data set of 1834 images (initially it was 6000 images before preprocessing).

Pegah Kharazmi et al. [27] detected and segment vascular structure from dermoscopy images (dataset of 759 images from three different sources). [28] Independent Component Analysis (ICA) method was applied to decompose the [29] dermoscopic images. Due to this edge detection was conceivable from input images termed image decomposition. The skin layer components melanin and hemoglobin are retrieved [30]. This hemoglobin component extracted achieved a better performance to get RGB values calculated through the Mahalanobis distance. The values of RGB assisted to perform K-means cluster to segregate three different classes [28] termed as pigmented, normal, and erythema migrans.

This study from Ramy Abdlaty et al. [31] states the possible measures of Erythema was assessed from Hyperspectral Images (HSI) [13]. The background segregation of the hyperspectral images shaped from the preprocessed image and the segregation of and the white standards from the preprocessed image lead to spectral reflectance images. Image registration was boosted by two inputs digital images (RGB) and the output from spectral reflectance image. [32, 33] The Visual Assessment (VA) declares the erythema regions through the X-OR correlation to produce the corrected images. [34] The performance evaluation was analyzed by the contradiction of colored digitalized images Red-Green-Blue (RGB) pigments. The [6] Hyper Spectral Images (HSI) and the RGB pigments are analyzed and classified via the smoothing of images by a low pass filter called Savitzky-Golay and the results are compared with colored images. From the analysis, two major work phase was stated; firstly it was known that to remove low informative bands column subset selection was framed based on the matrix rank [35] representation by Frobenius. In the second phase, the Weiner filter was applied for the noise removal from the outputs spectral reflectance images, registered images, and corrected images.

Examined by Philippe M. Burlina et al. [36] on skin lesions and detecting Erythema Migrans (EM) [9,11,37] using Artificial Intelligence (AI) and Deep Learning (DL) methods [38,39] is the main approach of this study. Early accurate identification of EM avoids rheumatology, neurology, and complications in cardiac. Comparison of the clinical-based skin conditions with Erythema Migrans detection using Artificial Intelligence models and Deep Learning methods was implemented and tested. The clinical skin conditions are tinea corporis, cellulitis, erythema multiforme, herpes zoster, and non-pathogenic normal skin. Complications of multi-class classification with high complexity along with incorporations of clinical-based binary classifications are taken into consideration [40]. The models and methods of AI and DL were trained and tested with images available publicly and also tested with images obtained from clinical data. These trained models and implemented methods were measured by ROC and with the gold standard. According to the metrics [4], public images in DL models produced an accuracy level of 71.58% to 94.23% for classification of 8- class problem [41] (having EM and other skin pathology) with binary classification (of EM and non – pathological skin). From the study, it was defined that the [42] DL system helps in prescreening for EM diagnosis as per the dataset [43].

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2.2. BCC Segmentation and Feature Extraction

By Wangting Zhou et al. [44] Malignant Melanoma (MM) and Basal Cell Carcinoma (BCC) [45] tumor growth detection were measured by the functional and structural variations and the study of biopsies in dermatologic condition was the mean in this paper. The apparent skin features and the required parameter data were lacking from the conventional optic imaging techniques to describe the skin disease pathophysiology correlations. Due to the issue [46, 47], All Optically Integrated Photoacoustic / Optical Coherence Tomography (AOIP / OCT) preclinical device was suggested. This AOIP / OCT device provided a free label of certain features. Table 1.1 describes the features list for the growth of the tumor by pathophysiologic correlations in MM [48, 49].

Table 1. Feature extraction and classifiers used in BCC classification.

Methods	Features	Classifiers
AOPA / OCT [44]	Vascular, Blood flow velocity, Heterogeneity of blood flow, Tissue microstructure changes, Pigment structures, Cytologic features.	-
Auto Encoder [50]	Patient profile, SAE feature leaning	SoftMax
Otsu's Method [27]	Vascular Features	Simple Logistics, Naïve Bayes, MLP, Random Forest

[51] By the measurable metrics of this device, the functional and morphological parameters are rehabilitated due to the impact of spatial-temporal heterogeneity of MM and BCC. Distinguishing the validation criteria of vivo [52, 53] from the imaging biomarkers and ex vivo from MM was also provided by the correlation analysis. The device was measured by the ROC analysis had AOIP / OCT parameters improved with the accuracy of MM with 68.4% and BCC with 95.8% correspondingly. As a result, this paper indicates that the accurate diagnosis of clinically translatable technologies was possible.

Early detection by Komal Sharma et al. [54] and segmentation of the BCC by Ramandeep Kaur et al. [55] to detect skin cancer was suggested in this work and also analyzed with [8] previous methods with the flow of preprocessing, feature extraction [1], classification, and measures. [56, 57] The input image was preprocessed and smoothly segregated the foreground and the background of the image by the k-means cluster along with the Particle Swarm Optimization (PSO) to improve the quality of background separation of the image. Speed Up Robust Features (SURF) and Scale Invariant Feature Tra nsform (SIFT) were implemented for feature extraction. Artificial Neural Network was trained to get better performance with the classification strategies and also measured with the metrics precision, accuracy, True Positive Ratio (TPR), and False Positive Ratio (FPR).

The work by Kharazmi P et al. [50] is classified into two; To learn the framework of unsupervised features using the [58] Sparse Encoder (SE), and to study the vascular features directly from the given image with its hidden characteristics. [59] Feature maps are derived from the filters that are considered by the individual weights of the learned kernel. Table 1 illustrates the features extracted from the sparse encoder. These feature maps helped to diminish the dimensions and to relate with the records of the patients. The outcome of the feature maps was fed to the SoftMax classifier for classifying the BCC.

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From the author, Luca Fania et al. [60] it was explained that due to exposure to sun and age population skin cancer has become a common occurrence worldwide. Non-melanoma skin cancer has a subtype [7, 61, 62] Basal Cell Carcinoma (BCC) is a very common type worldwide and started to spread globally. [63] People with an illness caused by this tumor die low in number. Individuals who cross to the next stage without perceiving are more in numbers. A survey in this field started with the pathophysiology till the novel approach therapeutic was taken. The diagnosis for BCC improved with different prognostic values along with the improvement in device strategies like reflectance confocal microscope, and recent dermoscopy images [19, 64, 65] and clinical features [13, 14]. Even though the initial stage of treatment was surgical to BCC many local non-surgical treatments are available. Depending on the patient's environmental and genetic behavioral collaborations BCC formation is possible. To treat the advanced level BBC or metastatic BCC hedgehog signaling like sonidegib, and vismodegib are represented in this pathogenesis.

3. Result and Discussions

As per the above survey on Erythema Migrans, Feature extraction, and BCC segmentation its performance analysis is discussed according to the methods applied and the accuracy levels obtained based on the data set used. According to Figure 1 The Hyperspectral

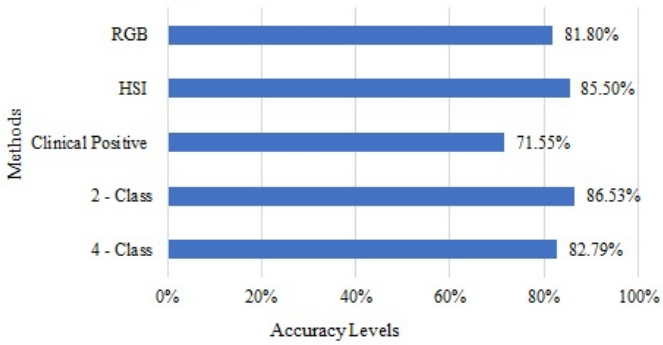

Figure 1. Erythema migrans performance.

Image (HSI) [31], and the Red – Green - Blue (RGB) pigment extraction for the erythema migrans detection resulted in an accuracy level of 85.5% and 81.8% respectively. The class-based optimization [17] in 2 class, 4 class, and clinical positive classifiers produced the accuracy outcome in the range of 86.5%, 82.79%, and 71.55% respectively. Methods and techniques used to segment Basal Cell Carcinoma for skin cancer have resulted by Artificial Neural Network with an accuracy of 97.9%, Sparse AutoEncode (SAE) feature extraction obtained an accuracy of 84.7%, HD-OCT performed the four different models as AlexNet, GoogLE Net, VGG-16, and VGG-19 outcome with the accuracies of 91.6%, 74.4%, 93.5%, and 89.1% respectively. The shape and erythema methods produced an accuracy of 79.1% and 66.7% which is represented in Figure 2.

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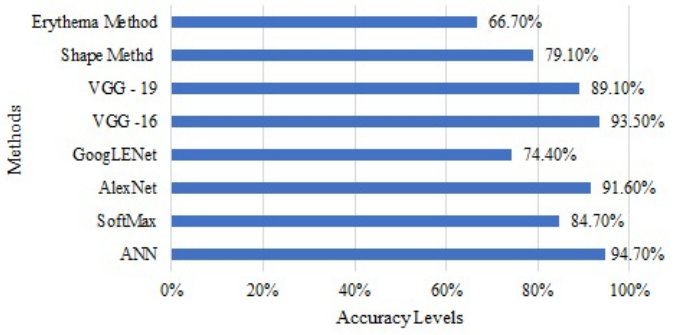

Figure 2. Basal Cell Carcinoma Performance.

4. Conclusion

From the consideration of previous work, analyzing various Deep Neural Network for segmentation (Fast RCNN, Faster RCNN, and U-Net) is considered to be the further study in this area. The keynote in measuring the outcome of medical image processing is accuracy and rapidity. Not enough statistics were done on these circumstances. The vision of this proposal is to analyze the techniques of Deep Learning algorithms to provide the best algorithm using the measurement parameters with various comparison studies. Skin diseases are a massive problem in the world, and there is an alarming necessity to get them into rheostat at the primary stage. so the actual actions can be taken up as soon as possible. Furthermore, the number of dermatologists is quite low as associated with the subjects, which is the scope. So, computer-aided analysis is a boon in such situations as they not only dilute the job of dermatologists but also add effects to their work by reducing the diagnosing time.

References

[1] Bhuiyan MA, Azad I, Uddin MK. Image processing for skin cancer features extraction. International Journal of Scientific & Engineering Research. 2013 Feb;4(2):1-6.

[2] Alsarori FA, Kaya H, Rahebi J, Popescu DE, Hemanth DJ. Cancer Cell Detection through Histological Nuclei Images Applying the Hybrid Combination of Artificial Bee Colony and Particle Swarm Optimization Algorithms. International Journal of Computational Intelligence Systems. 2020 Sep;13(1):1507-16.

[3] Ambika M, Raghuraman G, SaiRamesh L, Ayyasamy A. Intelligence–based decision support system for diagnosing the incidence of hypertensive type. Journal of Intelligent & Fuzzy Systems. 2020 Jan 1;38(2):1811-25.

[4] Burlina PM, Joshi NJ, Ng E, Billings SD, Rebman AW, Aucott JN. Automated detection of erythema migrans and other confounding skin lesions via deep learning. Computers in biology and medicine. 2019 Feb 1;105:151-6.

[5] Ambika M, Raghuraman G, SaiRamesh L. Enhanced decision support system to predict and prevent hypertension using computational intelligence techniques. Soft Computing. 2020 Feb 14:1-12.

[6] Augustus Devarajan A, SudalaiMuthu T. A cloud storage monitoring system using deduplication and file access pattern. International Journal of Recent Technology and Engineering. 2019 Sep;8(3):1972-6.

[7] Gandhi SA, Kampp J. Skin Cancer Epidemiology, Detection, and Management. The Medical Clinics of North America. 2015 Sep 2;99(6):1323-35.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[8] Masood A, Ali Al-Jumaily A. Computer aided diagnostic support system for skin cancer: a review of techniques and algorithms. International journal of biomedical imaging. 2013 Oct 30;2013:1-22.

[9] Bhate C, Schwartz RA. Lyme disease: Part I. Advances and perspectives. Journal of the American Academy of Dermatology. 2011 Apr 1;64(4):619-36.

[10] Lipsker D, Lieber-Mbomeyo A, Hedelin G. How accurate is a clinical diagnosis of erythema chronicum migrans? Prospective study comparing the diagnostic accuracy of general practitioners and dermatologists in an area where lyme borreliosis is endemic. Archives of dermatology. 2004 May 1;140(5):620-1.

[11] Nadelman RB. Erythema migrans. Infectious Disease Clinics. 2015 Jun 1;29(2):211-39.

[12] Huang H. Automatic translucency detection of basal cell carcinoma (BCC) via deep learning methods (Doctoral dissertation, University of British Columbia).[17.] He Huang, Automatic Translucency Detection of Basal Cell Carcinoma (BCC) Via Deep Learning Methods, A Thesis, The University of British Columbia, 2018.

[13] Kim DP, Kus KJ, Ruiz E. Basal cell carcinoma review. Hematology/Oncology Clinics. 2019 Feb 1;33(1):13-24.

[14] Marzuka AG, Book S. Basal cell carcinoma: pathogenesis, epidemiology, clinical features, diagnosis, histopathology, and management. The Yale journal of biology and medicine. 2015 Jun 1;88(2):167-79.

[15] Muthu TS, Kumar KR. Hybrid predictive approach for replica replacement in data grid. In2017 4th International Conference on Advanced Computing and Communication Systems (ICACCS) 2017 Jan 6 (pp. 1-5). IEEE.

[16] Sarah I, Soundarya K, Dhanalakshmi R, Deenadayalan T. DYS-I-CAN: An Aid for the Dyslexic to improve the skills using Mobile Application. In2020 International Conference on System, Computation, Automation and Networking (ICSCAN) 2020 Jul 3 (pp. 1-5). IEEE.

[17] Burlina PM, Joshi NJ, Ng E, Billings SD, Rebman AW, Aucott JN. Automated detection of erythema migrans and other confounding skin lesions via deep learning. Computers in biology and medicine. 2019 Feb 1;105:151-6.

[18] Krizhevsky A, Sutskever I, Hinton GE. Imagenet classification with deep convolutional neural networks. Advances in neural information processing systems. 2012;25:1097-105.

[19] Lallas A, Apalla Z, Argenziano G, Longo C, Moscarella E, Specchio F, Raucci M, Zalaudek I. The dermatoscopic universe of basal cell carcinoma. Dermatology practical & conceptual. 2014 Jul;4(3):11-24.

[20] LeCun Y, Bengio Y, Hinton G. Deep learning. nature. 2015 May;521(7553):436-44.

[21] Ajay H, Rao AR, Balavanan M, Lalit R. A Novel Cardiac Arrest Alerting System using IoT. International Journal of Science Technology & Engineering. 2017;3(10):78-83.

[22] Anand J, Dhanalakshmi M, and Raja PPJ. Smart Indication System for Spinal Cord Stress Detection. International Journal of Recent Technology and Engineering. 2019 Sep;8(3):6164-8.

[23] Wang H, Liu S, Guo M. 6C model construction and future prospects of innovation ecosystem research based on ecological theory. Arabian Journal of Geosciences. 2021 Jun;14(11):1-5.

[24] He K, Zhang X, Ren S, Sun J. Deep residual learning for image recognition. InProceedings of the IEEE conference on computer vision and pattern recognition 2016 (pp. 770-778).

[25] Kharazmi P, Lui H, Stoecker WV, Lee T. Automatic detection and segmentation of vascular structures in dermoscopy images using a novel vesselness measure based on pixel redness and tubularness. InMedical Imaging 2015: Computer-Aided Diagnosis 2015 Mar 20 (Vol. 9414, p. 94143M). International Society for Optics and Photonics.

[26] Mazori DR, Orme CM, Mir A, Meehan SA, Neimann AL. Vesicular erythema migrans: an atypical and easily misdiagnosed form of Lyme disease. Dermatology online journal. 2015;21(8):1-5.

[27] Kharazmi P, AlJasser MI, Lui H, Wang ZJ, Lee TK. Automated detection and segmentation of vascular structures of skin lesions seen in Dermoscopy, with an application to basal cell carcinoma classification. IEEE journal of biomedical and health informatics. 2016 Dec 8;21(6):1675-84.

[28] Tsumura N, Haneishi H, Miyake Y. Independent-component analysis of skin color image. JOSA A. 1999 Sep 1;16(9):2169-76.

[29] Argenziano G, Soyer HP, De Giorgio V, Piccolo D, Carli P, Delfino M, Ferrari A, Hofmann-Wellenhof R, Massi D, Mazzocchetti G, Scalvenzi M. Interactive atlas of dermoscopy. Milan, Italy: Edra Medical Publishing and New Media, 2000.

[30] Di Leo G, Paolillo A, Sommella P, Fabbrocini G, Rescigno O. A software tool for the diagnosis of melanomas. In2010 IEEE Instrumentation & Measurement Technology Conference Proceedings 2010 May 3 (pp. 886-891). IEEE.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[31] Abdlaty R, Doerwald-Munoz L, Madooei A, Sahli S, Yeh SC, Zerubia J, Wong RK, Hayward JE, Farrell TJ, Fang Q. Hyperspectral imaging and classification for grading skin erythema. Frontiers in Physics. 2018 Aug 28;6(72):1-10.

[32] Pramanik T, Khatiwada B, Pandit R. Color vision deficiency among a group of students of health sciences. Nepal Med Coll J. 2012 Dec 1;14(4):334-6.

[33] Trotti A, Colevas AD, Setser A, Rusch V, Jaques D, Budach V, Langer C, Murphy B, Cumberlin R, Coleman CN, Rubin P. CTCAE v3. 0: development of a comprehensive grading system for the adverse effects of cancer treatment. InSeminars in radiation oncology 2003 Jul 1 (Vol. 13, No. 3, pp. 176-181). WB Saunders.

[34] Madooei A, Abdlaty RM, Doerwald-Munoz L, Hayward J, Drew MS, Fang Q, Zerubia J. Hyperspectral image processing for detection and grading of skin erythema. InMedical Imaging 2017: Image Processing 2017 Feb 24 (Vol. 10133, p. 1013322). International Society for Optics and Photonics.

[35] Liu G, Lin Z, Yan S, Sun J, Yu Y, Ma Y. Robust recovery of subspace structures by low-rank representation. IEEE transactions on pattern analysis and machine intelligence. 2012 Apr 10;35(1):171-84.

[36] Burlina PM, Joshi NJ, Mathew PA, Paul W, Rebman AW, Aucott JN. AI-based detection of erythema migrans and disambiguation against other skin lesions. Computers in Biology and Medicine. 2020 Oct 1;125:103977.

[37] Steere AC, Sikand VK. The presenting manifestations of Lyme disease and the outcomes of treatment. New England Journal of Medicine. 2003 Jun 12;348(24):2472-4.

[38] Huang G, Liu Z, Van Der Maaten L, Weinberger KQ. Densely connected convolutional networks. InProceedings of the IEEE conference on computer vision and pattern recognition 2017 (pp. 4700-4708).

[39] Szegedy C, Ioffe S, Vanhoucke V, Alemi AA. Inception-v4, inception-resnet and the impact of residual connections on learning. InThirty-first AAAI conference on artificial intelligence 2017 Feb 12 (pp. 4278–4284).

[40] Liu Y, Jain A, Eng C, Way DH, Lee K, Bui P, Kanada K, de Oliveira Marinho G, Gallegos J, Gabriele S, Gupta V. A deep learning system for differential diagnosis of skin diseases. Nature medicine. 2020 Jun;26(6):900-8.

[41] Esteva A, Kuprel B, Novoa RA, Ko J, Swetter SM, Blau HM, Thrun S. Dermatologist-level classification of skin cancer with deep neural networks. Nature. 2017 Feb;542(7639):115-8.

[42] Zoph B, Vasudevan V, Shlens J, Le QV. Learning transferable architectures for scalable image recognition. InProceedings of the IEEE conference on computer vision and pattern recognition 2018 (pp. 8697-8710).

[43] Khan A, Sohail A, Zahoora U, Qureshi AS. A survey of the recent architectures of deep convolutional neural networks. Artificial Intelligence Review. 2020 Dec;53(8):5455-516.

[44] Niranjana S, Hareshaa SK, Irene ZB, Anand J. Smart Monitoring System for Asthma Patients. International Journal of Electronics and Communication Engineering. 2020 May;7(5):5-9.

[45] Stücker M, Esser M, Hoffmann M, Memmel U, Hirschmüller A, Von Bormann C, Hoffmann K, Altmeyer P. High-resolution laser Doppler perfusion imaging aids in differentiating between benign and malignant melanocytic skin tumours. Acta dermato-venereologica. 2002 Jan 1;82(1):25-9.

[46] Du L, Qin H, Ma T, Zhang T, Xing D. In vivo imaging-guided photothermal/photoacoustic synergistic therapy with bioorthogonal metabolic glycoengineering-activated tumor targeting nanoparticles. Acs Nano. 2017 Sep 26;11(9):8930-43.

[47] Zhou W, Chen Z, Yang S, Xing D. Optical biopsy approach to basal cell carcinoma and melanoma based on all-optically integrated photoacoustic and optical coherence tomography. Optics letters. 2017 Jun 1;42(11):2145-8.

[48] Ranjana P, Sridevi SL, Muthu TS, Gnanaraj VV. Machine Learning Algorithm in Two wheelers fuel Prediction. In2019 1st International Conference on Innovations in Information and Communication Technology (ICIICT) 2019 Apr 25 (pp. 1-5). IEEE.

[49] Revathi J, Anitha J, Hemanth DJ. Training feedforward neural network using genetic algorithm to diagnose left ventricular hypertrophy. Telkomnika. 2020 Jun 1;18(3):1285-91.

[50] Kharazmi P, Kalia S, Lui H, Wang ZJ, Lee TK. A feature fusion system for basal cell carcinoma detection through data-driven feature learning and patient profile. Skin research and technology. 2018 May;24(2):256-64.

[51] Zalaudek I, Kreusch J, Giacomel J, Ferrara G, Catricala C, Argenziano G. How to diagnose nonpigmented skin tumors: a review of vascular structures seen with dermoscopy: part I. Melanocytic skin tumors. Journal of the American Academy of Dermatology. 2010 Sep 1;63(3):361-74.

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[52] Longo C, Zalaudek I, Argenziano G, Pellacani G. New directions in dermatopathology: in vivo confocal microscopy in clinical practice. Dermatologic clinics. 2012 Oct 1;30(4):799-814.

[53] Yang Z, Chen J, Yao J, Lin R, Meng J, Liu C, Yang J, Li X, Wang L, Song L. Multi-parametric quantitative microvascular imaging with optical-resolution photoacoustic microscopy in vivo. Optics express. 2014 Jan 27;22(2):1500-11.

[54] Sharma K, Madaan S. Improved Segmentation algorithm using PSO and K-means for Basal Cell Carcinoma Classification from Skin Lesions. International Journal of Innovative Technology and Exploring Engineering (IJITEE). 2019 July;8(954):2278-3075.

[55] Ramandeep Kaur, Gagandeep, Parveen Kumar, Geetanjali Babbar. An Enhanced and Automatic Skin Cancer Detection using K-Mean and PSO Technique. International Journal of Innovative Technology and Exploring Engineering (IJITEE). 2019 July;8(9S):634-9.

[56] Sudalai Muthu T, Rohini A. A correlative scrutiny for improving the career guidance links in social network. International Journal of Engineering and Advanced Technology. 2019 Oct;9(1):1466-70.

[57] SudalaiMuthu T, RameshKumar K, Sarukesi K. A Weight based replica replacement algorithm in datagrid. Journal of Advanced Research in Dynamical and Control Systems. 2017;9(6):1164-78.

[58] Ng A. CS294A lecture notes: sparse autoencoder. 2010.

[59] Krizhevsky A, Hinton G. Learning multiple layers of features from tiny images.Master's thesis, Department of Computer Science, University of Toronto; 2009.

[60] Fania L, Didona D, Morese R, Campana I, Coco V, Di Pietro FR, Ricci F, Pallotta S, Candi E, Abeni D, Dellambra E. Basal cell carcinoma: from pathophysiology to novel therapeutic approaches. Biomedicines. 2020 Nov;8(449):1-38.

[61] McCormack CJ, Kelly JW, Dorevitch AP. Differences in age and body site distribution of the histological subtypes of basal cell carcinoma: a possible indicator of differing causes. Archives of dermatology. 1997 May 1;133(5):593-6.

[62] Scrivener Y, Grosshans E, Cribier B. Variations of basal cell carcinomas according to gender, age, location and histopathological subtype. British Journal of Dermatology. 2002 Jul;147(1):41-7.

[63] Trakatelli M, Morton C, Nagore E, Ulrich C, Del Marmol V, Peris K, Basset-Seguin N. Update of the European guidelines for basal cell carcinoma management. European Journal of Dermatology. 2014 May;24(3):312-29.

[64] Lallas A, Apalla Z, Ioannides D, Argenziano G, Castagnetti F, Moscarella E, Longo C, Palmieri T, Ramundo D, Zalaudek I. Dermoscopy in the diagnosis and management of basal cell carcinoma. Future Oncology. 2015 Nov;11(22):2975-84.

[65] Lallas A, Argenziano G, Zendri E, Moscarella E, Longo C, Grenzi L, Pellacani G, Zalaudek I. Update on non-melanoma skin cancer and the value of dermoscopy in its diagnosis and treatment monitoring. Expert review of anticancer therapy. 2013 May 1;13(5):541-58.

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Sign Language Translator Using YOLO Algorithm

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Abstract. Sign language is a terminology that encloses a motion of hand gestures which is an environment for the auditory impairment, individual (deaf or dumb) to deal with others. Nevertheless, so as to impart with the hearing impaired individual, the communicator obtains to acquire acquaintance in sign language. As follows is frequent to make undoubted that the message provided by the hearing impaired person acknowledged. This implemented system propounds an implementation of real time American Sign Language perception in Convolutional Neural Network (CNN) with the support of You Only Look Once version (YOLO) algorithm. The algorithm initially executes data acquisition, subsequently the pre-processing of gestures and are conducted to trace hand movement utilize a combinational algorithm.

Keywords. Sign Language Translation, Convolutional Neural Network (CNN), YOLO algorithm, hand tracking, segmentation, American Sign Language (ASL).

1. Introduction

Communicating is the mode of trading knowledge between transmitter and receiver via any environment accessible. The perception among two parties is key to assure that the message communicated is substantially deciphered by the receiver. Hard of hearing individuals utilize sign dialect as an environment to impart with rest. Sign dialect is the course of communication that's determined on hand development and optical orientation. Sign dialect specialists indicated that the visual accustomed sustains of hand shape (the way the hand and fingers shape a sign), an area of the hand, palm introduction and progress of the hand as its high spots. These profess illuminates that each hand signal or development encompasses distinctive significance to be mapped.

This study could be a CNN-based human hand signal recognition methodology [1]. CNN could be an investigate section of neural networks. Application of CNN to memorize human signals, there's no need to create complicated calculations to extricate picture features and determine them [2]. With the help of the convolution and sub-sampling level of a CNN, invariant highlights are permitted with little disruption. To decline the collision of different hand postures of a hand signal sort on the acknowledgment preciseness, the principal axis of the hand is found to calibrate the picture in this work [3]. Calibrated

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pictures are profitable to a CNN to memorize and recognize precisely. In a genuine circumstance, when ordinary individuals encounter with deaf people, communication deterioration arises due to different manners of communication. In order to convey with the hearing disabled individual, the information about sign dialect is indispensable, merely it fetch to be an obstruction for those who don't learn the dialect. The most common limitation confronted by hard of hearing individuals in communication is the nonattendance of a flag mediator [4]. Individuals are not keen to memorize sign dialect on account of the miserable stipulate of sign dialect course for ordinary individuals.

2. Literature Survey

The author of [5] conducted a framework entitled as "Indian sign language translator using gesture recognition algorithm". The framework interprets motions made in ISL into English. The gesture acknowledgment framework is to ensure gestural information. Vision based strategy incorporates picture refinement. The database for creating this framework is made to possess with the recorded recordings of hard of hearing and quiet endorsers. This makes the signals included to be authentic. The diversity of different calculations for Pre-processing, Feature extraction and vector quantization, the leading skillful calculation was shortlisted to be a combined yield calculation for pre-processing, 2D FFT Fourier Descriptors for feature extraction and 4 vector codebook LBG. The authors of [6] proposed a convolutional neural network (CNN) strategy for recognizing hand signals from camera activities of human task exercises. To obtain the CNN's preparing and examining the details, the skin demonstration and the gauging of hand location and introduction are related. Since light conditions have a major impact on complexion color, the proposed utilize a Gaussian Mixture model (GMM) to gear up the skin exposure; the latter is employed to effectively filter out non-skin color in an illustration. The contemplated framework has also acquired the palatable comes about on the attributive motions in an unrelenting movement utilizing the contemplated guideline. The authors of [7] discussed a sign dialect acknowledgment framework utilizing Back Propagation Neural Network Calculation contemplated instituted on American Sign Language. The proposed framework employments the pictures in accordance with the nearby framework or the outline detained from webcam as an input. The framework employments two classifiers: one employments crude image attributes and the other one employments thresholding highlights. Back propagation Algorithm was utilized for the proposed system as learning assessment. Marcel Inactive Hand Pose was used for the framework as a database.

3. System Design

In order to organize a communication with the hearing impaired individual, the communicator should have knowledge in sign vocabulary [8]. The interpretation amongst two parties is exceptionally imperative to secure that the message conveyed is substantially translated by the recipient. In a genuine circumstance, when ordinary individuals encounter with deaf people, disclosure deterioration arises scheduled to different styles of communication. ASL requires utilize of a person's hands so in case something happens where a wrist was sprained and it debilitates that individual from talking [9]. Sign di-

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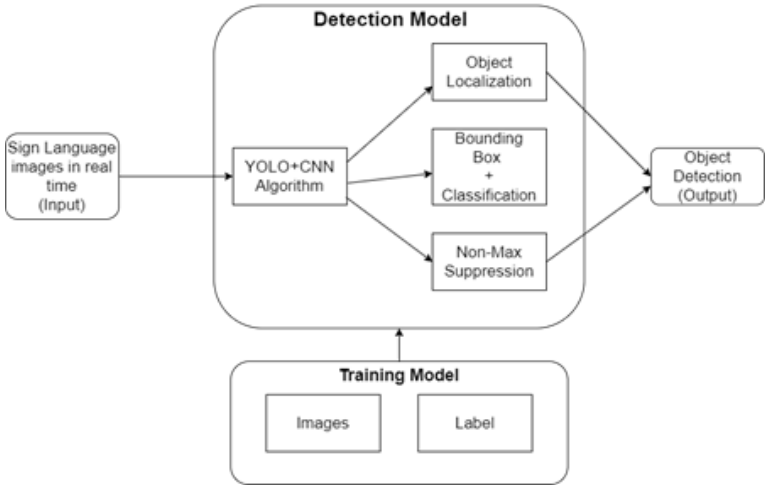

Figure 1. System Design

alect deciphering is one of the highest-risk callings for ergonomic injury. The investigate shows that translating causes more physical stretch to the limits than high-risk errands conducted in mechanical settings, counting gathering line work [10]. It is to found a coordinate interface between an increment within the mental and cognitive push of the interpreter and an increment within the hazard of musculoskeletal wounds such as carpal burrow disorder and tendonitis [11]. In order to solve this problem, the proposed system use Convolutional Neutral Network (CNN) and You Only Look Once (YOLO) algorithm, whereas CNN could be a study branch neural networks [12]. Application a CNN to memorize human movement, there's no necessity to formulate complicated assessment to extricate picture attributes and determine them [13]. CNN fundamentally utilized to perform image classification, protest acknowledgment and question discovery in today's innovation. The accuracy of system increases while using YOLO calculation appears to be one of speediest picture handling calculation with a speed of 45 frames/second, which has high robustness and precision for detecting the American Sign Language. Calibrated pictures are beneficial to a CNN to memorize and recognize accurately.

3.1. Methodology

The framework plan of this venture is as appeared in Figure 1, it was isolated into Training paradigm and Detection paradigm, where the Training paradigm comprises of names and trained database, and the Perception demonstrate as the testing handles of this venture. The framework will start to operate by getting input of sign dialect picture in genuine time via webcam. YOLO assessment will deal the picture by distinguishing the presence of trained snapshots within the input snapshot. On the off chance that the prepared picture exists in the input, a bounding box with a name that focuses the expected object will be compiled. Amid the information compilation of this extend, the sign language dataset from an online source, a database that mostly comprises of commonly used phrase of American Sign Dialect pictures were aggregate. Respectively sign dialect comprises of 500 pictures of 400x400 determinations with a diversity of radiance. As the

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literacy of American Sign Dialect is mostly known, in this manner a few of the phrases can be straightforwardly utilized in this extend. From the database, the category of sign dialect pictures furthermore partitioned into two sorts, which were remarked as true label and predicted label.

In this setting, inactive sign dialect make reference to a solitary hand progression and different hand progression was determined as an energetic sign dialect [14]. The example of picture naming that was driven amid the database planning. This extends centered on the progression of the inactive sign dialect because it is simpler to be dominated contrast to the energetic sign dialect. Subsequently the pictures were composed, the pictures were named based on the required phrases those signs represent. The annotated pictures data that contain facilitates of the picture was put away within the content directory and will be conducted within the draft session. Afterwards the planning of the database accom-

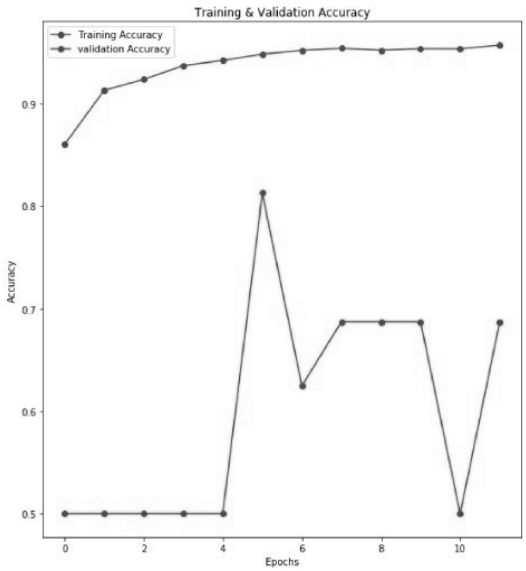

Figure 2. Epochs Vs Validation Accuracy Graph for all the Trained on Required Phrases

plished, the classified perception is grouped accordingly. The training sets are prepared, the desired criterion such as the count of classes and channels were given as parameters in the Python code accordingly. Ensuing, the name log, which embraces a directory of the objects to be entitled, was accomplished. In addition, the training prepare was enforced utilizing convolutional weights and being compiled within the Convolutional Neutral Network (CNN) system. Figure 2 appears the training case that was implemented. Later in the training procedure of demonstrating completed, the model testing prepare was enforced to conclude the precision of the prepared mass [15]. In Figure 3 shows the hand gesture for "sorry" which is extracted from the camera [16]. Later on the most exact weights was distinguished, the weights were analyzed in real-time, by means of which the video was detained utilizing a webcam. The outcomes of the further weights were organized and will be referred about within another segment.

The YOLO (You Only Look Once) algorithm takes the whole picture in a single occasion and predicts the bounding box arranges and class probabilities for these boxes.

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Figure 3. ”sorry” in American Sign Language

Image classification and localization are connected on each framework. YOLO at that point predicts the bounding boxes and their comparing class probabilities for objects as seen within the underneath diagram. Convolutional Neural Network (CNN) could be an acknowledgment calculation which utilized in acknowledgment of pictures, sound, content, etc. It has numerous highlights like convolution, pooling, dropout which are a few methodologies utilized to progress fault tolerances.

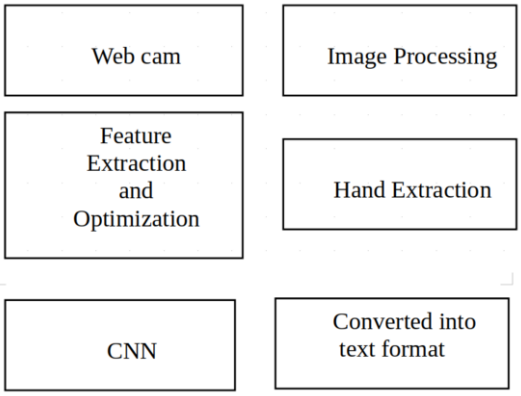

Figure 4. Architecture Diagram for Sign Language Translator

3.2. Pre-processing

The pre-processing process initiate with a dataset interpretation where the perception were aggregate and dominated to sort a dataset whichever will be moreover employed for validation and test batch. The perception in the local apparatus or the frame detained from the webcam is employed as input to the technique. Afterwards refinement input image, then classifiers catalogue the image which class it affiliate to accordingly. The Figure 4 shows architecture diagram of sign language translator.

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3.3. Hand Extraction

Tracking of a hand is more often than not troublesome as the development of hands can be exceptionally quick and their appearance can alter immensely inside some frames. In a vision schema, the luminance requirement is a substantial constituent to sway the framework execution. Utilizing colour verge to catalogue skin and non-skin colours is prevalent in habitual access; merely colour limits are not adequate to depict the empirical attribute of skin colour under various luminance conditions. Indeed, in spite of the fact that the YCbCr colour interval that is less delicate to the luminance state than the RGB colour space is deployed, the consequence is still lacking. The Grey Scale pictures for signal acknowledgment are utilized as the acknowledgment rate is moved forward compared to others.

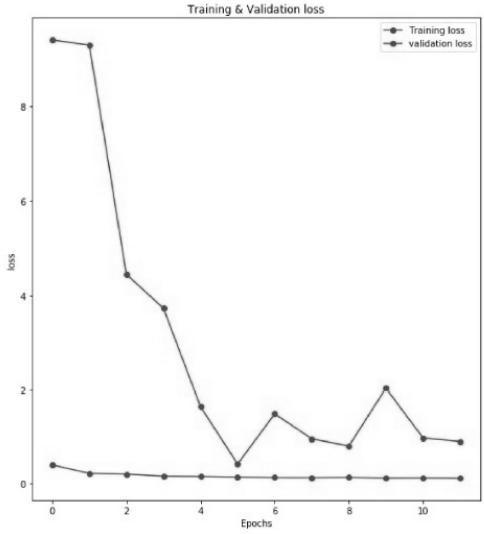

Figure 5. Epochs Vs Validation Accuracy Graph for Models Trained on each phrase

3.4. Feature Extraction

Feature extraction cites to the method of recognizing the principal considerations in a picture (intrigued focuses) that can offer assistance to characterize the images substance such as bend, pattern, boundary, and spot. Feature extraction upon the pictures has fetched in this way: Input pictures into the framework are changing over to an encrypted organize which suggests changing over a piece picture into a progression of RGB pixels [17]. YOLO process will prepare input pictures by recognizing the presence of trained pictures. It encompasses the outcome of the anticipated protest within bounding boxes. At that point, pictures are consolidated to be in the corresponding figure. Respectively perception diminishes to 76 x 66 PX.

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3.5. Testing phase

To begin with, the picture information is perused successively. In conjunction with this, the name records are stacked and the carriage return is stripped off. Following, the file representing the unused prepared demonstration is stacked as a graph in Figure 5. Once the show is stacked, the picture information is stacked as input to the chart, for a preparatory expectation. As a result of this preparatory run, each picture is relegated a rate certainty. The certainty percent portrays the level up to which demonstrate was able to foresee the result. After the primary expectation run, the names are appeared, sorted in arrange of certainty. Convolution Neural Network is utilized to excavate the profound data of multi-layer organize within the handle of face acknowledgment. It moreover applies a channel to an input to form a highlight outline that summarizes the nearness of recognized highlights within the input. Accuracy in testing is shown in Figure 6.

```
tLoss, tAccuracy = model.evaluate(X_test, y_test)

print('Test accuracy: {:2.2f}%'.format(tAccuracy*100))
```

```
9443/9443 [==============================] - 755s 80ms/step
Test accuracy: 99.90%
```

Figure 6. Test Accuracy on the Model

4. Result and Discussion

The outcome about this project shows that extension has more strength and exactness for detecting the American Sign Dialect. The proposed approach is being evaluated in genuine world circumstances by enforcing it through the medium of a webcam, occasionally it recognizes the problems that were not prepared to be ascertained. In this manner, it can be affirmed that this extended discovery demonstrates a solution as well. In the past, there are various issues which cause low accuracy in recognition and detection of a particular phrase or letter using various algorithms for images [18]. This might transpire scheduled to fewer components that impact the precision of the recognition such as picture clatter, the need for an assortment of diversion in the object pictures, an inadequate number of prepared images. The images are captured from the camera, which are detected and recognized as a phrase or a letter by using YOLO and CNN. Finally, they are converted to text format and displayed to ordinary individuals.

5. Conclusion

The proposed system contemplated an approach to develop a modified American Sign Dialect Translator which utilizing Convolutional Neural Network (along with YOLO) in a real world scenario. The proposed system is verified to detect the hand gestures at an accuracy of 92.5% for commonly used phrases. In future, a high-end semantic examination can be connected to the operative apparatus to improve the acknowledgment competency complicated individual assignments. The acknowledgment rate also can be expanded by improving the handling picture step as future work.

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References

[1] Albawi S, Mohammed TA, Al-Zawi S. Understanding of a convolutional neural network. In2017 International Conference on Engineering and Technology (ICET) 2017 Aug 21 (pp. 1-6). IEEE.

[2] Rajendran PS. Gesture Supporting Smart Notice Board Using Augmented Reality. InInternational Conference on Next Generation Computing Technologies 2017 Oct 30 (pp. 112-123). Springer, Singapore.

[3] Martin Sagayam K, Jude Hemanth D. Hand posture and gesture recognition techniques for virtual reality applications: a survey. Virtual Reality. 2017 Jun;21(2):91-107.

[4] Kumaran N, Rangaraj V, Dhanalakshmi R. Intelligent Personal Assistant-Implementing Voice Commands enabling Speech Recognition. In2020 International Conference on System, Computation, Automation and Networking (ICSCAN) 2020 Jul 3 (pp. 1-5). IEEE.

[5] Badhe PC, Kulkarni V. Indian sign language translator using gesture recognition algorithm. In2015 IEEE International Conference on Computer Graphics, Vision and Information Security (CGVIS) 2015 Nov 2 (pp. 195-200). IEEE.

[6] Lin HI, Hsu MH, Chen WK. Human hand gesture recognition using a convolution neural network. In2014 IEEE International Conference on Automation Science and Engineering (CASE) 2014 Aug 18 (pp. 1038-1043). IEEE.

[7] Karayılan T, Kılıç Ö. Sign language recognition. In2017 International Conference on Computer Science and Engineering (UBMK) 2017 Oct 5 (pp. 1122-1126). IEEE.

[8] ISL Dictionary Launch — Indian Sign Language Research and Training Center (ISLRTC), Government of India. 2019 [Internet]. Available from: http://www.islrtc.nic.in/isl-dictionary-launch.

[9] Deora D, Bajaj N. Indian sign language recognition. In2012 1st International Conference on Emerging Technology Trends in Electronics, Communication & Networking 2012 Dec 19 (pp. 1-5). IEEE.

[10] Sarah I, Soundarya K, Dhanalakshmi R, Deenadayalan T. DYS-I-CAN: An Aid for the Dyslexic to improve the skills using Mobile Application. In2020 International Conference on System, Computation, Automation and Networking (ICSCAN) 2020 Jul 3 (pp. 1-5). IEEE.

[11] Wankhede J, Kumar M, Sambandam P. Efficient heart disease prediction-based on optimal feature selection using DFCSS and classification by improved Elman-SFO. IET Systems Biology. 2020 Sep 16;14(6):380-90.

[12] Islam MR, Mitu UK, Bhuiyan RA, Shin J. Hand gesture feature extraction using deep convolutional neural network for recognizing American sign language. In2018 4th International Conference on Frontiers of Signal Processing (ICFSP) 2018 Sep 24 (pp. 115-119). IEEE.

[13] Belagiannis V, Zisserman A. Recurrent human pose estimation. In2017 12th IEEE International Conference on Automatic Face & Gesture Recognition (FG 2017) 2017 May 30 (pp. 468-475). IEEE.

[14] Martin Sagayam K, Jude Hemanth D. ABC algorithm based optimization of 1-D hidden Markov model for hand gesture recognition applications. Computers in Industry. 2018 Aug 1;99:313-23.

[15] Martin Sagayam K, Jude Hemanth D. A probabilistic model for state sequence analysis in hidden Markov model for hand gesture recognition. Computational Intelligence. 2019 Feb;35(1):59-81.

[16] Estrada Jiménez LA, Benalcázar ME, Sotomayor N. Gesture recognition and machine learning applied to sign language translation. InVII Latin American Congress on Biomedical Engineering CLAIB 2016, Bucaramanga, Santander, Colombia, October 26th-28th, 2016 2017 (pp. 233-236). Springer, Singapore.

[17] Prakash A, Krishnaveni R, Dhanalakshmi R. Continuous user authentication using multimodal biometric traits with optimal feature level fusion. International Journal of Biomedical Engineering and Technology. 2020;34(1):1-9.

[18] Kumaresan J, Perinbam JR, Ebenezer D, Vasanthi R. IRIS recognition optimized by ICA using parallel CAT swarm optimization. Journal of Engineering and Applied Sciences. 2015;10:4942-7.

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Student Performance Prediction Using Machine Learning

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Abstract. Performance analysis of learning outcomes is a system that will aim for excellence at all levels and dimensions of the student's field of interest. This paper suggests a comprehensive EDM framework in the form of a rule-based recommender system that not only analyses and predicts student achievement, but also demonstrates the reasons for it. The suggested framework examines students' demographic information, study-related characteristics, and psychological factors to gather as much information as possible from classmates, teachers, and parents. School reports and queries used to collect the world's latest data (e.g., student marks, population, social and school-related factors. Using a set of potent data mining methods, aiming for the greatest possible precision in academic performance prediction. The framework is effective in identifying the student's weaknesses and making relevant recommendations. In contrast to current frameworks, the proposed framework outperforms them in a practical case study involving 200 individuals.

Keywords. Data Mining, Student Performance Prediction, Classification

1. Introduction

Recently, online educational systems have grown in popularity, and student information stored has grown to be large in number. This allows for the development of rules and forecasts. Data mining tools used to process student teaching data. A variety of information about the student's social status, learning environment, or study notes can be used to make predictions about his or her achievements or failures. The purpose of this study is to predict the final level of students to assist teachers in taking steps to protect vulnerable children. To improve the prediction model's accuracy, a number of data preprocessing procedures were used. The level of accuracy of the three popular data mining algorithms (decision tree, random forest, and inexperienced Bayes) is then compared. In addition, the effects of the two separate phase ranges on data mining are investigated in this study: five-level grade categorization and binary grade categorization. Research in this field. The methods used in this study are briefly described to provide thorough understanding of the concepts. Experimental experiments with dataset descriptions, data pre-processing, and experimental result subtitles are summarized in Section 4. Section 5 concludes with a conclusion and recommendations for future studies.

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2. Related Works

Predicting students' educational performance is one among the most topics of educational data mining. With the upcoming of new technology, technology investment in the education sector has increased, in combination with technological advances, e-Learning platforms such as the web on-line learning and multimedia technologies have evolved, and each learning prices have reduced, and time and area limitations are eliminated, the rise of on-line courses and therefore the hike of online transactions and school-based transactions led to an increase in digital knowledge during the field [1, 2]. Costa stressed the info concerning the failing rate of the students; the teachers were involved and raised vital concerns about the failure prediction. Estimating student's performances becomes harder as a result of the massive volume of information in coaching databases. Descriptive statistical analysis is effectively accustomed offer the fundamental descriptive data of a given information. However, this isn't always sufficient. to inform faculty and students ahead of time, students may also be ready to determine ahead of time, using calculable modelling strategies, there is an advantage to defining university students in terms of how they can work in education in order to increase achievement levels and manage resources effectively [3–6]. Universities' huge expansion of electronic knowledge ends up in a rise within the ought to acquire significant data from these large amounts of information. By utilizing data processing techniques on educational data, it's possible to enhance the standard of the education [7–9]. To date, data processing algorithms have been used in various fields of education such as engineering education, physical education, and English language education. Some fields are oriented toward high school students, many of whom are highly interested in higher education. While some data analysis studies focus on predicting overall student outcomes, some studies focus on teacher outcomes as a whole. The authors of [10–12] made a project to learn the patterns of university student retention . Since reading the literature, it is clear that the present state of the art has a lot of space for change. Improvements are possible, as seen in the article, if we examine different learning styles; choose features carefully; examine the application of the studied hypothesis and not its moderate application, but also by the variation in that performance; and investigate the delta of student variables between those who remain and those who are retained. The following characteristics were considered to be informative using these methods for determining whether students would stay for the first three years of an undergraduate degree: family history and family's social-economic standing, high school GPA, and test scores. The authors of [13–15] researched the classification techniques used in data mining. There are three main components of data mining. Clustering, association laws and sequence analysis are all techniques for evaluating results. Process classification / collection process is the process of analyzing data and creating a set of collection rules that can be used to label a potential data label. The process of extracting data from a data set and converting it into an understandable structure is known as data mining. It is a mathematical method that incorporates methods from artificial intelligence, machine learning, analytics, and database systems to detect integration in big data sets [16–18]. The real data mining activity entails the automated or semi-automated processing of vast amounts of data in order to uncover previously identified trends [19, 20]. There are six different types of data mining activities. Anomaly identification, association rule learning, clustering, classification, regression, and summarization are some of the techniques used to diagnose anomalies. Classification is a popular data mining technique that is used

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in a number of fields. Classification is a method of digging data to predict the membership of a data model group. The basic classification techniques are discussed in this article. The aim here is to provide a systematic overview of various classification strategies in data mining, including decision tree inference, Bayesian networks, and the k-nearest neighbor classifier.

Salam et al. used ELM technique for the diagnosis of heart diseases. The diagnosis of heart disease, which affects millions of people, is one of the most important aspects of the use of machine learning technology. Patients with heart disease have a number of independent variables in general, such as age, sex, serum cholesterol, blood sugar, and so on, that can be used to diagnose them effectively. To model these variables, an Extreme Learning Machine (ELM) algorithm is used in this article. The proposed system would be used to supplement an expensive routine checkup with a warning system that alerts patients to the possibility of heart failure. The method is based on actual data obtained by the Cleveland Clinic Foundation, which included information on about 300 patients. According to simulation data, this architecture is around 80% accurate in detecting heart disease.

Shadab Adam Pattekari and Asma Parveen developed a predictive system for heart disease using the Naïve Bayes algorithm. The key goal of this study is to create an Intelligent System using the Naive Bayes data mining simulation methodology. It's a web-based programmed in which the user asks pre-determined questions. It pulls secret data from a database and compares user values to a trained data set. It will address with complex questions about heart disease treatement, allowing healthcare workers to make correct treatment choices than old decision systems. It also aims to lower healthcare costs by delivering successful care.

Oliver and Mangas made a health gear, a wearable machine to monitor and analyze physiological signals. Health Gear is a real-time wearable device that monitors, visualizes, and analyses physiological signals in real time. Health Gear is made up of a series of noninvasive physiological sensors that are attached to a mobile phone through Bluetooth and store, transfer, and interpret physiological data before displaying it to the user in an understandable manner. The emphasis of this paper is on a Health Gear implementation that uses a blood oximeter to track the user's blood oxygen level and pulse as they sleep. We further discuss two separate algorithms for predicting sleep apnea episodes automatically, as well as the overall system's success in a sleep trial of 20 volunteers.

3. Existing System

Previous predictive models relied solely on demographic data from students, such as gender, age, marital status, family income, and qualifications. Additionally, study-related characteristics such as homework and study hours, as well as past successes and grades, are included. This previous studies were restricted to predicting academic performance or loss without elaborating on the causes for this prediction. The majority of recent studies aimed to collect more than 40 attributes in their data collection in order to estimate a student's academic success. These characteristics came from the same type of data group, whether demographic, study-related, or both, resulting in a lack of variety in predicting laws. As a result, the information for the reasons for the student's dropout was not completely extracted by these created laws. Aside from the work described above, previous

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predictive research models from the viewpoint of educational psychology performed a couple of experiments to analyze the relationship between mental health and academic success. The guidelines were too brief, and they failed to demonstrate how to implement them.

4. Proposed System

The suggested paradigm starts by integrating demographic and study-related attributes with educational psychology areas, by applying psychological features to the historically used data collection (i.e., students' demographic and study-related data). We selected the most important attributes based on their justification and association with academic success after surveying the previously used variables for predicting the student's academic performance. The proposal's goal is to look at a student's longitudinal statistics, study-related information, and psychological attributes in terms of their final state and see whether they are on target, struggling, or even failing. In addition, we conducted a thorough analysis of our proposed model with previous similar models.

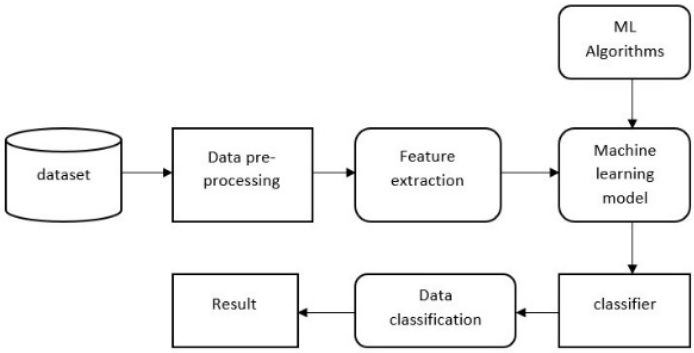

Figure 1. System Architecture

5. Method

As a result of the surge in digitalization, we now have an abundance of data in every field. When the right information and tools to use it are known, having more data becomes valuable. Using a variety of machine learning methods, data mining aims to extract data from data. It is possible to build links to data and make accurate predictions for the future using the data mine. Education is one of the applications for data mining. In education it is a field that encourages us to predict future predictions by analyzing historical data in the field of education and applying electronic learning methods to it. Data mining is divided into three categories: classification, collection, and organizational mine control. The classification task is the focus of this research. Depending on the analysis area and

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the sort of data we have, different data mining techniques may be used. On educational datasets, four well-known Data Mining Methods, Applications, and Systems classification algorithms were used to predict students' final grades.

5.1. Artificial Neural Network

Artificial Neural Network is a collection of input and output units connected by a heavy connection. ANN learns by adjusting link weights in such a way that it can predict the appropriate label of such input data sets. The retrieval algorithm is one of the most well-known learning methods for ANN training. ANN has many advantages, including high tolerance to noisy data sets and good results in the differentiation of untrained patterns, so it is helpful in situations where the relationship between class markers and negative data properties is understandable. Image and handwriting recognition, voice recognition, diagnostic medicine, and disease are just a real global launch of the ANNs. ANNs can be categorized according to their structure and style. ANN for fully integrated feed supply, with input layer, one or more hidden layers, and output output, is one example. In addition, connectors facing the input unit or output unit in the previous layer do not go back. In addition, each L unit layer provides details on each L + 1 unit layer. In this study, the three-layer ANN is fully integrated. The input layer, the two hidden layers, and the output layer form a network. Twenty input cells, or neurons, form an input layer, while six inverted connections form the first hidden layer. There are three other secret secrets in the second hidden layer. The output layer, which has a single output unit, is the fourth layer. The function of secret operating units has been implemented using the Rectifier Linear Unit.

5.2. Logistic Regression

The arithmetic simulation model defines the relationship between multiple independent variables, X1 ... XK, and the dependent variables, D. The preparation model uses a mathematical form known as the logistic equation, with a scale of 0 to 1 for all inputs provided. The order model can be used to define the probability of an event, which is usually a number between 0 and 1. The order model is represented by the formula below.

$$P(D = 1|X1, X2, \ldots, Xk) = \frac{1}{1 + e(a + \sum_k b_i x_i)} \tag{1}$$

Model parameters, a and b, can be read in a series of scenarios named in the training database. During the training process, the Gradient Descent Algorithm used for finding best values for model.

5.3. Support Vector Machine

It's a promising approach for both linear and non-linear data classification [21]. It transforms the initial training data into higher dimension using non-linear projection. We've described each since then. Each student has several variables, and each of them is referred to as a multidimensional entity. It looks for the linear optimal separating within this new dimension. A hyperplane is a "decision boundary" that separates students from one class from those of another. A hyperplane will often be used to distinguish data from

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two groups (H1 and H2). Support vectors (”critical” planning information samples) and edges (Large edge and Small edge, which are characterised by aid vectors) are used by the SVM to find this hyperplane. Many data analysts claim that this approach is slow during the training process, but it has a high precision, particularly for small numbers of support vectors that are independent of the object's higher dimensions. As a result, we can conclude that SVM is an excellent tool for classifying a small number of training samples with various parameters.

6. Experimental Result

The study collected a single set of data containing details and details of students from two secondary schools in Portugal. Database features include student marks, social and demographic data and school-related features. This is all based on records and inquiries. The database contains student achievement data from the Mathematics section, and the second contains student data for the Portuguese language course. The database has 33 attributes in total.

Attribute	Description (Domain)
sex	student's sex (binary: female or male)
age	student's age (numeric: from 15 to 22)
school	student's school (binary: *Gabriel Pereira* or *Mousinho da Silveira*)
address	student's home address type (binary: urban or rural)
Pstatus	parent's cohabitation status (binary: living together or apart)
Medu	mother's education (numeric: from 0 to 4[a])
Mjob	mother's job (nominal[b])
Fedu	father's education (numeric: from 0 to 4[a])
Fjob	father's job (nominal[b])
guardian	student's guardian (nominal: mother, father or other)
famsize	family size (binary: ≤ 3 or > 3)
famrel	quality of family relationships (numeric: from 1 – very bad to 5 – excellent)
reason	reason to choose this school (nominal: close to home, school reputation, course preference or other)
traveltime	home to school travel time (numeric: 1 – $<$ 15 min., 2 – 15 to 30 min., 3 – 30 min. to 1 hour or 4 – $>$ 1 hour).
studytime	weekly study time (numeric: 1 – $<$ 2 hours, 2 – 2 to 5 hours, 3 – 5 to 10 hours or 4 – $>$ 10 hours)
failures	number of past class failures (numeric: n if $1 \leq n < 3$, else 4)
schoolsup	extra educational school support (binary: yes or no)
famsup	family educational support (binary: yes or no)
activities	extra-curricular activities (binary: yes or no)
paidclass	extra paid classes (binary: yes or no)
internet	Internet access at home (binary: yes or no)
nursery	attended nursery school (binary: yes or no)
higher	wants to take higher education (binary: yes or no)
romantic	with a romantic relationship (binary: yes or no)
freetime	free time after school (numeric: from 1 – very low to 5 – very high)
goout	going out with friends (numeric: from 1 – very low to 5 – very high)
Walc	weekend alcohol consumption (numeric: from 1 – very low to 5 – very high)
Dalc	workday alcohol consumption (numeric: from 1 – very low to 5 – very high)
health	current health status (numeric: from 1 – very bad to 5 – very good)
absences	number of school absences (numeric: from 0 to 93)
G1	first period grade (numeric: from 0 to 20)
G2	second period grade (numeric: from 0 to 20)
G3	final grade (numeric: from 0 to 20)

Figure 2. Attribute Dataset

As in several European countries, the range of results in data ranges from 0-20. The data had to be converted into groups since the final grade of students is in the form of whole numbers, and the result should be in the form of category numbers. We used and compared two different classification schemes in the study: the inclusion of five levels and the binary grade. We divided the last measure into five sections first. The 0-9 scale applies to grade F, which is the lowest and points to ”failure.” Remaining category marks (D (adequate), C (satisfactory), B (good), and A (good / excellent) corresponding to D (sufficient), C (satisfactory), B (good), and A (good) excellent / excellent). We also divided the final grade into two categories: ”pass” and ”failed.” This helped us to

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compare marks. Finally using the dataset we dropped the attributes that are unique to the student and shows the lowest relationship with the target attribute. We use the train and test split to measure the accuracy of our model we split the data set into two training datasets 80% for training and the rest remaining 20% is utilized for the testing purpose. Using the various machine learning techniques mentioned above we test our data and find the accuracy of the model, at last we find the algorithm with the highest accuracy for predicting the student grades.

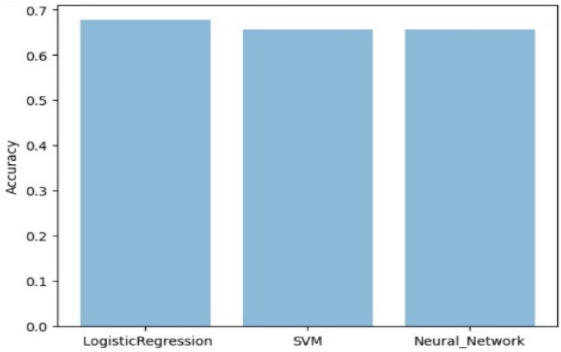

Figure 3. Result Graph

7. Conclusion and Future Work

Finally, student success monitoring is a big issue. It's vital that they're dealt with. The study presented in this thesis demonstrates the use of machine learning methods in conjunction with supervised learning algorithms to better understand the efficiency of the algorithm with respect to student records, where we analysed student performance and classified it into three categories: high, medium, and poor, with a 79% precision We will have some technological solutions in the future to increase the quality of student success. The user interface model may be developed to automatically include student records and to send staff warning messages about students who are doing poorly. We may use a Neural Network to construct the prediction and anticipate improved performance. Non-academic qualities should be combined with academic attributes.

References

[1] Sai Ramesh LS, Ganapathy S, Bhuvaneshwari R, Kulothungan K, Pandiyaraju V, Kannan A. Prediction of user interests for providing relevant information using relevance feedback and re-ranking. International Journal of Intelligent Information Technologies (IJIIT). 2015 Oct 1;11(4):55-71.

[2] Selvakumar K, Sai Ramesh L, Kannan A. Enhanced K-means clustering algorithm for evolving user groups. Indian Journal of Science and Technology. 2015 Sep 1;8(24):1-8.

[3] Pardo A, Gašević D, Jovanovic J, Dawson S, Mirriahi N. Exploring student interactions with preparation activities in a flipped classroom experience. IEEE Transactions on Learning Technologies. 2018 Jul 23;12(3):333-46.

[4] Shaleena KP, Paul S. Data mining techniques for predicting student performance. In 2015 IEEE international conference on engineering and technology (ICETECH) 2015 Mar 20 (pp. 1-3). IEEE.

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[5] Shahiri AM, Husain W. A review on predicting student's performance using data mining techniques. Procedia Computer Science. 2015 Jan 1;72:414-22.
[6] Meier Y, Xu J, Atan O, Van der Schaar M. Predicting grades. IEEE Transactions on Signal Processing. 2015 Oct 30;64(4):959-72.
[7] Arsad PM, Buniyamin N. A neural network students' performance prediction model (NNSPPM). In 2013 IEEE International Conference on Smart Instrumentation, Measurement and Applications (ICSIMA) 2013 Nov 25 (pp. 1-5). IEEE.
[8] Gray G, McGuinness C, Owende P. An application of classification models to predict learner progression in tertiary education. In2014 IEEE International Advance Computing Conference (IACC) 2014 Feb 21 (pp. 549-554). IEEE.
[9] Buniyamin N, bin Mat U, Arshad PM. Educational data mining for prediction and classification of engineering students achievement. In2015 IEEE 7th International Conference on Engineering Education (ICEED) 2015 Nov 17 (pp. 49-53). IEEE.
[10] Kleinbaum DG, Klein M. Logistic Regression A Self-Learning Text. 3rd ed. New York: Springer-Verlag New York. 2010.
[11] Kotsiantis S, Pierrakeas C, Pintelas P. Predicting Students ' Performance in Distance Learning Using Machine Learning Techniques. Applied Artificial Intelligence. 2004 May 1;18(5):411-26.
[12] Muñoz-Bullón F, Sanchez-Bueno MJ, Vos-Saz A. The influence of sports participation on academic performance among students in higher education. Sport Management Review. 2017 Aug 1;20(4):365-78.
[13] Hamsa H, Indiradevi S, Kizhakkethottam JJ. Student academic performance prediction model using decision tree and fuzzy genetic algorithm. Procedia Technology. 2016 Jan 1;25:326-32.
[14] Sarker F, Tiropanis T, Davis HC. Linked data, data mining and external open data for better prediction of at-risk students. In2014 International Conference on Control, Decision and Information Technologies (CoDIT) 2014 Nov 3 (pp. 652-657). IEEE.
[15] Huang S, Fang N. Work in progress: Early prediction of students' academic performance in an introductory engineering course through different mathematical modeling techniques. In2012 Frontiers in Education Conference Proceedings 2012 Oct 3 (pp. 1-2). IEEE.
[16] Anand J, Srinath D, Janarthanan R, Uthayakumar C. Efficient Security for Desktop Data Grid using Fault Resilient Content Distribution. International Journal of Engineering Research and Industrial Applications. 2009;2(8):301-13.
[17] Vaishnavi R, Anand J, Janarthanan R. Efficient security for Desktop Data Grid using cryptographic protocol. In2009 International Conference on Control, Automation, Communication and Energy Conservation 2009 Jun 4 (pp. 1-6). IEEE.
[18] Anand J, Janarthanan R, Kannan P, Konar A. Efficient Data Storage in Desktop Data-Grid Computing using Real-Time parameters. International Journal of Computer Science and Technology. 2011 Sep;2(3):392-7.
[19] Han J, Kamber M, Pei J. Data Mining: Concepts and Techniques. 3th ed. Morgan Kaufmann publications. 2012.
[20] Kelleher JD, Mac Namee B, D'arcy A. Fundamentals of machine learning for predictive data analytics: algorithms, worked examples, and case studies. MIT press; 2020 Oct 20.
[21] Sabena S, Kalaiselvi S, Anusha B, Ramesh LS. An Multi-Label Classification with Label Correlation. Asian Journal of Research in Social Sciences and Humanities. 2016;6(9):373-86.

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A New Approach for Security in Cloud Data Storage for IOT Applications Using Hybrid Cryptography Technique

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Abstract. The most demanded advanced technology throughout the world is cloud computing. It is one of the most significant topics whose application is being researched in today's time. Cloud storage is one of the eminent services offered in cloud computing. Data is stored on multiple third-party servers, rather than on the dedicated server used in traditional networked data storage in the cloud storage. All data stored on multiple third-party servers is not bothered by the user and no one knows where exactly data saved. It is minded by the cloud storage provider that claims that they can protect the data but no one believes them. Data stored over the cloud and flowing through the network in the plain text format is a security threat. This paper proposes a method that allows users to store and access the data securely from cloud storage. This method ensures the security and privacy of data stored on the cloud. A further advantage of this method is we will be using encryption techniques to encrypt.

Keywords. Cloud, RSA Algorithm, Key Generation, Private key, Public key, Secret key, Authentication, Encryption, Decryption.

1. Introduction

Cloud computing is a technology that uses the Internet and intermediate servers to store data and applications. Cloud computing allows consumers and businesses to use applications without having to install and access their files on any computer with an Internet connection. This technology allows for highly efficient computing by including storage, memory, processing, bandwidth. But where does security fit into all of this? Security analysts and general practitioners say keep it up, but keep an eye out. All the risks of sensitive corporate data associated with external outsourcing apply the cloud computing, and then others. Enforcing security policy and compliance requirements is difficult enough when dealing with third parties and their known or unknown contractors, especially around the world. We suggest how to build a reliable computer cloud computing environment by

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providing a way to encrypt data on the client-side using a private key before sending it to cloud storage and removing the privacy using that same private key after retrieving it from the cloud storage. All these operations are performed on the client-side using a private key in this way the private key never leaves the client computer and the user is assured of the security of the data stored in the cloud.

2. Literature Survey

Rajat Saxena and Somnath Dey [1], discussed Cloud Audit: How to Verify Data Using Cloud Computing. The proposed system involves multiple and distributed teams (Cloud Audit), which share the bulk of bulk testing among multiple TPAs with load measurement strategies. To perform the load balancing function and perform batch tests, we use multiple TPAs. To measure the effectiveness of the proposed system, the average number of requested data blocks and the total number of data blocks calculated varies by three parameters: probability (Px), file size (Fs), number of audits (A f). This method uses a CBC, PHC, homomorphic tag to ensure data integrity. Ideally, the method is suitable for cloud storage due to the efficient operation of the homomorphic tag and the benefits of PHC. Also, our process supports strong data performance above the minimum. This way, the CSP server does not require additional data structures to manage data performance. It also provides better security in the event of Man In The Middle Attack (MITM), Traffic flow analysis, Impersonation, Dismissal, misuse of data storage servers, due to Paillier's commitment to change small text without distorting clear text and misleading entrants.

The authors of [2] establishes a method to evaluate the latent heat structure based on the percentage of precipitation, space distribution and climatic conditions of the latent heat structure of the deep convective system under different regions and weather conditions and summarizes temporal and spatial distribution of coastal rainfall and typical rainfall characteristics.

Rongzhi Wang [3], discussed research on data security technologies in terms of cloud storage. The data that can be retrieved from the output results of the test module will be stored in a reliable log in the cloud. As one of the two basic modules of system design, R will play an important role in the system. Provides a gauge function and a Tun audit file results to view the operation of the partition, in this way, a reliable third party will carry as little as possible in the audit work without the need to manage a procurement and supply system, making a reliable third-party configuration possible. Users directly from the cloud to get audit results, without the need for a TTP connection. System subsystems, such as the DSBT system or the POR system based on a trusted log, operate not only in one of the roles, but include two or three characters. They play multiple roles and rely on a visual interface to coordinate each other's performance. The program module, therefore, does not depend on the role of the segregation of the body but is based on the fact that the system is subordinate to the concept of segregation.

Xiling Luo et al. [4] discussed An Effective Integrity Verification Scheme of Cloud Data Based on BLS Signature. A remote data integrity protection scheme is proposed that ensures public audibility, privacy protection, and blockless verification. Besides, the scheme may also support batch auditing operations. They introduced and formally defined a ZK-privacy model, where the adversary obtains zero knowledge from the auditing interactions. They proved the privacy-preserving property of our scheme under the

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ZK-privacy model. They had also evaluated the performance of the proposed scheme through mathematical analysis and compared it with related schemes in communication and computation overhead. Hence this paper proposes a secure and effective cloud data integrity verification scheme with privacy protection, EoCo, which is based on the BLS short signature .

Yuan Ping et al. [5] discussed the Sustainability of the Public Information Security System. Based on algebraic signature and elliptic curve cryptography, we propose a public verification system that supports effective data validation with low-level communication and computer heads. Besides, the corresponding encryption in the scheme ensures the privacy of the data blocks. To support dynamic renewal, a DCHL-based novel data structure is designed and maintained in TPA to make tasks such as data entry, modification, and deletion easier and more efficient. Using the proposed cloud storage system, security analysis suggests that even a malicious CSP cannot initiate a fraudulent attack, replace attacks and retaliate attacks to pass a guarantee of integrity. At present, the proposed system often exceeds the appropriate data verification schemes for efficiency that is guaranteed by numerical analysis and actual testing.

Yuan Zhang et al. [6] discussed Cryptographic Public Verification of Data Integrity for Cloud Storage Systems. Cruel auditors and external opponents can make SWP work. Most existing social security systems follow SWP, so they have the same framework as the threat model. As a result, these programs also cannot fight external enemies and malicious auditors. An external enemy can make SWP work because there is a clear linear relationship between the evidence information and the data blocks. To counteract external adversities outside of secure channels, a random encryption process was adopted for the compilation of evidence information. Specifically, the authors have used random encryption as a non-line interference code to alter the explicit linear relationship between evidence information and data blocks to non-linear relationships.

Vipul Bornare et al. [7] discussed sharing Data with sensitive information that hides secure cloud storage. The system provides a secure cloud storage system that supports third-party private research better than existing systems. This suggests that security can be increased if construction is converted from a single cloud to a multi-cloud space. The security measures involved in the investigation of third-party information are discussed. Methods are studied to perform research without requiring a local copy of the data and thus significantly reduce communication and computer calculations. Four schemes are being introduced that can be used in many cloud environments to increase security features. Hiding the usage statistics of a single-source provider for one cloud provider is available when the first method is used. Computer and data transfer rates are much lower when using the second method.

RajaniKanth Aluvalu and Lakshmi Muddana [8], discussed A Survey on Access Control Models in Cloud Computing. Every ciphertext is associated with an access policy on attributes in a CP-ABE scheme, and every user's private key is associated with a set of attributes. A user would be able to decrypt a ciphertext only if the set of attributes associated with the user's private key satisfies the access policy associated with the ciphertext. KP-ABE works in the reverse way of CP-ABE. The scheme's access structure or algorithm inherits the same method which was used in KP-ABE to build. The structure built in the encrypted data can let the encrypted data choose which key can recover the data; meaning the user's key with attributes just satisfies the access structure of the encrypted data. The concept of this scheme is similar to the traditional access

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control schemes. The encryptor specifies the threshold access structure for his interested attributes while encrypting a message. Based on this, the message of the access structure is then encrypted such that only those whose attributes satisfy the access structure can decrypt it. The most existing ABE schemes are derived from the CP- ABE scheme.

Paul R Rejin and Raj D Paul [9], discussed the verification of data integrity and cooperative loss recovery for secure data storage in cloud computing. For ensuring the correctness of data and preventing data losses, the works split the encrypted data into various cipher blocks and distribute among different service providers. Moreover, the data blocks are distributed equally to all CSPs which leads to a chance of fetching the blocks by any external adversary or malicious CSP in the future. Besides, the integrity of each block was not checked so that there may be a possibility of corrupted blocks. To prevent data access by unauthorized users from cloud storage, a Steganographic Approach using Huffman Coding (SAHC) was applied. For secure data storage in cloud computing, a VDI-CLR technique is proposed. In this approach, CDO encrypts the original file using the CP-ABE scheme and splits it into n/2 cipher blocks, where n denotes the number of CSPs. The randomly selected n/2 CSPs get cipher blocks being distributed to them.

Caiyun Xu [10], discussed Research on Data Storage Technology in computer science. Network storage is a special private data storage server, which can provide platform file sharing functionality. On a LAN, network storage usually takes its place without the need for an application server intervention to allow users to access the data on the network. In this setting, network storage controls and processes all data on the network, removes the load from the business application or server, effectively reduces total costs, and protects user investment. Peer-to-peer network technology, popularly known as peer-to-peer technology (P2P) is a new network technology that relies on computer power and network bandwidth, better than relying on a small number of servers. A clean point network does not have a client or server concept, it has only equal peer points, and ACTS as a client and server for other nodes in the network. P2P networks can be used for many purposes, such as various file-sharing software, real-time news business.

Hasan Omar Al-Sakran [11] discussed ”Finding Protected Data in the Cloud Computing Environment”. Using social media servers to store client data makes secure data sharing a challenge. Protecting the privacy of data stored in public data access policies must be enforced. The cryptographic method proposed in this project solves this problem. Private keys are stored by the data owner. Data must be encrypted before storage on the server, and the only way a client can access data is by providing a corresponding encryption key. Real data encryption and indexing and encryption are done on the owner’s side, and this information is sent to the public cloud service provider. The cloud service provider will create a directory using the owner’s written index that identifies the encrypted data on its site. The service provider cannot access any information from encrypted or indexed data. Clients are looking for blocks that contain specific keywords that encrypt the query on the owner’s site and send it to the service provider’s server. Search is only done on the query reference, and the results are returned to the client

3. System Architecture

There will be a UI where users have the option to upload a file. After uploading a file, clicking the submit button will start storing files in the cloud. If there is an error while

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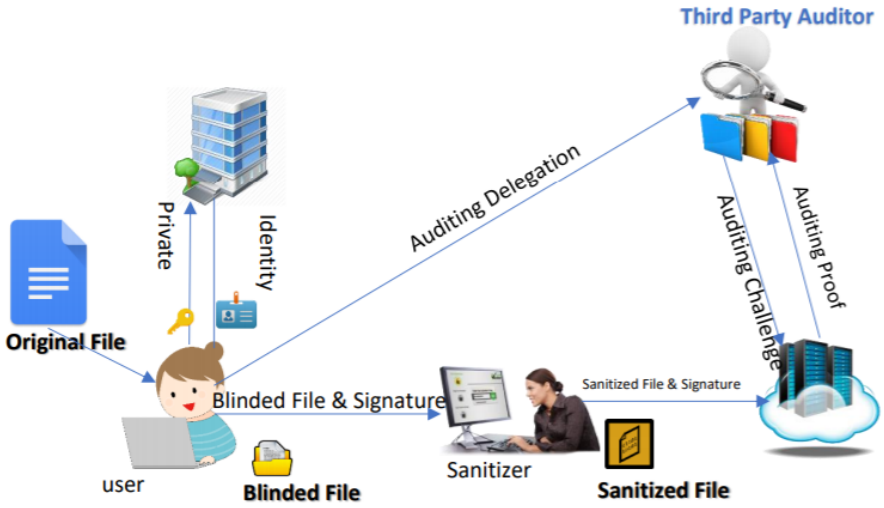

Figure 1. System Architecture

loading, the error will be notified, or else the blinding and cleaning process will take place. Sewage cleaning is called the process of removing/hiding sensitive information in a text. It will keep some parts of the text private and allow other parts to be displayed. After a successful blinding and cleaning process, the files are stored in the cloud. When you need to download a file, the person who will download the files must have the key/password to delete the file and download it.

4. Implementation

This program provides a secure cloud storage system that supports third-party privacy surveys better than existing systems. This suggests that security can be increased if construction is converted from a single cloud to a multi-cloud space. The security measures involved in the investigation of third-party information are discussed. Methods are studied to perform research without requiring a local copy of the data and thus significantly reduce communication and computer calculations. Four schemes are being introduced that can be used in many cloud environments to increase security features. Hiding the usage statistics of a single-source provider for one cloud provider is available when the first method is used. Computer and data transfer rates are much lower when using the second method. The third method provides security such as that one provider may not know the flow of a single application and the cloud provider could not or would not have access to all the data. The fourth method offers the advantage of very low data validation testing to verify file content. It is proved that the third period of the audit is better than the current one.

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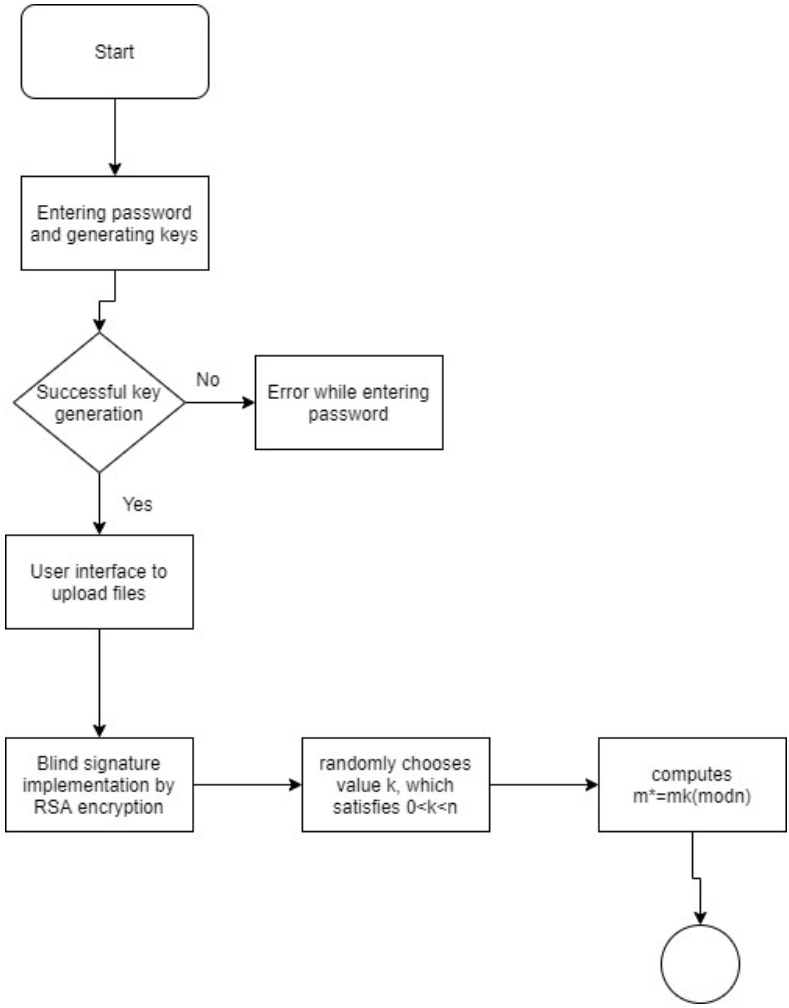

Figure 2. File Blinding Procedure

4.1. Blinding Files

This is the first phase of the module in which users will upload files. After uploading the files, the blinding will start and blind the process where the data is encrypted using the existing Pyycon Python module, which helps protect the contents of the file. Pycrypto allows clients and servers to encrypt customized data and authentication is done accordingly. Pycrypto is a combination of both secure hash functions (SHA256), as well as other encryption algorithms (AES, DES, RSA, ElGamal, etc.). The Pycrypto package is designed and organized in such a way that the installation of new modules is easy. Once blinding is done, the sanitizing phase will begin.

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4.2. Sanitizing files

RSA encryption takes effect during this process (file sanitization), which assists in the creation of user keys to access the cloud. RSA uses public-key encryption and is used to protect sensitive data, and is most commonly used when transmitted via an unsecured network such as the Internet. After encryption, a key/password will be generated. A user trying to access these files without a valid key will not be able to view the contents of the file completely.

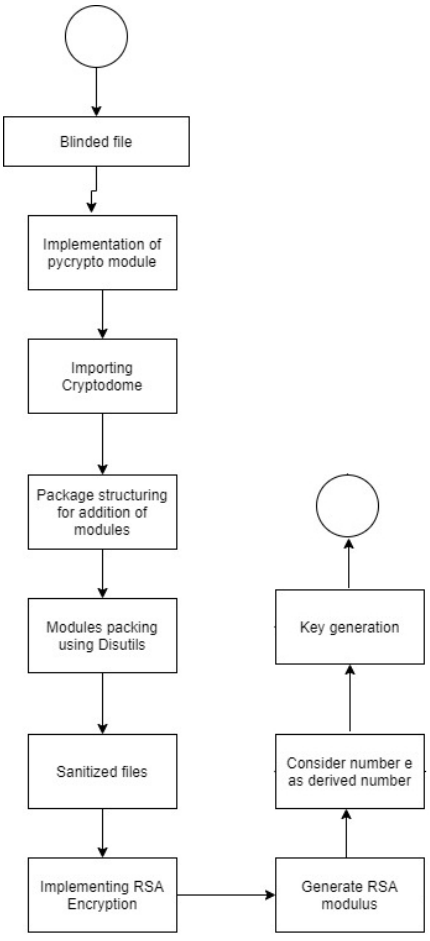

Figure 3. File Sanitation Procedure

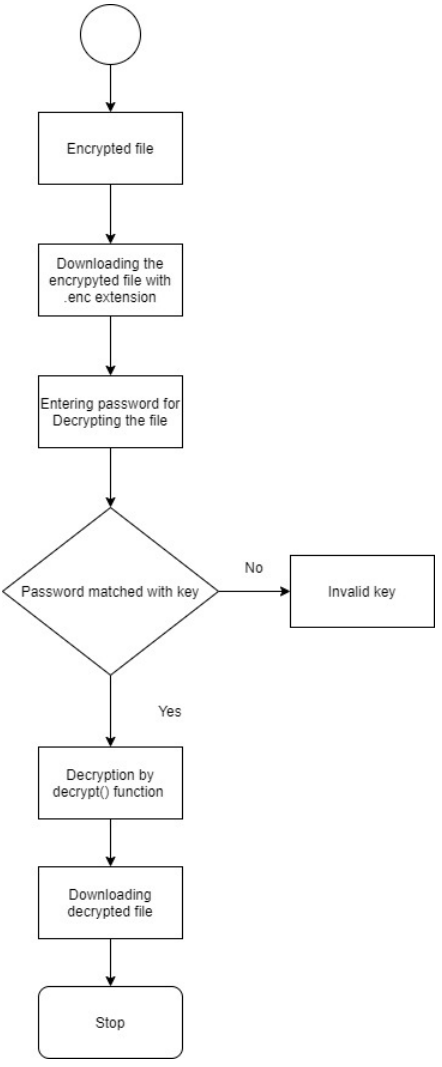

Figure 4. File Download Procedure

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4.3. Downloading files

The final module downloads files to the cloud. This user needs to upload the key to a clean file. After that, a stop key will be generated and the user will have to check if it is valid or not. If it works then the user can download the files successfully. If not, the translation key is invalid.

5. Conclusion

We have developed a secure cloud-based data analysis system, which supports data sharing with sensitive information in our system, a file stored in the cloud can be shared and used by others provided that sensitive file data is protected. Cloud storage in rapid development simultaneously also brings a series of negative issues, especially data security issues, which significantly hindered further use of cloud storage.

References

[1] Saxena R, Dey S. Cloud audit: A data integrity verification approach for cloud computing. Procedia Computer Science. 2016 Jan 1;89:142-51.
[2] Chi H. The characteristics of rainfall in coastal areas and the intelligent library book push system oriented to the Internet of Things. Arabian Journal of Geosciences. 2021 Jun;14(12):1-7.
[3] Wang R. Research on data security technology based on cloud storage. Procedia engineering. 2017 Jan 1;174:1340-55.
[4] Luo X, Zhou Z, Zhong L, Mao J, Chen C. An effective integrity verification scheme of cloud data based on BLS signature. Security and Communication Networks. 2018 Nov 19;2018:1-11.
[5] Ping Y, Zhan Y, Lu K, Wang B. Public Data Integrity Verification Scheme for Secure Cloud Storage. Information. 2020 Sep;11(9):1-16.
[6] Zhang Y, Xu C, Li H, Liang X. Cryptographic public verification of data integrity for cloud storage systems. IEEE Cloud Computing. 2016 Nov 11;3(5):44-52.
[7] Bornare V,Nikam K,Khedkar D,Hole S. Data Sharing with Sensitive Information Hiding for Secure Cloud Storage. IJSRD - International Journal for Scientific Research & Development. 2020;8(3):139-41.
[8] Aluvalu R, Muddana L. A survey on access control models in cloud computing. InEmerging ICT for Bridging the Future-Proceedings of the 49th Annual Convention of the Computer Society of India (CSI) Volume 1 2015 (pp. 653-664). Springer, Cham.
[9] Rejin PR, Paul RD. Verification of data integrity and co-operative loss recovery for secure data storage in cloud computing. Cogent Engineering. 2019 Jan 1;6(1):1-12.
[10] Xu C. Research on Data Storage Technology in Cloud Computing Environment. InIOP Conference Series: Materials Science and Engineering 2018 Jul 1 (Vol. 394, No. 3, p. 032074). IOP Publishing.
[11] Al-Sakran HO. Accessing secured data in cloud computing environment. International Journal of Network Security & Its Applications. 2015 Jan 1;7(1):19-28.

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Intelligent Framework for Number Plate Detection and Recognition in Toll Using Image Processing Techniques

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Abstract. The revolution in communication and embedded systems Electronic Toll Collection, the new era of intelligent transportation systems enables the automatic collection of Toll fees from the prepaid account through RFID. Yet there is lack of security in the existing system, number plate detection and recognition can be made. In the existing system detection is made with condition random field algorithm. Recognition method is implemented by optical character recognition. A system can be designed to extract the number plate from vehicle automatically using image processing technique, match with database automatically and generate the One Time Password(OTP) and bill without any delay and identify the theft vehicles. This is done by using Image processing and motion capturing technology

Keywords. Condition Random Field Technique, Image Processing Technique, Binarization, Artificial Intelligence.

1. Introduction

Vehicle registration is the process of registering vehicle with a government authority. The purpose of motor vehicle registration is to make a unique identity of the vehicle and to establish a link between a vehicle and an owner or user of the vehicle. For transportation certain amount of money should be paid to pass through the toll booth. To save money and energy minimum human interface is made in Toll plazas. With the revolution in communication and embedded systems Electronic Toll Collection(ETC), the new era of intelligent transportation systems(ITS)has been started. Electronic toll collection method has been implemented to collect money in toll automatically without human interference and to save time. FASTag system has been implemented recently to collect money in toll. This method is done by sensing the RFID of the individual using sensor, and money

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is taken from the respective person's bank account. In the existing system there occurs some disadvantages like double payments and it is also insecure .To overcome these disadvantages number plate detection and recognition method can be implemented by using image processing technology .The components in Digital Image processing is shown in Figure 1.

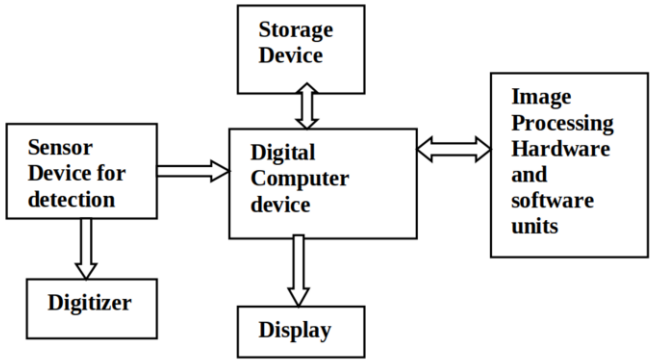

Figure 1. Components of Digital Image Processing

The transportation system has become an important aspect in the present situation and it act as a essential signs of the urban modernization level, but it also causes serious problems concerning transport system. Due to automation, minimum human interference is required and this provides the facility so that the time and energy can be saved and efficiency can be improved. The revolution of communication and embedded systems Electronic Toll Collection(ETC), the new era of intelligent transportation systems(ITS) has been started for the purpose of collecting money in Toll booths. Toll collections can be made electronically by various methods like ETC using laser technology, RFID, Barcode technology and GPS.

The number plate detection and recognition method involves the detection of number plate to generate toll bill automatically. The image of the number plate will be captured and it will undergo Binarization process to detect the foreground and background image of the number plate. Using the Condition Random Field algorithm obtained image will be detected. The detected text will be recognized and it will be converted to character using Optical Character Recognition. Once the detection and recognition process is completed the number plate details will be verified with the data stored in the database. Only when the data intersects with the detected and recognized number plate an One Time Password(OTP) will be sent to the respective vehicle owner's mobile number. Or otherwise an intimation message will be sent to the respective person's mobile number.

2. Literature Survey

License Plate Recognition process requires closest accuracy even when the image is captured from different angle, different distance. The authos of [1] proposed new advanced OCR engines extend the capability of accuracy into pre-processing for source images, sounds-like matching and for grammatical measurements for getting more accu-

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racy. Machine Learning play a major role in various fields of application one could say it is making the life simpler [2, 3]. Sharma [4] implemented algorithm which detected Nepali number plates The author used the various morphological operation like dilation, erosion, sobel edge detection, fill image, opening and closing for plate area localization and segment the image by using segmentation algorithm and the obtained accuracy of normalized cross correlation was 67.98% and phase correlation was 63.46%. Ghangurde et al. [5] used CNN for detecting number plate. The system interface created by [5] is user-friendly and is easier to use and the system has the capability of detecting number plate for different conditions for all Indian number plates. Simalar method also employed by [6, 7] which uses CNN for licence plate localization which reduces background interference. Manual toll collection os one of the main issue which creates the traffic For combat this issue semi or fully automated system is needed. One of the solution is usage of RFID for quick processing [8–12]. This could greately reduce the burdern for travellers from traffic jam. Li et al. [13] presented a jointly trained network for simultaneous car license plate detection and recognition and by using this network, license plates can be detected and recognized all at once in a single forward pass, with both high accuracy and efficiency.

3. System Architecture

In the existing system, the number plate is detected using the Tag which is affixed on the vehicle. But when occurs some problem like double payment during the amount detection using the RFID. There occurs some error when the Tag get damaged during the process of detection. Apart from these limitations stolen vehicles cannot be identified easily in the present Toll plaza system. The system architecture represents the structural way of the execution of the process. The flow of execution of the process as mentioned in Figure 2.

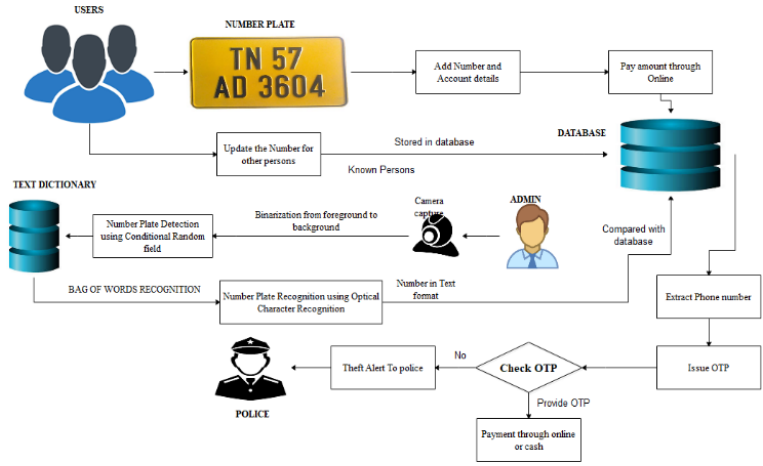

Figure 2. Architecture diagram

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1. The user should register with for receiving unique ID and password. Where all the details are stored in a database.
2. Once when the registration is completed the user can access the web portal provided for them using the Unique ID and password.
3. The user can also make the payment through online mode and the user can also update their mobile number according to their preference.
4. When the vehicle enters the Toll the admin will capture the Image of the number plate. The captured will undergo Binarization process to detect the foreground and background of the number plate.
5. With the extracted text the number plate is detected using Condition Random Field and Recognized using Optical Character Recognition.
6. With the Recognized data the details of the number plate will be matched with the data base.
7. Only when the OTP matches amount will be taken from the persons account. Or otherwise an intimation message will be sent to respective person and nearby police station.

4. Proposed Methodology

Each vehicle will be provided with a license plate number which contains unique ID for identification purpose. This license plate is captured by an image. When the vehicle reaches the toll booth web camera capture the license plate with number. Number plate digits are detected using Conditional random field algorithm. Recognition is done using. Optical Character Recognition. Based on the recognized number, OTP verification is made to predict the theft vehicles and to send alert to the authorized person.

The ETC method has rapidly becoming the most innovative technology for the commuters who pass through the toll plaza. In this module, user will be provided with a unique user ID and password. User should register their details such as name, mobile number and other details of the user stored in a database. Admin is responsible to maintain all details in single database.

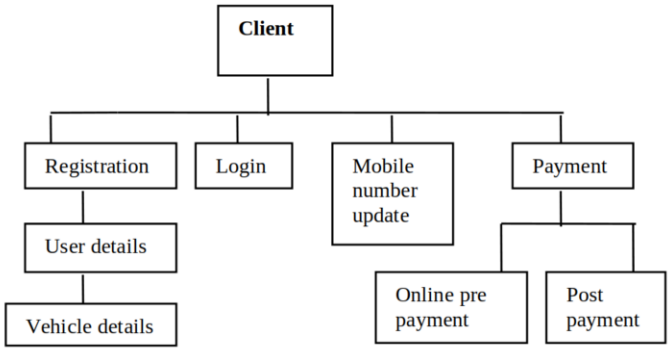

Figure 3. Framework for Toll collection System

The framework construction consist of the Home page where there will be options for the user and admin to login. Through this portal user can login using their unique

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user credentials and admin can login using their unique credentials. In admin page there will be separate tab to access and store the details. The framework construction for Toll collection system is shown in Figure 3.

The acquired image is completely unprocessed. In this module, admin can capture the image of the number plate through web camera. Camera will capture the image, then the Binarization technique is used to detect the foreground pixels. The process involved in Image acquisition method is shown in Figure 4.

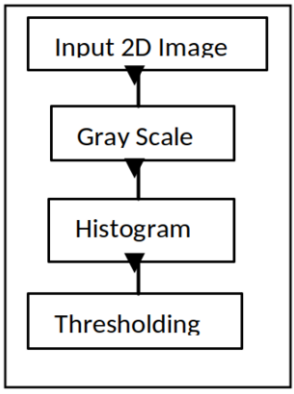

Figure 4. Method in Image Acquisition

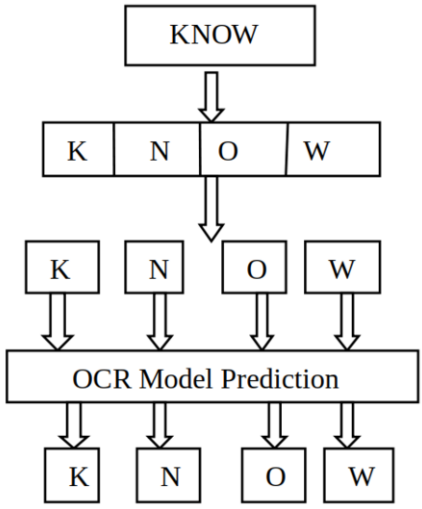

Figure 5. Text Recognition In OCR

Binarization is an important preprocessing step in several document image processing and Image classification tasks. Image Binarization is the process of separation of each pixel values into two collections, black as a foreground and white as a background. Thresholding technique is used for document image Binarization. The basic idea for fixed Binarization method is described as under. T shows global threshold value. Apart from that another method is also designed for Binarization in which the threshold is decided in accordance with the region. In Binarization method the image is divided into several regions or windows. Each region calculates and decides their own local threshold and then converts their region into two – tone region with the help of their local threshold. In Fixed Thresholding Binarization method fixed threshold value is used to assign 0's and 1's for all pixel positions in a given image. The Binarization process is represented as Eq. (1)

$$g(x,y) = \begin{cases} 1 \; f(x,y) \geq T \\ 0 \;\; otherwise \end{cases} \tag{1}$$

In Text Detection and Recognition module, implementation of number detection approach based on text strokes values which is defined in the form of minimum and maximum values in order to obtain the license plate only and remove other very small or very large identified objects which were outside the threshold range is done. The objects passed successfully through predefined threshold criterion will be forwarded to the train-

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ing process. In this module, text strokes in number plate are detected using Conditional Random field. Detected texts are drawn as bounding box. The purpose of Optical Character Recognition algorithm is to recognize the text. Optical Character Recognition (OCR) is a piece of software that converts printed text and images into digitized text form such that it can be manipulated by machine.

Conditional Random Field algorithm is a discriminative undirected probabilistic graphical model that represents the relationship between different variables. The structure of a CRF model helps to estimate the unobserved ones given with the observed one. CRF learns the probability of occurrence of each character and assigns it to the word tree and thus the path with the highest probability is recognized as the correct sequence of characters forming the word.

Linear chain CRF can be described as follows, Let x be inputs vector, y is the label vector, and w is the weight vector, P(y/x) is defined as follows,

$$P_w(y|x) = \frac{1}{Z_w(y_i.x)} exp \sum_{i=1}^{n} w_i f_i(y_i, y_{i-1}, x) \tag{2}$$

Where:

$$Z_w(y_{i-1}.x) = \sum_{y\varepsilon Y} exp(\sum_{i=1}^{n} w^T f_i(y_i, y_{i-1}, x)) \tag{3}$$

From Eqs. (1) and (3), Conditional Random Fields is described as

$$P_w(y|x) = \frac{1}{Z_w(x)} exp \sum_{j=1}^{n} \sum_{i=1}^{m} w_i(y_{j-1}, y_{i,x,j}, x) \tag{4}$$

Optical character recognition(OCR) is the method of converting an images which is handwritten, printed or typed text. The text is encoded into the machine-encoded text, either from a scanned document, a photo of a document, a scene-photo or from subtitle text superimposed on an image. The recognition of Image in Optical Character Recognition is shown in Figure 4. Following are the characteristics of Optical Character Recognition, Differentiate word contours associated with image. Eg: OpenCV contours, Image cropping. Differentiate letter contours associated with word contour image. Eg: OpenCV contour dilation, Image cropping. Preprocess letter images according to trained OCR input. Eg: Keras Framework in Detection, PIL library in image. Consolidate predictions associated OCR model to text.

In membership access method user can book the travel previously to select source and destination of their travel. After that calculate the toll amount and pay on online. User can also updates their neighbor numbers for future verification. In this module, user can update booking details in the system. The booking details are such as booking id, booking name, source, destination, toll plaza details, vehicle types, amount, date and vehicle image details etc. These details are stored in the system. So the admin can easily view user booking details in the system. Users are also updated with day by day toll plaza information in the system.

After verify the owner details, send OTP to owner mobile number. Payment may be online or cash on delivery. If OTP is not submitted within seconds, then it is automatically

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considered as theft vehicle. And automatically intimation message will be Sent to the owner of the vehicle and also to the nearby police station. An OTP is more secure than a static password, especially the password created by the user, which can be weak and/or reused across multiple accounts. OTPs may replace authentication login information or may be used in addition to it in order to add another layer of security. This system is used to take care of the security features which includes the generation of the OTP to the particular owner or with the person with which the vehicle is linked with.

When the OTP is not submitted within seconds it is indicated that the vehicle is a theft vehicle and the report is sent to the near by police station and to the owner's mobile which is linked to the database. Then the owner will be able to get back his/her vehicle with the appropriate proof related to that vehicle. Through this method the online payment is also possible with the correct submission of the OTP within seconds. As already mentioned the owner's bank account will be linked to the database and through which the payment is possible when crossing a toll booth.

5. Implementation and Discussion

Figure 6. Home Page

5.1. Framework construction

The framework construction is implemented using the Flask library function where it is used to build web applications. The From and Text field library functions are used to build the essential text boxes as per the requirements.

5.2. Image Detection and recognition

In this method the image is detected and converted into text using PIL library function which is used in different image processing functions. The process of image detection and recognition is shown in Figure 10. My sql is used as the back end in which all the personal data is stored. The new data will also get updated in the database and it is also accessible

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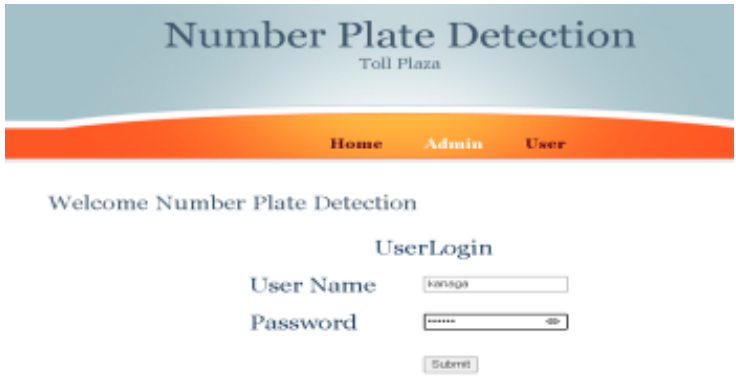

Figure 7. Admin login

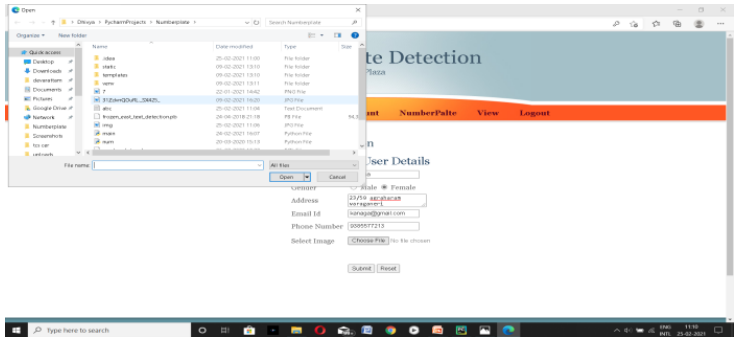

Figure 8. New User Registration

Figure 9. User Login

5.3. Membership access

In this module the user can select their start and destination place and they can also pay for it through online mode. The information regarding the amount for each toll and the number of toll passed will be accessible to the user.

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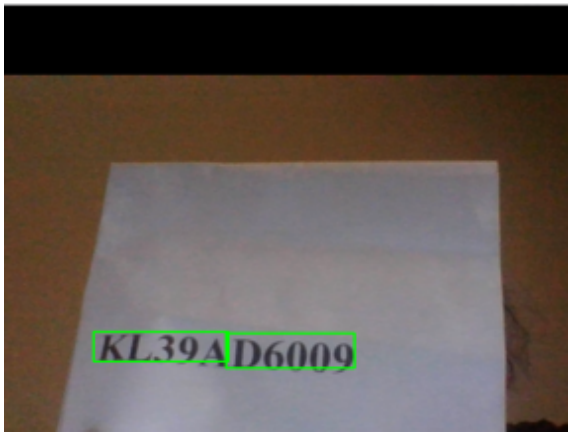

Figure 10. Image Detection and Recognition

Figure 11. User Details

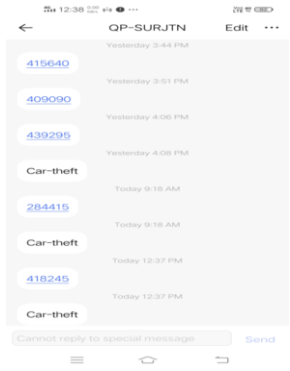

Figure 12. OTP Intimation message

5.4. Payment with alert system

Real time alert system is the important module where the money will be taken form a person's account only after verifying the OTP By comparing the stored data OTP will be sent to the respective persons mobile number using IoT framework. Using the Grisp environment OTP is generated and sent to the registered mobile number.

6. Conclusion and Future Enhancement

Toll Tax Management System is a web based application that can provide all the information related to toll plazas and the passenger checks in either online and pays the amount, then he/she will be provided by a receipt. It can be widely implemented on toll tax places .This system make saves time of driver and also of person on service for taking toll tax .This system automate the whole process of toll tax. The proposed system uses less cost to implement and require fewer changes to the current system. It provides the tracking system for theft vehicle which is secured and highly reliable. E-toll system can help

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to achieve proper traffic management, appropriate toll collection and improves security. Thus a system used as an Automated Toll collection booth, based on image processing saves the time at toll booth, minimizes the fuel consumption during the ideal condition of the vehicle. Also it serves in providing the tracking system for theft vehicle which is secured and highly reliable can be obtained. In this project we can implement more features advance technique in future enhancement. It can be widely implemented on toll tax places. This system make saves time of driver and also person on service for taking toll tax. It provides security for both toll fees and vehicle. Parking system with alert can be implemented in future to avoid parking vehicles in NO PARKING areas. This system reduces unwanted traffic jams and will be more useful for Traffic police.

References

[1] Venkateswari P, Steffy EJ, Muthukumaran DN. License Plate cognizance by Ocular Character Perception'. International Research Journal of Engineering and Technology. 2018 Feb;5(2):536-42.

[2] Anand J, Sivachandar K. An edge vector and edge map based boundary detection in medical images. International Journal of Innovative Research in Computer and Communication Engineering. 2013 Jun;1(4):191-3.

[3] Wei A. Machine learning-based detection of mountain soil composition and environmental and ecological management of tourist areas. Arabian Journal of Geosciences. 2021 May;14(10):1-4.

[4] Sharma G. Performance analysis of vehicle number plate recognition system using template matching techniques. Journal of Information Technology & Software Engineering. 2018 Apr;8(2):1-9.

[5] Ghangurde C, Gokhale A, Joshi R, Bhandarkar M. Automatic number plate recognition for different fonts and non-roman script. International Journal of Advance Scientific Resarch and Engineering Trends. 2019;4(14):21-25.

[6] Li X. Real-time License plate number detection based on image contour. InJournal of Physics: Conference Series 2020 Oct 1 (Vol. 1650, No. 3, p. 032073). IOP Publishing.

[7] He Z, Xiao Z, Yan Z. License Plate Location and Recognition on Neural Network. InJournal of Physics: Conference Series 2020 Sep 1 (Vol. 1642, No. 1, p. 012012). IOP Publishing.

[8] Satyasrikanth P, Penna M, Bolla DR. Automatic toll collection system using RFID. IJCSMC. 2016 Aug;5(8):247-25.

[9] Bhavke A, Pai S. Advance automatic toll collection & vehicle detection during collision using RFID. In 2017 International Conference on Nascent Technologies in Engineering (ICNTE) 2017 Jan 27 (pp. 1-5). IEEE.

[10] Balamurugan K, Elangovan S, Mahalakshmi R, Pavithra R. Automatic check-post and fast track toll system using RFID and GSM module with security system. In2017 International Conference on Advances in Electrical Technology for Green Energy (ICAETGT) 2017 Sep 23 (pp. 83-87). IEEE.

[11] Syafei WA, Listyono AF. Hardware design of queuing free environmental friendly automatic toll gate using RFID. In2017 4th International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE) 2017 Oct 18 (pp. 142-146). IEEE.

[12] Yu HY, Chen JJ, Hsiang TR. Design and implementation of a real-time object location system based on passive RFID tags. IEEE Sensors Journal. 2015 Sep;15(9):5015-23.

[13] Li H, Wang P, Shen C. Towards end-to-end car license plates detection and recognition with deep neural networks. IEEE Transactions on Intelligent Transportation Systems. 2017 Sep:1-9.

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IoT Based Health Monitoring System

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Abstract. Normally, a health issue or an emergency needs to viewed in a multi-disciplinary approach. And, thus a standard sensor-based diagnosis in the medical field, requires a greater number of sensors and human efforts if it's processed on a large scale. To overcome this issue an IoT-based health care application is proposed in this research work. The proposed system consists of an online mobile application that supports continuous wireless monitoring of patients. The Main aim of the paper is to implement a low-cost system and send the patient vital parameters in case of emergency situations. Sensors such as ECG Monitor sensor, Heart Rate sensor, and temperature sensor are used to quantify the patient vital signs. The sensor data are collected and transferred to the cloud for storage of the IoT platform via a module which is connected to the micro controller. The information is processed within the cloud and the appropriate feedback steps are taken on the analyzed data which may be further analyzed by a doctor remotely in person. Remote viewing reduces the burden to doctors and also provides the precise health status of patients. If the patient needs urgent attention, then a message alerts is sent to the care taker or doctor. This kind of mechanism helps in taking precautions beforehand and also helps the doctor to analyze the patient in a better way. The setup is verified using simulation and various test experiments.

Keywords. Health care system, IoT, sensors, IoT platform, Arduino.

1. Introduction

In the rural areas, as of our survey, there's a scarcity of proper health treatments for the people, and that they don't find the proper quality of treatment. Widely, people get the treatment after the disease has affected their body to the where it gets very critical. Meanwhile, while considering the value of treatment also many of the agricultural people, mostly farmers cannot afford it.

Thus, to act as a much easier treatment process, we have designed our project in a minimalistic form but much more effective. This project is meant to offer a major parameter to diagnose the disease. The Internet of Things (IoT) is rapidly growing attention not only in certain fields but much more, especially in personalized healthcare [1–5]. Medical scientists and researchers, work hard within the field of innovation and research for many decades to urge better health services and happiness in human lives [6, 7]. The

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blood heat, pulse, vital signs, respiration rate are the most vital parameters to diagnose a disease. This project gives temperature and pulse values using sensors and these data can be viewed efficiently with the help of the IoT platform-ThingSpeak.

2. Literature Survey

The literature review of the paper that were referenced and those that serves the base paper and supporting paper which provides the clear idea of the healthcare system and machine learning algorithms and proper method of recommendations.

Shoban Babu et al. [8] has put forward a concept where a patient's health is monitored efficiently with the help of IoT. It is primarily used to discover a patient's disorder and it provides a suitable remedy for the recovery of patient's health. IoT also helps in alarming the peers in the event of sensing an abnormality by the help of various sensors setup.

Sreekanth et al. [9] discuss on collection and transferring of a data in the cloud. The sensed data is then processed by the microcontroller however there is no proper method to send the data or to classify the data according to the patients.

Wan et al. [10] has designed the IoT Based Patient Health Monitoring System. In this, the wireless sensors from different parts of the body are interlinked to the node and then connected to the server. But the downside of this work is that the sensors are wireless and the data derived across the sensors can be uncertain.

Valsalan P et al. [11] used only Arduino to operate the data which collects data across the sensors and these are stored and then transferred to the database to access them for future purpose. They didn't create a EMR profile for patients, which is used to record the patient's information that can be easily accessed by anyone.

Yeri V et al. [12] proposed an idea about monitoring the body condition of the patients from anywhere in the world. But they didn't use RFID tag for the sensors to collects the patient's body information in a particular manner. The main drawback is that the data across the sensors which is transferred to the database is not proper and it's difficult to access them at any instant of time and lack of documentation.

3. Methodology

The Table 1 show the hardware components used to develop a device. In this Arduino UNO is the microprocessor, Max30100, Ec0567, Ad8232 are the sensor that are connected in the human body. The LCD used for the display

3.1. Hardware parts

3.1.1. Esp8266 Module

The development board consisting of the ESP-12E module is incorporated with the ESP8266 chip having 32-bit LX106 RISC microprocessor. The Board operates at a clock frequency of 80MHz to 160 MHz. Most of the IoT projects commonly use the NodeMCU module which is capable of storing data and programs in its 4MB flash memory. NodeMCU is powered through a micro-USB inlet and has inbuilt Wi-Fi support. It supports UART, SPI, and I2C interface.

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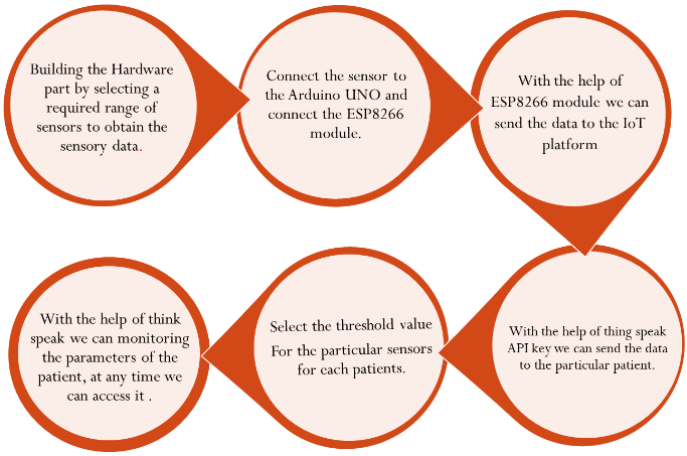

Figure 1. Methodology of the system

Table 1. Hardware Components Description

S. No	Name of the components	Description
1	ESP8266	Send data to the MySQL Database through Wi-Fi module.
2	MAX30100 Pulse oximeter sensor	Sensor used to sense the blood oxygen level in body.
3	Arduino UNO R3	This microcontroller board is used to Reads the data from the sensors.
4	EC-0567 heart sensor	Detects the heart rate of the human body.
5	AD-8232 ECG Monitor sensor	Sense the pulse rate and gives the ouput is in the waveform (ECG wave).
6	LM35	Sensor used to measure the body temperature.
7	Thing speak	It stores and retrive the data sensed by the sensors.

3.1.2. Arduino Uno

It is one of the most commonly used microcontroller boards named ATmega328P. This UNO board consists of 14 digital Input and output pins, 6 analog inputs, one USB connection, a single power channel, and a reset button. The Arduino board can be powered via USB cable by connecting to the computer or by using an AC-to-DC adapter.

3.1.3. Heart Rate Sensor

The heart sensor measures pulse rate, which is the changes in the volume of a blood vessel that occurs when the heart pumps the blood. The heart rate sensor is reliable. The live heart rate data can be viewed on the display. Pulse Sensor has an inbuilt amplification and noise cancellation circuit in the hardware. The data can be read faster and easier. Pulse Sensor works on either a 3V or 5V DC power supply. It can be plugged straight into a NodeMCU or a Breadboard.

3.1.4. ECG Monitor Sensor

It is integrated by a single chip which is specially designed for extraction, amplification, and filtering the bipotential signals. It consists of three leads that act as an operational

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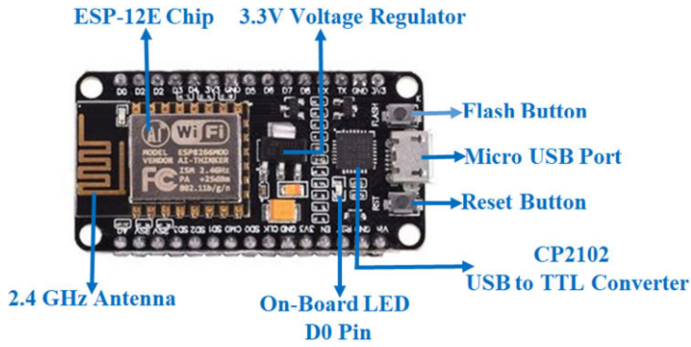

Figure 2. ESP8266

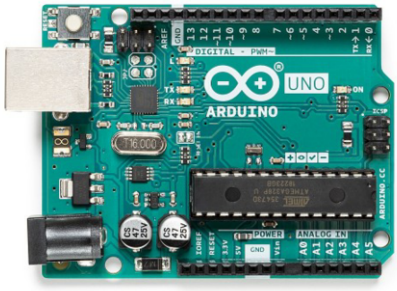

Figure 3. Arduino UNO

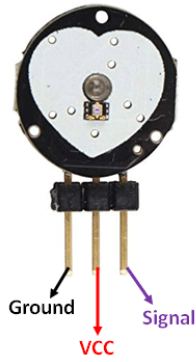

Figure 4. Hear rate sensor

amplifier to get a clear signal. The ECG signals obtained from the patient contain more noise at the output side. In order, to overcome this issue an operational amplifier is used in the module which helps in obtaining a clear output signal.

3.1.5. LM 35 Temperature Sensor

A temperature sensor is used to detect the body temperature. It can measure the temperature in the range of -55 degrees centigrade to 150-degree centigrade. The accuracy range of the temperature sensor is high when operated at optimal temperature and humidity level. The input voltage on the sensor varies from 4v to 30v and also consumes a current of 50Ma.

3.1.6. Thing Speak (IoT Platform)

It is an open IoT platform used to transfer data from any Internet-enabled device to the cloud. By configuring various actions and alerts it supports your real-time data and unlocks your data using visual tools. Think speak helps the developers to a great extent by capturing the sensor data and convert it into useful information. Thing Speak server is an open service that is free of cost and helps the development of the small noncommercial project.

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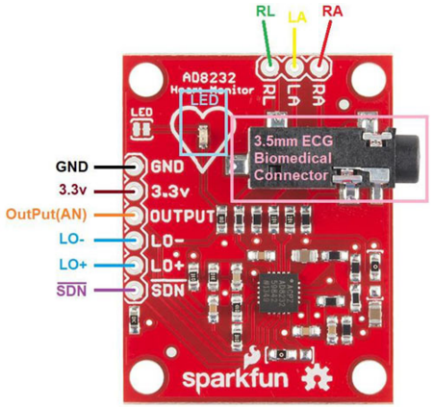

Figure 5. ECG monitor sensor

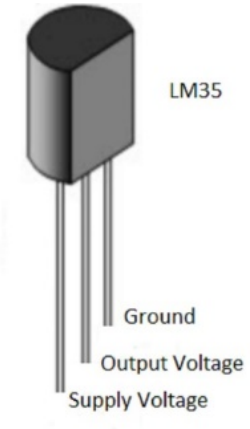

Figure 6. Pulse oximeter

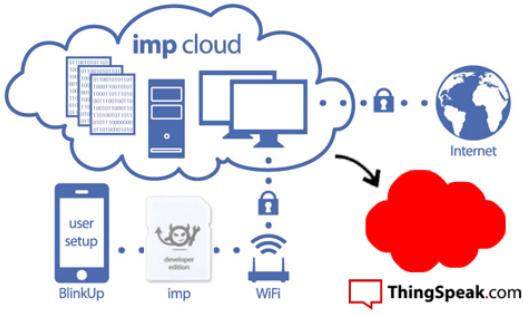

Figure 7. Overview of ThingSpeak

4. Architecture of the Health Monitoring system

In this system, the sensors are collecting the health data from the patients for data acquisition. Communications in the hardware part can be done by Arduino UNO and ESP8266 module for sending data to the server. The ThingSpeak server can be identified with the help of an API key. Data processing is done at the ThingSpeak server. the sensed data are stored in the database of the ThingSpeak. If patients want to know their health-related information's was shown on the web page of the Thing speak. Here Thing speak plays and Arduino UNO plays the major role. Because the Arduino collects the data from each sensor. And transfer to the thing speak IoT platform. With the use of an API key, we can transfer the data to the specified space in the cloud. Here we can access these data at times and also documentation available. We can download the data in .CSV format. But in the free version, we can only access some limited storage.

The hardware part shows the accurate results of the vitals of the patient as shown in above Figure 8. the sensor senses the data from the patient body. The Node MCU helps to process the data and sent it to the Thing speak cloud. If any parameter value crossed the threshold value the sensor reading is changed into red color and indicating to the doctor of an emergency situation in which the patient goes to an abnormal state which requires immediate assistance to the patient. The patient can move freely if the

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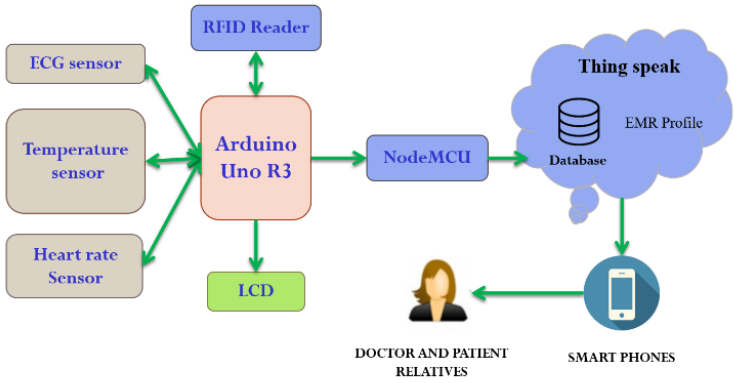

Figure 8. Block diagram

patient wants. The processor processes the data sensed by the sensors and processed data transferred to the ThingSpeak cloud through the ESP8266 module. The sensed data from the patient body can be seen on the webpage using the PC or mobile. The sensors sense and transfer the data every 20seconds. if any data of the vital parameters of the patient will exceed the threshold values, then the doctor will receive an alert message. So, he will take immediate action to the patient.

5. Results

This hardware setup basically consists of Heart Rate sensor, ECG Monitor sensor, Temperature sensor. These sensors are used to measure and monitor the values of pulse and temperature. After the values are found out the data is sent to the micro controller. The micro controller takes the necessary action and decides on sending the data. The data is sent using a Wi-Fi Module and it is stored in ThingSpeak.

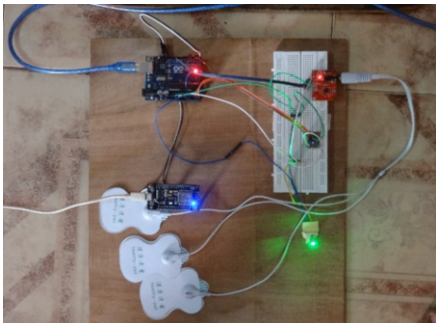

Figure 9. Hardware setup

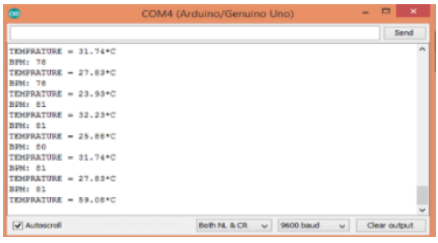

Figure 10. Simulation on Arduino IDE

In order to analyse the sensors and test our sensors we have used a software called Arduino IDE which is the only software that supports our micro controller. The above

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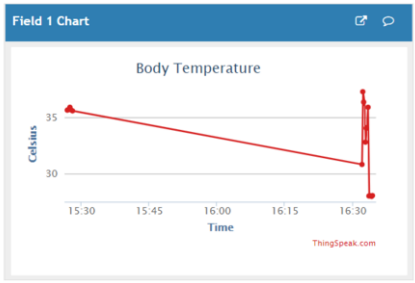

Figure 11. Graph on Temperature sensor output

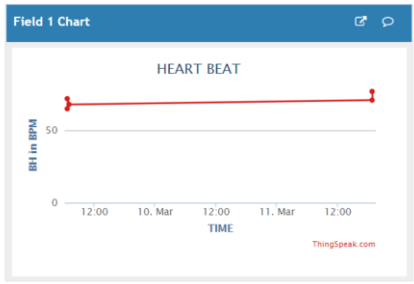

Figure 12. Graph on Heart rate sensor output

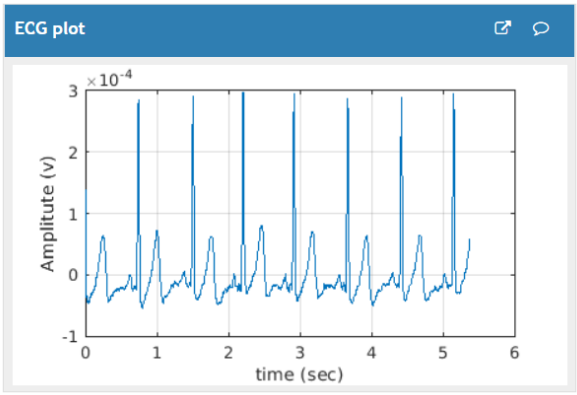

Figure 13. Graph on ECG sensor output

figure, denotes the simulations performed during testing platforms. In order to analyse the sensors and test our sensors we have used a software called Arduino IDE which is the only software that supports our micro controller. The above figure, denotes the simulations performed during testing platforms. The heart rate values are sent to the cloud platform called ThingSpeak and the values are continuously monitored and stored. The above figure depicts the fluctuations in temperature of the patient and it can be monitored by the doctor any time. The Electro Cardiogram signals are sent to the cloud platform called ThingSpeak and the values are continuously monitored and stored. The above figure depicts the fluctuations in temperature of the patient and it can be monitored by the doctor any time.

6. Conclusion and future work

The Human services field is always containing a huge measure of medical data, for handling those medical information certain methods are utilized. processing is one altogether method that is regularly utilized by the experts in this field. This paper focuses on the important time data for more accurate prediction using IoT. The predicted info is observed within the google sheet. Further, It will be very helpful for the villages people

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for mass screening system where hospital facilities are not available like in rural areas. In future work, we will add some additional Features like automatic and ease of Use, of The Patient Having Other Kinds of Diseases Too. In order to add machine learning is used to predict the disease and giving some helpful recommendations to the patients whether the body is in the normal state or abnormal state. To Make Use of Smaller and Light Weight Sensors in the Wearable Device in Order to Measure Number of Parameters Hence Making the Classification of Diseases More Accurate and Precise.

References

[1] Prasath JS, Ramachandraiah U, Muthukumaran G. Modified Hardware Security Algorithms for Process Industries Using Internet of Things. Journal of Applied Security Research. 2021 Jan 2;16(1):127-40.

[2] Prasath JS, Jayakumar S, Karthikeyan K. Real-Time Implementation for Secure monitoring of Wastewater Treatment Plants using Internet of Things. International Journal of Innovative Technology and Exploring Engineering. 2019;9(1):2997-3002.

[3] Selvanayakam A, Varishnee AC, Kalaivani M, Ranjithkumar G. Health Monitoring System Using IoT. InInnovations in Electrical and Electronics Engineering 2020 (pp. 739-750). Springer, Singapore.

[4] Usha Rani S, Ignatious A, Hari B, Balavishnu V. IoT patient health monitoring system. Indian Journal of Public Health Research and Development. 2017 Oct 1;8(4)1329-34.

[5] Luo Y. Environmental cost control of coal industry based on cloud computing and machine learning. Arabian Journal of Geosciences. 2021 Jun;14(12):1-6.

[6] Abarna SS, Renija D, Saffana Parveen S, Saradha Preetha S. Smart wearable health monitoring system for diagnosing diseases in patients. International Research Journal of Engineering and Technology (IRJET). 2018 Feb;5(2):178-81.

[7] Al-Aubidy KM, Derbas AM, Al-Mutairi AW. Real-time healthcare monitoring system using wireless sensor network. International Journal of Digital Signals and Smart Systems. 2017;1(1):26-42.

[8] Shoban Babu B, Srikanth K, Ramanjaneyulu T, Lakshmi Narayana I. IoT for healthcare. International Journal of Science and Research. 2016 Feb;5(2):322-6.

[9] Sreekanth KU, Nitha KP. A study on health care in Internet of Things. International journal on recent and innovation trends in computing and communication. 2016 Feb;4(2):44-7.

[10] Wan J, Al-awlaqi MA, Li M, O'Grady M, Gu X, Wang J, Cao N. Wearable IoT enabled real-time health monitoring system. EURASIP Journal on Wireless Communications and Networking. 2018 Dec;2018(1):1-10.

[11] Valsalan P, Baomar TA, Baabood AH. IoT based health monitoring system. Journal of critical reviews. 2020;7(4):739-43.

[12] Yeri V, Shubhangi DC. IoT based Real Time Health Monitoring. In2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA) 2020 Jul 15 (pp. 980-984). IEEE. Yeri V, Shubhangi DC. IoT based Real Time Health Monitoring. In2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA) 2020 Jul 15 (pp. 980-984). IEEE.

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Traffic Monitoring System Using IoT and DL

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Abstract. In Metropolitan cities, where the amount of automobile continuously expands faster than the obtainable traffic framework to support them, congestion may be a strenuous issue to affect and it becomes much worse in case of car accidents. This problem affects many aspects of contemporary society, health damages, traffic accidents, duration spent, grow in greenhouse emissions and including economic expansion. In this context, current societies can rely on the traffic management system to diminish traffic congestion and its negative chattels. In this project, we propose a traffic management system where the traffic will be monitored with all the automobiles on the road. We will track the number of automobiles entering the signal zone and will predict the traffic is high or low. Hang on the quantity of automobiles in each signal zone, the traffic signals can be automated. So that maximum amount of duration is given to more automobiles whereas the lesser duration for some automobiles. Thus this project aims at reducing the traffic and managing the signals automatically leading to the sensor less traffic management system.

Keywords. Traffic Signal monitoring, recommendation system, Image processing, deep learning.

1. Introduction

Traffic congestion in four of Indias major cities Mumbai, Bengaluru, Delhi, and Pune have crawled back very on the brink of levels seen before the Convidinduced lockdown, which had originated global annual traffic congestion to fall for the first duration in at least 10 years, Traffic congestion is a condition in movement that is characterized by low speed, overlong trip duration, and expansion automotive queueing. Traffic congestion on urban road networks has growd substantially, since the 1950s. When traffic demand is great enough that the interaction between automobiles lows the speed of the traffic stream, this leads to some congestion. While congestion may be a possibility for any mode of transportation, this text will specialize in automobile congestion on public roads. As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic jams sets in. When automobiles are fully stopped for periods, this is known as a traffic jam or (informally) a traffic snarl-up. About half of U.S. traffic

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congestion is recurring, and is attributed to the sheer weight of traffic; most of the rest is attributed to traffic incidents, road work, and weather events. In terms of traffic operation, rainfall reduces traffic capacity and operating speeds, thereby leading to greater congestion and road net-work productivity loss. Traffic research still cannot fully predict under which conditions a ”traffic jam” (as opposed to heavy, but smoothly flowing traffic) may suddenly occur. It has been establish that individual incidents (such as accidents or maybe one car braking heavily during a previously smooth flow) may originate ripple chattels (a cascading failure) which then spread out and create a sustained traffic jam when, otherwise, the usual flow might have recommenced for some duration overlong.

2. Literature Survey

The literature review of the paper that were referenced and those that serves the base paper and supporting paper which provides the clear idea of the traffic monitoring system and machine learning algorithms and proper method of recommendations. [1–3] Due to the swift enlargement of automotive transportation and urbanization, traffic jam has been enlarging and becomes a significant problem in most major cities worldwide. Then, an algorithm is presented to spot congested road segments and construct congestion propagation graphs to model congestion propagation in urban road networks [4, 5]. Traffic jams are also coupled with accidents which can be seen widely [6]. There is also need for rerouting traffic for ambulance and emergency occasion [7]. [8–14] Autonomous and connected cars (ACCs), together with edge computing (EC), have been recognized as a promising solution to realize green intelligent transportation for smart cities. This paper aims to deal with short-term traffic prediction, a fundamental enabler for the success of ACC applications, under the ECU Telecommunications Standards Institute (ETSI) multi-access EC (MEC) architecture that exhibits different constraints from conventional cloud computing.

3. Methodology

The Table 1 Show The hardware Components Used To develop A Device. In This Arduino UNO Is the Microprocessor, Max30100, Ec0567, Ad8232 Are the Sensor That Are Connected In The Human Body. The sensor that are connected in the human body. The LCD used for the display

Table 1. Hardware Components table

S.No	Name of the components	Description
1	ESP8266	Send data to the MySQL Database through Wi-Fi module.
2	MQ-5	To sense the atmospheric gas
3	ATmega-328	Microcontroller which has access to MQ-5

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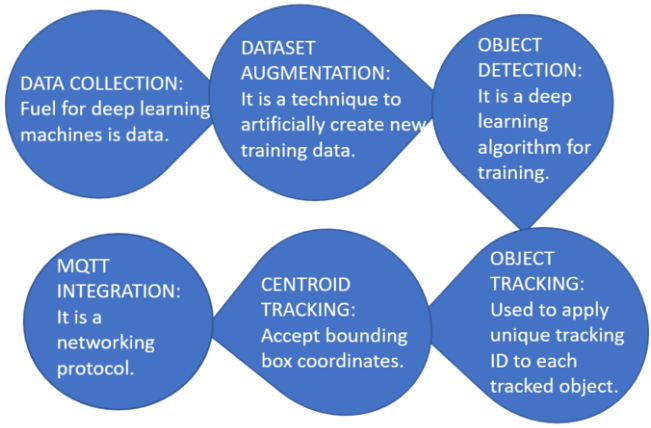

Figure 1. Methodology of the system

3.1. Hardware parts

3.1.1. Esp8266 Module

The enlargement board consisting of the ESP-12E module is incorporated with the ESP8266 chip having 32-bit LX106 RISC microprocessor. The Board operates at a clock frequency of 80MHz to 160 MHz. Most of the IoT projects commonly use the NodeMCU module which is capable of storing data and programs in its 4MB flash memory. NodeMCU is powered through a micro-USB inlet and has inbuilt Wi-Fi support. It supports UART, SPI, and I2C interface.

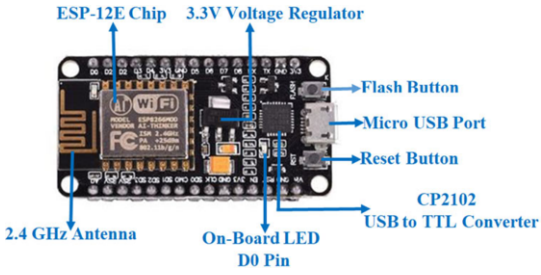

Figure 2. ESP8266

Figure 3. MQ-5

3.1.2. MQ-5 Gas Sensor

The resistance of the SnO2 filament drops, which ends up during a corresponding rise in Output Voltage (Vout), and this output voltage may be measured to point the concentration of any flammable gas that's a gift. The MQ-5 has Associate in Nursing analog (voltage) output.

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3.1.3. ATmega-328

ATmega-328 is a complicated Virtual reduced instruction set computer (AVR) micro-controller. It supports the information up to eight (8) bits. ATmega-328 has 32KB internal integral memory. This micro-controller contains a heap of alternative characteristics. you ought to even have a glance at Introduction to PIC16F877a (it's a PIC Microcontroller) then compare the functions of those 2 Microcontrollers. ATmega 328 has 1KB Electrically effaceable Programmable storage (EEPROM). This property shows if the electrical provide equipped to the micro-controller is removed, even then it will store the information and might give results once providing it with the electrical provide.

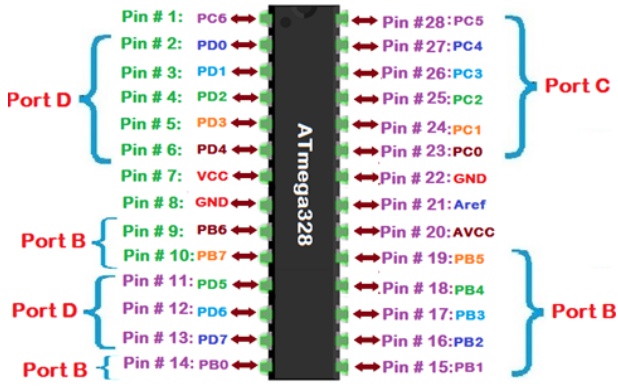

Figure 4. ATmega-328

3.2. Module Description

3.2.1. Dataset Collection Module

A data set is a collection of data. Machine Learning [15] has become the go-to method for solving many challenging real-world problems. And, in the deep learning era, data is very well arguably the most valuable resource. Mighty has been doing self-driving car image annotation and has become pretty big in the space where CVPR 2018 too. Payment AI is less specialized than Mighty AI, offering image annotation for any domain.

3.2.2. Dataset Augmentation

Dataset augmentation is a method in which a new training data is derived from the existing data. Domain specific techniques are applied to the examples from the training data that results in creating a new and different training examples. Image data augmentation is usually only applied to the training dataset, and to not the validation or test dataset. This is different from data preparation like image resizing and pixel scaling; they need to be performed consistently across all datasets that interact with the model

3.2.3. Object Detection Training

Single Shot Multi-Box Detector could be a fashionable algorithmic rule in object detection. After trying an exact of convolutions for feature extraction, we've got a bent to

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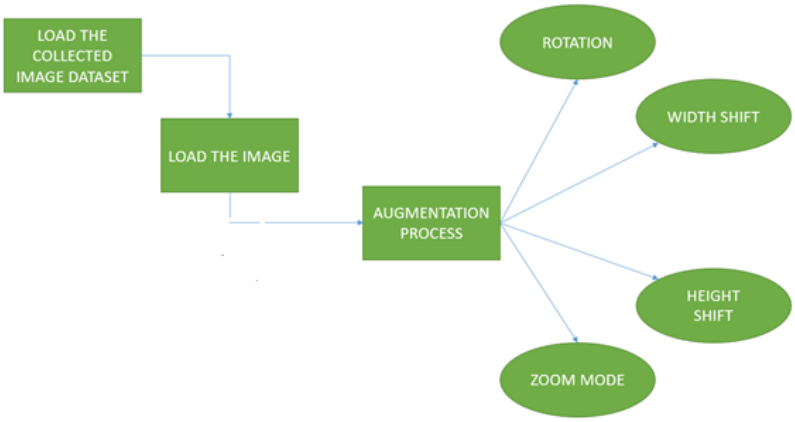

Figure 5. Data augmentation

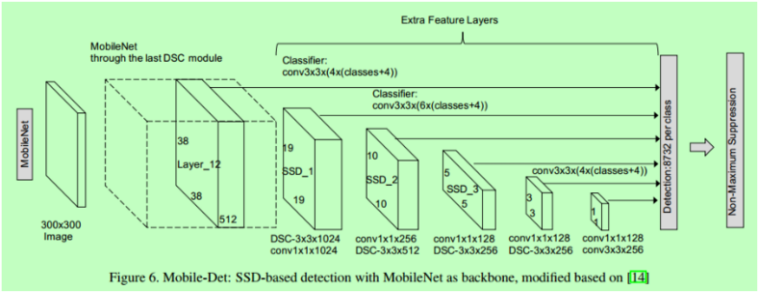

Figure 6. Mobile net SSD architecture

induce a feature layer of size mn (number of locations) with p channels, like 88 or 44 more than. And a 33 convolution is applied on this mnp feature layer. For each location, we've got a bent to got k bounding boxes. These k bounding boxes have whole different sizes and aspect ratios.

3.2.4. Object Tracking

Object chase has many smart applications similarly as investigating, medical imaging, traffic flow analysis, self-driving cars, people investigation and audience flow analysis, and human-computer interaction. Technically, object chase starts with object detection identifying objects in a very image and distribution them bounding boxes. the article chase algorithm assigns Associate in Nursing ID to each object illustrious at intervals the image, and in resultant frames tries to carry across this ID and establish the new position of a constant object. Their unit two main kinds of object tracking: Offline object chaseobject trailing on a recorded video where all the frames, similarly as future activity, unit well-known ahead.

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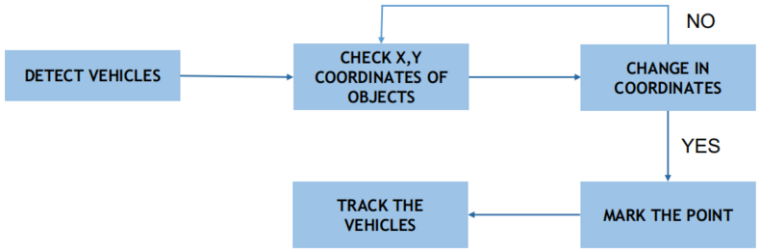

Figure 7. Object Tracking

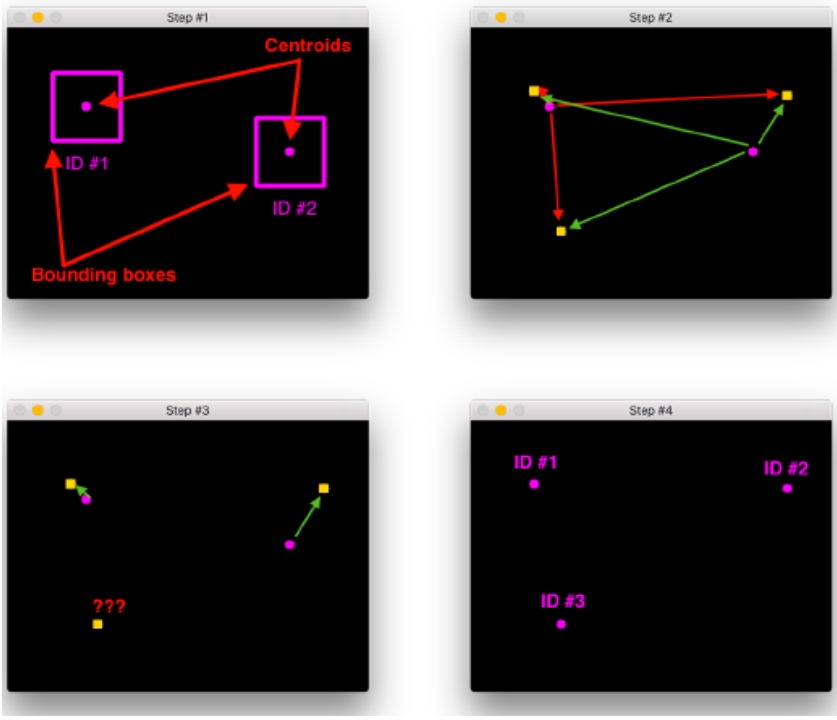

Figure 8. Centroid tracking

3.2.5. Centroid Tracking

Update (x, y)-coordinates of existing objects Register new object - Registering just suggests that we've got a bent to unit adding the new object to our list of caterpillar-tracked objects by (1) distribution it a replacement object ID, and (2) storing the center of mass of the bounding box coordinates for that object Deregister recent/lost objects that have removed of the frame - we have a tendency to square measure reaching to deregister recent objects once they cannot be matched to any existing objects for a whole of N succeeding frame. Here we wish to assign the direction mode, either "vertical" or "horizontal", that we tend to area unit about to be reckoning our objects. The parameters just like the peak and dimension of the input image given. If the direction mode is "vertical", exclusively the popular and total down. Similarly, if direction mode is "horizontal, exclusively the

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popular right and total left thought of. This module accepts a traceable object And one center of mass.

3.2.6. MQTT Integration

The protocol popularly runs over TCP/IP but any network protocol that gives ordered, lossless, bi-directional connections can support MQTT. It's designed for connections with remote locations where a "small code footprint" is required or the network system of measurement is out. Associate in Nursing MQTT client is Associate in Nursing device that runs AN MQTT library Associate in Nursing links to Associate in Nursing MQTT broker upon network knowledge is organized in an extremely hierarchy of topics. This might be given by the basic protocol transport exploitation measures to safeguard the unity of transferred knowledge from interception or duplication

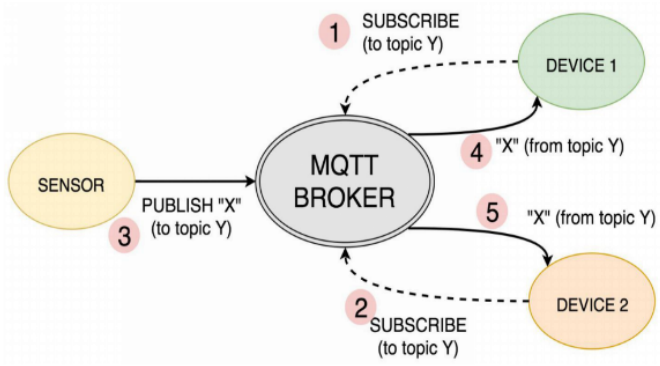

Figure 9. MQTT protocol

4. Architecture of the Traffic Monitoring System

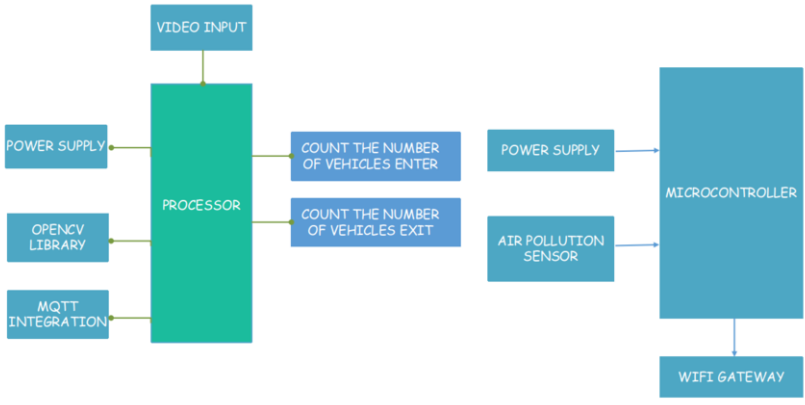

Figure 10. Architecture of the Traffic monitoring system

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A data set may be an assortment of information. Deep Learning has become the go-to technique for resolution several difficult real-world issues. Its positively out and away from the best-performing technique for pc vision tasks. The image on top of showcases the facility of deep learning for pc vision. With enough coaching, a deep network will phase and determine the key points of each person within the image. These deep learning machines that are operating therefore well want to fuel millions of fuel; that fuel is knowledge. And, within the deep learning era, knowledge is incredibly well arguably the foremost valuable resource. There square measure 3 steps of assembling knowledge

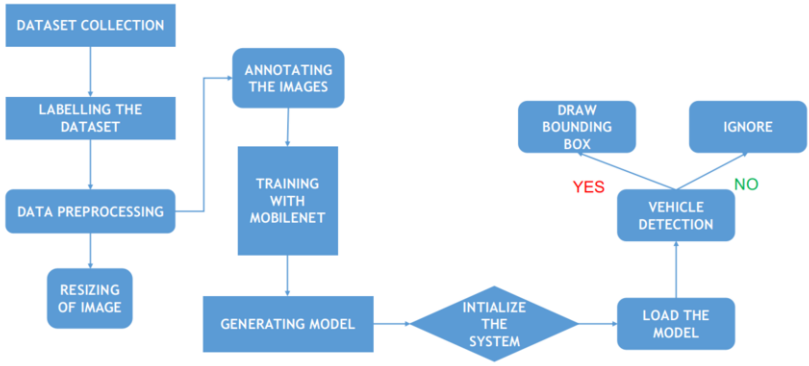

Figure 11. Atomobile Prediction algorithm

5. Results

The Figure 12 shows the count update after few seconds. The Figure 13 shows the complete hardware kit for chattelive air pollution. The Figure 14 shows traffic timing change after every 10 seconds. The Figure 15 shows the mitt mobile application for wireless

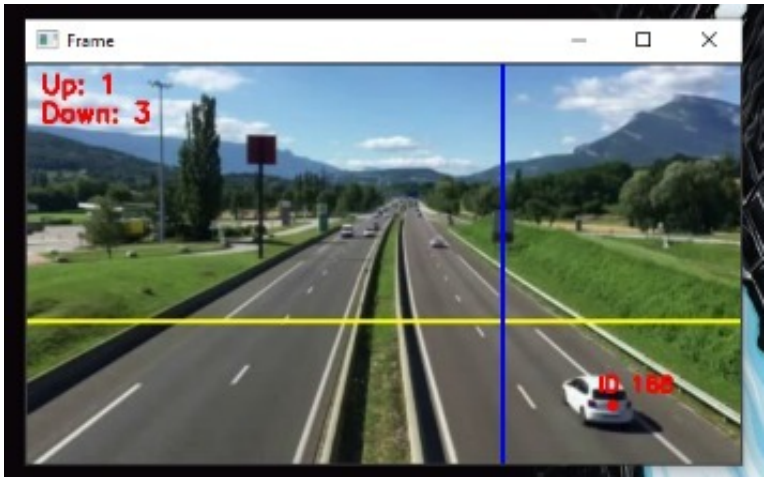

Figure 12. Count update after few seconds

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viewing of values. The Figure 16 shows graphical analysis of left and right count through the MQTT mobile application.

Figure 13. Hardware setup of the project

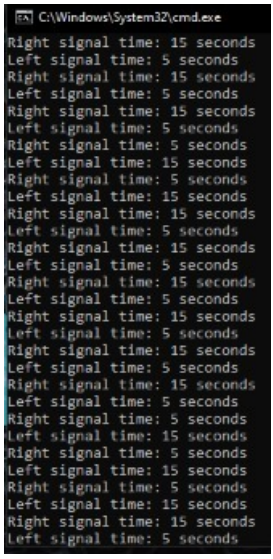

Figure 14. Traffic timing change after every 10 seconds

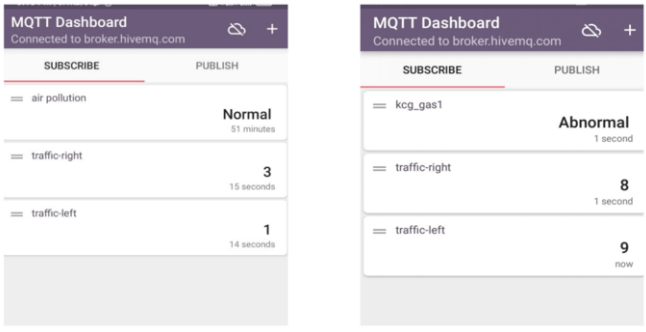

Figure 15. MQTT mobile app interface values

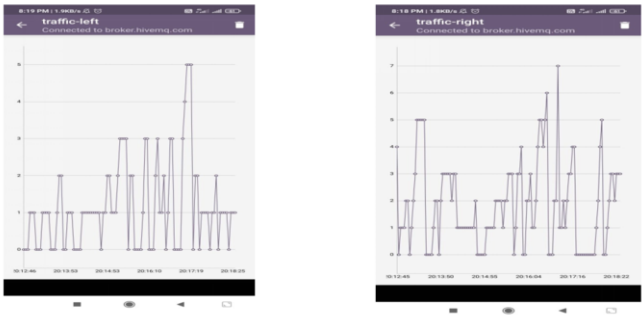

Figure 16. Graphical analysis of lest right count

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6. Conclusion and future work

This project is successfully implemented for effective traffic monitoring. This project is very helpful in reducing the burden on traffic management by the traffic department removing traffic congestion in certain areas. In the coming future, we review the application of the traffic monitoring technology in the traffic department and it can promote the advancement of the traffic management system with more accuracy. In this field, there is more chance to develop or convert this project in many ways. Thus, this project has an efficient scope in the coming future where this idea can be cheaply converted to computerized production.

References

[1] Prasath JS, Ramachandraiah U, Muthukumaran G. Modified Hardware Security Algorithms for Process Industries Using Internet of Things. Journal of Applied Security Research. 2021 Jan 2;16(1):127-40.
[2] Lin L, Li J, Chen F, Ye J, Huai J. Road traffic speed prediction: a probabilistic model fusing multi-source data. IEEE Transactions on Knowledge and Data Engineering. 2017 Jun 22;30(7):1310-23.
[3] Chen M, Yu X, Liu Y. PCNN: Deep convolutional networks for short-term traffic congestion prediction. IEEE Transactions on Intelligent Transportation Systems. 2018 Jun 21;19(11):3550-9.
[4] Hou Z, Li X. Repeatability and similarity of freeway traffic flow and long-term prediction under big data. IEEE Transactions on Intelligent Transportation Systems. 2016 Jan 26;17(6):1786-96.
[5] Backfrieder C, Ostermayer G, Mecklenbruker CF. Increased traffic flow through node-based bottleneck prediction and V2X communication. IEEE Transactions on Intelligent Transportation Systems. 2016 Jul 18;18(2):349-63.
[6] Singh D, Mohan CK. Deep spatio-temporal representation for detection of road accidents using stacked autoencoder. IEEE Transactions on Intelligent Transportation Systems. 2018 May 28;20(3):879-87.
[7] Anand J, Flora A. TG: Emergency traffic management for ambulance using wireless communication. IPASJ Int. J. Electron. Commun.(IIJEC). 2014;2(7):1-4.
[8] Payalan YF, Guvensan MA. Towards next-generation vehicles featuring the vehicle intelligence. IEEE Transactions on Intelligent Transportation Systems. 2019 Jun 11;21(1):30-47.
[9] Prasath JS, Jayakumar S, Karthikeyan K. Real-Time Implementation for Secure monitoring of Wastewater Treatment Plants using Internet of Things. International Journal of Innovative Technology and Exploring Engineering. 2019;9(1):2997-3002.
[10] Ahmed SA, Dogra DP, Kar S, Patnaik R, Lee SC, Choi H, Nam GP, Kim IJ. Query-based video synopsis for intelligent traffic monitoring applications. IEEE Transactions on Intelligent Transportation Systems. 2019 Jul 26;21(8):3457-68.
[11] Savino G, Pierini M, Baldanzini N. Decision logic of an active braking system for powered two wheelers. Proceedings of the Institution of Mechanical Engineers, Part D: Journal of automobile engineering. 2012 Aug;226(8):1026-36.
[12] Kaplan S, Guvensan MA, Yavuz AG, Karalurt Y. Driver behavior analysis for safe driving: A survey. IEEE Transactions on Intelligent Transportation Systems. 2015 Aug 26;16(6):3017-32.
[13] Zhao D, Huang X, Peng H, Lam H, LeBlanc DJ. Accelerated evaluation of automated vehicles in car-following maneuvers. IEEE Transactions on Intelligent Transportation Systems. 2017 May 25;19(3):733-44.
[14] Gillespie T, Hailes S. Assignment of Legal Responsibilities for Decisions by Autonomous Cars Using System Architectures. IEEE Transactions on Technology and Society. 2020 Aug 5;1(3):148-60.
[15] Luo Y. Environmental cost control of coal industry based on cloud computing and machine learning. Arabian Journal of Geosciences. 2021 Jun;14(12):1-6.

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Distinct Actions Classification Using Human Action Tracker Technique in Sports Videos

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Abstract. Recognizing human action in sports is difficult task as various sequences of activities involved in every scene. Identifying each action individually without overlapping of movements is a tedious process due to continuous change of frames within short duration. So proper tracking of human movements for each action is important. Hence new structure-based human action recognition and tracker technique (HART) is proposed. It uses joint trajectory images and visual feature to design each human action. At first, a structural based method employed to extract human skeleton data points from RGB (Red Green Blue) videos. Next, a Multitude Object Tracker (MOT) is proposed which uses the trajectory of human skeleton joints in an image space for identification of actions. Then, Histogram of Oriented Gradients (HOG) combined with Support Vector Machine (SVM) is applied to extract physical body shape and action information. Finally, the action label and interconnected keypoints in humans is jointly detected as end result. The proposed HART technique effectively performed well with the accuracy of about 82% over the other activity recognition methods.

Keywords. Histogram of Oriented Gradients, Support Vector Machine, Openpose, Human Action Recognition and Tracker (HART).

1. Introduction

Human activities have an inherent hierarchical structure, which can be considered as a three-level categorization. First, for the bottom level, there is an atomic element in which more complex human activities are constitutes as action primitives. After that, the detection of action/activity comes as second level. Finally the top level is complex interactions, which refers to the human activities that consist of involvement of more than two persons and objects. This three-level categorization varies and maintains a consistent theme. Action primitives are those atomic sports actions at the limb level, such as "stretching the left arm," and "raising the right leg". There are two challenges arising that make state-of-the-art deep network-based action recognition algorithms ineffective.

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First problem is to extract boundary based shape features to overcome the occlusion and noise. Second, wide field-of-view (FoV) considering in the point of omnidirectional cameras results and not as multiview (actor style, clothing style, ethnicity) in the sports field. In a practical scenario where the camera is installed at a place with large pedestrian volume, the videos are likely to capture many people performing actions at the same time. Since it is computationally intensive to analyse each person individually, an efficient method is needed to simultaneously recognize actions performed by multiple people. Furthermore, from the perspective of curating training data, it is both expensive and more time-consuming to extensively annotate each person's position (i.e., bounding box) and action. On the other hand, it is much easier to acquire annotation only for the video-level action labels without linking each action to a specific person. The main contribution of the proposed HART model:

i) Specify distinction among various object present in a frame,
ii) Track the variations in targeted object individually and notify them,
iii) Spot on labelling each sports action using target object motion pattern separately.

2. Related works

2.1. Vision based Human Activity Recognition

Set of actions that are performed by specific part of the human body is called as atomic actions [1]. Like "stretching the left arm," and "raising the right leg" etc. are the actions that results due to the movements of hands, arms, or upper body part. An actions primitive [2,3] in terms of temporal sequence of a single person interaction (not more number of objects, humans) is considered for this approach. As it works based on space-time interest points (STIPs) [4] in which the variations among the image vectors is shown in terms of both time and space. Meanwhile, another method based on local descriptors such as histogram of oriented gradients (HOG) [5] and histogram of optical flow (HOF) is used for recognizing object. This method is widely used for 3D in HAR area.

2.2. Multi-Person Action Recognition

To monitor multi person actions the camera along with viewing angle plays an important role. When camera is placed at a maximum height (top view) omnidirectional cameras [6] can be more convenient while comparing with other multi conventional cameras. It provides high quality 4k videos at lower cost. Installation also simple as it needs an algorithm for entire working. This will avoids the synchronization problem, coordination among multiple conventional cameras, and reduces security risks of privacy attack. Still there are two challenges in recognizing of humans. First is to identify the appearance of distorted [7] humans. Next to recognize the occluded human's structure. To overcome these issues a deep network-based action recognition [8,9] method is proposed. In which an omni-directional video is transformed into a panoramic video where people stand upright. Another method which is similar to [8] called as multiple instances learning (MIL) [10] is mostly used for predicting drug activity. By incorporating deep network with this MIL, weakly supervised classification can be done in an effective manner. Extended version of this approach is used for multi-label learning, which can recognise multiple instances at a time.

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2.3. Joint Trajectory Character Recognition for Human Action Recognition

Estimating the human posture based on visual features [11] is carried out by considering Red Green Blue images (RGB) and its depth (RGB-D). As it provide the information in terms of position, direction and scale information of different human parts in the images, which helps a lot for human action recognition. Skeleton structure based human pose estimation [12] is another method where joints are plotted as individual points and they are interconnected [13] along with its position. This process is done in every video frame which creates a trajectory. Finally, all the trajectory images are combinedly used for recognizing the actions. For lengthy video field coordinating the trajectory is again a big problem. So a Coordinate-based action [14] representation is used for different coordinate systems. It works on optical character recognition method like joining of handwritten characters [15], the joining trajectory is taken place. This transforms the action recognition problem into characters detection that being drawn from the skeleton joint trajectory. Finally, a graph theory [16] based approach is proposed, where common count of joint point is made over a 2D image. To meet different needs, Openpose [17] method is used as it provides different real-time detection points. By using this method 18 body joint point is generated on the Microsoft COCO data set. Using these joint points the trajectory is constructed and tracked to finalize the action performed in that video.

3. Proposed Human Action Recognition and Tracker (HART) model

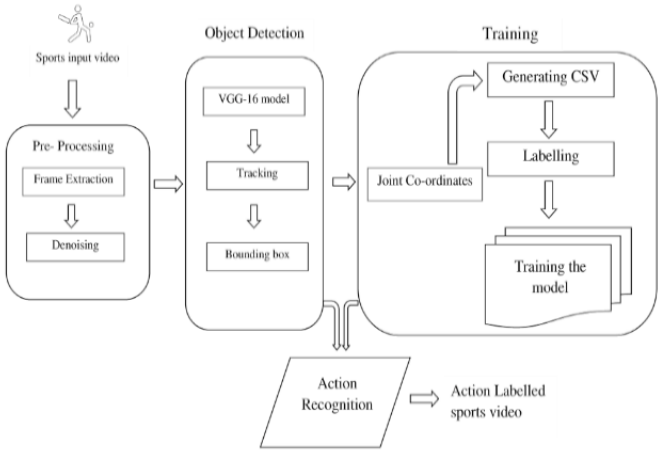

Figure 1. Proposed architecture for HART model

In the proposed method (Figure 1), sports scene is given as input where frames are extracted and denoising is done for all segregated frames. Once the noise removal [18,13] is done, cleaned data is given as input for the VGG-16 model [19] in which filter is used for convolution [20] taken care by its hyper parameter. It has dual fully connected layer (FC) followed by a softmax layer results with a refined feature vector value for each class. The 16 layers in the VGG-16 model helps in identifying the various set of objects present in

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each frame along with humans (as object) for further processing. Object tracking [21] based on not just distance, velocity but also what that person looks like. Multitude Object (MOT) tracker algorithm in table-1 allows us to add this feature by computing deep features for every bounding box and using the similarity between deep features also factor into the tracking logic.

Kalman filter [22] allows us to model tracking based on the position along with velocity of an object and predict where it is likely to be. It models future position and velocity using Gaussians [12]. When it receives a new reading, it can use probability to assign the measurement to its prediction and update itself. It is light in memory and fast to run. And since it uses both position and velocity of motion, it has better results than the centroid based tracking.

Algorithm 1 Multitude Object Tracker (MOT) algorithm.

Input: Sports video scene
Output: Feature value for each object

Use KNN to find the distance- both partial fit and distance
Generate bounding box , confidence score, feature matrix
Apply NMS for the detected confidence score less than 0.7
Track the predicted object using mean() and covariance()
Match the detected value with partial fit and distance in step1
Update track with corresponding detection
if track is mismatched|updated time is too long **then**
    Delete Track
for unmatched detection and mismatch **do**
    Obtain latest track list, save only confirmed and tentative
    Update distance metrics and collect track ID of confirmed status
    Join and match track ID with features
    Update feature set value
Return feature value

For each object present in the frame multiple predicted boxes is generated. So it is necessary to provide a bounding box that exactly fit in over the object. It can be done with the help of non-maxima suppression (NMS) techniques [23] which select box based on the two metrics. One is using the objectiveness score given by the model. Second is the comparison with the IoU (Intersection over Union) score of the box. Once these two processes completed removal of boxes is done with a threshold of IoU score value below 50% among overall score. At last the bounding box that satisfy the highest score value is taken in account. Next is to recognise the actions with the help of identified object along with the relationship among them. For that the OpenPose [14] technique is used. It is constructed based on two branch multi stage VGG-16 convolution neural network, in which top branch predicts the confidence maps of various locations of human body parts. Bottom branch is used to predict the Part Affinity Fields (PAF) of each level. During the first stage the initial set of confidence map (M) and affinity fields (A) is identified and in subsequent stages previous results from both the branches along with image feature (L) is get concatenated . In the part of set (affinity fields), correlation information of each point is described. Finally, the points are transformed into confidence maps and 18 two-dimensional body joints of all people in the image are obtained by reasoning and analy-

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sis of Hungarian matching algorithm [24]. At first the skeleton trajectory is extracted by HOG (Histogram of Oriented Gradients), which is a histogram of directional gradients. It is used to extract human body shape and action information. The generation of HOG feature vectors is split into five steps. Initially, the image is normalized by colour and Gamma. Then the gradient of the image is calculated by first-order differential within the vertical or horizontal direction. Then, the direction weight projection supported the gradient magnitude is carried out, and therefore the weight of every cell's gradient direction is calculated by using the oblong HOG model. Gradient of the image is calculated by first-order differential in the vertical or horizontal direction. Then, the direction weight projection based on the gradient magnitude (Eq. (1)) is carried out. The weight of each cell's gradient direction (Eq. (2)) is calculated by using the rectangular HOG model [25].

$$G = \sqrt{G_u^2 + G_v^2} \tag{1}$$

$$\theta = arctan\frac{G_v}{G_u} \tag{2}$$

Where G is the magnitude of the gradient along u and v point, is the direction of gradient along three channels. Finally, the gradient histogram of the cell is obtained and the L2-norm function is used to normalize the feature vectors. The final feature vectors of HOG containing the location information of many skeleton joints are obtained.

4. Experimental Results

UCF101 dataset which is a human action video data set used in our proposed work. It contains 101 action categories. For each different action category, videos are divided into 25 groups. Video clips in the same group may share some common features, similar backgrounds or similar perspectives. Because the number of recognizable videos provided by different action categories in UCF 101 data sets is different, the 4 action sets used in the experiment are filtered [26] according to the amount of data. For each action category, we selected 4 groups as the experimental data. During training phase, the detection function of 18 body joints based on UCF-101 data set provided by OpenPose is applied. OpenPose provides different real-time human body detection points in a text format. Using that text data, we first generate a CSV file using those points. CSV file contains the (x,y) co-ordinates of all 18 body parts and binary data of each class. Next step of action recognition is training the model using that CSV file. Trained data will be stored in the h5 file. Next is to label the data by identifying the connected components in an image and assigning each one a unique label. The resulting matrix is called a label matrix. Each video in the data set is belonging to a particular class. Class label is mapped to a specific class according to the binary data contained in the CSV file. In Figure 2 the output of the proposed system is shown for various actions like kick, run, bowl and jump. As video scenes in the dataset consist of single player performing various sports actions, the skeleton is generated focusing on individual person but in concern from various orientations.

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Figure 2. Resulted recognised action labels from UCF-101 dataset

Finally, recognition is done based on the given input data and the trained model. Generating skeleton joint [17] position matrix and skeleton joint trajectory in the input frame and the order of frame sequence in the video is then applied into the trained model. Humans are mapped in a bounding box and the action label is placed on top of that. The performance evaluation for the proposed model is done using the confusion matrix where x –axis represent the predicted actions and y-axis is the true label shown in Figure 3. From the matrix it is evident that correctly prediction rate of HART model is about

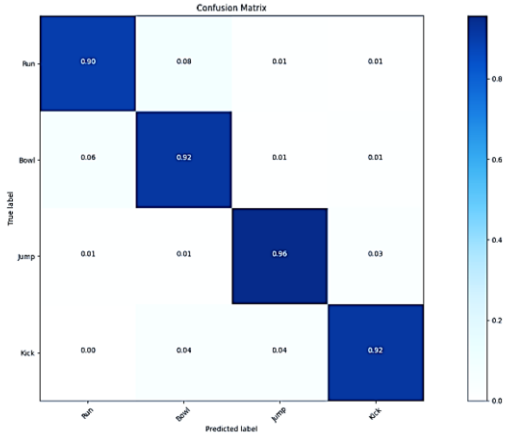

Figure 3. Confusion matrix for the proposed model

96% for all the considered human actions.

The performance of the proposed system is compared with other state-of-art methods which clearly shown in Table 1. The HART model outperforms other methods on an average of about 4% higher than corresponding methods.

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Table 1. Performance comparison with state-of-art method

Methods	Accuracy
SVM	89%
CNN	91.3%
ResNet	92.5%
Proposed HART	96%

5. Conclusion

Core motivation of the proposed work is to recognise and track human actions individually in sports videos The VGG-16 model is used to extract the image feature vector. The HART model uses MOT algorithm in table-1, where every objects present in the frame is highlighted. Then filtering is made so that only targeted object along with its actions is tracked individually. Human actions are divided into three levels including action primitives, actions/activities, and interactions. At last summarization of the classic and representative approaches to activity representation is done. The proposed model results with 96% of performance improvement in recognising and tracking of human actions. In future, the work is focused towards detection of multi target and movements in an entire sports video. This can be more helpful in preparing sports commentary.

References

[1] Ullah A, Muhammad K, Del Ser J, Baik SW, de Albuquerque VH. Activity recognition using temporal optical flow convolutional features and multilayer LSTM. IEEE Transactions on Industrial Electronics. 2018 Nov 22;66(12):9692-702.

[2] Zhang S, Wei Z, Nie J, Huang L, Wang S, Li Z. A review on human activity recognition using vision-based method. Journal of healthcare engineering. 2017 Jul 20;2017.

[3] Li X. Influence of sandstorm on air pollution based on Gaussian mixture model and sports detection. Arab J Geosci. 2021;14(15):1-3.

[4] Sagayam KM, Hemanth DJ. A probabilistic model for state sequence analysis in hidden Markov model for hand gesture recognition. Computational Intelligence. 2019 Feb;35(1):59-81.

[5] Dalal N, Triggs B. Histograms of oriented gradients for human detection. In 2005 IEEE computer society conference on computer vision and pattern recognition (CVPR'05) 2005 Jun 20 (Vol. 1, pp. 886-893). IEEE.

[6] Wang L, Qiao Y, Tang X. Action recognition with trajectory-pooled deep-convolutional descriptors. InProceedings of the IEEE conference on computer vision and pattern recognition 2015 (pp. 4305-4314).

[7] Bu X. Human Motion Gesture Recognition Algorithm in Video Based on Convolutional Neural Features of Training Images. IEEE Access. 2020 Aug 28;8:160025-39.

[8] Huang Z, Huang L, Gong Y, Huang C, Wang X. Mask scoring r-cnn. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition 2019 (pp. 6409-6418).

[9] Nagrath P, Jain R, Madan A, Arora R, Kataria P, Hemanth J. SSDMNV2: A real time DNN-based face mask detection system using single shot multibox detector and MobileNetV2. Sustainable cities and society. 2021 Mar 1;66:1-11.

[10] Zucker JD, Chevaleyre Y. Solving multiple-instance and multiple-part learning problems with decision trees and decision rules. Application to the mutagenesis problem (Doctoral dissertation, LIP6).

[11] Khurana R, Kushwaha AK. Deep Learning Approaches for Human Activity Recognition in Video Surveillance-A Survey. In 2018 First International Conference on Secure Cyber Computing and Communication (ICSCCC) 2018 Dec 15 (pp. 542-544). IEEE.

[12] Singh A, Agarwal S, Nagrath P, Saxena A, Thakur N. Human pose estimation using convolutional neural networks. In 2019 Amity International Conference on Artificial Intelligence (AICAI) 2019 Feb 4 (pp. 946-952). IEEE.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[13] Sharieff AH, Sabena S, Sathiyavathi V, SaiRamesh L. Intelligent framework for joint data hiding and compression using SMVQ and fast local image in-painting. Int. J. Sci Technol. Res. 2020;9(2):2267-71.
[14] Cao Z, Hidalgo G, Simon T, Wei SE, Sheikh Y. OpenPose: realtime multi-person 2D pose estimation using Part Affinity Fields. IEEE transactions on pattern analysis and machine intelligence. 2019 Jul 17;43(1):172-86.
[15] Sagayam KM, Hemanth DJ. ABC algorithm based optimization of 1-D hidden Markov model for hand gesture recognition applications. Computers in Industry. 2018 Aug 1;99:313-23.
[16] Shen L, Yeung S, Hoffman J, Mori G, Fei-Fei L. Scaling human-object interaction recognition through zero-shot learning. In 2018 IEEE Winter Conference on Applications of Computer Vision (WACV) 2018 Mar 12 (pp. 1568-1576). IEEE.
[17] Liang X, Zhang HB, Zhang YX, Huang JL. JTCR: Joint Trajectory Character Recognition for human action recognition. In2019 IEEE Eurasia Conference on IOT, Communication and Engineering (ECICE) 2019 Oct 3 (pp. 350-353). IEEE.
[18] Ren H, El-Khamy M, Lee J. Dn-resnet: Efficient deep residual network for image denoising. InAsian Conference on Computer Vision 2018 Dec 2 (pp. 215-230). Springer, Cham.
[19] Li J, Liu J, Yongkang W, Nishimura S, Kankanhalli M. Weakly-Supervised Multi-Person Action Recognition in 360° Videos. In Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision 2020 (pp. 508-516).
[20] Albawi S, Mohammed TA, Al-Zawi S. Understanding of a convolutional neural network. In 2017 International Conference on Engineering and Technology (ICET) 2017 Aug 21 (pp. 1-6). IEEE.
[21] Salhi A, Ghozzi F, Fakhfakh A. Estimation for motion in tracking and detection objects with Kalman Filter. InDynamic Data Assimilation-Beating the Uncertainties 2020 Oct 8. IntechOpen.
[22] Vinodhini CA, Sabena S, Ramesh LS. A Robust and Fast Fundus Image Enhancement by Dehazing. In International Conference On Computational Vision and Bio Inspired Computing 2018 Nov 29 (pp. 1111-1119). Springer, Cham.
[23] Shepley A, Falzon G, Kwan P. Confluence: A robust non-IoU alternative to non-maxima suppression in object detection. arXiv preprint arXiv:2012.00257. 2020 Dec 1.
[24] Yang H, Yuan C, Xing J, Hu W. SCNN: Sequential convolutional neural network for human action recognition in videos. In 2017 IEEE International Conference on Image Processing (ICIP) 2017 Sep 17 (pp. 355-359). IEEE.
[25] Yue-Hei Ng J, Hausknecht M, Vijayanarasimhan S, Vinyals O, Monga R, Toderici G. Beyond short snippets: Deep networks for video classification. InProceedings of the IEEE conference on computer vision and pattern recognition 2015 (pp. 4694-4702).
[26] Alippi C, Disabato S, Roveri M. Moving convolutional neural networks to embedded systems: the alexnet and VGG-16 case. In 2018 17th ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN) 2018 Apr 11 (pp. 212-223). IEEE.

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Smart Wearable System to Assist Asthma Patients

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Abstract. Asthma is a perpetual lung infection that inflames and shortens the airways leading to intricacy in breathing. It affects 300 million human life globally out of which 20 million people are Indians, and every year about 2.5 lakh people die of asthma prematurely around the world. The estimation of asthma patients globally will exceed 100 million by the year 2025. All the deaths due to asthma are preventable with proper care and guidance [1]. This paper provides a user-friendly wearable device included with an android app that monitors the environmental factors faced by asthma patients as well as their health parameters and transmits the collected data to a cloud platform. The parameters are deliberated using special sensing element like temperature sensing unit, humidity sensing unit, gas sensor unit and pulse rate sensor unit. The evaluated parameters are the presence of polluted gas, abnormal temperature, humidity and pulse rate, and the specific location of the user. All these parameters are regularly updated in the display unit attached to the wearable device as well as in an android app, which consists of Asthma Symptom Test (AST) to predict the probability of asthma and it gives essential precautions to the patients by gathering details from the cloud which prevents them from provoking a severe attack. The proposed system was implemented and tested in real-time environment.

Keywords. Air Quality, Asthma, Cloud, Sensors, Wearable System.

1. Introduction

Asthma is a persistent illness that has an effect on the lungs and weakens airways through the acquisition of excessive quality mucus which results in a limited amount of oxygen delivered to vital organs. Asthmatic people often experience various symptoms that lead to a diagnosis of asthma [2]. The accurate cause of asthma is not yet known. However, studies have revealed that a mixture of genetic and environmental factors leads to enhance in asthmatics worldwide. The major causes of asthma symptoms vary from person to person. There are different types of asthma present such as primary, intermediate and critical level; this varies from person to person. The asthma indications diverge drastically from one person to another person. Even now, one information is common with asthma, that when airways experience some asthma triggers, then it gets narrow,

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inflamed and get filled with the mucus, and excessive amounts of mucus contribute to airway contraction [3].

According to Indian doctors, there has been an increase in air sickness in children due to an increase in pollution [4]. The framework mentioned for the detection of environmental factors by constantly evaluating the air quality using various sensors and helping the patient to reduce the risk of asthma by providing a sophisticated device along with safety precautions. If the collection of air particles exceeds a certain amount, the pollutants present in the atmosphere is shown to the patient by the android app with appropriate suggestions to them. The user's health condition is regularly observed and updated in the cloud database, which helps them to take preventive measures by them immediately and able to contact the physician if the situation is an emergency. The foremost objectives of the paper are, to monitor and improve the health conditions of asthma patients, to provide preventive measures to the patients, to observe the environment of the patient constantly, to identify the quality of air and to provide a user friendly and portable device.

Remaining article is structured as follows. Existing methods is explored in section 2. Section 3 describes the system outline. Finally, working is detailed in section 4 followed with results in section 5. At last conclusion and references are given.

2. Existing Methods

Under this topic we introduce a summary of some significant assistance made by numerous researchers in the subject of asthma monitoring devices using embedded and IoT:

The authors in [5] proposed an m-health system which has a mobile application used for an Android platform and a WEB application. The online structures of Firebase to control asthma by providing a tool for patients to calculate the quality of airway control. This system is grounded on Asthma Control Questionnaire (ACQ), Asthma Control Test (ACT) which is the most widely used clinical practice. This contributes to self-management by shaping the quality of patient management. For usability assessment in a system, maximum of the users valued it as useful and on using the system commonly to maintain the self-management of asthma.

The authors in [6] designed a transportable device that displays the environmental disclosures practiced by an asthmatic patient and directs the data to the cloud environment. A proper technique for recognition of asthma activates is proposed to assistance recognize the factors that cause asthma in a particular person. a transportable device that displays the surrounding exposed by the patients and directs the data to the cloud. These conceptions focus on measuring various gases such as CO, smoke and contrast it with a standard air quality index (AQI) as a reference. Patients are intimated by messages when there is a rapid change in the data.

The authors in [7] examine the air quality index (AQI) and provides personalized and localized feedback to patients which to helps them improve their health conditions. This paper focuses on both indoor and outdoor air quality. This paper proposed planning for smart asthma controlling. This gathers data using Microsoft Excel and analysis information using MATLAB, thereby gives response to provide limited and personalized smart asthma observing. AQI for outdoor air quality is considered a reference for our paper.

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The authors in [8,9] used machine learning for prediction for their application, the algorithm applied for forecasting asthma threat. The study is created on Peak Expiratory Flow Rates (PEFR) for some pediatric patients. PEFR outcomes are unruffled twice in a day and separated into three groups as 'Green' (normal), 'Yellow' (mild to moderate exacerbation) and 'Red' (severe exacerbation) with orientation to their finest peak flow rate. Long Short-Term Memory (LSTM) prototypical is initiate to forecast the asthma threat groups as compared to MultiNomial Logistic (MNL) regression as it integrates the increasing properties of PM attentions. This method could possibly play an innovative part for the technical data-driven medical choice creation.

The authors in [10] proposed a structure for examining and calculating asthma exacerbation based on e-health and using medical IoT devices to gather and investigate data in physical period to regulate the harshness of asthma and to give defensive actions and measures in order to constantly display the sickness and stop the risk of asthma attack. The device provides altering messages in critical situation.

The authors in [11] offered a scheme that will be able to forecast likely asthma spell for the patients and aware them. The scheme is consisting of air pollutant nursing device joint with an Android application which helps to decrease asthma attacks for asthma patients by supervised learning technique and examining air pollutant data. Also examining modified data of patients it will be likely to recommend a new operator about the safe and unsafe region of the city. As a by-product, it will be likely to generate a high-density air pollution chart of cities to television air pollution.

The authors in [12] proposed a software and hardware system for heart beat related biomedical parameters monitoring scheme using the IoT and Sensors using ESP8266 Wi-Fi module. The system monitors and obtain the heart rate in bpm and temperate value which are observed continuously. The system is connected to the cloud and an app to convey the vital parameters of human body using the Wi-Fi module.

The author in [13] proposed the software and hardware construction of the e-health smart pulse oximeter scheme combined into Seat Display Unit (SDU) for passenger's scrutiny in-flight. The idea of this smart scheme come emerged from the information that during the flight, the inside cab conditions, such as little pressure, absence of oxygen and little humidity are threat factors in patient's misery from pulmonary illnesses, cardiovascular illnesses, venous thrombosis illnesses, asthma sicknesses, lung emphysema illnesses, surgical operations suffered recently, epilepsy, diabetes, mental illnesses and infectious illnesses. The system monitors oxygen stages in the blood and pulse amount throughout the phases such as takeoff/flight/landing to offer info on the health status of passengers and this data could be recycled in the medical field to deliver proposal to patients who have exact ailments and to travel by air. Few optimization logics which are used in biomedical applications are discussed in [14,15].

3. System Outline

In the proposed method consists of both hardware and software. The hardware consists of a micro-controller, gas sensing unit, temperature sensing unit, humidity sensing unit, GPS module, and pulse rate sensing unit. The sensors are attached the portable device to examine the pollutants such as carbon monoxide and carbon dioxide in the environment, to detect the rapid changes in the temperature and humidity, and to scrutinize the health

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parameters. The data found from the different sensors are delivered to the cloud intermittently. Data found in the cloud is used to investigate and offer patients with security actions through the mobile app attached to the cloud.

Figure 1. NodeMCU

Figure 2. Gas Sensor

Figure 3. DHT11

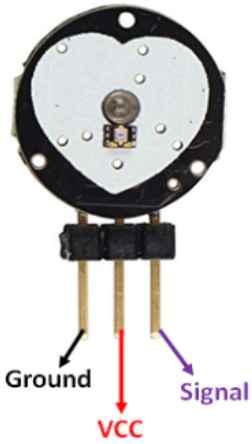

Figure 4. Pulse Sensor

3.1. Microcontroller

NodeMCU is a computing expansion board based on the ESP8266 integrated Wi-Fi unit. It has FCC certified Wi-Fi modules and a PCB antenna. The board incorporates over-all function General Purpose Input Output (GPIO), Inter Integrated Circuit (I2C), Analog to Digital Converter (ADC). Its firmware executed on Express ESP8266 Wi-Fi System on Chip (SoC) system. NodeMCU on average has 128 KB of memory. It has easy and visual scripting language. The board consists of a micro-USB port for power and communication with the Personal Computer (PC). It can be effortlessly operated from a USB to a micro USB port via a power bank. Due to the relative ease of use and the built-in Wi-Fi modules, NodeMCU is commonly preferred over other micro-controllers.

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3.2. Gas Sensor

The MQ-2 gas sensor is generally a susceptible sensor for identify SnO2 and CO. It is appropriate for escalating carbon monoxide concentrations (ppm) in polluted air. It is quick, consistent, and enduring. SnO2 is the substantial component and this sensor unit that detects gas concentrations efficiently and precisely. SnO2 has low concentrations in air. It can regularly compute CO concentrations from 20 to 2000 ppm. The output of the sensor specifies analog resistance. The conductor circuit is effortless and consists of a voltage divider that operates from the heater coil with 5V AC or DC, which is connected to load resistance and output ADC or linear.

3.3. Humidityand Temperature sensor

Here we are using cost-effective DHT11, digital temperature and humidity sensor unit. It has the feature of a humidity sensor and a thermistor unit that estimates the nearby atmosphere and provides a digital indication on the data pin. It is handy but requires more time to position the data. The output is obtained within 2 seconds.

3.4. Heart rate sensor

The heart rate sensing unit which is used sense the pulse amount of the user. The analog output is acquired by placing the finger on the LED. It gives output in BPM and it can also be used to find the oxygen level in the blood. It can be easily integrated with any micro-controller. It also includes an examining app that regularly monitors e data and updates in the app. It is a painless method to compute the heart rate in an inexpensive manner.

3.5. OLED

OLED (Organic Light-Emitting Diodes) is made by keeping the organic thin films between two conductors in a series manner. A bright light is produced when the current is applied to it. OLEDs are more proficient than LEDs as they are thinner in a structure that does not need a backlight. It is not only efficient but also provides good image quality and this can be made more flexible and transparent.

Figure 5. OLED

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3.6. Arduino Development Environment

The Arduino IDE which is abbreviated as Arduino Integrated Development Environment is a software which is applied to write and upload code into a dissimilar Arduino boards. This software consists of various in-built libraries that enclose essential functions which makes programming easy. It also has a immense characteristic which marks it opportune to clear up mistakes and troubleshoot problems. The NodeMCU can also be planned using Arduino IDE by connecting the libraries essential and selecting ESP8266 NodeMCU in the Board Manager Option. The NodeMCU microcontroller is programmed using embedded C language.

3.7. Firebase

Firebase is a cloud platform that is used to gather data in real time. Firebase the whole thing with the platforms like Arduino, ESP8266 and Raspberry Pi. It has a commanding API. It allows the user to send and observe the data in cloud. If the threshold from the data is found correctly, there are alternatives to set triggers. Data are immediately reorganized to the cloud for each 1 second, permitting real-time data observing. The dashboard in IO allows the user to allow feeds in different formats of his choice. Data acknowledged from the gas sensor is broadcasted to this cloud platform.

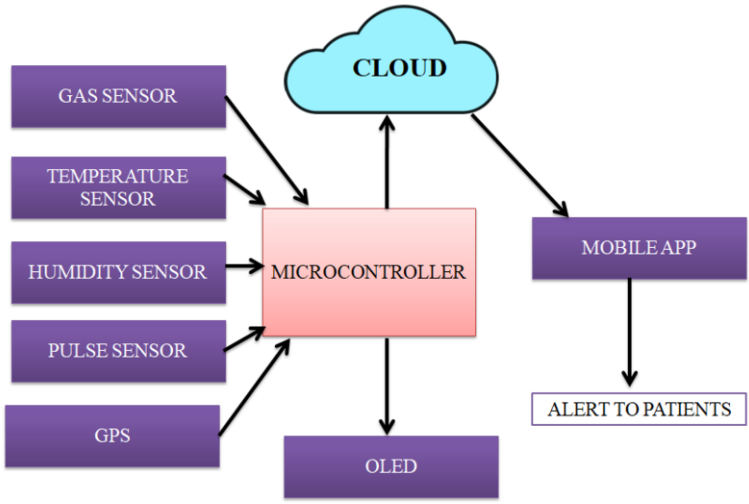

Figure 6. Basic Block Diagram of Prototype

4. Working

Our idea aims to decrease the risk of asthma by providing a compact and transportable device incorporated with an android app which gives continuous precautions to the patients whenever needed. The hardware consists of various sensors such as gas sensor which detects the hazardous gases in the atmosphere, a temperature sensor to intellect

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the temperature, a humidity sensor to intellect the changes in the climate, a pulse sensor which detects the heart rate as well as the oxygen level in the blood, a GPS module to track the user's location and also it identifies the polluted area and this details are updated to the government as healthy as to the cloud and a Wi-Fi module is provided to update the responses of the sensor to the cloud. All the details from these sensors are uploaded to the cloud, and frequent changes in these responses are changed to the patients via an android app. The superior step in the android app is to register the personal details of the user, and then the system continues with an asthma symptom test which contains a number of questions to test the symptoms of asthma before consulting a doctor. If the test comes out to positive, then two selections are provided to consult the doctor or to take the test again. The consistent precautions are rapidly given to the registered user by accurately comparing their health conditions as well as environmental conditions. The user's health condition is regularly watched and restructured in the database or the cloud for succeeding reference. In the case of a critical situation, the app will use its superior feature to call the doctor or a registered member. The device is simple and wearable that is used by asthmatic patients and even it can be used by the ordinary person. This app is accessible and inspires the user to care for their health and yield the precautions in stark conditions which initially make them self-dependent and the patients will be able to therapy before having an asthma attack.

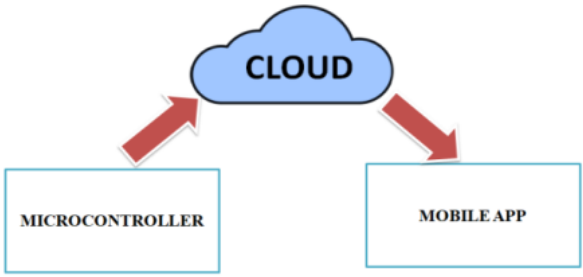

Figure 7. Basic Overview

5. Results and Discussion

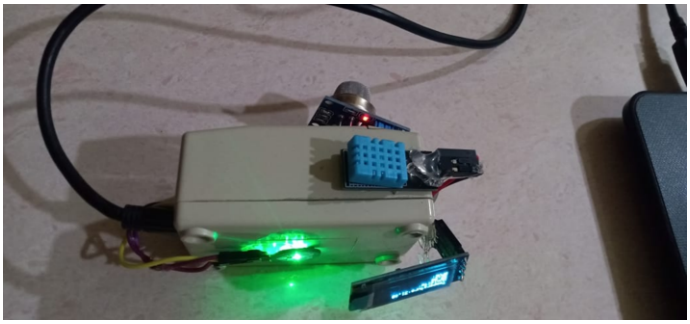

Figure 8. Basic Prototype

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Figure 8 is the basic prototype of our paper which consists of DHT11 (temperature and humidity sensor), pulse rate sensor, gas sensor and OLED. This hardware setup is integrated with the cloud and mobile app.

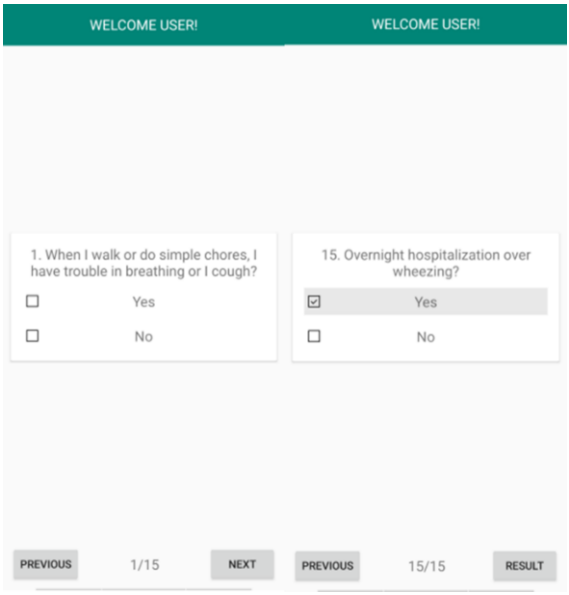

Figure 9. Asthma Symptom test

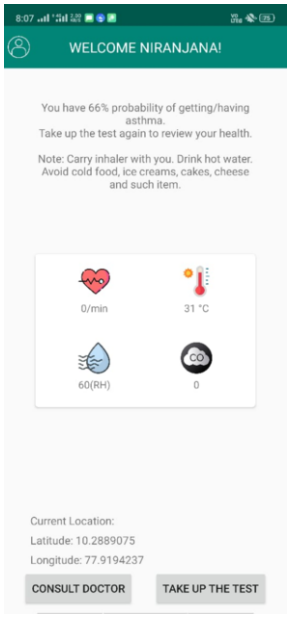

Figure 10. Android app

Figure 9 is the second section of Android app, is the beginning of the asthma symptom test (AST).AST is few Yes or No questions which is used to predict the probability of asthma. In the Figure 9 is the first question of AST and is the last question of AST respectively. The probability of asthma is predicted by the number of Yes or No questions answered by the user. Figure 10 is the user output of Android app which provides the probability of asthma; precautions need to be taken which is provided according with probability of asthma and environmental conditions around the patients. Location of the patients is also displayed. In case of emergency situation, the user can consult doctor and share his location for help.

6. Conclusion

The projected system consists of hardware as well as software components. The hardware components are banged to develop a dense and transportable device made up of various sensors such as gas sensor, pulse rate sensor and temperature and humidity sensor and also an OLED is used for the display of these values rapidly. The transportable device is impeccably integrated with an android app. The sensor's response is regularly updated to the cloud and this is used to give precautions to the user for the quick changes in the sensor response with the help of online sorts of the firebase cloud. These suitable precautions are delivered in the inventive app along with the present data of the sensor from the cloud. The future scope of the system is to implement machine learning in the

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system to track the user and also to involve a spirometer test that will be joined with the app as well as device.

References

[1] The Global Asthma Report 2014. Auckland. New Zealand: Global Asthma Network. 2014.

[2] Hwang L. "Global Strategy for Asthma Management and Prevention". Global Initiation for Asthma 2018 (Vol. 112, No. 3, p. 8).

[3] Cottini M, Asero R. Asthma phenotypes today. Eur Ann Allergy Clin Immunol. 2013 Feb 1;45(1):17-24.

[4] Air Pollution and Health in India: A review of the current evidence and opportunities for the future July 2017. Public Health Foundation of India/Centre for environmental Health, India. 2017:1-64.

[5] Silva TA, Costa MG, Stelmach R, Bley PK, Gutierrez MA, Costa Filho CF. Development of a system mobile-based to assist asthma self-management. In2018 3rd Biennial South African Biomedical Engineering Conference (SAIBMEC) 2018 Apr 4 (pp. 1-4). IEEE.

[6] Indulakshmi S, Adithya M, Anirudh AR, Jawahar A. Design and Development of Prototype Model for Asthma Trigger Detection. In2018 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET) 2018 Mar 22 (pp. 1-5). IEEE.

[7] Isaac N, Sampath N, Gay V. SAM smart asthma monitoring: focus on air quality data and Internet of Things (IoT). In2018 12th International Symposium on Medical Information and Communication Technology (ISMICT) 2018 Mar 26 (pp. 1-6). IEEE.

[8] Kim D, Cho S, Tamil L, Song DJ, Seo S. Predicting asthma attacks: effects of indoor PM concentrations on peak expiratory flow rates of asthmatic children. IEEE Access. 2019 Dec 18;8:8791-7.

[9] Luo Y. Environmental cost control of coal industry based on cloud computing and machine learning. Arabian Journal of Geosciences. 2021 Jun;14(12):1-6.

[10] Maach A, El Alami J. A fog-driven IoT e-Health framework to monitor and control asthma exacerbation. In2019 International Conference on Wireless Networks and Mobile Communications (WINCOM) 2019 Oct (pp. 1-6). IEEE.

[11] Hoq MN, Alam R, Amin A. Prediction of possible asthma attack from air pollutants: Towards a high density air pollution map for smart cities to improve living. In2019 International Conference on Electrical, Computer and Communication Engineering (ECCE) 2019 Feb 7 (pp. 1-5). IEEE.

[12] Ajay H, Rao AR, Balavanan M, Lalit R. A Novel Cardiac Arrest Alerting System using IoT. International Journal of Science Technology & Engineering. 2017;3(10):78-83.

[13] AILENI RM, PAŞCA S, FLORESCU A. E-health monitoring by smart pulse oximeter systems integrated in SDU. In2019 11th International Symposium on Advanced Topics in Electrical Engineering (ATEE) 2019 Mar 28 (pp. 1-4). IEEE.

[14] Anand J, Rajaa Paul Perinbam J, Meganathan D. Design of GA-based Routing in Biomedical Wireless Sensor Networks. International Journal of Applied Engineering Research (IJAER). 2015;10(4):9281-92.

[15] Anand J, Perinbam JR, Meganathan D. Q-learning-based optimized routing in biomedical wireless sensor networks. IETE Journal of Research. 2017 Jan 2;63(1):89-97.

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Covid-19 Sentiment Analysis Using Deep Learning and Machine Learning

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Abstract. As we see in later days the covid-19 is spreading broadly. In this the individuals from diverse places within the world discussing about this widespread in numerous ways. So In this respect here we are employing a estimation examination to classify each and each survey of the individuals. What estimation examination will do is it'll qualify and measure the comes about agreeing to the voice of client so for this individuals reaction is taken from online platform such as twitter stack the information and store this information in shape of datasets after that we got to do investigation on information utilizing conclusion mining. In this venture we got to take the covid-19 tweets information from twitter, based on the information we need to made the investigation of the information by utilizing the opinion analysis. In this venture we have long shortterm memory(LSTM), Naïve Bayes and Calculated Regression. Then we discover the exactness's of each calculations based on that we'll conclude that which calculation will be great in arrange to execute assumption investigation.

Keywords. LSTM, naïve Bayes, COVID-19.

1. Introduction

Opinion mining is one of a strategy to decide and made an investigation on the information in terms of positive, negative and impartial classifications. Assumption investigation makes a difference information examiners inside expansive ventures gage open conclusion, conduct nuanced advertise investigate, screen brand and item notoriety, and get it client encounters [1].

Machine learning may be a method that mimics intelligence as a part of homo sapiens. It helps in an exceedingly heap of the way like doing analysis, designing, and call making. In machine learning, there are several hidden tracks that are useful in doing many tasks. Here in each track, they are a group of neurons that will mimic the homo sapiens brain [2–4]. These characteristics of machine learning are making the output more accurate. Machine learning will help us to improve our output in the best ways. Even though it takes more time data for processing the out is accurate when compared to other models. for every track, we will perform some functions which will give activations [5, 6].

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Long short-term memory (LSTM) is an fake repetitive neural organize (RNN) design utilized within the field of machine learning. It was proposed in 1997 by Sepp Hochreitr and Jurgen schmidhuber. Not at all like standard feed-forward neural systems, LSTM has criticism associations. It can handle not as it were single information focuses (such as pictures) but too whole arrangements of information (such as discourse or video) [7]. A common LSTM unit is composed of a cell, an input entryway, an yield door, and a disregard entryway. The cell recollects values over subjective time interims, and three doors direct the stream of data into and out of the cell. LSTM is well-suited to classify, handle, and anticipate the time arrangement given of obscure duration. The LSTM primarily comprises 3 gates: i)Input gate (ii)Yield gate(iii)Disregard gate [8].

Credulous Bayes classification works on Baye's hypothesis. Basically naïve bayes classification calculation tends to be a standard arrangement for assumption examination task. The fundamental thought of this bayes is to calculate the probabilities of classes relegated to writings by utilizing Joint probabilities of words and classes. Navie Baye's Classification can be utilized for restricted measure Preparing information to appraise vital parameters and are very productive to actualize. Based on over-simplified suspicions of conditional likelihood and shape of the information dissemination. There are four models in NBC, Here we utilized Gaussian NB for assumption investigation which works highlights are spoken to with frequency. Y=argmaxyp(y)(pi)n=1np(xi/y) Here arg implies returns the most elevated likelihood of taken features. Calculated relapse could be a factual show that in its fundamental frame employments a calculated work to demonstrate a double subordinate variable, in spite of the fact that numerous more complex expansions exist. In relapse examination, calculated relapse or log it relapse is evaluating the parameters of a calculated show a shape of double regression [9]. Since the speculation work for logistic regression is sigmoid in nature consequently [10], The Primary important step is finding the slope of the sigmoid work. Ready to see from the induction underneath that angle of the sigmoid work takes after a certain pattern.

Machine learning may be a method that mimics intelligence as a part of homo sapiens. It helps in an exceedingly heap of the way like doing analysis, designing, and call making. In machine learning, there are several hidden tracks that are useful in doing many tasks. Here in each track, they are a group of neurons that will mimic the homo sapiens brain. These characteristics of machine learning are making the output more accurate. machine learning will help us to improve our output in the best ways. Even though it takes more time data for processing the out is accurate when compared to other models. for every track, we will perform some functions which will give activations, it is just like the process work of homo sapiens. An LSTM could be a long short term memory which can take the entire input at once and process it in like manner to the likelihood work. An LSTM is the progressed form of the repeat neural arrange which is within the field of machine learning. This demonstrate was proposed by S. Hochriter and J. schmidhuber in year 1978. Not at all like the fake neural systems (ANN) it takes after nourish forward arrange where as in LSTM it has criticism association in each and each cell. At a time LSTM will prepare a single unit of information as well as bulk data.

The applications of Long brief term memory is finding and extricating designs in information discourse or voice recognition in it. In for the most part an LSTM may be a composition of a cell input entryway, disregard door and yield door into it. And these three entryways will direct a stream of input and yield information from one put to another in specific interim of time and anticipate and extricate design in specific interim

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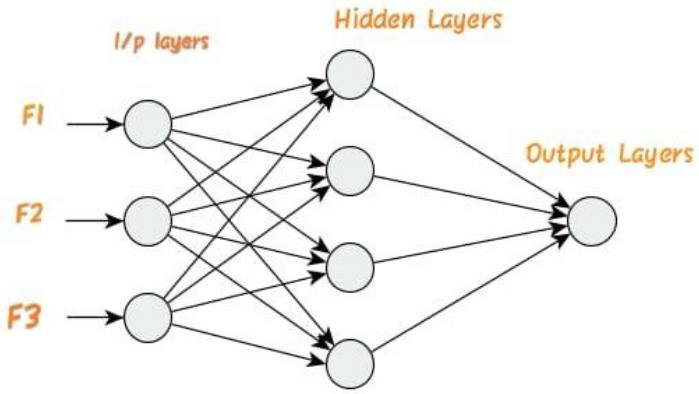

Figure 1. Neural Network Architecture

of time.Input gate: An input door could be a entryway which it'll take input and alter the input within the memory unit of cell. In this respect a sigmoid work will choose the esteem of input in or 1.A tanh esteem will dole out a weights to each and each cell and adjust esteem from -1 to 1. Forget gate: A disregard entryway could be a door which a sigmoid work will choose the esteem and get the subtle elements of the occupied from square it takes the past state and execute the another state based on past state (xt-1) and streams the yield to each cell agreeing to it. Fgt=∑(Wf.[hnt-1,xt]+bf). Output gate: An Yield entryway could be a entryway where the esteem in memory unit will choose the yield of whole piece. A sigmod work will decide that which esteem to stream within the square a tanh esteem will choose esteem of the square climate or 1 in it. In this way the the esteem of the yield will depend upon the these two handle and this handle rehashes until will get way better precision. Opt=∑(Wo.[hnt-1,xt]+bo) Hnt=opt*tanh(cnt).

Credulous Bayes classification works on Baye's hypothesis. Primarily naïve bayes classification calculation tends to be a pattern arrangement for assumption investigation task. The essential thought of this bayes is to calculate the probabilities of classes alloted to writings by utilizing Joint probabilities of words and classes. Navie Baye's Classification can be utilized for constrained estimate Preparing information to assess essential parameters and are very productive to execute. Based on over-simplified suspicions of conditional likelihood and shape of the information conveyance. There are four models in NBC, Here we utilized Gaussian NB for opinion investigation which works highlights are spoken to with frequency. This generally classified and utilized in content classification have higher victory rate to differ to the programs. Bayes Theorem $P(m/hj) = p(hj/m)p(m)p(hj)Y = argmaxyp(y)(pi)n = 1np(xi/y)$.

Calculated relapse could be a factual demonstrate that in its essential frame employments a calculated work to demonstrate a double subordinate variable, in spite of the fact that numerous more bigger expansions there. In relapse examination, calculate relapse or logit relapsing is getting the argument of a calculated show a frame of 2 side. Since the theory work for logistic regression is sigmoid in nature subsequently, The Primary important step is finding the slope of the sigmoid work. We will see from the induction underneath that slope of the sigmoid work takes after a certain design [11].

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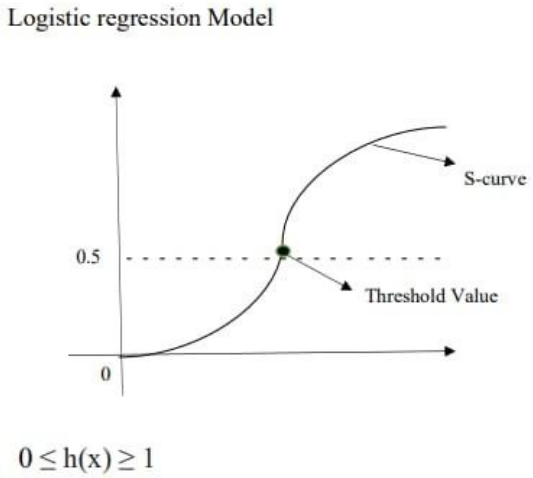

Figure 2. Logistic Regression Model

2. Methodology

Based on the data available in dataset is consists of three fields namely ID, Text, Sentiment. Opinion Investigation is the method of deciding whether a chunk of composing is positive, negative or impartial. Assumption investigation makes a difference information examiners inside expansive ventures gage open conclusion, conduct nuanced advertise investigate, screen brand and item notoriety, and get it client encounters. Based on this data available in dataset we made an analysis on the data by implementing four different types of algorithms. The four algorithms are: Deep learning [12], LSTM using RNN, Navie Bayes, Logistic Regression With the help of all these algorithms we made analysis on the data finally find the accuracy of each model.

Algorithm 1 Implementation of sentiment analysis using Artificial Neural Networks

1: import nlk, numpy, pandas, keras packages and load the dataset.
2: After importing, clean the tweets and remove the stop words from the tweets.
3: Do the text processing on tweets.
4: Convert the words into vectors using tokenizers.
5: Derive the dataset into training and test datasets.
6: Apply the sequential model as a base model with 64 neurons in hidden layers.
7: In order to remove the overfitting from the model, implement reduced, regularized and dropout model.
8: Find and accuracy and loss function for each model.

Implementation of sentiment analysis [13–15] using Naïve Bayes and Lexicons is as follows Load the covid-19 dataset into idle and Remove all outliers and noise of data to make convenient for analysis. In the second phase convert the target classes to positive to negative with help of lexicons and Divide the data into train and test data for making analysis. In the third phase Create the model for the naïve bayes for training the dataset

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Algorithm 2 Implementation of sentiment analysis using LSTM

1: First we have to install all predefined libraries in Io
2: For Implementing LSTM we have to import a KERAS package in it we have to implement a Tensor flow in backend.
3: Then we have to load the dataset into it for preprocessing data.
4: Remove an unwanted noise, outliers in the data in order to make data fit for the analysis.
5: Then create basic LSTM model to fit the data in it.
6: Split the data into train and test with 70% and 30% .
7: Create model of LSTM and evaluate model.
8: Predict outcome of result by using LSTM model.
9: Run for each and every approach of model. For getting trained to model.
10: Display accuracy of the model

and Fit the train data to module. Finally Predict the target variables (attributes in dataset) and Find the accuracy of module and display result. Implementation of sentiment analysis using Logistic regression Load the covid 19 dataset into python idle. Remove all outliers and noise of data in order to make convenient for analysis. Divide the data into train and test data for making analysis.

- Fit the train data to module.
- Create the model for the logistic regression for training purpose.
- Predict the target variables with set of all independent variables i.e., attributes in dataset

3. Results and Discussion

```
print(classification_report(predictions,y_test))
```

	precision	recall	f1-score	support
anger	0.54	0.68	0.61	145
fear	0.65	0.58	0.61	158
joy	0.82	0.67	0.74	192
sad	0.72	0.77	0.74	177
micro avg	0.68	0.68	0.68	672
macro avg	0.68	0.68	0.67	672
weighted avg	0.69	0.68	0.68	672

```
accuracy = lr.score(X_test,y_test)
print(accuracy*100,'%')
```

```
67.85714285714286 %
```

Figure 3. Accuracy of regularized model

The main applications of the sentiment analysis is the sentiment analysis mainly focus on voice of the customer which means the what sentiment analysis will do is the data

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collected from datasets, forums, surveys and social media platforms it will load the data and made analysis on particular data and recognize some pattern in data made easily to do analysis.

```
reg_results = test_model(reg_model, 5)
print('/n')
print('Test accuracy of regularized model: {0:.2f}%'.format(reg_results[1]*
100))
```

```
10/10 [==============================] - 0s 2ms/step - loss: 0.9854 - ac
curacy: 0.7411
/n
Test accuracy of regularized model: 74.11%
```

Figure 4. Accuracy of LSTM

```
In [15]: y_pred=clf.predict(X_test)

In [16]: print("Accuracy:",getAccuracy(y_test, y_pred))
```

```
Accuracy: 0.9
```

Figure 5. Accuracy of Navie Bayes and Lexicons

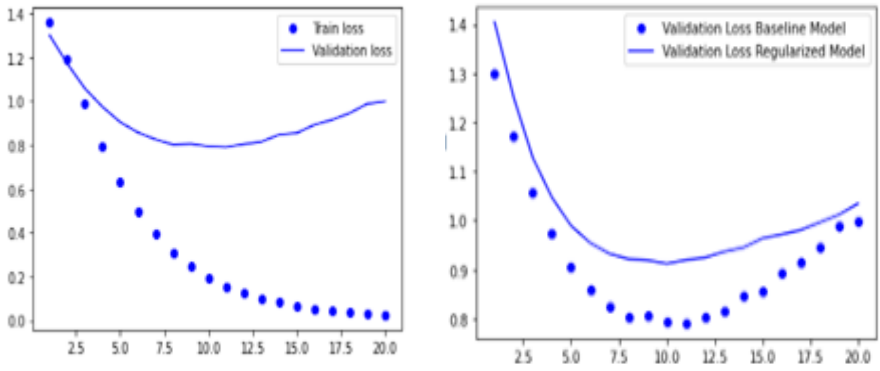

Figure 6. Loss functions of Regular model

In the field of business if a product is launched in market then business people will do survey on particular product based on voice of customer. With the help of sentiment analysis they can easily find or extract patterns into it. So then can made decisions easily. Recently we heard about covid-19 pandemic due to this so many people in the world reacted on this situation positively, negatively, and neutral and these data is taken from social media platform and made analysis on data so it is easy to take decision to the government to control pandemic based on voice of customer. There also many applications on sentiment analysis such as in medical, customer support, product analysis etc.

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4. Conclusion

We conclude that implementation of sentiment analysis using lstm is better model when compared with other algorithms, even though we got 90% accuracy on implementing Navie bayes, for some cases the algorithm fails. Therefore using LSTM will give us better result.

References

[1] Wan X. A comparative study of cross-lingual sentiment classification. In 2012 IEEE/WIC/ACM International Conferences on Web Intelligence and Intelligent Agent Technology 2012 Dec 4 (Vol. 1, pp. 24-31). IEEE.

[2] Meng X, Wei F, Liu X, Zhou M, Xu G, Wang H. Cross-lingual mixture model for sentiment classification. In Proceedings of the 50th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers) 2012 Jul (pp. 572-581).

[3] Shin W, Vaezi M, Lee B, Love DJ, Lee J, Poor HV. Non-orthogonal multiple access in multi-cell networks: Theory, performance, and practical challenges. IEEE Communications Magazine. 2017 Aug 15;55(10):176-83.

[4] Shin W, Cherish MJ, Destitute. Non-orthogonal numerous get to in multi-cell systems: Hypothesis, execution, and down to earth challenges. IEEE Commun. Mag. 2017;55(10):176-83.

[5] Xu X. Machine learning-based prediction of urban soil environment and corpus translation teaching. Arabian Journal of Geosciences. 2021 Jun;14(11):1-5.

[6] Fan R, Jiang H. Optimal multi-channel agreeable detecting in cognitive radio networks. IEEE Trans. Remote Commun. 2010;9(3):1128–38.

[7] Sadhana SA, SaiRamesh L, Sabena S, Ganapathy S, Kannan A. Mining target opinions from online reviews using semi-supervised word alignment model. In 2017 Second International Conference on Recent Trends and Challenges in Computational Models (ICRTCCM) 2017 Feb 3 (pp. 196-200). IEEE.

[8] Pang B, Lee L. A sentimental education: Sentiment analysis using subjectivity summarization based on minimum cuts. arXiv preprint cs/0409058. 2004 Sep 29.

[9] Sulthana AR, Jaithunbi AK, Ramesh LS. Sentiment analysis in twitter data using data analytic techniques for predictive modelling. InJournal of Physics: Conference Series 2018 Apr 1 (Vol. 1000, No. 1, p. 012130). IOP Publishing.

[10] Mitola J. Cognitive radio for adaptable portable mixed media communications. Versatile Netw. Appl. 2001;6(5):435-41.

[11] Liu Y, Qin Z, Elkashlan M, Hanzo. Non-orthogonal multiple access (NOMA) with successive interference cancellation for future radio access. IEICE Trans. Commun. 2009;3(6):1016-23.

[12] Socher R, Perelygin A, Wu J, Chuang J, Manning CD, Ng AY, Potts C. Recursive deep models for semantic compositionality over a sentiment treebank. InProceedings of the 2013 conference on empirical methods in natural language processing 2013 Oct (pp. 1631-1642).

[13] Pan SJ, Ni X, Sun JT, Yang Q, Chen Z. Cross-domain sentiment classification via spectral feature alignment. In Proceedings of the 19th international conference on World wide web 2010 Apr 26 (pp. 751-760).

[14] Bollegala D, Weir D, Carroll J. Cross-domain sentiment classification using a sentiment sensitive thesaurus. IEEE transactions on knowledge and data engineering. 2012 May 22;25(8):1719-31.

[15] Peddinti VM, Chintalapoodi P. Domain adaptation in sentiment analysis of twitter. InWorkshops at the Twenty-Fifth AAAI Conference on Artificial Intelligence 2011 Aug 24.

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Maize Grain Quality Classification Using Convolutional Neural Network

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Abstract. The major goal of our research would be to classify the quality of maize grain after obtaining the crop output. Grains have been the most important grain for farmers to boost their farming revenue in a country. One of the most significant food crops is wheat grain. The majority of the country's grain is used for animal feed, human consumption, and the creation of industrial products. The amount of mechanization used to assess grain quality is modest, and the majority of the job is done by hand. Every day, different prices are introduced in various marketplaces, and farmers face losses every year quality of service estimate and market rates. With our classification we can give accurate progress on the seed which will help farmer's to sell with better price along with that this assumption can idealize him to give good nutritious fertilizer to the crop.

Keywords. Convolutional Neural Networks (CNN), Deep Learning, VGG-16, VGG-19 Architectures.

1. Introduction

Agriculture will be incredibly efficient if it is combined with high-quality produce and competitive platforms where the produce is valued at the highest level. Grains [1] are the most important crop for farmers to grow in order to boost their agricultural revenue. One of the really important cereal crops is maize grain [2]. It is one of the most adaptable growing harvests, allowing it to thrive in a variety of agricultural production situations. The mechanization level of maize crop assessment [3] is tough, and the majority of the job is done by hand. The majority of maize is utilised for livestock feed, public consumption, and a variety of industrial goods. Mechanical goods have advanced rapidly in recent decades [4].

The method of wheat crop guide association is modest, has limited repeatability, and has a degree of sensitivity that is difficult to assess, both in terms of commercial enterprise and technological consequences. Visual inspection of grain seed is tedious and time-eating process, this can motive problems which include eyesight, intellectual state, paintings stress etc. In diverse markets distinctive fees [5] are introducing for each day, with the exceptional assumption and with the marketplace fees farmers are going through losses each year. These responsibilities require automation and create imaging frame-

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works that may be beneficial to differentiate maize grain. These troubles may be decreased with the adoption of latest superior technologies withinside the subject of Computer Science which makes our lives less complicated and solves complicated problems. These upgrades boom the performance and decreases human intervention. The field of image analysis in machine learning has also expanded and demonstrated its benefits in resolving a wide range of issues related to agriculture.

Transfer learning [6] is one method which makes use of the preceding information of a few different projects and attempts to resolve a awesome project with an alternate in primary intuition. This painting illustrates and compares diverse neural net-paintings architectures which offers the first-class outcomes in classifying maize corn classes.

2. Related Works

Cereals are one of the most important agricultural products that go into making a wide range of cuisines. The evaluation of wheat yield is determined by a variety of factors, including aspect, texture, brightness, aroma, taste, water temperature, infection, pollutant presence, and so on. Several types of grains are considered impurities: crushed grains, which account for less than half of the total grains; crushed grains, account for half of the total grains. Small, wrinkled, and green grains; sprouted grains, grains with moldy germs, ranging from dark deep violet; Fusarium infects wheat. Non-grain contaminants include: damaged grains, corn grains on the cob, parts of leaves and stems, pebbles, dirt, sand, obscene grains, and harmful elements.

Numerous comes about have been distributed, in which color characteristics examination was utilized to survey a few specific quality highlights. To determine the hue or tone group mixture that offered the most notable categorization correctness in evaluating the real-ness of wheat flour, the textural properties of individual bits were extracted from various colors and color band combinations of images. hue descriptors interpretation was utilized too to survey course [7], diseases [8], germi-nation [9], weed distinguishing proof [10], etc.Also the system designed by [11] offered higher accuracy based on optimiztion in real time. It used Fast R-CNN which adapts to complex and rapid flying environment changes.

Evaluation of the grain test immaculateness was performed by profile examination of corn parts utilizing 1-D computerized signals based on its double pictures [12], by simulating the geometry using a set of physiological highlights [13] and by shape curvature examination [14]. Computer vision strategies were too utilized for assurance of distinctive wounds: corn part mechanical harm and form harm [15], entire and broken bit identification [16], etc.

Diverse approaches were utilized for this reason. A few successful comes about were gotten utilizing classification based on multi-layer neural systems (NN) [17]. In [18], the recognition rate of 9 artificial neural architectures was tested to categorize 5 different types of wheat flour. When interpreting a comparative assignment, [19] showed a difference between a four-layer backpropagation neural network and a pseudo factual predictor. The results show that the neural net predictor outperformed the non-parametric classifier in almost every categorization situation.

The fineness of wheat test components was analyzed using neural systems in conjunction with hue, contour, and size of the items. They are often used to examine the

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lesson, virtue, various mechanical damages, germination, contaminations, and weed seed detection, among other things.

3. Analysis of Maize Grain

3.1. Theoretical Analysis

Image popularity is the method of classifying the photograph primarily based totally at the data. Image popularity is used to carry out a massive range of machine-primarily based totally tasks, like content material of photos labelling with meta- tags, appearing photograph search, guiding the cus-tomers, even in a few instances self-riding vehicle and coincidence fending off structures etc., whilst human brains apprehend gadgets with ease, computer systems have issue with the task. Software for photograph popularity calls for deep mastering techniques.

Performance is likewise excellent with the use of of convolution neural network. For our device maize grading, we're the use of convolution neural networks for grading maize grains. Wheat seems to be the most agricultural commodity for villagers to increase overall agricultural revenue. Wheat grain is among the most abundant cereal crops. This are among the most adaptable developing yields, allowing it to thrive in a variety of different agricultural situations.

The robotic stage rating [9,10] of maize grains is difficult, and the majority of the work is done manually. The majority of the maize harvest is utilized for livestock feed, public consumption, and a variety of commercial items. Machine tools have advanced fast in recent years. The process of guide association of wheat flour is mild, has low repeatability, and has a stage of subjectivity difficult to assess, each in its commercial enterprise in addition to scientific ramifications.

Microscopic inspection of wheat crop [12,13] is a tedious and time-eating process, this will reason troubles which include eyesight, intellectual state, paintings strain etc. In diverse markets unique costs are introducing for each day, with the fine assumption and with the marketplace costs farmers are dealing with losses each year. These duties require au-tomation [14,15] and create 17 imaging frame-works that may be beneficial to differentiate maize grain. These troubles may be decreased with the adoption of latest superior technology withinside the discipline of Computer Science which makes our lives less complicated and solves complicated troubles.

3.2. Statistical Analysis

Data evaluation and facts are extraordinarily im-portant to many fields. In fact, facts and statistics evaluation are important for undertaking inner audits and overall performance reviews. In many industries like marketing, research, monetary offerings and medical or medical research, facts and statistics 6 analysis are important. This is authentic due to the inherent strength of facts withinside the reading of statistics.

Statistics also can be vital to attain extremely vital boom and performance objectives. Because it's so vital for corporations to apply information to result in significant outcomes, interpretations and enterprise decisions, the significance of information can't be overstated. Statistical Analysis assist can play a pivotal position in any task regarding

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information as Statistical Analysis Help produces excessive exceptional outcomes irrespective of the sphere or concern matter. We gathered this data from Agricultural Department. The count value in various markets are different due to various reasons like types of crop, irrigation, transportation and the irrigation.

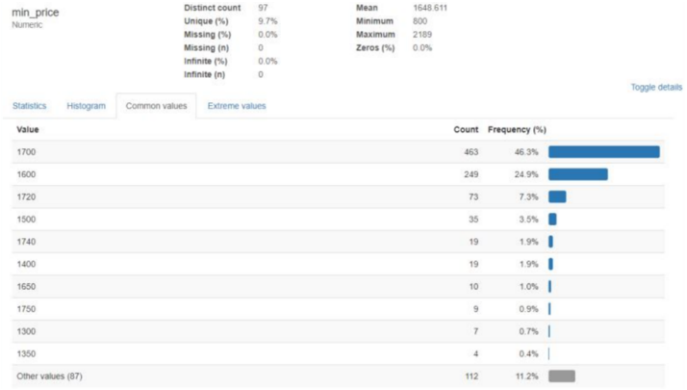

Figure 1. Word Frequency Count

From the above table it clarifies that where the count value is high the frequency of the crop is also high. In these markets overall all crops in India is traded but maize is traded more. There are 8 markets in which 2 markets are not good with maize crop, the count values of other markets are raises in between 103 – 210. This area has high yield growth, with this marketing frequency is also high. Various types of crops are marketing in different markets.

Unique crop marketing is compared less which approximately 0.8 Above data is representing the prices all over the nation. The prices in various markets are similar/different. The estimation of price is from 800 – 1700 based on the yield of the crop and the availability of crop in that area. If the demand is high and the stock is less then automatically prices go up. The overall mean average price of the crop in our country is 1648.611 and the maximum it reaches is 2189.

4. Methodology

4.1. Data Description

The collection contains wheat grain images gathered from the Andhra Pradesh Agriculture Department in India. Throughout the data collection, wheat grain pictures were categorised into five categories depending on their excellence. Excellent, Good, Average, Bad, and Worst are among the directions. The dataset includes 2500 pictures wherein every class includes 500 pictures resembles a balanced dataset. The below image depicts the different categories of the maize corn grains.

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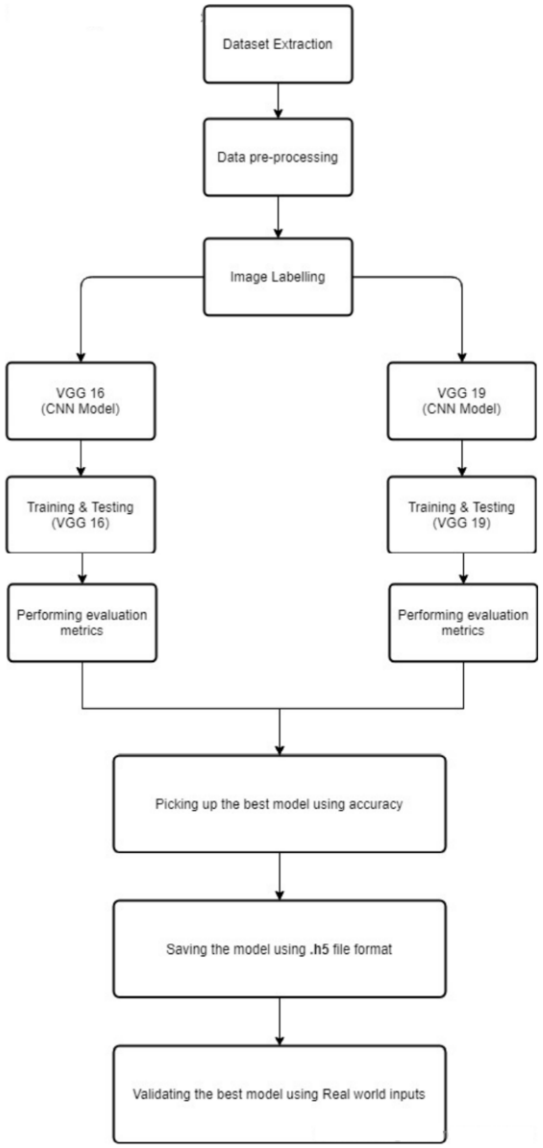

Figure 2. Proposed Methodology

4.2. Data Pre-Processing

In actual global it's far very tough to put together exceptional photo facts for education a neural network. The preliminary stage requires a lot of hard to make the difference in producing improved result. The pics in our dataset are of very large proportions. As a result, all of the photos have been downsized to 256x256 pixels. The 10 photos are down sampled and adjusted, making them easier for the neural net to understand. Gen-

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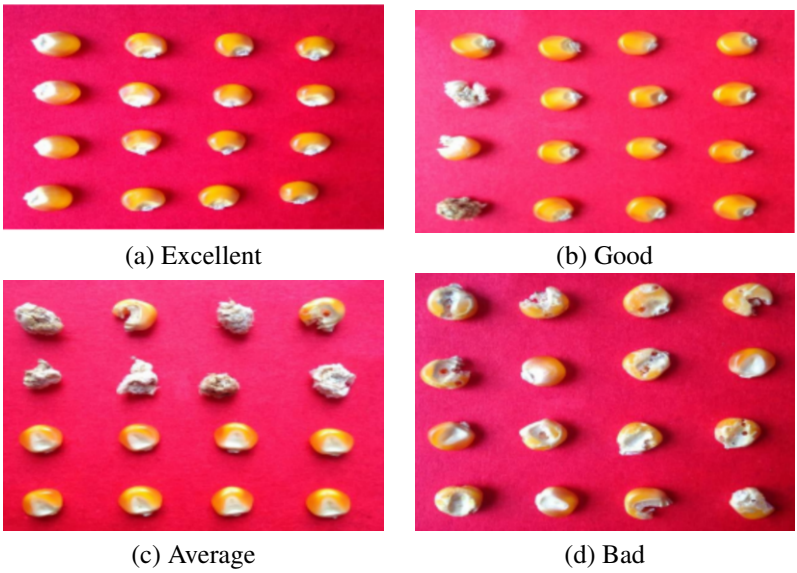
erally, Deep Learning Models calls for large quantity of facts to per-shape well. Since the dataset includes much less quantity of facts, we implemented photo augmentation approach. As a consequence of this approach's software, photos are synthetized using various techniques, demonstrated that using this approach also prevents the version from over becoming, which in turn adjusts the error value at each cycle. The image data is



(a) Excellent (b) Good

(c) Average (d) Bad

Figure 3. Different types of Maize Grain Quality

sent to multiple neural network designs, including VGG-16, VGG-19, InceptionV3, and Resnet50, after the preliminary stage. The utility of switch gaining knowledge of strategies in those neu ral networks architectures makes using weights of every layer which might be skilled on Image internet Dataset includes one thousand classes. We removed the bottom layer weights and re-trained on other architectures because the instinct of the problem is distinct. Categorical move entropy is the loss function used in neural network community, while Stochastic Gradient Descent is the optimizer (SGD). We ran the data collection through various designs using the measure of specified detection rate as the measure.

4.3. Convolutional Neural Network (CNN)

Convolutional Neural Networks are very just like regular Neural Networks they're created from neurons which have learnable hundreds and inclinations. Each neuron gets a few inputs, plays a dot product and optionally follows it with a non-linearity The complete community nonetheless expresses a single differentiable rating function: from the uncooked photograph pixels on one quit to elegance ratings on the other. And they nonetheless have a loss function (e.g. SVM/SoftMax) at the last (absolutely connected) layer and all of the tips/hints we advanced for getting to know every day Neural Networks nonetheless apply. .ConvNet architectures make the specific assumption that the inputs are images, which lets in us to encode positive houses into the architecture. These

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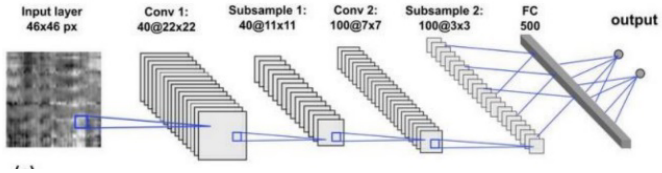

Figure 4. Convolution Network Architecture

then make the ahead characteristic extra efficient to put into effect and massively lessen the wide variety of parameters withinside the network.

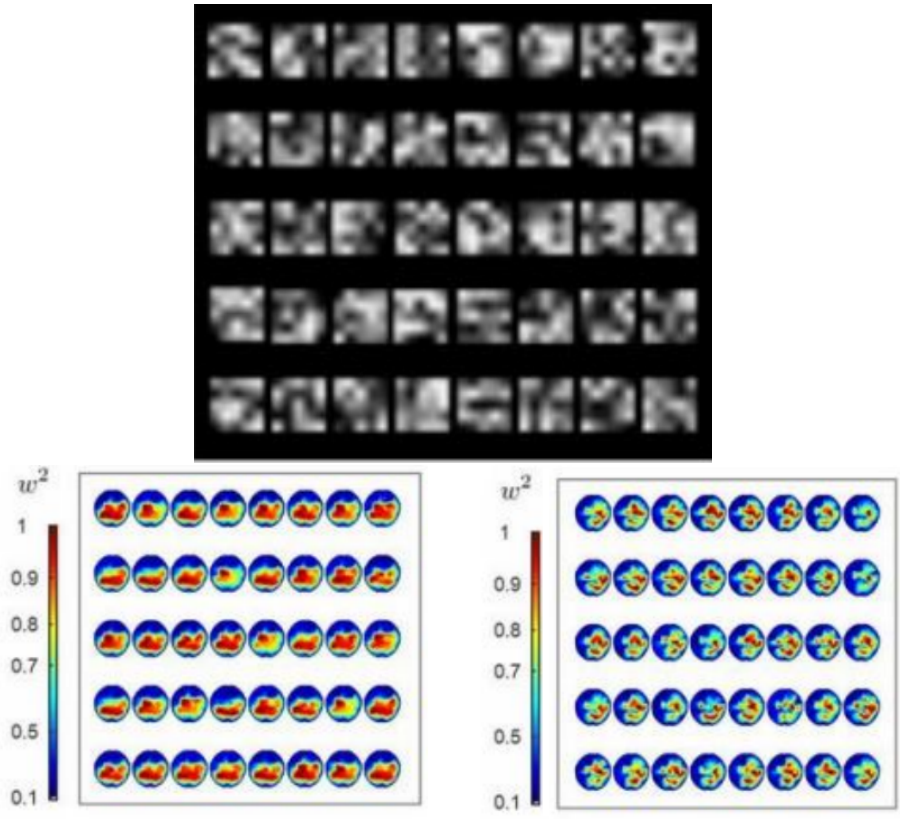

Figure 5. Implementation Result

4.3.1. VGG-16 CNN Model

VGG16 is a convolutional neural net (CNN) architecture that was utilized to win the 2014 ILSVR(ImageNet) competition. It is regarded amongst the most inventive and foresightful version structures ever created. The most distinctive feature of VGG16 is that, rather than obtaining a large number of hyper-parameters, they focused on creating 26 levels of 3x3 clear out with a step 1 and al-approaches employed similar padding as well as a max-pool level of 2x2 clear out of step 2. For the lifespan of the structure, it

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maintains this relationship between convolution and max pool levels. In the cease it has 2 FC (completely linked layers) observed through a soft-max for results. The sixteen in VGG16 alludes to the fact that it has 16- weighted levels. This community is a pretty massive community and it has approximately 138 million (approx.) parameters.

4.3.2. VGG-19 CNN Model

In this research, we look at the impact of the convolutional community intensity on its accuracy withinside the large-scale photo popularity setting. Our most important contribution is a radical assessment of networks of growing intensity the use of an structure with very small (3x3) convolution filters, which suggests that a vast development at the prior-artwork configu-rations may be executed with the aid of using pushing the intensity to 16-19 weight layers. These findings have been the idea of our ImageNet Challenge 2014 submission, wherein our crew secured the primary and the second one locations withinside the localization and category tracks respectively. We additionally display that our representations generalize nicely to different datasets, wherein they reap state-of-the artwork results. We have made our best-acting ConvNet fashions publicly to be had to facilitate similarly studies on using deep visible representations in pc vision.

5. Results and Analysis

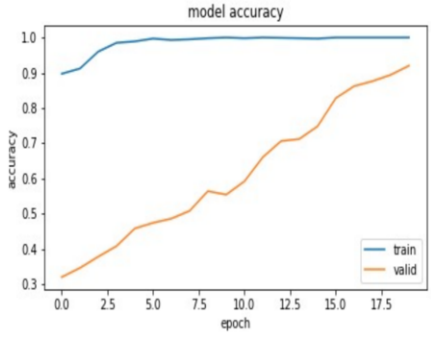

Figure 6. Model Accuracy of VGG-16

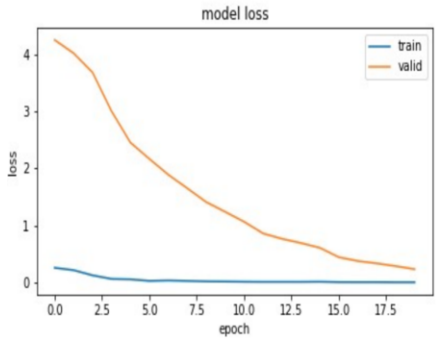

Figure 7. Model Loss of VGG-16

The above desk suggests the explicit accuracies of VGG16 VGG-19 architectures. It may be inferred from the desk that VGG-sixteen structure offers the fine overall performance in comparison to VGG-19 structure in grading the maize classification. So, the adoption of VGG-sixteen structure with the assist of switch gaining knowledge of method offers the fine results.

Table 1. Average Accuracy and Loss Values of VGG-16 and VGG-19

Model	Accuracy (%)	Loss (%)
VGG-16	92	08
VGG-19	90	10

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References

[1] OuYang AG, Gao RJ, Sun XD, Pan YY, Dong XL. An automatic method for identifying different variety of rice seeds using machine vision technology. In 2010 Sixth International Conference on Natural Computation 2010 Aug 10 (Vol. 1, pp. 84-88). IEEE.

[2] Parmar RR, Jain KR, Modi CK. Image morphological operation based quality analysis of coriander seed (Coriandrum satavum L). In 2011 International Conference on Emerging Trends in Networks and Computer Communications (ETNCC) 2011 Apr 22 (pp. 482-486). IEEE.

[3] Xun Y, Zhang J, Li W, Cai W. Automatic system of seeds refined grading based on machine vision. In 2006 6th World Congress on Intelligent Control and Automation 2006 Jun 21 (Vol. 2, pp. 9686-9689). IEEE.

[4] Yuanyuan Z, Jilong Z, Lingshen F. Research on quality evaluation of maize seed shape based on support vector machine. In 2016 2nd IEEE International Conference on Computer and Communications (ICCC) 2016 Oct 14 (pp. 695-699). IEEE.

[5] Yi X, Eramian M, Wang R, Neufeld E. Identification of morphologically similar seeds using multi-kernel learning. In 2014 Canadian Conference on Computer and Robot Vision 2014 May 6 (pp. 143-150). IEEE.

[6] Khunkhett S, Remsungnen T. Non-destructive identification of pure breeding rice seed using digital image analysis. In 4th Joint International Conference on Information and Communication Technology, Electronic and Electrical Engineering (JICTEE) 2014 Mar 5 (pp. 1-4). IEEE.

[7] Khoenkaw P. An image-processing based algorithm for rice seed germination rate evaluation. In 2016 International Computer Science and Engineering Conference (ICSEC) 2016 Dec 14 (pp. 1-5). IEEE.

[8] Hashim H, Osman FN, Al Junid SA, Haron MA, Salleh HM. An intelligent classification model for rubber seed clones based on shape features through imaging techniques. In 2010 International Conference on Intelligent Systems, Modelling and Simulation 2010 Jan 27 (pp. 25-31). IEEE.

[9] Han SH, Lee KY. Implemetation of image classification CNN using multi thread GPU. In 2017 International SoC Design Conference (ISOCC) 2017 Nov 5 (pp. 296-297). IEEE.

[10] Paliwal J, Visen NS, Jayas DS. Evaluation of neural network architectures for cereal grain classification using morphological features. Journal of agricultural engineering research. 2001;79(4):361-70.

[11] Yang R. UAV landmark detection on fast region-based CNN. Arabian Journal of Geosciences. 2021 Jun;14(12):1-9.

[12] Paliwal J, Visen NS, Jayas DS, White ND. Cereal grain and dockage identification using machine vision. Biosystems engineering. 2003 May 1;85(1):51-7.

[13] Aitkenhead MJ, Dalgetty IA, Mullins CE, McDonald AJ, Strachan NJ. Weed and crop discrimination using image analysis and artificial intelligence methods. Computers and electronics in Agriculture. 2003 Aug 1;39(3):157-71.

[14] Mladenov M, Dejanov M. Application of neural networks for seed germination assessment. In Proceedings of the 9th WSEAS international conference on Neural Networks CNN 2008 May 2 (Vol. 8, pp. 67-72).

[15] Mladenov M, Penchev S, Dejanov M, Mustafa M. Quality assessment of grain samples using color image analysis. choice. 2011 Feb 16;1(3):37-44.

[16] Majumdar S, Jayas DS. Classification of cereal grains using machine vision: III. Texture models. Transactions of the ASAE. 2000;43(6):1681-7.

[17] Sabena S, Kalaiselvi S, Anusha B, Ramesh LS. An Multi-Label Classification with Label Correlation. Asian Journal of Research in Social Sciences and Humanities. 2016;6(9):373-86.

[18] Sabena S, Sai Ramesh L, Selva Kumar K. Multiple Cancer's Prediction using Hybrid Naïve Baye's Classifier. Asian Journal of Research in Social Sciences and Humanities. 2016;6(6):1770-82.

[19] Mittal A, Soorya A, Nagrath P, Hemanth DJ. Data augmentation based morphological classification of galaxies using deep convolutional neural network. Earth Science Informatics. 2019 Dec 9;13:1-7.

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Finding State of Mind Through Emotion and Sentiment Analysis of the Twitter Text

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Abstract. In this paper, the main aim of the project is to identify and do analysis of sentiment and emotion of the person and through the analysis find the state of the mind of the person. After finding the state of the mind of the person we can help people through NGO. We know that now top people are using social media twitter, and that place people are posting their thoughts and feelings. In this paper, our job is to do a twitter text analysis and make recommendations based on human emotions and also find state of mind of the person. Here we collect a tweet from the tweeter and their posts and make an analysis of this post. Emotional analysis is the study area for analyzing people's reviews, emotions, attitudes, and feelings from a tweeter in a written language. Emotional analysis has applications such as data collection and analysis of that data. However, the large volume and unstructured nature of text or data poses a challenge to properly analyzing data. Similarly, skilled algorithms or computer techniques are needed to mine and reduce tweets and find emotional words. Many of the existing computer systems, models, algorithms in sensory diagnostics from such informal data rely on machine learning techniques on the voice bag process as its basis. Understanding public opinion from a tweeter can help improve future decision-making. Comment mines are a way to get knowledge about online services from tweeter blogs, micro blogs , and social media. Individual opinions vary from person to person, and Twitter tweets are the most important source of this type of data. However, the large volume and unstructured nature of text / ideas data poses a challenge to analyzing the efficient data system. we know that millions of people are posting their reviews and comments on Twitter. By performing a tweeter analysis we will use other data science techniques to make an example, processing, classification of Bayes naive, k means algorithm integration, etc.

Keywords. Emotion Analysis, Sentiment Detection, Term Frequency-Inverse Document Frequency (TF-IDF), Naïve Bayes, Random Forest Classifier, Xgb Classifier.

1. Introduction

Emotion is nothing but a feeling, thoughts of the people, according to that person having their relationship with others. Emotion is a very important characteristic of the human

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which defines the personality and behaviour of a human. Human express emotion [1, 2] in daily life. They use different processes for expressing emotion. Mainly people express emotion by giving a speech or by facial expression. But in upcoming days people are using technology and social networking for expressing their emotions in the form of text or video or in audio. By reading the various research papers we found that many researchers in different fields (computer science, data science) are already focusing on recognizing and analyzing emotion from the text. And different authors applied different methods to assess the true mood of the people which is in the form of text. We know that humans having so many types of emotion sp for detecting the correct emotion from the text, it's too difficult . For example- Happy, Angry, sad, etc . We can represent the emotion in the form of polarity that is positive, negative, and neutral. If any human will say "Today I am very happy", means emotion of the human behind that, he is very happy we can say that sentiment polarity is **positive**. If any human will say "Today I am very sad", means emotion of the human behind that, he is very sad, then we can say that sentiment polarity is **negative**. Now in upcoming days, Twitter data is very popular for sentiment analysis. And we know that in the world maximum people are using Twitter to express their opinion and ideas.

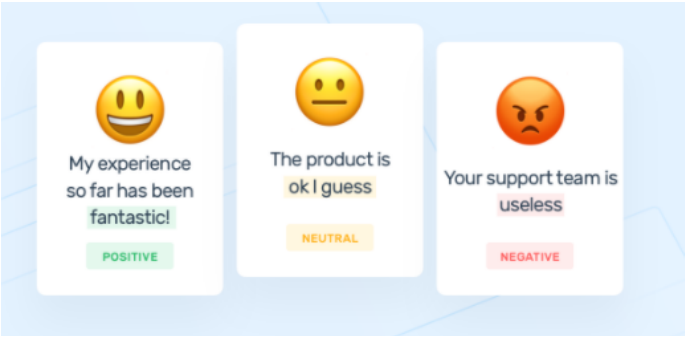

Figure 1. Different type of emoji of sentiment

2. Related Work

Emotions have already been addressed by religious, psychological, and philosophical researchers [1–5] since the beginning of the study fields. In 1872, Darwin attempted to explain the link between emotions and evolution. Following that, cognitive scientists [6] discovered that emotions are a product of other brain system processes. With development technology, emotional analysis was field of information technology research, also [20] performs the soil corpus transfer learning with better results. Because human emotions play such a significant role in human interaction, it was necessary to develop a method for robots to accurately classify emotions. Most methods and techniques for recognizing emotional responses through speech, facial expressions [7], body language [8], writing [9], and other methods of communication are related with current technology. The emotional interpretation of the text will be the emphasis of this study. Emotional discoveries in texts such as chapters, books, music lyrics, theatrical texts, logs, weblogs,

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Facebook postings, twitter posts, and customer reviews were scrutinized for a prolonged period by the computers experts engaged. Investigators cited different sizes of people's feelings in various ways. 'Segmentorical' and 'Dimensional' models are the two types of emotions that exist [10]. Elman's, Shaver's, and Oakley's emotional models divide feelings and emotions into a few major categories. On the other side, state-of-the-art models [11] like Plutchik's model, Circumplex Model, OCC (Ortony, Clore, and Collins) Model, and Loveim's model segregate sentiments in great detail utilising a variety of sizes (e.g. data structures). Lists, trees, wheels, cubes, and other objects are used to create sub-species. Because of the enormous quantity of participants and posts in recent emotional analysis research, support platform [12] postings have been employed for textual emotional analysis. About 2.46 billion individuals use social media sites such as Facebook [13], Twitter [14], Instagram [15], and YouTube, and are members of one or more of them. Discovering and controlling the flow of information on any online community might require locating powerful persons and organizations.

Real-time data analysis [16] is not a one-time thing. Whenever data is not heard we need to do an analysis of why we should not use previous analysis results. It's growing method allows the existing effect to be updated using only new data conditions, without re-processing past events. This can be helpful in situations where all databases are not available if the data changes [17] over time.the paper. Do not number text heads-the template will do that for you.

3. Methodology

In this paper we are using machine learning algorithm for implementation. Following steps are –

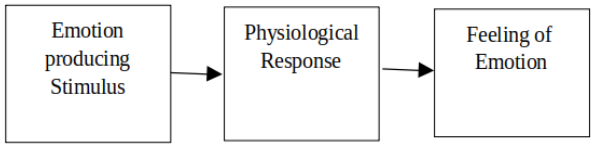

Figure 2. Emotion Calculation Flow

3.1. Data collection

With 330 million members worldwide, Twitter is among the most famous social networking networks today. People express their views on a range of political, governmental, and international issues through their daily lives. People communicate their thoughts in 280 character bursts and occasionally audio/video clips. The comments are known as twitter posts and are open to the general public. Some people have the ability to like, remark on, or modify postings. On Twitter, people may follow just one or even become buddies with each other. Twitter, unlike many other social networking sites, permits single-direction connections [18], which means that one user may follow another without having to re-establish the connection. This is a partnership that resulted in the creation of a communication network.

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The database we utilized for our experiment comprises a collection of tweets, remarks, and replies, as well as their respective users' information. The 'Emotion in Text data set,' 'ISEAR,' 'Amazon Reviews,' 'US airlines data set,' 'EmmoBank,' 'TREC,' and other text databases are used for emotional and emotional analysis. Existing Twitter data sets, on the other hand, could not be used for our research since most of them contain messages or user-to-user communication. We wanted an emotional network [19] based on user content for our research, not on who follows who. We too needed feedback on those tweets and marketers / commenters details. In our emotional network, We required user communication based on their feelings about a certain issue. In our experiments, we've picked a few significant news and difficulties and will gather tweets with various emotions. *Syria keywords, *DonaldTrump, *SchoolShooting, *Christmas2017, *NewYear, *ValentinesDay2018, *Terrorism, *olympicgames2018, *WomensDay, *Oscars2018.

3.2. Data Pre-Processing

The impact of new data science approaches may be seen in the image below. Data analysis is a statistical technique that entails turning original data into an accessible format. Data from the real world is frequently imprecise, inconsistent, and/or deficient in specific behaviors or styles, as well as including numerous mistakes. Fixing data is a tried and true method of resolving such problems.

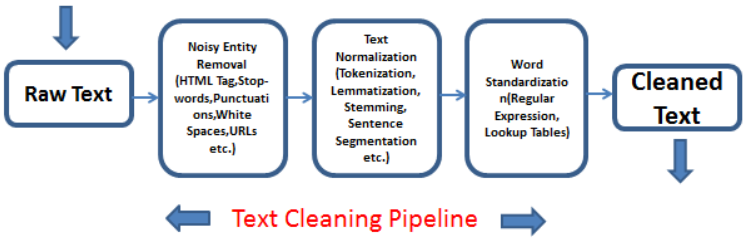

Figure 3. Text Cleaning Pipeline

We can obtain sentence tokenization (splitting text into sentences) as well if we wish to. However, we would have to include a pre-processing pipeline in our "nlp" module for it to be able to distinguish between words and sentences.

- **Decoding data**: In this stage, complex symbols in the twitter are converted in to simple text characters, inspite of encoding techniques like UTF-8.
- **Removal of Stop-words**: Most of the words in the English sentence are prepositions, articles, conjunction (like and, I, the, am, an, we) etc., which does not convey information for emotion detection. The job of the Count Vectorizer is that it removes all stop words present in the twitter text, which is already defined in twitter text.
- **Removal of Punctuations**: Another main difficulty in text processing is the presence of symbols like ".", ",","?". Some are important and needs to be processed and some needs to ignored. In this stage, punctuations are removed.
- **Removal of URLs**: Similarly, the presence of URLs and hyperlinks in tweet data in the form of comments, likes, dislikes, emoticons, reviews plays a major role in automatic understanding of detecting sentiments and emotions.

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3.3. Feature Extraction

In this research, Term Frequency–Inverse Document Frequency (TF-IDF) are employed as feature representation for text analytics. Let's take a quick look at this. Count Vectorizer simply measures the number of times each word appears in the tweet text. First, we tokenize the whole sentence in to words and integerID is assigned. A count is maintained for each the occurrence of each token. Followed by, lower case transformation, punctuation removal, which occurs by setting all the parameter values to default values.

Tf-Idf Vectorizer is a single model that incorporates all of the features of CountVectorizer and Tf-Idf Transformer. Frequency of each word is maintained for each tweets. Further, Normalization is also done to convert in to Normalized feature vector.

3.4. Classification

We provide an outline of the methodologies used to identify sentiment analysis and emotion recognition in tweets in this section. We outline the general process involved in this paper:

Algorithm 1 Pseudo Code of Overall process

Input: Dataset D and Training data T

for each post TW in collection D **do**
    Perform Tweet Tw Extraction process in dataset D
    Cut C is initialized to the top root node Tweet Tw
    Extract the Feature Vector F
    Sub-set Features Fe are extracted from Feature Vector F
for each Sub-Set features E in Dataset D **do**
    Extracted features E are compared to training data T using Naïve Bayes/ Random Forest/ Xgb Classifier model and store result in P
if Polarity P is positive **then**
    Output the Positive Result
else if Polarity p is negative **then**
    Output the Negative Result
else
    Output the Neutral Result

3.4.1. Naïve Bayes Classifier

Naive Bayes may be a basic methodology for performing identification: Mathematical equations that predicts class labels to issue situations, expressed as vectors of feature integers, in which the category name-tags are derived from a fixed number. In many real situations, maximum likelihood is used to estimate parameters for naive Bayes models; in other terms, the naive Bayes model may be used without adopting Bayesian probability or utilizing Bayesian methods. Nave Bayes is a contingent ability to handle that assigns probabilities to the current instance given a drag instance to be categorized, represented by a vector $x = x_1, x_2, ...x_n$ reflecting some n properties (input variables), it assigns to the present instance probabilities. This model is used with a decision rule in the nave Bayes

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classifier. The most prevalent approach is to choose the most likely hypothesis; this is known as the utmost a posteriori or MAP choice rule. A Bayes classifier is the function that assigns the category label for some k as follows:

$$P\left(\frac{C_k}{x}\right) = \frac{P(C_k)P\left(\frac{x}{C_k}\right)}{P_x}$$

$$y = argmaxP_{k=1,2,\ldots k}(C_k)\prod_{i=1}^{n} P\left(\frac{X_i}{C_k}\right)$$

	label	sentiment	text	len
0	3204	sad	agree the poor in india are treated badly thei...	270
1	1431	joy	if only i could have spent the with this cutie...	93
2	654	joy	will nature conservation remain a priority in ...	85
3	2530	sad	coronavirus disappearing in italy show this to...	94
4	2296	sad	uk records lowest daily virus death toll since...	69
5	4624	fear	joe biden's coronavirus web address lands on a...	111
6	2596	sad	respected sir in our telangana all private tea...	263
7	4131	fear	so is also 20 times more lethal than influenza...	63
8	3184	sad	thull is passing the most dangerous and ultra ...	249
9	3175	sad	thull is passing the most dangerous and ultra ...	248

Figure 4. Sentiment dataset

3.4.2. Random Forest Classifier

A random forest is a stochastic predictor that employs averaging to improve predicted accuracy and control overfitting by matching a range of decision tree classifiers on various sub-samples of the dataset. The random forest may be thought of as a classification method made up of numerous decision trees. It employs bagging and randomization in the construction of each individual tree in order to create an uncorrelated forest of trees whose committee forecast is more accurate than that of a single tree. The most important parameters during this are : n_estimators : Number of trees in random forest. Default is 10. criterion: “gini” or “entropy” similar to decision tree classifier. min_samples_split: the least proportion of working sets necessary to divide at each node. The default value is 2.

3.4.3. Xgb Classifier

We’d simply use a normal machine learning model, such as a decision tree, to train a single model on our dataset and utilise it for prediction. We might fiddle with the parameters or add more details, but we’re still working with a single model in the end. Even if we build an ensemble, each classifier is constructed and presented to our data independently. Rather of teaching all of the models separately, boosting teaches them in sequence, with each new model being learnt to rectify the faults made by the preceding ones. Models are added in a logical order until there are no more improvements to make. Gradient Boosting is a method of training new models to forecast the residuals (i.e. mistakes) of previous models.

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4. Results and Analysis

In this experiment we taken emotion and sentiment data set which is available in Kaggle for sentiment analysis. Here we calculate accuracy by using different algorithm. The

Table 1. Comparison Table

Algorithm	Training Accuracy(%)	Validation Accuracy(%)
Decision Tree Classifier	82	78
Naive Bayes Classifier	88	83
Random Forest	95	90
Xgb Classifier	99	96

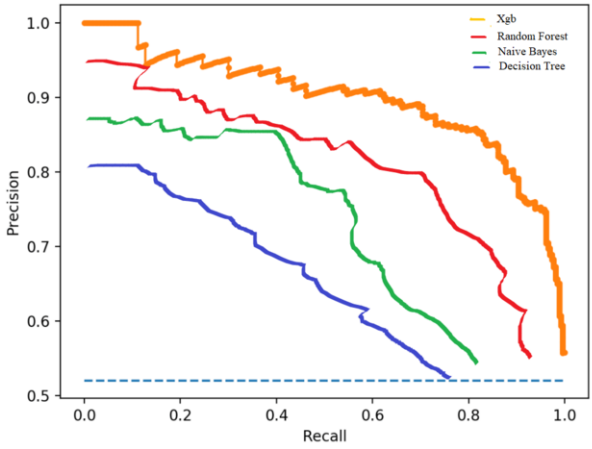

Figure 5. Comparison of Precision-recall curves of Various Classifier.

number of genuine positives separated by the entirety of genuine positives and wrong positives breaks even with accuracy. It shows how well a demonstrate predicts the positive lesson. The positive prescient value is alluded to as precision. Recall is calculated as the proportion of the number of genuine positives separated by the entirety of the genuine positives and the wrong negatives. Recall is the same as sensitivity. A precision-recall bend may be a plot of the exactness (y-axis) and the recall (x-axis) for distinctive limits, much just like the ROC bend. Clearly in Figure 5, Xgb classifier performs well both in cases of training and validation data sets.

5. Conclusion and Future Work

In this research, we performed experiments to detect to identify the state of the mind through Naïve Bayes, Random Forest, Decision Tree and Xgb classifier. At first, we performed data harvesting from different twitter accounts to perform data cleansing. In data cleansing, we removed special punctuations, stop, frequent, rare words. We converted emojis in to words. The specialty is we considered tweet replies , likes and dislikes also in this work. We used TF-IDF for extracting features in the tweets. Implememtation part

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is done in two phases: a) Training and Testing Phase. In learning phase, Different models are implementation with the help of Naive Bayes Classifier, Random Forest, Decision Tree Classifier, Xgb Classifier. During validation phase, the trained model are tested with new data set. After experimental results, we found out that Xgb classifier performs well in detecting state of mind through tweets.

References

[1] Parveen H, Pandey S. Sentiment analysis on Twitter Data-set using Naive Bayes algorithm. In2016 2nd international conference on applied and theoretical computing and communication technology (iCATccT) 2016 Jul 21 (pp. 416-419). IEEE.

[2] Anand J, Sivachandar K. An edge vector and edge map based boundary detection in medical images. International Journal of Innovative Research in Computer and Communication Engineering. 2013 Jun;1(4):191-3.

[3] Garg Y, Chatterjee N. Sentiment analysis of twitter feeds. InInternational Conference on Big Data Analytics 2014 Dec 20 (pp. 33-52). Springer, Cham.

[4] Anand J, Flora TA, Philip AS. Finger-vein based biometric security system. International Journal of Research in Engineering and Technology eISSN. 2013 Dec;2(12):197-200.

[5] Sailunaz K, Alhajj R. Emotion and sentiment analysis from Twitter text. Journal of Computational Science. 2019 Sep 1;36:1-18.

[6] Zucco C, Calabrese B, Agapito G, Guzzi PH, Cannataro M. Sentiment analysis for mining texts and social networks data: Methods and tools. Wiley Online Library, Advanced Review. 2019:1-32.

[7] Patil HP, Atique M. Sentiment analysis for social media: a survey. In2015 2nd International Conference on Information Science and Security (ICISS) 2015 Dec 14 (pp. 1-4). IEEE.

[8] Wongkar M, Angdresey A. Sentiment analysis using Naive Bayes Algorithm of the data crawler: Twitter. In2019 Fourth International Conference on Informatics and Computing (ICIC) 2019 Oct 16 (pp. 1-5). IEEE.

[9] Sibia EV, Mareena G, and Anand J. Content Based Image Retrieval Technique on Texture and Shape Analysis using Wavelet Feature and Clustering Model. International Journal of Enhanced Research in Science Technology & Engineering. 2018;3(8):224-9.

[10] Munezero M, Montero CS, Sutinen E, Pajunen J. Are they different? Affect, feeling, emotion, sentiment, and opinion detection in text. IEEE transactions on affective computing. 2014 Apr 14;5(2):101-11.

[11] Kwak H, Lee C, Park H, Moon S. What is Twitter, a social network or a news media?. InProceedings of the 19th international conference on World wide web 2010 Apr 26 (pp. 591-600).

[12] Riquelme F, González-Cantergiani P. Measuring user influence on Twitter: A survey. Information processing & management. 2016 Sep 1;52(5):949-75.

[13] Kafeza E, Kanavos A, Makris C, Vikatos P. T-PICE: Twitter personality based influential communities extraction system. In2014 IEEE International Congress on Big Data 2014 Jun 27 (pp. 212-219). IEEE.

[14] Francalanci C, Hussain A. Influence-based Twitter browsing with NavigTweet. Information Systems. 2017 Mar 1;64:119-31.

[15] Lahuerta-Otero E, Cordero-Gutiérrez R. Looking for the perfect tweet. The use of data mining techniques to find influencers on twitter. Computers in Human Behavior. 2016 Nov 1;64:575-83.

[16] Joshi S, Deshpande D. Twitter sentiment analysis system. arXiv preprint arXiv:1807.07752. 2018 Jul 20;180:35-9.

[17] Sadhana SA, SaiRamesh L, Sabena S, Ganapathy S, Kannan A. Mining target opinions from online reviews using semi-supervised word alignment model. In2017 Second International Conference on Recent Trends and Challenges in Computational Models (ICRTCCM) 2017 Feb 3 (pp. 196-200). IEEE.

[18] Selvakumar K, Ramesh LS, Kannan A. Enhanced K-means clustering algorithm for evolving user groups. Indian Journal of Science and Technology. 2015 Sep 1;8(24):1-8.

[19] Sulthana AR, Jaithunbi AK, Ramesh LS. Sentiment analysis in twitter data using data analytic techniques for predictive modelling. InJournal of Physics: Conference Series 2018 Apr 1 (Vol. 1000, No. 1, pp. 1-8). IOP Publishing.

[20] Xu X. Machine learning-based prediction of urban soil environment and corpus translation teaching. Arabian Journal of Geosciences. 2021 Jun;14(11):1-5.

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A Novel Dual Encryption Algorithm to Enhance the Security in Image Transmission Using LSB 3-2-2 Technique

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Abstract. Nowaday's providing the security for image is essential for correspondence.Steganography and cryptography are a technical method for the transfer of information to eliminate burglary and stealing of information.. Cryptography steganography hides the occurrence of a mystery message. We need more Secured and confidential images to transfer. Steganography procedure on RGB genuine nature utilizing LSB 3-3-2 technique.On the RED & GREEN line, on the LSB Three-Three-two is a procedure, while on the blue channel, it is just 2 LSB. Messages are not exactly RED and GREEN on BLUE platforms.Double encryption techniques are used, such as Caesar cipher & Vigenere cipher, to preserve the nature of the stegno photos and to increase message safety.Use of steganographic strategies are insufficient to give security to informingit is imperative to join the strategy of cryptography.A combination of Caesar Encryption and Vigenere applies to message until they are inserted in LSB Three-Three-Two methods to provide extra protection. At this pointwe are providing the Caesar code and Vigenere image estimating to enhance security. The target of this is to upgrade the secrecy & security of the image steganography. It will be more efficient becauseusing the two fold layer of security.

Keywords. Stegonography, Caesar, LSB, Vigenere Encryption.

1. Introduction

Today assortment of innovation is progressed, and everybody can without much of a stretch use innovation to help with performing activities. Nonetheless, as the innovation propels, the wrongdoing is additionally expanding the secure data issues, by unapproved parties. Cryptography is connected strategy where these methods are utilized to give information security and secure correspondence [1]. Cryptography gives highlights, for example, secrecy, realness and trustworthiness of information. For instance, classification is accomplished through encryption calculation which blends the private data so it gets muddled to anybody aside from the collector [2–4]. As predetermined by cryptography estimation, for example, RSA can be utilized to change the information into an indistinguishable arrangement. Steganography can't be distinguished by untrustworthy

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gatherings. Steganography requires in any event two properties, to be specific: compartments or spread and messages. steganography is recognized as the grouping of media for instance image, sound, and video; in any case, pictures are used to shroud data. Additionally, the progressions in highly developed images are characteristically unnoticeable to independently. Along these lines, joining the cryptography with steganography is the best arrangement in making sure about a message [5, 6]. Here we use some sample images for steganography. There are primarily two type of images. The first is Rastor Images and a series of pixels or individual blocks are created in order to create a frame. JPEG, GIF, and PNG are both raster extensions to images. Any image you find online is a sort of raster image. Pixels are based to a certain degree on their resolution, and where they are stretched to take place, images are distorted or vague. We cannot however resize raster images without losing their resolution in order to maintain the pixel quality.The file extension for Roster images are PEG (or JPG) ,PNG GIF – Graphics [7]. The second category of images consists of Vector images that are additionally stretching and shaped to a certain degree by relative formulas. EPS, AI and PDF are the best way to construct graphics that still need to be resized [8].The same as a vector was shaped like logo and brand graphics and we should still have a very relevant dossier.The PDF - Portable Document Format, EPS - Encapsulated Postscript,AI - Adobe Illustrator is the extension for these styles of images. Documentation Stegnograpy [9, 10] is come into messages in the digital images in the technique of LS Bit. Message estimate with LSB technique is finished by supplanting and every portion of spread picture with computerized message bit. The Caesar imageis the mostly refer to calculations in the crypto as the most seasoned and easiest, so it is whatever but difficult to utilize [11, 12]. The Caesar image moves in a similar action with a cap of just 26 keys, so the amount of health is small for all characters in plaintext. In this loop, the level is very low. You must have an alternative equation for this function.Vigenere Cipher is a kind of polyalphabet substitution, but Caesar has safer locks. Essentially, Vigenere Cipher is like Caesar Cipher, it is important to transfer all the features of this message in Caesar Cipher, with all the features in Vigenere Cipher, so that the key and one byte are changed to bits in a message, the first three message sections are rooted in three pieces [13].The blue shading has only two messages embedded, since it is more sensitive and can change the data from the spreadsheet more extensively.

2. State of Art

Steganography implements techniques to mask clustered data, e.g. photographs, text, sound or advanced video, with the aspiration of not suspected the proximity of these puzzle data.In electronic steganography there are two main ways that they encrypt and disengage. All plaintexts, chips, pictures and other serious data may be communications. Encoding is the road to embedding a message into a remarkable image called the spreading image in order to construct stego media.By embedding them to the bottom portion of the pixel LSB is a fundamental and simple steganographic technique. Usually a 1 part message is inserted on of pixel pixel image with the grayscale image embedding of message. There are LSB 3-3-2 processes in the shading image. This technique is mainly designed to attain the dominant quality of the painting, LSB frame, where eight parts of a riddle are considered to be embedded spreads.As a result, in the 3RLSB pixel bits the three fundamental components of the confidential correspondence are hidden and the next 3

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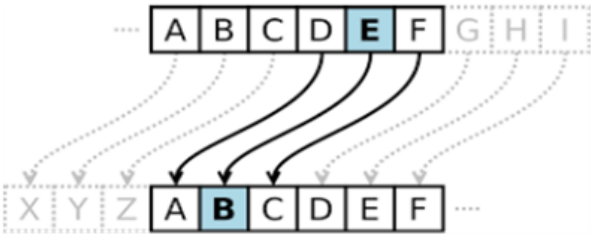

Figure 1. Caeser Cipher

pieces in the LSB Green pixels are enclosed in two BLSB pixels. Given the response of the human eye to blue, the bit is less bluish.

Caesar's cryptographic scheme guarantees that the message is obtained by replacing any letter of a particular plaintext with an additional letter in the plaintext's three letters. Science has the potential to write the encryption process equation using the figure of the Caesar with respect to the decoding process using the equation.

$$Ct(pt+n)Mod26 \tag{1}$$

$$pt = (Ct-n)Mod26 \tag{2}$$

Here C= Cipher text and P=Plain text and n= number of interval For example a plaintext encryption: STEGANO, n = 3 is ciphertext: VWHJDQR

Vigenere Cipher Technique mainly is for scrambling text with figure lines dependent on catchphrases. At first, the encryption sequence of this calculation can utilize the tabularecta where each column in the table expresses the cipher text as in the Caesar image [14]. The far left part of the tabularecta speaks to the key, and the top line to the plaintext. The essence of tabula recta shows that the chip text starts with the plaintext. Example: Essential Ciphertext: XQVLRVTM. CIPHER Key:

The integer can be generated by means of a hexadecimal 0x... In decimal prose, for instance, 0x1f represents 16+15=31. Hexadecimal entries may also be made. Bitor is inclusive logical or (bit-to-bit). Bitor input (0x12,0x38) or bitor output: 58

Figure 2. Bitand Bitor example

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3. Proposed Work

Image steganography exploits the impediments of the natural eye. This exploration then uses a true nature image of RGB as a propagated picture to inject a hidden message using a 3-3-2 LSB approach related to both techniques. There are two standard structures in the projected methodology, for instance the embeddings strategy and the extraction technique .An image Stegonagraphy mode has four main processes encryption, embedding, decryption and extracting. In this paper from encryption process two encryption methods are used with new Algorithm.

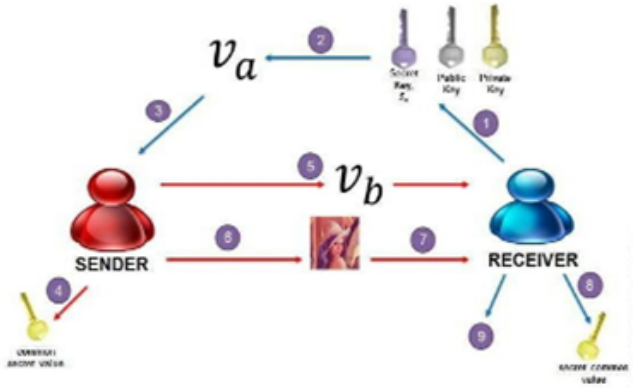

Figure 3. Secure Image Stegonagraphy model

3.1. Novel Dual Encryption Algorithm

"ABE encryption technique is not the only technique in PBE, there is IDE (Identity-Based Encryption) and Fuzzy-IDE as well" [15]. However this RGB as cover image and text messages is already available in this pre-owned 24-piece [7]. In this Algorithm initial RGB color image is taking as input and converted into binary format and in the second step Encryption formula is applied on the test message which we would like to send by applying the formula .Once it is done then apply vignere cipher for the tex obtained .Finally the converted binary image will come as output .In that image we can Keep secret image in LSB to RGB pixels . The subtleties of the installation process are:

1. Transformed RGB colour image to binary form
2. Formula for Encrtyption is applied for the text read from message

$$C_t(P_{t+n})Mod26 \tag{3}$$

3. Apply vigenere Cipher for text you obtained after applying Caesar Cipher

$$C_t(P_{t+n})Mod26 \tag{4}$$

4. Finally convert the binary form to Cover Page
5. Insert per 8-bit LSB secrecy message into the RGB pixel screen.

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Table 1. Bitand on Red Color with 248

Sample Pixel Cover Red	0	0	0	0	0	0	0	0
Bits (248)	1	1	1	1	1	0	0	0
Results	0	0	0	0	0	0	0	0

THREE RED bits, THREE GREEN pixel bits, TWO BLUE pixel bits await all the embedded mystery message pieces. Do as in the red, green and blue channels with whole pixels. After that, render a message Bitand cycle with an estimated RED channel of 128, 64, 32, 16, 8 and 4 and Bit with a Blue Channel of 2 and 2.If the bitand results match the bits of each pixel so execute the red and green pixel calculation bitor with bits of 4, 2 and 1 and parts of 2 and 1 for blue pixel.

Table 2. Bitand on red with 128

Bitwise AND									
Message	1	1	1	0	0	1	1	0	Bitand
Bit (128)	1	0	0	0	0	0	0	0	
Results	1	0	0	0	0	0	0	0	

Table 3. Bitor on red with 4

Bitwise OR If result Bitand message and bit 128 = 128									
	128	**64**	**32**	**16**	**8**	**4**	**2**	**1**	
Red pixel	0	0	0	0	0	0	0	0	Bitor
Bit (4)	0	0	0	0	0	1	0	0	
Results	0	0	0	0	0	1	0	0	

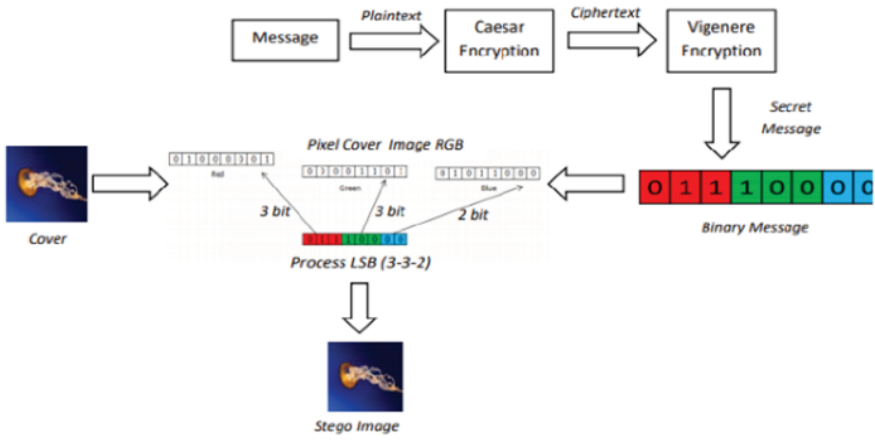

Figure 4. Embedded Process

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4. Result and Analysis

At this stage 5 primary photographs from windows are used as an expansion photo of the specific dimension 1920x1200 using 8x8, 32x32, 64x64, 128x128 and 256x256 pixels of a resize ability.Embedded messages are maxed, half and 10 percent for the sums of characters. In case of photo sized m*n, at this stage maximum weight m*n bytes, the payload was acquired by multiplication of pixel size, illumining that the message RGB stuck 8 bit in 1 pixel.

Figure 5. 256X256 sample images of normal and Stego

The first picture and the stego are not separated from each other. The assessment of the MSE and PSNR figures was then determined to determine the picture quality. The MSE calculation is calculated in order to measure the PSNR as the average square error which calculates the contrast from the assessment value to the actual value of the loss of image quality or quantity. The MSE appreciation will first be calculated by PSNR. PSNR constitutes an opportunity for the calculation of commotion between the bulk of the big sign and the amount.The spread picture is entailto as a sign, and commotion is spoken to as a blunder. PSNR figures are smaller than 30 dB, anywhere bending is apparent because of inclusion. Efficiency is usually poor. However the high quality of stego pictures is at or above 40dB.

The Mean Square Error(MSE): The medium squared error calculation has to be predicted or calculated along with a It is stated that the data function is indicator or estimator.

$$MSE = \frac{1}{MN} \sum_{x=1}^{M} \sum_{x=1}^{N} (Sxy - Cxy)^2 \tag{5}$$

M and N shall be the sizes of the pictures, X and Y shall be the co-ordinate value of the pixel and S shall be stego and C shall be the cover graphic. Peak Signal to Noise Ratio:PSNR Since numerous signs have a wide powerful range, (proportion betweenvalues of an alterable amount) the PSNR is usually expressed in decibel scale.Systematically to recognize whether a specific calculation creates better outcomes [16].The parameter under investigation is the peak-signal-to-noise proportion.On the off chance that we can show that a calculation or set of calculations can upgrade a corrupted realized picture to all the more intently take after the first, at that point we can all the more precisely reason that it is a superior calculation.

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Table 4. Comparison of Various Values of Various images

Resolution in pixel	Payload (bytes)	PSNR	MSE	bpp
8x8	64	30.9063	18.875	2.67
	32	40.4402	4.84896	1.33
	6	60.8156	0.703125	0.25
32x32	1024	31.1942	27.028	2.67
	512	35.8452	24.1683	1.33
	102	50.1794	4.09635	0.265
64x64	4096	34.5066	11.2694	2.67
	2048	39.5936	8.33138	1.33
	409	49.2905	6.02865	0.27
128x128	16384	37.9212	6.71733	2.67
	8192	43.5932	4.02779	1.33
	1638	55.2288	1.84395	0.27
256x256	65536	39.1224	5.7837	2.67
	32768	46.4125	2.79809	1.33
	6553	61.3623	0.642695	0.27

$$PSNR = 20log10\left(\frac{C^2max}{MES}\right) \tag{6}$$

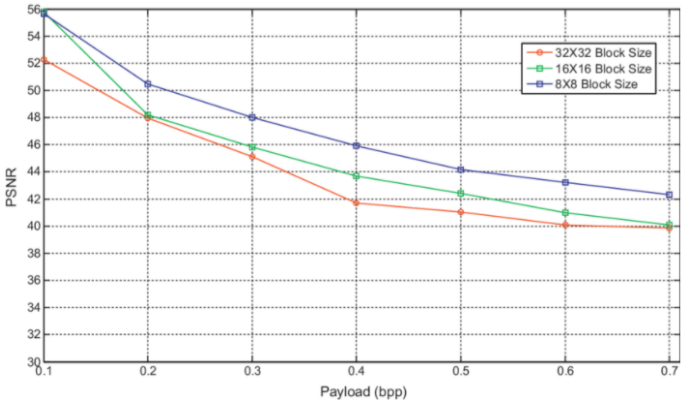

Figure 6. PSNR vs. payload for block size 8 × 8 to 32 × 32 for the input image (LEENA)

Indeed the geometry of a stego picture can decrease, if additional weight message is embedded in a spread image. With this evaluation, the most remarkable weight message is understandable, which the large image will now persevere on the indistinguishable border. After the figure is taken, the contrast calculation from MSE to PSNR is calculated from one image to the next in compliance with the image scale and message attribute measurements. The PSNR norm evaluation, which has been proven to be over 40dB, seems to mean a higher performance strategy. To test the nature of the extraction, (CER) is utilized as an estimating instrument. Message extraction must be done consummately; in any case, the proposedsteganographic technique will be futile. The Figure 7 the his-

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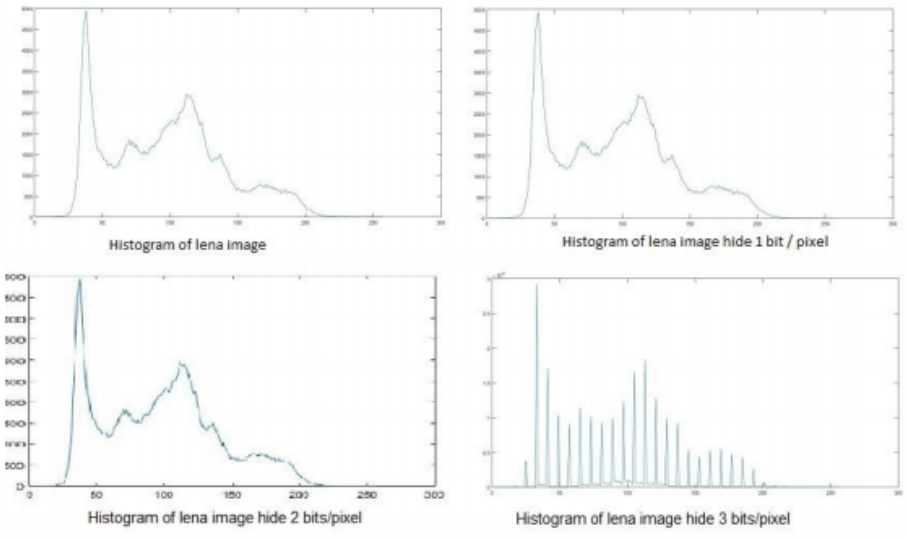

Figure 7. Histograms of Original and Stego images

togram of the original image and images after embedding data within cover image for one ,two and three bit per pixel.

5. Conclusion

Taking into Account this model is strong and is separating information without knowing the design of the proposed procedure is troublesome. Regardless of whether, the interloper gathers the LSB from the spread picture; he despite everything couldn't peruse the mystery message since it is as ciphertext. From the test result, it has confirmed that the proposed model will generate a decent quality picture subsequent to embeddings the high limit of mystery message with the PSNR estimation of 71.9 dB. At the point when the inserting limit of the mystery message expands, it will bring about slight decay of PSNR esteem.

References

[1] Anand J, Sivachandar K, Yaseen MM. Contour-based Target Detection in Real-time Videos. International Journal of Computer Trends and Technology. 2013;4(8);2615-18.
[2] Gayathri P, Umar S, Sridevi G, Bashwanth N, Srikanth R. Hybrid cryptography for random-key generation based on ECC algorithm. International Journal of Electrical and Computer Engineering. 2017 Jun 1;7(3):1293-8.
[3] Murali K, Madhumati GL, Khan H. Stochastic key generation mechanism in cryptography applications through partial reconfiguration. Journal of Advanced Research in Dynamical and Control Systems. 2017;9(12):1566-86.
[4] Tumati G, Rajesh Y, Manogna T, Ram Kumar J. A new encryption algorithm using symmetric key cryptography. International Journal of Engineering and Technology(UAE). 2018;7(32):436-8.
[5] Anand J, Flora TA, Philip AS. Finger-vein based biometric security system. International Journal of Research in Engineering and Technology. 2013 Dec;2(12):197-200.

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[6] Anitha R, Pandiyaraju V, Muthurajkumar S, Sai Ramesh L, Rakesh R. Secure data sharing in cloud storage using KAC with certificateless encryption. Advances in Natural and Applied Sciences. 2015 Jun 1;9(6):134-9.

[7] Sahu AK, Swain G. A novel n-rightmost bit replacement image steganography technique. 3D Research. 2019 Mar;10(1):1-8.

[8] Sibia EV, Mareena G, Anand J. Content Based Image Retrieval Technique on Texture and Shape Analysis using Wavelet Feature and Clustering Model. International Journal of Enhanced Research in Science Technology & Engineering. 2014;3(8):224-9.

[9] Santoso HA, Rachmawanto EH, Sari CA. An improved message capacity and security using divide and modulus function in spatial domain steganography. In2018 international conference on information and communications technology (ICOIACT) 2018 Mar 6 (pp. 186-190). IEEE.

[10] Pawar SS, Kakde V. Review on steganography for hiding data. International Journal of Computer Science and Mobile Computing. 2014 Apr;3(4):225-9.

[11] Prasad GR, Vivek T, Rohith P, Yashwanth Y. Verilog implementation on cryptography encryption and decryption of 8 bit data using ECC algorithm. Journal of Advanced Research in Dynamical and Control Systems. 2017;9(14):2711-9.

[12] Vyas K, Pal BL. A proposed method in image steganography to improve image quality with LSB technique. International Journal of Advanced Research in Computer and Communication Engineering. 2014 Jan;3(1):5246-51.

[13] Murali Krishna B, Harika P, SasiPriya V, Nikitha K, Bharath M. Homomorphic cryptography. Journal of Advanced Research in Dynamical and Control Systems. 2018;10(4):129-36.

[14] Ramesh C, Rao DV, Murthy KS. Short Note on the Application of Compressive Sensing in Image Restoration. InSmart Intelligent Computing and Applications 2019 (pp. 267-273). Springer, Singapore.

[15] Selvakumar K, SaiRamesh L, Sabena S, Kannayaram G. CLOUD COMPUTING-TMACS: a robust and verifiable threshold multi-authority access control system in public cloud storage. In Smart Intelligent Computing and Applications 2019 (pp. 365-373). Springer, Singapore.

[16] Prasad GS, Praneetha DL, Srivalli S, Sukesh BV. Information security in cloud by using enhanced triple-DES encryption algorithm. International Journal of Innovative Technology and Exploring Engineering. 2019;8(5):679-82.

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Applications of Object Detection, Brain Tumor Detection and Classification

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Abstract. In the medical diagnosis system, detection and labelling of the specific region of interest and classification of diseases in Computer Tomography (CT) images and Magnetic Resonance Imaging (MRI) scans is a challenging task. Another major application is tumor or cancer type of cell detection as well as finding its size and location in the image. This research work focuses on addressing the most challenging research gaps existing in the field of medical diagnosis such as brain tumor identification in medical images, retrieving similar images or region from the database. In these applications, the major task involved in the extraction of sufficient and relevant features, is to identify the region of interest. With the extracted features development of efficient algorithms for the detection of region of interest (ROI) and the learning algorithms also required to classify the new images for the existing features. The highlight of the proposed work is to design an automated detection of the presence of tumor cells in the brain image and classification of normal and abnormal brain images.

Keywords. DWT, k-means clustering, LBP, GLCM, Neural Network.

1. Introduction

Applications of object detection play a major role in different domains including medical diagnosis, biometrics, industry inspection, geographical information satellite systems, 3D object identification, web searching and historical research and so on [1–3]. In the medical environment, day by day the size of medical images like CT and MRI images increases continuously [4]. The applications involving images face more challenges and crucial problems such as storage management, indexing, knowledge management, and content understanding. It requires an efficient recognition mechanism to process and learn the region of interest from a different database [5–7]. The techniques developed in the area of target object detection, attempts to solve the problems associated with it and return a set of objects from the database based on similarity features like color, shape, and

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texture. In geographical information satellite systems, content-based retrieval of remote sensing images for analysis is effectively used.Statistics of the global burden of cancer across the world have been given by researchers, using the GLOBOCAN 2018 –

International Agency for Research on Cancer, with a focus across 20 world regions. Advancements in cancer prevention, early detection, and treatment, have resulted in a 23% drop in the cancer death rate, from a peak of 215.1 (per 100,000 populations) to 166.4 in 1991. Medical diagnosis at an early stage requires efficient image processing algorithms that are applied to various image modalities like CT and MRI. The high contrast of soft tissues and spatial resolution nature of Magnetic Resonance Imaging (MRI) helps in making the segmentation process easier. These segmentation results are applied to various medical diagnoses like disorders, epilepsy, Alzheimer's disease, schizophrenia, Parkinson's disease, cerebral atrophy, etc. Jimenez-Alaniz (2006) proposed non-parametric density estimation, using the Mean Shift (MS) algorithm. With joint space-range density function cluster points are detected. The cluster class boundaries are improved by edge confidence map that truly maps the pixels with adjacent regions and it is an iterative approach that enhances by Region Adjacency Graph (RAG). Kass et al. (1988) used deformable models for region boundary detection. The region growing methods are formulated from homogeneity and connectivity points. In this method initial seed points are identified, then adjacent points are collected depending on the homogeneity and similarities in intensity. These methods are depending on level set and energy functions. Due to complex structures in medical images, these techniques additionally involve the statistical feature models to improve accuracy. The following challenges are exist in designing an object recognition and image retrieval system such as presence of noise and background intensity variations make analysis of brain tumor complicated, identifying a fitting segmentation algorithm to distinguish the tumor mass in a brain image, identification of tumor mass regions with in the segmented regions, identification of suitable feature descriptor to enable classification of normal and abnormal image and Absence of automated diagnosis system to identify the cancerous brain image.

2. Proposed system for brain tumor identification

This paper work intends to suggest an algorithm to extract meaningful and accurate information by which effective identification of tumor cells in the brain image. This includes, design and implement an algorithm for pre-processing of MRI images such that removal of streak artifacts, design and implement a segmentation algorithm and locate the affected mass region in an image, design a texture measure algorithm to differentiate the images, design an accurate classifier to compare the defected and normal images and design an algorithm to carry out automated detection of tumor regions and proper measure to measure the region statistical features. The main tasks of the proposed system include, Gaussian smoothening, median filter and template matching which are used to enhance the image by removing noise and smoothening the edges, Discrete Wavelet Transform (DWT) is used for the reduction of dimensionality, k-means clustering algorithm and morphological operators are used to perform image partitioning, Texture feature in an image is extracted using Gray Level co-occurrence Matrix (GLCM) and Local Binary Pattern (LBP) operators, Euclidean distance metric is used for similarity measures, Precision and recall measures are used to evaluate the performance of the diagno-

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sis system with brain MR images [8]. The Figure 1 describes the architecture diagram of the proposed work. Initially when the MRI images from the database is passed to the classification system, it is transformed into uniform scale. Gaussian filter and template matching used for the removal of streak artifacts to further enhance the image. The transformed image is partitioned using 'k-means clustering' algorithm in a gray scale form of the input image. The above-mentioned algorithm is best used to scrutinize regions of the image effectively, yet may consist of a few false regions that are needed to be checked. The morphological operators are put to use extensively, to avoid additional false regions present in the image by applying the dilation mask. Once the image is converted into a binary image, the false regions present in the true region are removed using fill holes function. The image is now prepared to go through further steps in object extraction. The boundaries of every region are extracted and these regions are stored in the object vector. In order to classify the images, features descriptor is derived for the regions stored in the object vector .the feature descriptor describes the texture properties as well as region properties of the image. Using these descriptors, the dataset is constructed for neural network. To get more accurate results, the neural network is trained using 75 examples to classify the normal and abnormal images.

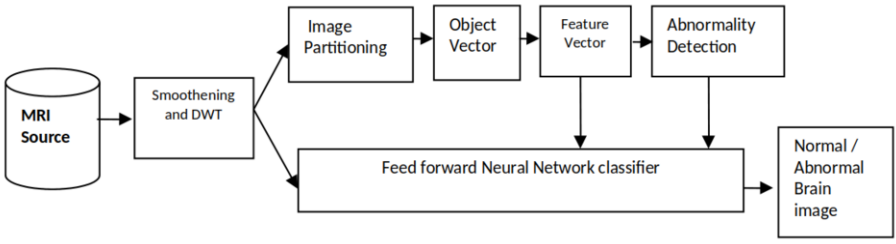

Figure 1. Overall process flow of the proposed system

3. Methodology to extract tumor region and classification of MRI

3.1. Removal of Noise

MRI images captured usually are prone to Gaussian noise and salt and pepper noise which has influence on the MRI image quality [9, 10]. The Poor quality of MRI image tends to degrade the performances of any works such as feature extraction, reduction and classification of the processed MRI images. The Gaussian smoothing, median filter and template matching provides a high performance in removing streak artifacts and background noise [11].

3.2. Dimensionality Reduction using DWT

For the storage reduction and to improve the computational complexity, two-dimensional Discrete Wavelet Transform (DWT) is applied for the image [12, 13]. It decompose the image is into mutually orthogonal wavelet basis functions. These wavelet functions are translated, scaled and dilated versions of mother wavelet Φ. DWT generates two kinds of

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coefficients namely approximation coefficients and detail coefficients. These are generated using low pass filter and high pass filter . From these coefficients when it is applied to column wise it generates four sub bands such as LL,LH,HL,HH. The Figure 2 shows the generation of four sub bands from the input image. The more detailed information exists in LL sub band so that it is used for the remaining processing techniques.

3.3. k-means Clustering Algorithm

k-means clustering act as an appropriate algorithm for brain image segmentation and performs crisp partitioning.This algorithm is used to segment the image, even the image contains shadowing, noise and camera variations in the image .This algorithm takes image as a argument and which is represented as a n-dimensional vector space.it returns the set of clusters which include the correspoding pixels based on the similarity ofneighbour pixel value.Euclidean distance metric values are calculted between the pixel and centroid of the clusters to classify the pixels.

3.4. Morphological Operators- Erosion and Dilation

When the image is segmented in to clusters, the image is converted in to binary image. This segmented image consists of additional noise and smaller holes that is not belongs to region of interest. These problems rectified by performing image smothening using morphological operators such as opening and closing.

3.5. Neural Network Classifier

To classify the normal and abnormal brain images the probability based classifier is required to detect the brain tumor at early stage.the feed foreward neural network is a efficient type of NN-classifier, act as an appropriate algorithm for classification of medical images. The texture metric very much useful for the clasification of images bacause of the variation in the intensity levels,this is measured by computing LBP histogram and GLCM .the images stored in the database divided into training and testing images. For all suspected and normal brain images the texture features are calculated and the set of texture properties are retrieved from the LBP histogram and GLCM measures. The most prominent feature metrics are idetified to classify the nomal and defected images.The input vector and output vectors are constructed with the labels such as normal and abnormal to train the neural network is effectively.

3.6. Texture Metrics – LBP & GLCM

Local Binary Pattern (LBP) - this technique approximates the variation in the texture by comparing the center pixel with the neighbouring pixels. It is used to detect the local patterns in an image. LBP code is calculated using 3 x 3 neighbourhoods with center pixel acting as a threshold. First, it calculates the gray scale difference and the difference are multiplied with weights of the corresponding pixels.Given an image for each pixel, an LBP code is computed by the Eq. (1) and Eq. (2) as,

$$LBP_{P,Q} = \sum_{i=0}^{p-1} 2^i f(g_i - g_c) \tag{1}$$

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$$f(x) = \begin{cases} 1 \Lambda x \geq 0 \\ 0 \Lambda \ else \end{cases} \quad (2)$$

Where $f(g_i - g_c)$ function applied to the gray level difference, gc is the intensity value of the center pixel, gi is the intensity value of its neighbours, P is the total number of neighbours involved and Q is the radius of the neighbourhood. In order to construct feature vector for texture classification, cumulative LBP histogram is constructed. The statistical measures such as mean, variance, standard deviation, entropy, skewness and kurtosis are calculated from the constructed LBP histogram and represented as a feature vector for classification of images.

3.7. Gray Level Co-Occurrence Matrix (GLCM))

In GLCM the texture metrics is measured by considering the spatial existence between the pixels of statistical method.texture vlaues are computed by pairs of specific values and ina specified spatial relationship occur in an image,thus creates a GLCM vector of textures values between the pixels [14]. From the GLCM vector statistical measures contrast, correlation,energy and homogenity are computed and represented as feature vector for classification.

4. Implementation results and performance analysis

Nearly 100 MRI based brain images are collected from different patients . The images have been reviewed by a consultant radiologist to identify abnormalities and truth data is available with the database. Images are numbered conveniently from 1 to 100. The information from the radiologist is taken as reference standard for checking accuracy of results presented in this research work. The entire work is implemented in MATLAB.

4.1. Dimensionality Reduction by DWT

Initially the filtering and smoothening techniques are applied to remove the noise and streak artifacts in an image. Then the processed image is reduced using DWT and generated four sub bands namely LL, LH, HL, HH using low pas and high pass filters. The Figure 3 shows the sub bands generated for the reference brain image.

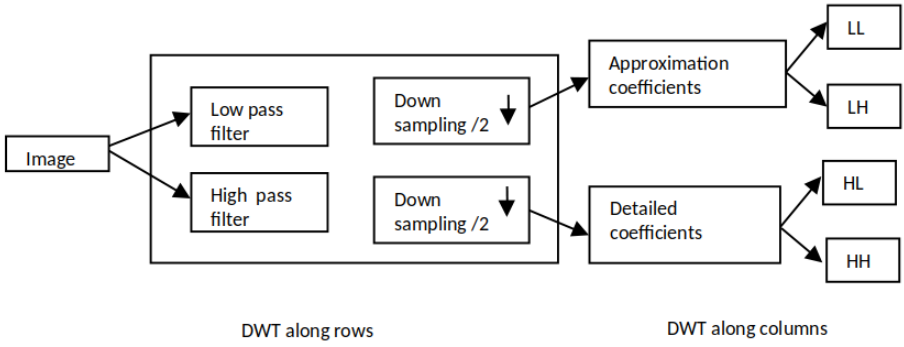

Figure 2. Frequency Band extraction Using DWT

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4.2. Image Segmentation and Tumor Region Detection

The pre-processed image is partitioned in to different clusters using k-means clustering technique [15]. The following Figure 4 shows the segmented image for the reference image. The segmented is smoothened by morphological operators using erosion and dilation function. [16–19] The defected region is identified by filling holes in the binary image. Brain tumor regions are extracted from the image and region properties such as Area, Perimeter, bounding box, Extent and Eccentricity are calculated to identify the spreading level of tumor cell occupied in the brain for the evaluation of brain tumor diagnosis. Figure 6 shows the tumor regions properties and its values. Accuracy or correct rate of classification is the efficiency of appropriate identification to the total number of images and it is defined by the Eq. (3) as,

$$Accuracy(\%) = \frac{CorrectIdentification}{TotalNumberofImages} * 100 \tag{3}$$

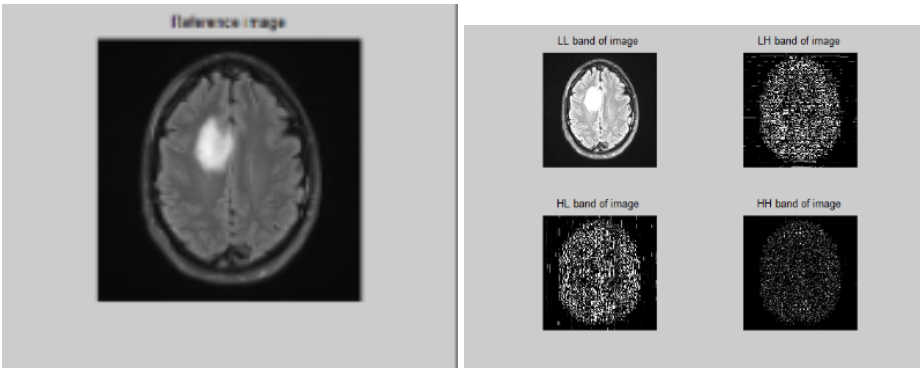

Figure 3. Frequency Band extraction for the brain reference image

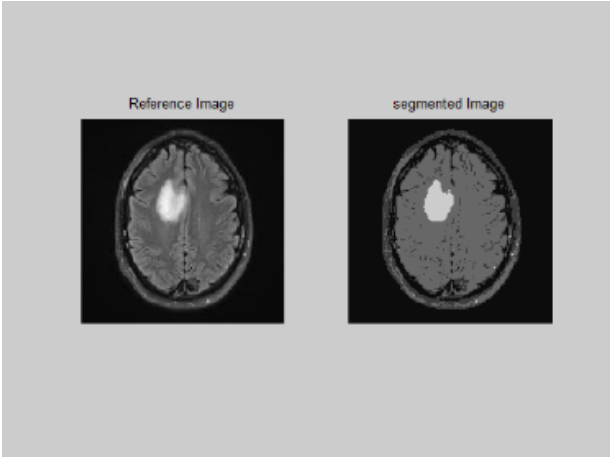

Figure 4. Reference and segmented image

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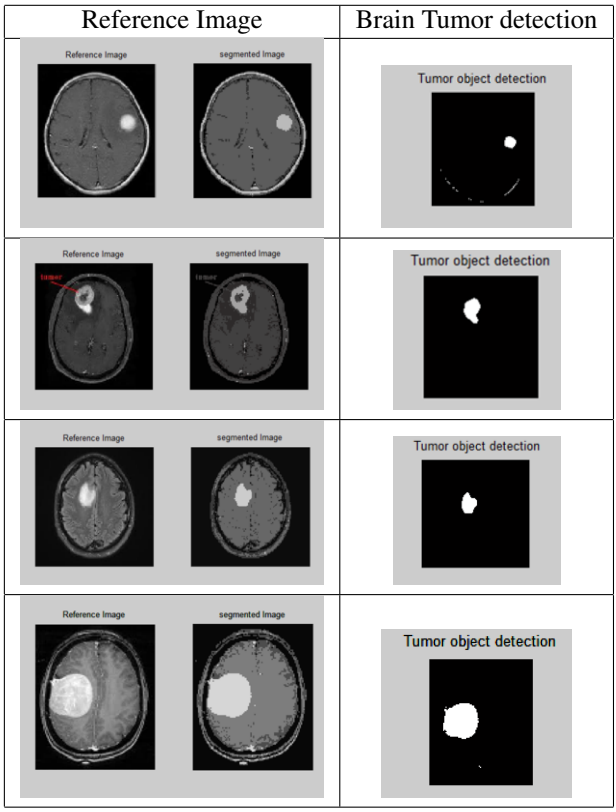

Figure 5. Detection of Brain Tumor Region

4.3. Activation of Neural Work for the Classification of Images

For every normal and defected image stored in the database texture features are extracted using LBP histogram and GLCM and labelled as normal and abnormal respectively. The Table 1 and 2 describes the sample-extracted features for the brain images. The feed forward neural network is trained using the input and output vectors of the feature vector [20].

Table 1. GLCM- Textural statistical features

S.No.	Trained Images	GLCM- Statistical Features				Label
		Contrast	Correlation	Energy	Homogeneity	
1	Image 1	0.302	0.964	0.204	0.901	Normal
2	Image 2	0.403	0.906	0.262	0.901	Normal
3	Image 3	0.161	0.912	0.353	0.936	Normal
4	Image 4	0.291	0.949	0.228	0.906	Abnormal
5	Image 5	0.401	0.895	0.270	0.902	Abnormal
6	Image 6	0.151	0.863	0.358	0.938	Abnormal

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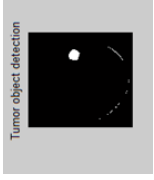
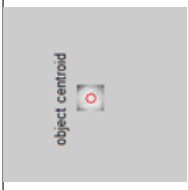
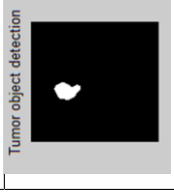
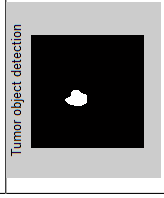
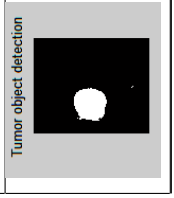
Brain Tumor detection	Tumor Object Centroid	Area	Perimeter	Bounding Box	Extent	Eccentricity
		141	40.57	[0.5,0.5,12,13]	0.90	0.41
		257	64.77	[0.5,0.5,16,24]	0.66	0.75
		254	64.95	[0.5,0.5,16,24]	0.66	0.75
		844	104.3	[0.5,0.5,31,31]	0.87	0.27

Figure 6. GLCM- Textural statistical features

4.4. Analysis of Classification Accuracy

Feed forward neural network was used for training and testing purposes. Training was carried out using 75 MR images which consists of both normal and abnormal brain images. From GLCM and LBP statistical features, four parameters are selected to classify the network, namely contrast, correlation, homogeneity and entropy. For the neural network, input layer consisted of 10 neurons and an output layer had a single neuron, to represent binary classification. Binary '0' represents normal MRI and Binary '1' represents abnormal MRI. Number of neurons in hidden layer of this network found to have an

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Table 2. LBP – Textural statistical features

S.No.	Trained Images	LBP- Statistical Features				Label
		Entropy	SD	Skewness	Kurtosis	
1	Image 1	0.219	495	10.92	148.75	Normal
2	Image 2	0.272	976	14.22	217.99	Normal
3	Image 3	0.289	876	13.98	212.67	Normal
4	Image 4	0.091	489	10.93	148.80	Abnormal
5	Image 5	0.237	967	14.22	217.94	Abnormal
6	Image 6	0.242	850	13.96	211.70	Abnormal

impact on classifier accuracy. By varying number of hidden layer neurons, classification accuracy was plotted. Figure 7 shows the accuracy results for the training and test images by the proposed neural network. Results of neural network show that 90% accuracy so that tumor region is extracted quite accurately.

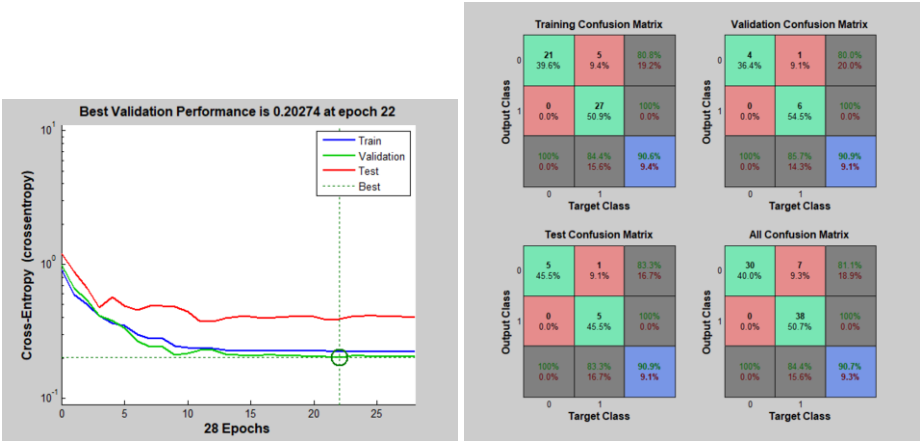

Figure 7. Classifier -Performance results and confusion matrix

5. Conclusion

This paper focuses on early detection of affected brain regions in order to reduce the death rate due to brain tumor world wise. To support this research work, five different patients MR images of various stages of tumor are used and trained to identify the tumor regions effectively. The stored MR images in the database are pre-processed by Gaussian and median filter to remove noise that improves the performance measures and reduces the error rate during classification. The k-means segmentation algorithm detect the brain region effectively. The Morphological operators are used to remove the unwanted objects exits in the image. Overall this dilation process identified the brain tumor regions efficiently. Using the features of tumor region properties the level tumor occupied in the brain can be effectively determined and it is useful for the doctors to make the diagnosis process is easier. The neural network, which classifies the normal and defected brain images effectively using the feature vectors which is constructed by LBP and GLCM

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texture measures. In future, this research work is extended to identify the cancer cells in the stomach and lungs.

References

[1] Vilaplana V, Marques F, Salembier P. Binary partition trees for object detection. IEEE Transactions on Image Processing. 2008 Oct 3;17(11):2201-16.

[2] Traina AJ, Balan AG, Bortolotti LM, Traina C. Content-based image retrieval using approximate shape of objects. In Proceedings. 17th IEEE Symposium on Computer-Based Medical Systems 2004 Jun 25 (pp. 91-96). IEEE.

[3] Anand J, Flora TA, Philip AS. Finger-vein based biometric security system. International Journal of Research in Engineering and Technology eISSN. 2013 Dec;2(12):197-200.

[4] Jiménez-Alaniz JR, Medina-Bañuelos V, Yáñez-Suárez O. Data-driven brain MRI segmentation supported on edge confidence and a priori tissue information. IEEE transactions on medical imaging. 2005 Dec 27;25(1):74-83.

[5] Rui Y, Huang TS, Chang SF. Image retrieval: Current techniques, promising directions, and open issues. Journal of visual communication and image representation. 1999 Mar 1;10(1):39-62.

[6] Rui Y, Huang TS, Ortega M, Mehrotra S. Relevance feedback: A power tool for interactive content-based image retrieval. IEEE Transactions on circuits and systems for video technology. 1998 Sep;8(5):644-55.

[7] Zhang X, Wan JW. Image restoration of medical images with streaking artifacts by euler's elastica inpainting. In 2017 IEEE 14th International Symposium on Biomedical Imaging (ISBI 2017) 2017 Apr 18 (pp. 235-239). IEEE.

[8] Turner MR. Texture discrimination by Gabor functions. Biological cybernetics. 1986 Nov;55(2):71-82.

[9] Wu MN, Lin CC, Chang CC. Brain tumor detection using color-based k-means clustering segmentation. In Third International Conference on Intelligent Information Hiding and Multimedia Signal Processing (IIH-MSP 2007) 2007 Nov 26 (Vol. 2, pp. 245-250). IEEE.

[10] Mei X. Object clustering by K-means algorithm with binary sketch templates. In 2016 International Conference on Progress in Informatics and Computing (PIC) 2016 Dec 23 (pp. 360-363). IEEE.

[11] Russ JC. The image processing handbook. Fifth Edition 2006.

[12] Sibia EV, Mareena G,,Anand J. Content Based Image Retrieval Technique on Texture and Shape Analysis using Wavelet Feature and Clustering Model. International Journal of Enhanced Research in Science Technology & Engineering.2014;3(8):224-9.

[13] Leauhatong T, Atsuta K, Kondo S. A new content-based image retrieval using color correlogram and inner product metric. In Eighth International Workshop on Image Analysis for Multimedia Interactive Services (WIAMIS'07) 2007 Jun 6 (pp. 33-33). IEEE.

[14] Ojala T, Pietikainen M, Maenpaa T. Multiresolution gray-scale and rotation invariant texture classification with local binary patterns. IEEE Transactions on pattern analysis and machine intelligence. 2002 Aug 7;24(7):971-87.

[15] Zulkoffli Z, Shariff TA. Detection of Brain Tumor and Extraction of Features in MRI Images Using K-means Clustering and Morphological Operations. In 2019 IEEE International Conference on Automatic Control and Intelligent Systems (I2CACIS) 2019 Jun 29 (pp. 1-5). IEEE.

[16] Kass M, Witkin A, Terzopoulos D. Snakes: Active contour models. International journal of computer vision. 1988 Jan 1;1(4):321-31.

[17] Anand J, Sivachandar K. An edge vector and edge map based boundary detection in medical images. International Journal of Innovative Research in Computer and Communication Engineering. 2013 Jun;1(4):191-3.

[18] Anand J, Sivachandar K, Yaseen MM. Contour-based Target Detection in Real-time Videos. 2013;4(8):2615-8.

[19] Lu Y, Zhang H, Wenyin L, Hu C. Joint semantics and feature based image retrieval using relevance feedback. IEEE transactions on multimedia. 2003 Aug 26;5(3):339-47.

[20] Thakoor N, Gao J, Jung S. Hidden Markov model-based weighted likelihood discriminant for 2-D shape classification. IEEE Transactions on Image Processing. 2007 Oct 15;16(11):2707-19.

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Parallel Computing Enabled Cloudd-Based IOT Applications

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Abstract. In delay-sensitive IoT applications, the acquisition and processing of data from the sensor devices to the cloud-based computing environment result in higher computational cost and inefficient system. The cloud servers dedicated to performing larger tasks are found quite difficult as IoT applications collect data frequently. Hence there is a constant retrieval and updating leads to the synchronization of data in the cloud. The potential of cloud servers and virtual machines tend to lose the ability of computing larger tasks. Hence the scope of parallel computing in cloud-based IoT applications are proposed with certain parallel shared models of computation. The Parallel Random Access Machine is introduced in cloud-based IoT applications. The parallel algorithms are designed to eliminate the conflicts encountered in the proposed model. Hence Conflicts of Concurrent Read Concurrent Write PRAM and Conflicts of Concurrent Read Exclusive Write PRAM algorithms are introduced which promotes the efficiency of cloud-based IoT applications.

Keywords. IoT, parallel computing model, parallel algorithms, Cloud computing.

1. Introduction

Internet of Things is a promising technology that provides a feasible solution to the problem being addressed in computation and communication networks. The intense smart applications of IoT that is recently been implemented in various fields such as healthcare [1, 2] , agriculture, vehicular automation etc,.. are in the lead of managing the huge data being generated. The big data evolved from the applications due to frequent collection of sensor data urge the utilization of data processing techniques. For instance, the numerous data from the IoT sensor devices namely blood pressure level, heartbeat rate and similar other attributes consequently promotes efficient data organizing, managing and storing. Thus the cloud computing paradigm [3] provides the open-source infrastructure to the number of real-time applications for secure storage and management of data. The delay-sensitive IoT applications are influenced by computational cost and efficiency. To improve the throughput of the system, the simultaneous processing of data is expected. The resource allocation and scheduling of tasks to the cloud servers are certainly expected to be appropriately assigned. The challenges of latency and high performance are encountered in cloud-based IoT applications. The scope of parallel computing in cloud-

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based IoT applications enhances the performance of the system. With the introduction of parallel computing [1] design techniques and algorithms the computational cost, energy consumption and latency can be reduced. Parallel Computing in the cloud divides the larger task into sub-tasks to the dedicated processors. The set of instructions are executed sequentially in traditional serial computing. Thus parallel computing is introduced to perform instructions simultaneously with the number of dedicated processors. The processors in the network of parallel systems [4] execute the tasks simultaneously. The inherent sequentialities in parallel computing are solved by using suitable models and algorithms. The output of a task can be an input to another task is said to be data dependence. Hence the data dependence causes the inherent sequentialities in parallel computing. The connected network's algorithm is applied to the parallel random access memory model of computation. The shared memory sub-models have resulted in conflicts for its specific operations. The proposed Conflicts of Concurrent Read Concurrent Write algorithm (CCRCW PRAM)and Concurrent Read Exclusive Write algorithm (CCREW PRAM) solves the conflicts in the parallel computing shared models of computation and promotes the entire application.

2. Related Works

The inevitable IoT applications based on raspberry pi [5] used for automation systems are designed using parallel computing platform's. The components are considered clusters in IoT servers and experimented with the Apache Hadoop framework. Based on the number of requests the IoT servers in the parallel computing framework [6–8] in apache Hadoop have been shown with better performances. The scheduling of tasks using a map-reduce algorithm in first-order logic is allocated for heterogeneous resources. The proper resource utilization and resource allocation are done with the map-reduce algorithm to process huge data through servers. The Soil Quality Analysis in a parallel computational framework [9] for agricultural risk management is observed by decision making parameters. The data collection in smart agricultural management [10, 11] is processed to distribute tomographic images. The cloud computing environment performing various operations and software services are identified with the challenges for doing parallel jobs. To tackle all these challenges the cloud computing platform [12, 13] are dealt with parallel scheduling and dynamic allocation. The cloud computing services like infrastructure, software and platform are continuously facing several challenges [3, 14] when the data gets generated are greater. The virtual machines in the cloud could manage data processing by intelligently distributing computing request. The parallel computing framework with python-based implementation resulted in studied.

3. Proposed system Model

This proposed system model involves a shared memory model of computation in parallel computing. The cloud computing layer comprises the Parallel Random Access Model [3] for parallel allocation, synchronization and resource utilization. The appropriate parallel algorithms for the shared memory model of computation are proposed to enhance the performance of the cloud with parallel computing for IoT applications. The architecture of parallel computing enabled cloud-based IoT applications as shown in Figure 1.

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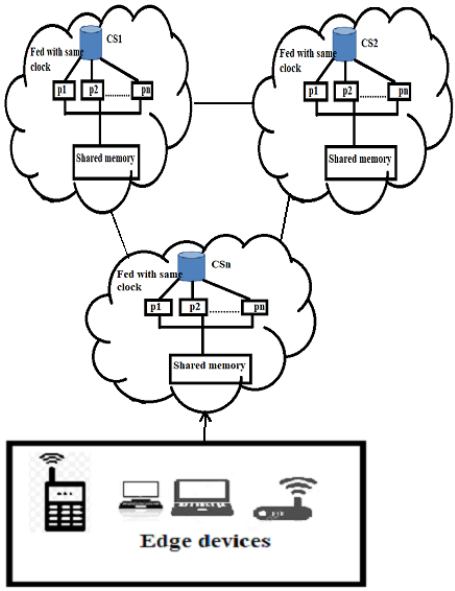

Figure 1. Parallel Computing enabled Cloud-based IoT Applications

3.1. Data Acquisition

The bottom layer of the proposed model is the edge data acquisition layer which is responsible for collecting sensor data from the edge devices. The noticeable sensor devices are temperature sensor, infrared sensors, ultrasonic sensors, etc, in numerous IoT applications updates the data often. The data can be visualized by the user in mobile applications and other web applications. IoT allows the data collected from the physical objects involved in applications could be monitored in available IoT platforms like Blynk, Thingspeak IoT and certain other platforms. The acquisition of sensor data is temporarily stored in the edge devices. The larger task of the application is derived from the organisation of data in the sensor nodes. The sensor nodes offload the compilation of task to the cloud environment.

3.2. Cloud Computing Environment

After every successful updation of sensor nodes, the data collected for the task computation will be offloaded to the cloud environment [3]. Thus the proposed parallel computing model enables the cloud to work efficiently. The shared memory concept of parallel computing makes the cloud performs a set of instructions without conflicts [15].

3.2.1. Parallel Random access machine PRAM

A random-access machine typically stores the program output in the memory. The read and write operations are handled in random access machines with unbounded sequences of registers. A Parallel Random access machine is a shared memory model which executes instructions like load, store, JMP, CMP, etc. Consider P processors are fed with the same clock. Each P is a parallel Random Access Memory machine assigned with

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a unique address. The machines are accessible by indexing i.e memory locations. The cloud with numerous updation request from the sensor data performs the task regardless of modifications. When the request has often initiated the control of processing those data has to be carried out in an organised approach. When parallel Random Access Machines allows read, write, jump instructions the resources can be properly handled. The upper bound for memory locations available in the parallel computing shared memory model is infinite. This model of computation with infinite memory locations faces a challenge on conflicts for specific operations. Thus the conflict occurs when there is a request for retrieval of data of the same memory location. To solve these conflicts certain operations are considered.

3.2.2. Exclusive Read Exclusive Write EREW

Exclusive Read Exclusive Write doesn't allow the processors to read or write to the same memory locations at the same time. For instance there are n processors, P_1,P_2,P_3,P_4,P_5....P_n. with dynamic memory locations . When there is a read and write request from the processors P_1,P_4,P_5,P_6 there comes the conflict as the processors are requesting for reading from and write to operations at the same memory locations.

3.2.3. Exclusive Read Concurrent Write ERCW

Exclusive Read Concurrent Write enables the write operation to the same memory locations at the same time from any two processors. But no two processors can request to read from the same memory locations.

3.2.4. Concurrent Read Exclusive Write CREW

Concurrent Read Exclusive Write allows read operation from two processors at the same memory location and same time but no two processors can write to the same memory locations at the same time.

3.2.5. Concurrent Read Concurrent Write CRCW

Concurrent Read Concurrent Write allows processors to read from and write to the same memory locations at the same time. When the number of processors is allowed to write at the same memory locations at the same time the concurrent write has to be constrained. Concurrent write conflicts are constrained by the submodels such as Priority CRCW,Arbitrary CRCW and Common CRCW.

4. Problem Consideration

Consider the cloud servers C_1,C_2,C_3...C_n are allocated for performing tasks T_1,T_2,T_3....T_n in the parallel computing environment. The task can be completed in total time T_1(n) where n is the size of the task. With p processors, the task can be completed in T_p(n). Thus the total execution time can be calculated from T_1(n)/ T_p(n). But p may be impossible to accomplish the task given from the applications as there is an inherent sequentiality. To overcome this the parallel computing random machines are proposed that avoid data dependence thus all processors execute the task simultaneously with the shared memory model of computation.

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The concurrent conflicts found in parallel Random Access machine can be addressed by the following parallel algorithms. The parallel algorithms serve the purpose of cloud-based either solved using the depth-first search or breadth-first search. The following are the CCRCW PRAM algorithm and CCREW PRAM algorithm to find the components of the connected graphs to manage the conflicts encountered in parallel models.

4.1. Conflicts Of Concurrent Read Concurrent Write Pram – CCRCW Pram Algorithm

The undirected graph containing the number of vertices and edges are solved to the conflicts detected in parallel machines. Consider an undirected graph G = (V, E). It is necessary to find the parent pointer of the graph for every vertex. The vertex in a graph is chosen to represent a component. It is also important to find out the star graph i.e. the tree of level 2. To do that the graph is represented in an adjacency list. It is assumed that there is the number of processors to compute the number of data stored in a linked list. When multiple processors are requesting access in the same memory location it is noted that any one of the processors will gain the rights to do an operation. The steps involved in the CCRW PRAM algorithm are as follows

1. In the initialisation step, for every vertex v in V, the vertex is defined to its parent accordingly.
2. The parent pointer can be pointed to itself and every vertex will have a unique parent.
3. Hooking, pointer jumping and contracting are the essential steps followed in this algorithm to reduce the possibility of conflicts.
4. The height of the tree is reduced by executing pointer jumping to every vertex.
5. If a tree has more than two levels grandchildren will find its root node by its parent.

Algorithm 1 CCRCW PRAM

Input: undirected graph G= (V, E) **Output**: connected component on CRCW PRAM

```
for uε v do
    Assign p(v)=v
    for (u,v) ε E do
        edge(u,v)←— edge(v,u)
        if p(v)¡p(p(v)) then
            p(p(u)= p(v)
    for each (u,v) do
        if  p(u)= p(p(u) then
            p(u)== p(v)
```

4.2. Conflicts Of Concurrent Read Exclusive Write Pram Algorithm

To find the connected components on concurrent read exclusive write the CCREW PRAM algorithm is proposed. The undirected graph with the number of vertices and edges are stored in adjacency list representation with twin pointers i.e. I and j respectively. The neighbours and children of the vertices are to be chosen and if a vertex is not

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found with children then it arbitrarily chooses the neighbouring child. Edge plugging, Renaming and merge sort are important functions implemented in this algorithm. The steps followed in the CCREW PRAM algorithm are as follows.

1. Find the smallest neighbour of the vertex
2. For every vertex find out its children if not choose arbitrarily.
3. Every parent pointer is a directed version.
4. Take the adjacency list of the vertex and combine it into the adjacency list representation which is a doubly-linked list.
5. Reduce the tree into super vertex by performing pointer jumping;
6. Rename the edges and perform merge sort to find out the connected components.

Algorithm 2 CCREW PRAM

Input: undirected graph G= (V, E) Output: connected component on CREW PRAM

```
for uεv do
    G=smallest neighbour(U¡V)
    if G==true then
        Assign P(v)=u
    for vεV do
        P(v)⟵ [p(v),v]
    for each (u,v) do
        if p(v)=p(p(v)) then
            [u,v]=r(u),r(v)]
        paramergesort(val,n,data)
        Data = mergesort(data)
    for d=1 to n do
        Data= paramerge(val,d,data)
    New ⟵data
```

5. Experiments And Evaluation

The data for IoT application is experimented by implementing both conventional and proposed model. The number of resources offloaded to the cloud environment computes the task and calculates the total execution time in sec. Figure 2 illustrates that the total execution time is improved in the proposed model than the conventional serial computing.

The proposed parallel random-access machine model of computation performs concurrent retrieval and updation of data obtained from edge devices of IoT applications. Figure 3 explains that the CRCW PRAM model found conflicts when the number of processors requesting to access the same memory location. When two processors accessing the same memory location at the same time are executed by the proposed algorithm the machine more processors computed in lesser time. Similarly, exclusive write operations are allowed to only one processor. The arbitrary CCCRW PRAM model implemented in Figure 4 explains that a randomly chosen processor performs IoT data updating to the

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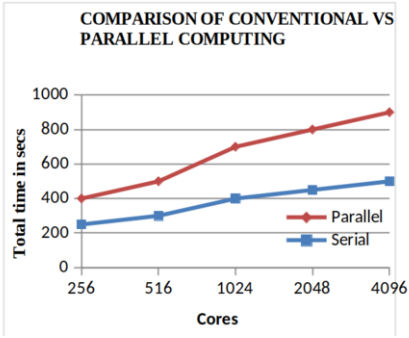

Figure 2. Comparison of conventional vs parallel computing

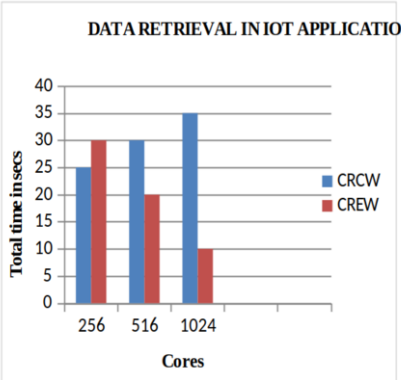

Figure 3. Data retrieval in IoT Applications

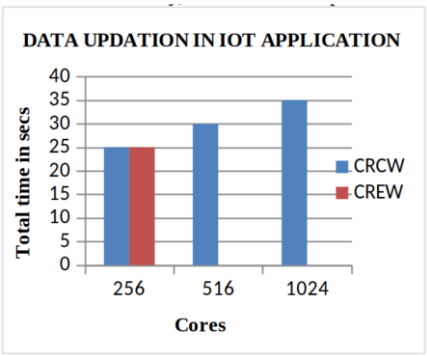

Figure 4. Data updation in IoT application for different data values

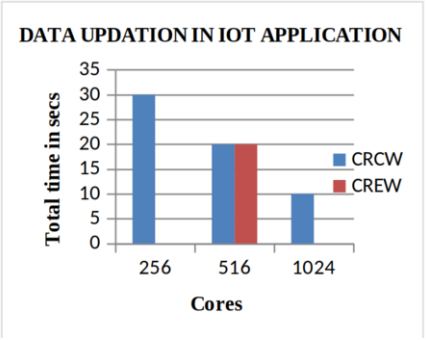

Figure 5. Data updation in IoT application for similar data values

cloud. Similarly, the CCREW PRAM algorithm executes the exclusive updation. When the number of processors requests for accessing the same dataset updation all the processors are allowed to access simultaneously and the time consumption is accordingly computed with the number of processors.

6. Conclusion

The proposed parallel computing shared model of computation improves the performance of IoT applications in terms of efficiency and lower computational cost. The workload of the cloud is managed as the number of processors available to execute the task simultaneously with the proposed parallel computing algorithms. The CCRCW PRAM and CCREW PRAM algorithms are implemented in a way to reduce the total computation of data from edge devices in IoT applications. Further, the energy consumption of the cloud can be reduced in future research.

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References

[1] Sukesh B, Venkatesh K, Srinivas LN. A Custom Cluster Design With Raspberry Pi for Parallel Programming and Deployment of Private Cloud. Role of Edge Analytics in Sustainable Smart City Development: Challenges and Solutions. 2020 Jul 15:273-88.

[2] Sai Ramesh L, Sundar SS, Selvakumar K, Sabena S. Tracking of Wearable IoT Devices Through WAP Using Intelligent Rule-Based Location Aware Approach. Journal of Information & Knowledge Management. 2021 Feb 29;20(supp01):2140005.

[3] Fang A, Cui L, Zhang Z, Chen C, Sheng Z. A Parallel Computing Framework for Cloud Services. In 2020 IEEE International Conference on Advances in Electrical Engineering and Computer Applications (AEECA) 2020 Aug 25 (pp. 832-835). IEEE.

[4] Tyagi N, Rana A, Kansal V. Load Distribution Challenges with Virtual Computing. Intelligent Computing in Engineering. Advances in Intelligent Systems and Computing. 2020 Apr 9;1125:51-6.

[5] Nugroho S, Widiyanto A. Designing parallel computing using raspberry pi clusters for IoT servers on apache Hadoop. In Journal of Physics: Conference Series 2020 Apr 1 (Vol. 1517, No. 1, p. 012070). IOP Publishing.

[6] Yang X, Nazir S, Khan HU, Shafiq M, Mukhtar N. Parallel computing for efficient and intelligent industrial Internet of Health Things: an overview. Complexity. 2021 Jan 23;2021:1-11.

[7] Dafir Z, Lamari Y, Slaoui SC. A survey on parallel clustering algorithms for big data. Artificial Intelligence Review. 2021 Apr;54(4):2411-43.

[8] Ianni M, Masciari E, Mazzeo GM, Mezzanzanica M, Zaniolo C. Fast and effective Big Data exploration by clustering. Future Generation Computer Systems. 2020 Jan 1;102:84-94.

[9] Pereira MF, Cruvinel PE, Alves GM, Beraldo JM. Parallel Computational Structure and Semantics for Soil Quality Analysis Based on LoRa and Apache Spark. In 2020 IEEE 14th International Conference on Semantic Computing (ICSC) 2020 Feb 3 (pp. 332-336). IEEE.

[10] Shi J, Shun J. Parallel algorithms for butterfly computations. In Symposium on Algorithmic Principles of Computer Systems 2020 (pp. 16-30). Society for Industrial and Applied Mathematics.

[11] Reshma R, Sathiyavathi V, Sindhu T, Selvakumar K, SaiRamesh L. IoT based Classification Techniques for Soil Content Analysis and Crop Yield Prediction. In 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) 2020 Oct 7 (pp. 156-160). IEEE.

[12] Ding L, Wang Z, Wang X, Wu D. Security information transmission algorithms for IoT based on cloud computing. Computer Communications. 2020 Apr 1;155:32-9.

[13] Xhafa F, Sangaiah AK. Advances in Edge Computing: Massive Parallel Processing and Applications. IOS Press; 2020 Mar 10.

[14] Luo Y. Environmental cost control of coal industry based on cloud computing and machine learning. Arabian Journal of Geosciences. 2021 Jun;14(12):1-6.

[15] Branitskiy A, Kotenko I, Saenko IB. Applying machine learning and parallel data processing for attack detection in iot. IEEE Transactions on Emerging Topics in Computing. 2020 Jul 1:1-12

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A Survey on Securing Medical Data in Cloud Using Blockchain

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Abstract. Security is a major concern in every technology that is introduced newly to facilitate the existing mechanism for better maintenance and handling. This is also the case in electronic health records. The data of the hospitals and the associated patients gets digital in the past few decades. The data is stored in the cloud for various reasons such as convenience of the participating entities to access it, easy maintenance. But, with this there also arises various security concerns. It has been observed from the reason studies that blockchain is used as the means of securing the healthcare data in the cloud environment.This study discusses the following. 1) Applications of blockchain in cloud environment, 2) Applications of blockchain in securing healthcare data 3) General issues and security concerns in blockchain technology and what features of block chain makes it suitable for securing health care a nd what features restricts it from using.This work helps the future researchers in getting a deep understanding of the in and out of applying blockchain in cloud and healthcare environment.

Keywords. Cloud environment, blockchain, healthcare data, security.

1. Introduction

Blockchain can be defined as the distributed data store[1] .the data can be anything such as events or records. This data are framed as blocks. Each block contains a hash value generated with the content in that particular block. Each block also contains its previous block's hash value also. These kinds of framework make the secure and tamper proof [2]. The following Figure 1 represents the basic structure of a block chain. The architecture of any blockchain process can be explained with the following Figure 2. The features of the blockchain that makes it suitable for applying in various domains for incorporating security are its distributed nature, the security it provides with the help of their cryptography algorithms and access permission methods, the transparency it provides, the method of deciding on whether a transaction is valid or not by all the nodes which is called as

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consensus algorithm and its flexibility. The transaction specified in the figure can be any operation done in a particular domain such as storing a health care data or modifying it.

Blockchain is used in various domains to provide security to the models developed in the respective domains. Studies have revealed that the major domains in which the blockchain technology such as Cybersecurity, Helathcare, Internet of Things[3]. This work concentrates on studying the various state of art models pertaining to the usage of the blockchain technology in Health care in order to improve the security in various means.It is also observed that there is a trend towards usage of healthcare data in the cloud environment. Hence, the survey made in this work is classified in to two groups.

- The works related to the application of blockchain in Healthcare both in with and without cloud context.
- The works related to the application of blockchain in cloud environment.

Both the study is made in perspective of the application of blockchain to resolve various security issues. In addition to this the various common security issues pertaining to the block chain is discussed along with the hurdles in implementing block chain technology in healthcare domain, The features of the blockchain that makes it suitable for the healthcare domain is also discussed along with this. The following Figure 3 represents the number of works discussed in both the above specified groups.

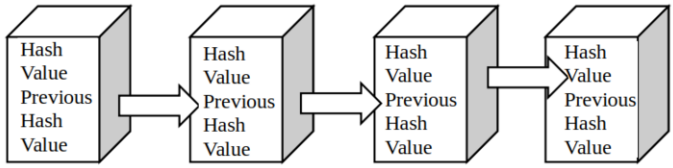

Figure 1. Structure of Blockchain

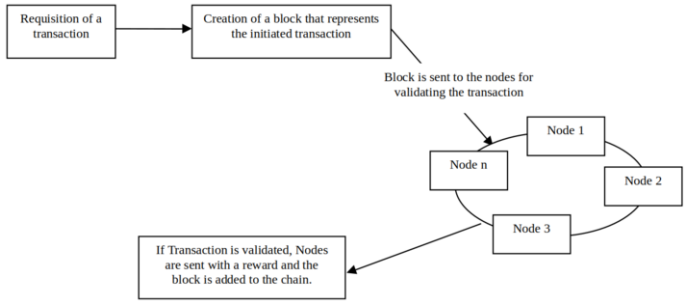

Figure 2. Working of Blockchain

The organization of the paper is as follows. The second section specifies and shortly discusses the details of the works and the content provided that discusses the security vulnerabilities and the risks associated with the blockchain technology. It also discusses the general hurdles in implementing the blockchain technique in healthcare domain given in the literature. The third section explains how different features of blockchain technology make it suitable for securing health care applications. The fourth section in detail

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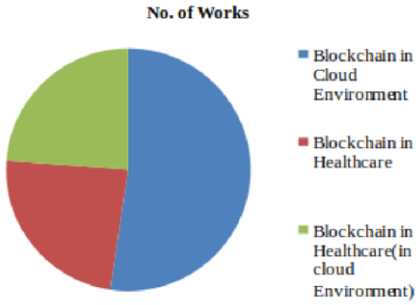

Figure 3. Summary of the work

explains the state of art models that uses block chain technology in cloud environment and addresses the various security issues related to the cloud environment. The fifth section explains the works that uses blockchain for addressing security issues in healthcare environment. The last and the sixth section give the conclusion and the inferences made.

2. Issues and Risks with the Blockchain Technology

As discussed in [4] , the general problems that occur with blockchain technology are shown in the following Figure 4 Since this work concentrates on studying the security concerns of the blockchain, only the issue pertaining to it is considered. In [5] various other security concerns of blockchain are considered. They are summarised in the following Figure 5.it also discusses in detail the various vulnerabilities with reference to these risks. [6] have specified a list of security concerns that may arise in the blockchain environment.

- There are possibilities that a user's identity is stolen
- Miners who are important players of the blockchain environment are the main targets of risk
- Due to the distributed nature of the blockchain environment, it is vulnerable to various risks such as the malicious code injection, leakage of transaction details from individual nodes. As per [7] the general hurdles in incorporating the blockchain technology in healthcare domain are given below.
- In case of the smart health care systems, it is observed that there is no rule of thumb to be followed in different activities such as the collection of data, sharing of data and the other associated communication mechanism.
- Since the model is user centralized, there are possibilities in certain cases that the users, in our case, patients are not in a position to grant access
- There are issues that might arise when the data are transferred from the Electronic Health record to blockchain Other general issues includes the unavailability of the government policies or government rules to govern the various aspects of blockchain such as the ownership of the data, issues related to legal aspects and punishments in case of any violations.

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3. Benefits of using blockchain in healthcare

The [7] also gives a set of benefits of utilizing the blockchain model in the healthcare domain.

- Though there are certain security concerns with the distributed nature of blockchain, on the other hand, it also provides a secured means of storing the medical data of the patients as well as the clinical data.
- Since the blockchain model requires different participants of the model to authorize each transaction, patients can play an integral role in managing their data and even the system can be designed centred around them.
- The immutable nature of the blockchain model enables a trusted system and also it provides a better control over the system. Blockchain technology avoids the various shortcomings that arise in the centralised model.

It paves way for the secured means of sharing the data

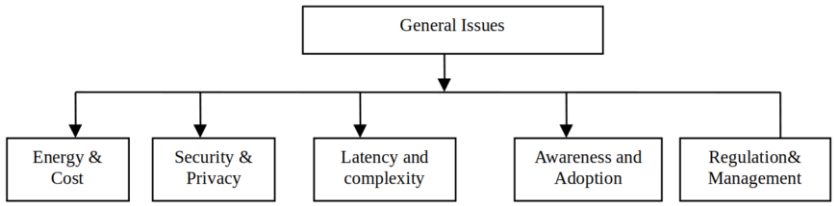

Figure 4. General issues with Blockchain

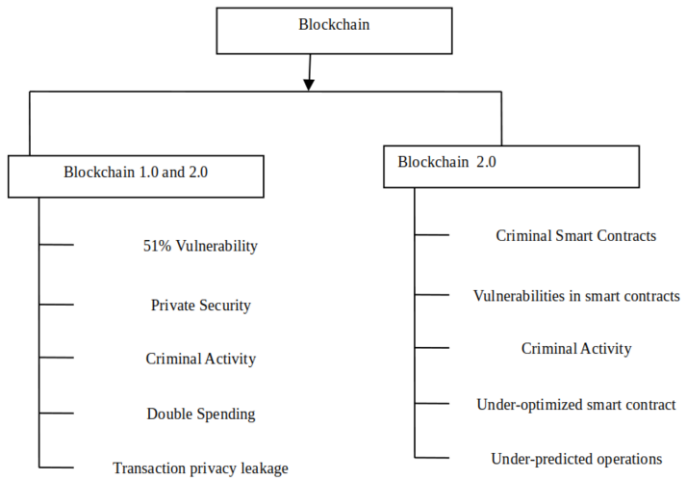

Figure 5. Risks in Blockchain models

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4. Blockchain in Cloud Environment

The following is the summary of the various state of art models that uses blockchain technology in the cloud environment. There are various access control mechanisms that are in use in cloud storage environments. In [8] , a blockchain based access control mechanism, that can be used in the cloud environment is proposed. The various integrated processes of any access control mechanism such as the generation of keys, providing access to different requests, assigning access control policies, making changes in the access control policies, revoking the assigned policies and their corresponding logs are implemented with the support of the blockchain technology called as the decentralized ledger. The encryption model employed in the work is attribute based encryption. It is implemented with the etherum virtual machine. In cloud environment, the owner is not sure about the capabilities of making restriction on their data pertaining to the access control and maintains the integrity of the data. The main objective of the authors of the [9] is to design a blockchain enabled database suitable for the cloud environment. It is also helps in maintaining the integrity of the database. The model implements two layers of blockchain, the forst layer that uses the proof –of –work consensus algorithm and the second layer that employs the miners. The design approach proposed also addresses the various research questions pertaining to data integrity.

The security of the cloud environment in specific the data provenance is key element for addressing the various other security concerns, in [10], blockchain technology is used for meeting the requirements pertaining to the data provenance in the cloud environment. The authors after implementing the blockchain in cloud environment also concentrate on the security issues that would occur in the blockchain cloud. Particularly, the attack addressed in the model is the block without holding attack. Distinct pool rewarding mechanism is used for solving this issue and the various measurements and their impact are discussed and analysed [11,12]. In order to solve the data integrity issues in the environments such as cloud computing.[13] A technology based on mobile agents is used for creating a virtual machine agent, this helps in achieving the goal of verifying the trust of the data. This model helps in ensuring the reliability of the data. cloud environment, block chain technology is used in [14]. Verification of the trust of the data is an important task in The same mechanism can be used in ensuring the integrity of the in the blockchain mechanism. The authors have employed merkel key has for generating the hash values that are used for monitoring the smart contracts that are used for data change. In addition to ensuring the integrity of the model the other performance parameters measured and compared are construction cost and the reconstruction time.

Interoperability plays a key role in the personal cloud computing. It is the process that acts behind the sending and receiving the messages and securing them. In [15], the authors have proposed a blockchain based solution for ensuring the validity of the interoperability .in specific, the work concentrates on authentication. The mechanism of authentication and encryption of end to end data transfer is governed by JSON web tokens in this work where the activities are dependent on the central server. It is replaced with the blockchain technology. In case of [16] the authors concentrates on the implementation of the blockchain technology in the outsourcing services. The security issues considered are malleability attacks and the eavesdropping attacks. Blockchain implementation is made between the client and the service provider. The process consists of five phases. The phases ensure that the service provider provides the services that it has promised for.

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This is ensured with the help of the challenging mechanism followed at the client end. Majority attack is a kind of attack that occurs in the blockchain environment due to the distributed nature of it. This kind of attack is also known as 51% attack. This is made by the miners. The threat model considered is based both on the one that occurs due to the user collisions and another that occur due to bad users. These problems are taken into consideration in [17] and a solution is provided based on block chain. The model provides secured mechanisms for document management and document modification. The various performance parameters considered and evaluated are Gas cost and time.

Monitoring and tracking of all the data objects in the cloud environment is a vital process to be followed in order to ensure the privacy of the data, accountability of the data. In [18] a novel architecture is provided based on blockchain . The architecture ensures that all the provenance data is verified by associating them with the blockchain. The security issue addressed with this model are reliability and privacy of the user. Three phases are employed by the authors that deal with the provenance data, one for collecting the data, one for storing the data and at last one for validating it. The limitations in the mobile devices such as the low storage capacity and the limitation in the computing power, is resolved with the help of the mobile cloud computing. In case of decentralized models in mobile cloud computing where, the resources such as the computational power and the storage are integrated together and used without the employment of the centralised server, there exists the problem of authenticating the mobile devices, in [19], and the authors have proposed a blockchain based model for mobile authentication. They ensure the proper authentication of the mobile devices that enters the mobile resource management network.

In case of the cloud computing, the users will store their files in the cloud storage. The cloud service providers might be vulnerable .this makes the users to encrypt their file and store in the cloud. The problem that arises with this is the overhead that arises with the transmission of the encrypted file. In [20], a block chain based approach is provided in order to split the data file in to number of chunks which are secured by means of encryption. The data is later placed in P2P network. Additionally, file block replica placement problem is also addressed with the help of genetic algorithm. The performance parameters considered are transmission delay and file security. In case of the cloud based models, both the cloud service providers and the clients depend on the third party auditor for ensuring the integrity of the data. In [21] it has been specified that availability of third party auditors is a question of concern in all the cases. The authors have proposed a blockchain based approach for replacing the third party auditor. The model concentrates on facilitating the auditing process of the cloud based models. The smart contracts designed for this purpose makes the cloud service providers to ensure it provides genuine service to its clients.

5. Blockchain in Addressing Security Issues in Health Care Domain

In [22] the authors have addresses two problems, former, the inability of the patients to access their records in certain cases and later the privacy of the data associated when the data is accessed by the stake holders. The framework proposed by the authors both the problems by means of blockchain technology. Six different contracts are designed and used. Service contract, owner contract, classification contract , relationship contract and

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consensus contract. All the operations such as addition of patients, manipulating access control permissions, working with records are done with the help of these contracts. Patient privacy is ensured with the help of encryption. In case of [23] two contracts are defined, one for performing the CRUD operations with the patient data and another for providing granular access control. A block chain is formed between the users and the implementation. The role contracts used by the authors are Rolesmart. It is a contract that belongs to the OpenZeppelin library. inorder to ensure that the blockchain in secure, consensus algorithm called as Proof of Work is employed. Every CRUD operation in the work is validated, authenticated and authorized. The addressed security issues in the paper are integrity, access control and confidentiality.

With an implementation of a private blockchain the authors of [24] addresses the security considerations of the health care data. In addition to this, a mechanism has been formulated which enables the patients with similar symptoms to communicate securely with a session key after authentication. Pairing based cryptography and openSSL libraries are used for implementation. The model also enables the doctors belonging to different hospitals to share the data securely between them. Proxy re-encryption is used for ensuring the security of the data during transit. Various other security issues are also addressed. The performance parameters that are evaluated are Computational cost, communication cost, security level.

Authentication and integrity are the major concerns of [25]. The authors uses keyless signature infrastructure for ensuring security of the digital signatures employed in the model and hence the associated authentication issues. The integrity of the data is addressed by the incorporated blockchain technology. In case of [26], patient driven interoperability is considered and the possibilities of applying the blockchain technologies to address the various issues pertaining to the specified interoperability is discussed. This is possible with the different kinds of features provided by the blockchain technology such as the immutability, identity, liquidity , aggregation and access rules. But in addition to specifying the possibilities of using blockchain technology in electronic health care domain, the authors have also specified the various barriers. In [27], blockchain technology is used in two places, first in case when the patients make their decisions on the authorization policies for their medical records and write the same in blockchain for further approval. In second case, when the node responsible for bookkeeping writes the description of the medical data to the blockchain. It also includes the location of the data in the cloud. Both these practice is included in order to ensure two security concerns namely the integrity of the data and traceability.

It has been specified by the authors of [28] that the centralized nature of cloud environment, leads to various security concerns such as data privacy. It has its impact in the transit of data also. The authors have proposed a protocol based on blockchain for sharing data. In this model, the authors have used the blockchain technology to store the keyword ciphertext. This keyword ciphertext is used for searching the data in the electronic healthcare records and also used for sharing the data. The security issues that are addressed are authorization, protection of identityand privacy. [29] have listed few issues related to the implementation of blockchain in healthcare systems. They are listed in the following Table 1. Though studies have specify that, solution to the above specified problems is in the form of storing the data outside the chain and the corresponding hash values in the blockchain these are the things to be considered in future researches with respect to the application of blockchain in healthcare. There are different security

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concerns that while outsourcing the electronic health care data in the cloud environment. The authors of [30] have designed a blockchain model for resolving various attacks such as forgery attacks,modification attacks and impersonation attacks.This is ensured by various aspects. First, an authentication mechanism is designed for ensuring that only the the authenticated users are allowed to outsource the data. The participants of the model, at any time can verify the integrity of the data.

Table 1. Few Blockchain Issues and Associated Problem

Issue	Property	Associated Problem
Integrity	Immutability	The Law of certain countries says that the personal data of individuals have to be erased based on the request.
Data Storage	Blockchain is suitable for storing transaction data and the associated backtracking	Medical data need more specific use cases such as the handling images, searching etc.

6. Conclusion and Inferences Made

The following were made from the study made. Though blockchain can be used in health care domain for addressing various security issues, Blockchain has its own security issues and General issues in terms of adapting it to Healthcare Domain. It is also observed from the study that though cloud is a centralised model, blockchain has its own applications in the cloud environment. Though there are only few studies that are related to the application of blockchain in securing health care records that are stored in the cloud environment, it addresses various security issue and still there are scope for future research.

References

[1] Blockchain definition [Internet]. [cited 15th June 2020]. Available from: https://*en.bitcoin.it/wiki/Block_chain*.
[2] Nofer M, Gomber P, Hinz O, Schiereck D. Blockchain. Business & Information Systems Engineering. Springer. 20 March 2017;59(3):183–7.
[3] Islam A, Shin SY. A blockchain-based secure healthcare scheme with the assistance of unmanned aerial vehicle in Internet of Things. Computers & Electrical Engineering. 2020 Jun 1;84:106627.
[4] Meng W, Tischhauser EW, Wang Q, Wang Y, Han J. When intrusion detection meets blockchain technology: a review. Ieee Access. 2018 Jan 30;6:10179-88.
[5] Wang Y, Zhang A, Zhang P, Wang H. Cloud-assisted EHR sharing with security and privacy preservation via consortium blockchain. IEEE Access. 2019 Sep 23;7:136704-19.
[6] Niranjanamurthy M, Nithya BN, Jagannatha S. Analysis of Blockchain technology: pros, cons and SWOT. Cluster Computing. 2019 Nov;22(6):14743-57.
[7] Tripathi G, Ahad MA, Paiva S. S2HS-A blockchain based approach for smart healthcare system. In Healthcare 2020 Mar 1 (Vol. 8, No. 1, p. 100391). Elsevier.
[8] Sukhodolskiy I, Zapechnikov S. A blockchain-based access control system for cloud storage. In 2018 IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering (EIConRus) 2018 Jan (pp. 1575-1578). IEEE.
[9] Gaetani E, Aniello L, Baldoni R, Lombardi F, Margheri A, Sassone V. Blockchain-based database to ensure data integrity in cloud computing environments. In 2017 Italian Conference on Cybersecurity 2017 Jan 20 (pp. 1-10).

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[10] Wang H, Qin H, Zhao M, Wei X, Shen H, Susilo W. Blockchain-based fair payment smart contract for public cloud storage auditing. Information Sciences. 2020 May 1;519:348-62.
[11] Saranya MS, Selvi M, Ganapathy S, Muthurajkumar S, Ramesh LS, Kannan A. Intelligent medical data storage system using machine learning approach. In 2016 Eighth International Conference on Advanced Computing (ICoAC) 2017 Jan 19 (pp. 191-195). IEEE.
[12] Luo Y. Environmental cost control of coal industry based on cloud computing and machine learning. Arabian Journal of Geosciences. 2021 Jun;14(12):1-6.
[13] Selvakumar K, SaiRamesh L, Sabena S, Kannayaram G. CLOUD COMPUTING-TMACS: a robust and verifiable threshold multi-authority access control system in public cloud storage. In Smart Intelligent Computing and Applications 2019 (pp. 365-373). Springer, Singapore.
[14] Wei P, Wang D, Zhao Y, Tyagi SK, Kumar N. Blockchain data-based cloud data integrity protection mechanism. Future Generation Computer Systems. 2020 Jan 1;102:902-11.
[15] Faisca JG, Rogado JQ. Personal cloud interoperability. In 2016 IEEE 17th International Symposium on A World of Wireless, Mobile and Multimedia Networks (WoWMoM) 2016 Jun 21 (pp. 1-3). IEEE.
[16] Zhang Y, Deng RH, Liu X, Zheng D. Blockchain based efficient and robust fair payment for outsourcing services in cloud computing. Information Sciences. 2018 Sep 1;462:262-77.
[17] Zhu L, Wu Y, Gai K, Choo KK. Controllable and trustworthy blockchain-based cloud data management. Future Generation Computer Systems. 2019 Feb 1;91:527-35.
[18] Liang X, Shetty S, Tosh D, Kamhoua C, Kwiat K, Njilla L. Provchain: A blockchain-based data provenance architecture in cloud environment with enhanced privacy and availability. In 2017 17th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing (CCGRID) 2017 May 14 (pp. 468-477). IEEE.
[19] Kim HW, Jeong YS. Secure authentication-management human-centric scheme for trusting personal resource information on mobile cloud computing with blockchain. Human-centric Computing and Information Sciences. 2018 Dec;8(1):1-3.
[20] Li J, Wu J, Chen L. Block-secure: Blockchain based scheme for secure P2P cloud storage. Information Sciences. 2018 Oct 1;465:219-31.
[21] Tosh DK, Shetty S, Liang X, Kamhoua CA, Kwiat KA, Njilla L. Security implications of blockchain cloud with analysis of block withholding attack. In 2017 17th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing (CCGRID) 2017 May 14 (pp. 458-467). IEEE.
[22] Gordon WJ, Catalini C. Blockchain technology for healthcare: facilitating the transition to patient-driven interoperability. Computational and structural biotechnology journal. 2018 Jan 1;16:224-30.
[23] Shahnaz A, Qamar U, Khalid A. Using blockchain for electronic health records. IEEE Access. 2019 Oct 9;7:147782-95.
[24] Liu X, Wang Z, Jin C, Li F, Li G. A blockchain-based medical data sharing and protection scheme. IEEE Access. 2019 Aug 26;7:118943-53.
[25] Nagasubramanian G, Sakthivel RK, Patan R, Gandomi AH, Sankayya M, Balusamy B. Securing e-health records using keyless signature infrastructure blockchain technology in the cloud. Neural Computing and Applications. 2020 Feb;32(3):639-47.
[26] Wang H, Song Y. Secure cloud-based EHR system using attribute-based cryptosystem and blockchain. Journal of medical systems. 2018 Aug;42(8):1-9.
[27] Vora J, Nayyar A, Tanwar S, Tyagi S, Kumar N, Obaidat MS, Rodrigues JJ. BHEEM: A blockchain-based framework for securing electronic health records. In 2018 IEEE Globecom Workshops (GC Wkshps) 2018 Dec 9 (pp. 1-6). IEEE.
[28] Li X, Jiang P, Chen T, Luo X, Wen Q. A survey on the security of blockchain systems. Future Generation Computer Systems. 2020 Jun 1;107:841-53.
[29] Esposito C, De Santis A, Tortora G, Chang H, Choo KK. Blockchain: A panacea for healthcare cloud-based data security and privacy?. IEEE Cloud Computing. 2018 Mar 28;5(1):31-7.
[30] Cao S, Zhang G, Liu P, Zhang X, Neri F. Cloud-assisted secure eHealth systems for tamper-proofing EHR via blockchain. Information Sciences. 2019 Jun 1;485:427-40.

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Network Lifetime Analysis in IOT Environment in Healthcare Sectors Using Deep Learning Routing Approach

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Abstract. The Internet of Things (IoT) provides an improved flexibility in data collection, network deployment and data transmission to the sink nodes. However, depending on the application, the IoT network tends to consume lot of power from the individual devices. Various conventional solutions are provided to reduce the consumption of energy but most methods focus on increasing the data acquisition speed, data transmission and routing capabilities. However, these methods tend to fall under the trade-off between these three factors. Hence, in order to maintain the trade-off between these constraints, a viable solution is developed in this paper. A deep learning-based routing is built considering the faster acquisition of data, faster data transmission and routing path estimation with increasing path estimation. The paper models a Deep belief Network (DBN) to route the data considering all these constraints. The experimental validation is conducted to check the network lifetime, energy consumption of IoT nodes. The results show that the DBN offers greater source of flexibility with increased data routing capabilities than other methods.

Keywords. Multi-layered perceptron, routing, energy consumption, IOT.

1. Introduction

The IoT is a new technology that aims to take care of physical objects in our everyday lives. The IoT core concept is fitted with interconnected sensors that make it into a smarter entity and devices that are clearly linked and transmitted to the Internet. IoT is designed to work together between the machines, leading to complex tasks. Consequently, these instruments have the capacity to store, process and transfer data. Only existing technologies including smart sensor networks, Radio Frequency Identification (RFID), Near-Field-Communication (NFC), cell technology, and the internet make convergence possible. Through incorporating this technology into a single device, the IoT architecture is developed from a variety of processors, from strong and complicated servers, into the RFID Tag.In particular, some devices are supposed to have low efficiency and performance considering their heterogeneous IoT environment. Because of inadequate

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processing, limited capacity, low energy, and low latency, network machines have low throughput and a high latency [1].

Traditional solutions to the routing dilemma of such networks do not function appropriately when taken into account limitations such as the need for a significant volume of money and energy.In recent years, not much research has been carried out to improve the minimal conventional solutions. The problems and the routing algorithm ought to be changed to use IoT in common citizens. Lack of robust data forwarding is a major impediment to data transfer between source and destination in vast networks. The Internet of Things poses unique problems and limitations that were not taken into consideration when designing past routing protocols, each with different network requirements. In this situation, it is essential to handle rapidly evolving network topologies. As we have proposed in this paper, an IoT routing protocol is to choose the best path.Intelligent agents choose routes based on battery capacity, plunging size, usable bandwidth, and path stability rating based on their proposed system.

The intelligent way to prepare nodes for optimal paths is by using the Deep belief Network (DBN). It maintains trade-off between these energy efficiency and power consumption. A DBN is built considering the faster acquisition of data, faster data transmission and routing path estimation with increasing path estimation. The paper models a DBN to route the data considering all these constraints. The experimental validation is conducted to check the network lifetime, energy consumption of IoT nodes. The results show that the DBN offers greater source of flexibility with increased data routing capabilities than other methods.

2. Related works

Devices that are linked to different computing capacities were enhanced through the development of IoT. Multimedia streaming on IoT cannot adapt to heterogeneous devices with a high level of service and, perhaps, it is impossible for a system to accept data from all devices. Heterogeneity of devices in order to react to requirements. The authors of [2] proposed an algorithm for balancing the layers in the following problem. For IoT multimedia streams, this algorithm uses network decoding, whereas for multimedia network entity streaming, it uses network coding. The writers used primitive and primal decomposition in this article. The Lyapunov principle was often used to show that the suggested algorithm converges and maintains its stability. The usage of wireless sensor networks is highly prevalent in linking the real environment with the IoT knowledge world. Around the same time, the WSN has a greater need for frequent communication with the power supply. In the case of a multicast transmission, the base station transmits to a single recipient (which is called a community in this context), whereas multiple beneficiaries get the info. To answer this question, we need to break it down into the Steiner tree dilemma, which has been shown to be an NP-complete problem.

An example of a modern multicast routing protocol is the multicast routing algorithm used in [3], which solves the issue of service consistency constraints. Link estimates are unintended because they are being aggregated or because the load of traffic changes suddenly. Furthermore, since the relation requirements are not aggregate, the deterministic algorithms of the multi-thread tree do not apply. Random parameters, on the other side, take relations and offer them distinct, concrete descriptions, which can

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be provided as inputs for quantitative modelling or qualitative characterization. The developers of [4] looked at how to use information-centered networks to make it easier to deploy Internet artefacts and have a modular framework that allows IoT to operate better in such a network. The naming requirements, corporate procedures, protection, and energy conservation were all taken into account in the designed architecture. The writers have reviewed the total amount of physical interaction that is made through IoT device protection mechanisms in this article.

In the text, the authors of [5] came up with a greedy method with Small World Model Properties for IoT sensor networks (SWMP). The GMSW identifies the two greedy nodes as separate nodes in the network and uses them as a criteria for assigning significance to numerous other nodes. They implemented the concept of node local value, which they defined using these various parameters. They implement an algorithm which enables them to modify the network in order to manipulate the characteristics of a narrow global model, which is done by using shortcuts between individual nodes that are focused on the location of those nodes.

The authors of [6] recommended a content-conscious approach for sensor nodes to shape SSONs in the form of Ant clusters in knowledge awareness, which implements a similar strategy to SSONs in form of Ant clusters inside a cluster of linked sensor nodes. After classifying the sensors into SSONs based on their structure, the next step is to conduct the analysis. After the nodes are clustered using the suggested antclust algorithm, the nodes are joined to the network. Another beneficial aspect of these new procedures is that they decrease expenses while also keeping the network operational.

The presented solution, according to [7], is built on a novel real-time IoT routing algorithm, where generalised information decisions are utilised to increase the overall security and response time of IoT transmissions. In addition, the authors have developed a delay iterative method (DIM) to address the issue of missing valid routes, which is entirely based on delay calculations. in particular In addition, the REPC, a current transmission device, collects and reveals additional information about the energy level in the nodes, which makes for a more efficient distribution of network resources. This research done by [8] authors compared routing protocols and IoT Medium Access Control (MAC), and their conclusions indicated that existing protocols do not provide for cooperation between routing strata and MAC layers; new requirements were therefore proposed as a consequence of this discovery. These requirements enable routing protocols to perform necessary modifications, such as to the MA and routing protocols, while also allowing adjustment of the parameters as needed. The authorization standards in 9 included consistency of Internet connectivity specifications and methodologies for enhancing service efficiency parameters. Any model can be understood in the context of a computing analogy, and the dynamic system model of service efficiency is simplified. The algorithm has been modernised by integrating quality service technology with complicated service technology.

In this paper [9], the authors addressed the issue of misplaced wearable IoT devices by using their MAC address to track its location, this can be done through examining the access points in which the devices are currently connected. In this work [10], proposed a recommendation system for crop yield prediction using Support Vector Machine and Decision Tree algorithm. This system is IoT based, which automatically determines the suitable crop by analysing the characteristics of the soil and climatic conditions and recommends the same to optimize the yield.

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In [11], they introduced a secure energy efficient protocol for efficient routing in Wireless Sensor Networks. This protocol works based on the sender responsive technique which uses energy for node mobility prediction and when connection failure occurs. It implements fuzzy rules and consider trust value of a node for secure routing and to improve the packet delivery ratio.

3. Proposed Method

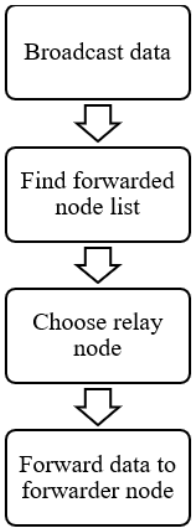

Figure 1. Architecture of IoT assisted DBN Routing

As literature indicates that an IoT energy consumption has a significant effect on the existence and efficiency, it is therefore essential that energy efficient, protocols for routing be designed to increase overall network life and improve the quality of the IoT network. In this paper, we use DBN for discovery of routes and maintenance of routes, where the details are given below.

Step 1: Use DBN for broadcasting the packet from source node to destination nodes by finding the forwarder node list.
Step 2: Choose relay among the IoT sensor nodes from the forwarder list.
Step 3: Forward the collected IoT data to the forwarder node or relay node.

3.1. Deep Belief Network

Consider a set (v, h) with the validation function E (v, h|θ) that acts as an energy function for training the deep belief network and it is expressed as below:

$$E(v,h|\theta) = -\sum_{i=1}^{n} a_i v_i - \sum_{j=1}^{m} b_j h_j - \sum_{i=1}^{n}\sum_{j=1}^{n} v_i w_{ij} h_j \quad (1)$$

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where in Eq. (1), θ - DBN parameter $\theta = \{W_{ij}, a_i, b_j\}$ with w is considered as the connection weight a is considered as the visible hidden layer bias and b is considered as the hidden layer bias.

The joint probability distribution for an output and hidden layer (h) is hence expressed as follows:

$$P(v,h|\theta) = \frac{e^{-E(v,h|\theta)}}{Z(\theta)} \tag{2}$$

$$Z(\theta) = \sum_{v,h} e^{-E(v,h|\theta)} \tag{3}$$

CDF(a,b) or the conditional distribution function is thus expressed in the form of Gibbs sampling process and it is expressed as below:

$$P(h_j = 1|v,\theta) = sigmoid\left[b_j + \sum_i v_i w_{ij}\right] \tag{4}$$

$$P(v_j = 1|v,\theta) = sigmoid\left[a_j + \sum_i h_i w_{ji}\right] \tag{5}$$

With the expression in Eq. (3), the probability of hidden layer can thus be derived for active state. DBN tends to provide symmetric feature with the probability over activation state, which is regarded as visible states and hidden layer states h.

3.2. Route discovery phase

In the case of an IoT network, a node graph could be used. When two devices have the ability to communicate directly with each other through their radio system, we name them connected.Since one of these two nodes would have more powerful transmitters than the other, there is a chance that contact will form between the nodes but not the other way around. Furthermore, when two nodes are in the radio spectrum, there is no guarantee that they can communicate; buildings, hills, or other obstacles will prevent them from communicating. The features (identifier number, application ID) in a local table comprising packet records are searched first, and if the packet has already been retrieved and analysed, the application ID is used instead. The package will be discarded if it has been duplicated, and its sorting will be completed. If the packet attribute is not duplicated, it will be imported into the record table, which means that it will not be stored in the future, which therefore will preclude the loop from routing.

3.3. Route Maintained Phase

As the IoT nodes may be switched off in this form of network to minimize the level of the battery, the network configuration is often modified. This protocol is supposed to solve this problem somehow. The Hello broadcast containing the identity and location

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information, is also transmitted alternatively to each node on the networkThe editor of the communication will be alerted if no answer is received. In this instance, the editor will know that his neighbour is unable to respond, and that the link has been severed. It is expected that the neighbours react to the post.

4. Results and Discussions

This section presents the results of various metrics by the proposed method that includes energy consumption, network throughput, network lifetime and network delay in delivering the packets to the destination with various existing techniques like MLP (Multi-Layer Perceptron), RNN (Recurrent Neural Network), DBN (Deep Belief Networks). The Figure 2 shows the results of energy consumption between the sensor nodes. It is evident that the DBN maintains the task of route allocation and route maintenance effectively such that the data packets are transmitted effectively from source node to destination node. The results of simulation shows that the proposed method attains higher rate of energy conservation than other existing models. The effects of network throughput between the

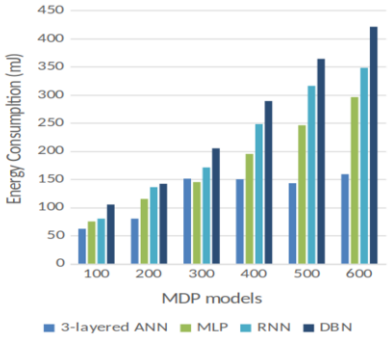

Figure 2. Energy Consumption

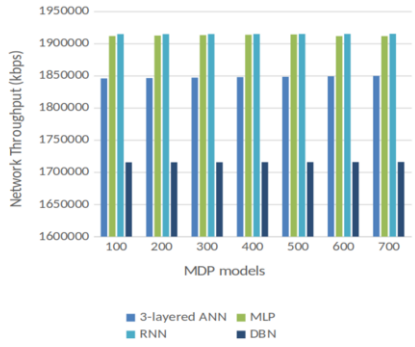

Figure 3. Network Throughput

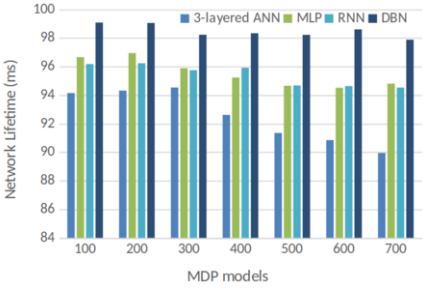

Figure 4. Network Lifetime

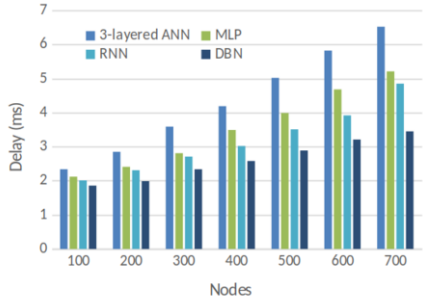

Figure 5. Network Delay

sensor nodes are seen in Figure 3. It is clear that the DBN improves network throughput by allocating routes optimally and avoiding communication failures, ensuring that data packets are easily transferred from source to destination nodes. Simulation findings

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reveal that the proposed approach achieves a higher network throughput rate than other current models. The Figure 4 shows the results of network lifetime between the sensor nodes. It is evident that the DBN increases the network lifetime using optimal allocation of routes without transmission failure so that the data packets are transmitted effectively from source node to destination node. The results of simulation shows that the proposed method attains higher rate of network lifetime than other existing models. The Figure 5 shows the results of end-to-end delay between the sensor nodes. It is evident that the DBN reduces the delay including transmission delay, reception delay and propagation delay in delivery the packets from source node to destination node. The results of simulation shows that the proposed method attains reduced rate of delay than other existing models.

5. Conclusion and Future Enhancement

A DBN provides faster routing of data, faster data transmission and routing path estimation with increasing path estimation. The DBN routes the data considering all these constraints that includes path estimation, data transmission and routing parameters. The validation shows that the DBN attains increased network lifetime, reduced energy consumption of IoT nodes. The results show that the DBN offers greater source of flexibility with increased data routing capabilities than other methods. Data encryption will be allowed in the future when data is being transferred between source and destination nodes. Furthermore, the usage of blockchain technologies will allow for the most efficient and reliable data transfer from the source to the destination nodes.

References

[1] Duraipandian M. Performance evaluation of routing algorithm for Manet based on the machine learning techniques. Journal of trends in Computer Science and Smart technology (TCSST). 2019 Sep;1(01):25-38.

[2] Troia S, Rodriguez A, Martín I, Hernández JA, De Dios OG, Alvizu R, Musumeci F, Maier G. Machine-learning-assisted routing in SDN-based optical networks. In 2018 European Conference on Optical Communication (ECOC) 2018 Sep 23 (pp. 1-3). IEEE.

[3] Tang Y, Cheng N, Wu W, Wang M, Dai Y, Shen X. Delay-minimization routing for heterogeneous VANETs with machine learning based mobility prediction. IEEE Transactions on Vehicular Technology. 2019 Feb 15;68(4):3967-79.

[4] Yuvaraj N, Kousik NV, Jayasri S, Daniel A, Rajakumar P. A survey on various load balancing algorithm to improve the task scheduling in cloud computing environment. J Adv Res Dyn Control Syst. 2019;11(08):2397-406.

[5] Yao H, Yuan X, Zhang P, Wang J, Jiang C, Guizani M. Machine learning aided load balance routing scheme considering queue utilization. IEEE Transactions on Vehicular Technology. 2019 Jun 10;68(8):7987-99.

[6] Yuvaraj N, Raja RA, Karthikeyan T, Kousik NV. Improved Privacy Preservation Framework for Cloud-Based Internet of Things. In Internet of Things 2020 Dec 29 (pp. 165-174). CRC Press.

[7] Tabrizi AF, Rakai L, Darav NK, Bustany I, Behjat L, Xu S, Kennings A. A machine learning framework to identify detailed routing short violations from a placed netlist. In2018 55th ACM/ESDA/IEEE Design Automation Conference (DAC) 2018 Jun 24 (pp. 1-6). IEEE.

[8] Kannan S, Dhiman G, Natarajan Y, Sharma A, Mohanty SN, Soni M, Easwaran U, Ghorbani H, Asheralieva A, Gheisari M. Ubiquitous vehicular ad-hoc network computing using deep neural network with iot-based bat agents for traffic management. Electronics. 2021 Jan;10(785):1-16.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[9] Sai Ramesh L, Sundar SS, Selvakumar K, Sabena S. Tracking of Wearable IoT Devices Through WAP Using Intelligent Rule-Based Location Aware Approach. Journal of Information & Knowledge Management. 2021 Feb 29;20(supp01):2140005.

[10] Reshma R, Sathiyavathi V, Sindhu T, Selvakumar K, SaiRamesh L. IoT based Classification Techniques for Soil Content Analysis and Crop Yield Prediction. In 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) 2020 Oct 7 (pp. 156-160). IEEE.

[11] Dhanalakshmi B, SaiRamesh L, Selvakumar K. Intelligent energy-aware and secured QoS routing protocol with dynamic mobility estimation for wireless sensor networks. Wireless Networks. 2021 Feb;27(2):1503-14.

[12] Anand J, Perinbam J, Meganathan D. Design of GA-based Routing in Biomedical Wireless Sensor Networks. International Journal of Applied Engineering Research (IJAER). 2015;10(4):9281-92.

[13] Sangeetha SB, Blessing NW, Yuvaraj N, Sneha JA. Improving the training pattern in back-propagation neural networks using holt-winters' seasonal method and gradient boosting model. In Applications of Machine Learning 2020 (pp. 189-198). Springer, Singapore.

[14] Anand J, Jeevaratinam RP, Deivasigamani M. Performance of Optimized Routing in Biomedical Wireless Sensor Networks Using Evolutionary Algorithms. Comptes rendus de l'Académie bulgare des Sciences. 2015 Aug 1;68(8):1049-55.

[15] Dudukovich R, Hylton A, Papachristou C. A machine learning concept for DTN routing. In 2017 IEEE International Conference on Wireless for Space and Extreme Environments (WiSEE) 2017 Oct 10 (pp. 110-115). IEEE.

[16] Luong NT, Vo TT, Hoang D. FAPRP: A machine learning approach to flooding attacks prevention routing protocol in mobile ad hoc networks. Wireless Communications and Mobile Computing. 2019 Jan 1;2019(6869307):1-17.

[17] Rupasinghe T, Cooray P. Machine Learning-Based Parameter Tuned Genetic Algorithm for Energy Minimizing Vehicle Routing Problem. 2017;2017(3019523):1-13.

[18] Yu C, Lan J, Guo Z, Hu Y. DROM: Optimizing the routing in software-defined networks with deep reinforcement learning. IEEE Access. 2018 Oct 23;6:64533-9.

[19] Militani DR, de Moraes HP, Rosa RL, Wuttisittikulkij L, Ramírez MA, Rodríguez DZ. Enhanced Routing Algorithm Based on Reinforcement Machine Learning—A Case of VoIP Service. Sensors. 2021 Jan;21(504):1-32.

[20] Arappali N, Rajendran GB. MANET security routing protocols based on a machine learning technique (Raspberry PIs). Journal of Ambient Intelligence and Humanized Computing. 2021 Jun;12(6):6317-31.

[21] Anand J, Perinbam JR, Meganathan D. Q-learning-based optimized routing in biomedical wireless sensor networks. IETE Journal of Research. 2017 Jan 2;63(1):89-97.

[22] Zeng W, Zhang B, Davoodi A. Analysis of security of split manufacturing using machine learning. IEEE Transactions on Very Large Scale Integration (VLSI) Systems. 2019 Aug 6;27(12):2767-80.

[23] Proietti R, Chen X, Zhang K, Liu G, Shamsabardeh M, Castro A, Velasco L, Zhu Z, Yoo SB. Experimental demonstration of machine-learning-aided QoT estimation in multi-domain elastic optical networks with alien wavelengths. Journal of Optical Communications and Networking. 2019 Jan 1;11(1):A1-10.

[24] Sharma DK, Dhurandher SK, Agarwal D, Arora K. kROp: k-Means clustering based routing protocol for opportunistic networks. Journal of Ambient Intelligence and Humanized Computing. 2019 Apr;10(4):1289-306.

[25] Tang F, Mao B, Fadlullah ZM, Kato N, Akashi O, Inoue T, Mizutani K. On removing routing protocol from future wireless networks: A real-time deep learning approach for intelligent traffic control. IEEE Wireless Communications. 2017 Oct 27;25(1):154-60.

[26] Caglayan MU. G-networks and their applications to machine learning, energy packet networks and routing: Introduction to the special issue. Probability in the Engineering and Informational Sciences. 2017 Oct;31(4):381-95.

[27] Troia S, Martinez DE, Martín I, Zorello LM, Maier G, Hernández JA, de Dios OG, Garrich M, Romero-Gázquez JL, Moreno-Muro FJ, Mariño PP. Machine learning-assisted planning and provisioning for SDN/NFV-enabled metropolitan networks. In 2019 European Conference on Networks and Communications (EuCNC) 2019 Jun 18 (pp. 438-442). IEEE.

[28] Etengu R, Tan SC, Kwang LC, Abbou FM, Chuah TC. AI-Assisted Framework for Green-Routing and Load Balancing in Hybrid Software-Defined Networking: Proposal, Challenges and Future Perspective. IEEE Access. 2020 Sep 14;8:166384-441.

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An Comprehensive Survey on Applications of Precision Agriculture in the Context of Weed Classification, Leave Disease Detection, Yield Prediction and UAV Image Analysis

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Abstract. Advancement in technologies such as Machine vision, Machine Learning, Deep Learning algorithms enables them to extend its horizon in different applications including precision agriculture. The objective of this work is to study the various works pertaining to precision agriculture under four categories, weed classification, disease detection in leaves, yield prediction and image analysis techniques in UAV. In case of the weed classification, both classifying weeds from the crops and classifying the different types of weeds are analysed. In disease detection, only the diseases that occur in the leaves of different plants are considered and studied. It is continued with the state of art models that predicts yields of different crops. The last part of the work concentrates on analysing the images captured UAV in the context of precision agriculture. This work would pave a way for getting a deep insight about the state of art models related to the above specified applications of precision agriculture and the methods of analysing the UAV images.

Keywords. precision agriculture, weed classification, yield prediction, disease detection.

1. Introduction

The following can be inferred from the definition of the precision culture provided by international society of precision agriculture. Different data are collected from different sources through different tools; this data includes spatial data, temporal data, and individual data. Decisions were made on the basis of the data gathered and other available

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information to improve the overall process in terms of various parameters. According to the objectives of the precision agriculture is to Improving the product's quality, Increase the Productivity, Energy optimization, Optimized use of products like fertilizers and pesticides and to take measures against pollution. The concept of precision agriculture dated back to 1980's is enabled with different techniques such as Global Positioning System, Geographic information system, remote sensing, Wireless sensor networks, unmanned aerial vehicles and Machine vision [1]. Though there are various applications based on precision agriculture, this work concentrates on making a deep survey on precision agriculture in the following perspectives such as Weed Classification, Leaf disease detection, Yield prediction and Image analysis in UAV. The papers that were analysed include the models that were used in various form of precision agriculture. A separate section for studying the state of art models that analysis images captured by UAV is also given in addition to the various models.

2. Weed classification

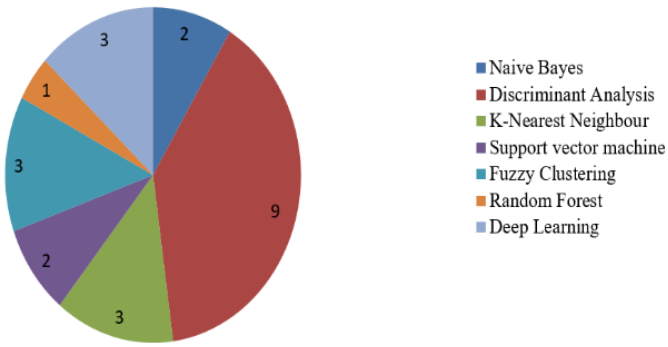

Figure 1. Summary of models for weed Detection

Weeds are wild plants that grow in between the cultivated plants; the process of detecting the weeds is an important process in agriculture. There are various weed detection mechanisms that employs various machine learning and deep learning models. They are Naïve Baiyes, Discriminant Analysis,K-Nearest Neighbour, Support Vector Machine, Fuzzy Clustering, Random Forest and Deep Learning. The weed classification can be divided into two such as Classification of weeds and crops and Classification of weeds.

2.1. Classification of weeds and crops

(A. Piron et al. 2009) states that in the earlier studies the height of the crops and the multispectral features are considered individually for classification of plants and the weeds with the help of quadratic discriminant analysis. The authors have observed that employing both the features results only in slight increase in the classification accuracy. Hence the authors introduce a model for improving the classification accuracy by introducing

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a threshold between the height of the weeds and the height of the crops. With the introduction of the model, the classification accuracy achieved is 82%.

Segmentation of the plant species from the soil and classification of plants and different kinds of weeds are performed in (Okamoto, H et al. 2007)through Euclidean distance and the discriminant analysis. The later model uses wavelet coefficients .step by step discriminant analysis performs well in classifying the plants and the weeds than the model that employs Euclidean distance. (Kazmi, W et al. 2015) have proposed a model for classifying the thistles from the sugar beet fields. Around 14 features were employed by the authors and two models called linear discriminant analysis and mahalanobis distance were employed. Different combinations of the features were employed and the best performing features are color index for vegetation extraction, excess green and green minus blue. This feature produces accuracies that were higher than 90%. In another experiment the combination of the features excess green and green minus blue produces a better accuracy of 95%.

Identification of weeds and classification of tomato leaves were done in (Lee, W. S. et al. 2004) Initially the images are classified in to regions with plants and without plants. The features that were considered for this classification are saturation, hue and intensity. Bayesian decision model is used for this classification. This process is continued by the identification of leaves which is done through the series of steps that result in removal of noise. Noise removal is made with processes called as shrinking followed by swelling. Plant recognition procedure is applied and the leaves are classified to either good or bad initially. For this purpose, around 10 shape features are considered. After the leaves are classified into good or bad, it is classified in to four classifications, cotyledon, tomato leaves- true/miscellaneous and weeds. Here also Bayesian discrimination is used. The accuracy obtained in identification of the weeds is only 48%.

(Muhammad Hamza Asad and Abdul Bais 2019) have proposed a model for classifying weeds in the canola fields. The process of segmenting the plants and the vegetation is done with maximum likelihood model. After this segmentation, manual labelling of pixels indicating weeds is done for further training and classification. Different deep learning models are employed and the performances are evaluated. UNET_VGG16, SegNet_VGG16, UNET_ResNet-50,SegNet_ResNet-50 are used, though the overall accuracies are higher the performance in detecting the weed is low.The performance metric used for measuring the identification of weed is intersection over union.

Carrots and weeds are classified in (Florian J. Knoll et al. 2019) with deep convolutional neural networks, though decreasing the computation time is the objective of the work , the overall classification accuracy obtained by the authors is 99%. The accuracy of identifying the weed detection is 93.12% in conventional model and the accuracy value decreases in the optimized model to 86.88%.

(Astrand.B and Baerveldt.A 2002) designed a mechanical robot that is used for detecting the weeds among the sugar beets. Histogram thresholding is used for segmenting the plants from the rest of the image. This is followed by extracting the features; the features include colour, shape and moment-based features. KNN is used for classifying the weeds from the sugar beets. The accuracy obtained is 97%. (Ahmed.F et al. 2012) have proposed a model for classifying weeds from the chilli plants using support vector machine. The image processing steps includes image segmentation by means of binarization , it is followed by morphological opening for removing the noise. The features

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that were extracted are moment invariants, shape features that are independent of the size and the colour features. 97% accuracy is obtained with SVM.

Random forest classifier and soft independent modelling by class analogy is employed in (Micael Felipe de Souza et al. 2020) for classifying weeds from the sugar cane. Random forest model performs better than the other models and produces an accuracy of 99.5% in classifying the weeds from the crops. (Tellaeche, A et al. 2007) have produced a model to classify weeds from the plants, in this approach, binarized images are created from the RGB images using thresholding approach. Morphological opening is used for removing unwanted pixels. From the resulting image , extraction of Area based attributes is done and it is given as input for the Bayesian and fuzzy K-means for classification. The accuracy obtained is 91%.

2.2. Classification of weeds

Meyer, G et al. 1998 have proposed a model for differentiating the grass/weeds from the soil . The experimentation is done with two kinds of leaves and two kinds of weeds. In order to segment the soil and the plant, as a first step, sub images were generated by the authors each one for red, green and the blue. From the colour model, the values are normalized and average excess green image is computed. It has been observed that the pixels representing the soil are not as brighter as the pixels that represent the plants. In order to make the discrimination between the plants and the soils and the discrimination between the plants, texture features are obtained from pixels of plant and soil. The features that were considered are excess green, local homogeneity, entropy, inertia and angular second moment. The result obtained is high (99%) for soil discrimination and it is low for classifying the species (30% to 70%). Also the author from

Classification of six types of weeds is done in Burks, T et al which employed by the authors is colour co-occurrence method. The RGB images are converted to HSI images from which the CCM matrices are generated. The texture properties are extracted from it and CCM statistical methods were applied for classification. The accuracy obtained with weed classification is 93%.

Weed classification has been done in (Ahmad. I et al 2011) with K-nearest neighbour classifier enabled with Haar Wavelet transform. The work includes three processes segmentation by which the unwanted regions are removed; extraction of features with Haar wavelet transform by means of which 200 features were extracted and finally classification is done. The features extracted are texture features and it includes horizontal, diagonal and vertical coefficients. Classification is done with KNN classifier and the accuracy obtained is 94%.

A mechanism has been proposed in (Pereira, L.A et al. 2012) for identifying aquatic weeds. Image segmentation is applied for extracting the similar regions from the images. The exact shape of the leaves is extracted by further processing called filling regions and elimination of connected components. The image segmentation is followed by shape analysis and classification. Five feature extraction models are employed and different classifiers such as optimum path classifier, support vector machine, Bayesian classifier, multilayer perception and self organizing map are employed. The best accuracy is achieved with optimum path classifier with beam angle statistics extractor.

Apart from both these kinds of classifications there are certain works that concentrates on finding the weed density, classifying the weeds from grasses in grass lands. Such works are described below.

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A model has been proposed in (Gebhardt Steffen et al. 2006) for identifying a particular kind of weeds in grasslands. The leaves of the plants and the leaves of the weeds are distinguished from the background by the authors through homogeneity measurement. With the homogeneity threshold binary images were formed by the authors. The features that were considered for classification are colour, shape and texture. Maximum-likelihood is employed for classifying the weeds and the accuracy obtained varies from 71 to 95%. Weed density is measured in (Solahudin, Mohamad et al. 2010) with the help of RGB colour components. The weed density is defined by the features intensity, saturation and hue. The weeds and the plants are categorized based on the fractal dimensions. The authors have presented the results in terms of the values of the fractal dimension of the plants and the weeds.

(Neto, J.C et al. 2006) have used the identification of individual leaves as a mean of classifying the weeds and the other plants. Technologies, Gustafson-Kessel clustering, genetic algorithm are used for extraction of the leaves. The outcome of the research is given in terms of the percentage of the leaf extraction.

Two datasets were considered in (Alessandro dos Santos Ferreira et al. 2019) one that is captured in soybean field and the dataset is used for discriminating between the grass and the broad leafs. The second dataset contains eight types of weeds and it is used for discriminating between the weeds. Two models are employed, first one uses Deep Clustering for making clusters of Visual Features and it is called as DeepCluster and the second model is called as JULE which stands for Joint Unsupervised Learning of Deep Representations and Image Clusters . Both of these clustering models are based on Alexnet and VGG-16 convolutional neural network. It is also observed that incorporation of transfer learning increases the accuracy of the model.

3. Disease detection

Disease detection is the process of identifying the diseases that occurs in various parts of the leaves [2]. Studies have shown that various classification algorithms are in use for disease classification. Disease detection can be made in Leaves, Fruits and Other parts of the plants The one that is concentrated in this study is the leaves disease detection. The study includes both the machine learning and deep learning models. Fluorescence features extracted by fluorescence sensors are used for identifying the Huanglongbing disease in citrus leafs in Sankaran. S and Ehsani. The machine learning models employed are naive bayes classifier and bagged decision tree classifier. While the naive bayes classifier performs well in the laboratory condition,bagged decision tree outperforms it in the field. The overall accuracy obtained with the later model is 94%.

Features like hue, intensity and saturation are extracted and analysed with color co-occurence model. this is used for classifying the citrus leaves as scab, greasy spot, melanose and normal in (Bandi et al 2013). Four classifier models are employed Random Forest, KNN, Naive Bayes and linear discriminate analysis. Linear discriminate analysis performs well than the other models with an accuracy of 98.75

Yellow vein mosaic virus disease is identified in (Mondal, D et al. 2017). Morphological features are extracted from okra leaves and bitter gourd leafs. From the okra leaves ten key features are extracted and from bitter gourd leaves 9 key features are extracted by the authors. 95% accuracy is obtained in case of identifying yellow vein mosaic virus disease in okra and the accuracy obtained in case of bitter gourd is 82.67%.

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Continuous wavelet analysis is used in (Zhang, J et al. 2017) for identifying and discriminating diseases and the damages that are found in the leaves. Fisher's linear discriminant analysis (FLDA) is employed for classifying the disease. This is based on the wavelet scalogram that are continuously decomposed .the features that are employed are wavelet features. The overall accuracy obtained is 77%.

Disease classification of three types of disease are made in the leaves and canopies in (Shi, Y et al. 2017). The model used by the authors is kernel discriminant analysis. Spectral features were used for discrimination. The accuracies obtained are given in leaf level and canopy level. In the former case the accuracy ranges from 76% to 95% and in the later case, the accuracy is greater than 87%.

Multi band optical sensor is used in (Mishra, A et al. 2011) for identifying the Huanglongbing disease in the citrus leaves. Reflectance of the canopy is measured in four different bands and five classification algorithms are employed , decision trees, KNN, Logistic Regression, Neural Networks and support vector machines. Results depicts that SVM has lower classification error.

989 spectral features were collected in (Sankaran, S et al. 2011) from the spectral reflectance data with visible-near infrared spectroscopy. The number of features is reduced to 86 with the help of PCA. quadratic discriminant analysis (QDA), linear discriminant analysis, soft independent modelling of classification analogies(SIMCA) and k-nearest neighbour are the algorithms that are employed for classification.Comparative result analysis shows that quadratic discriminant analysis provides better result.

Two types of diseases canker and Huanglongbing are identified in (Sankaran, S et al. 2013) with the help of the spectral features. Both mid infrared spectroscopy and visible-near infrared spectroscopy are employed for getting the spectral images. Two types of classifiers are employed, K-Nearest neighbour and Quadratic discriminant analysis. Both produces accuracy greater than 90%.

Two kinds of apple leaf diseases called as alternaria and miner pest were detected in (Omrani, E et al. 2014) with classification algorithms, support vector regression machine and artificial neural networks. The infected regions of the plant leaves are first detected with K-means clustering followed by extraction of colour, texture and shape features. Then the classifiers are applied. Support vector regression model performs well than the artificial neural network model. Two kinds of kernels are experimented in support vector regression model, RBF and polynomial. The performance parameter considered for evaluating the models is coefficient ofdetermination. It is inferred that support vector regressor with RBF kernel performs well than the other models. Co-occurrence and texture features are obtained from the leaf images. The extracted features are fed to two classifiers as input, the classifiers are SVM and minimum distance criterion (Arivazhagan, S et al. 2013). The classification accuracy obtained in the formal model is 86.77% and the accuracy obtained in the later model is 94.74%.

Classification of diseases such as Southern green stink bug, Bacterial angular, Ascochyta blight are classified in (Camargo, A et al. 2009) with the help of the following features. shape, texture, lacunarity, dispersion, fractal dimension, grey levels, grey histogram discrimination and fourier descriptor. These features are given as input to the support vector machine for classification. Experimentation is done with different combination of features and the best result is achieved with all features.

Diseases such as the scab disease and the rust disease that occurs in grape leaves are identified in (Meunkaewjinda, A et al. 2008). The pre processing work includes the

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segmentation of the grape leaves , the affected regions of the leaves are segmented with the help of the self organizing map and genetic algorithm . The same is used for optimization. Finally support vector machine is used for grape leaves classification.

SVM is used in (Sannakki, S.S et al. 2013) for classifying the disease that occurs in pomegranate leaves. K-means clustering is used for segmenting the colour images and the result is fed to SVM. The features extracted and given as input to the classifier are hue, energy, saturation and entropy. The accuracy obtained is 97.30%.

95% accuracy is achieved in (Islam, M et al. 2017) for classifying the potato leaves that has disease and that does not have. Plant village dataset is used for evaluating the model. The leaf region is extracted and the colour and the texture features are got from it. The features are given as input to the support vector machine. The disease classified is blight disease either in early or later stage. The spots representing the disease in the rice plant leaves are identified by extracting the colour features, texture features and shape features. The features were given as inputs to the support vector machine. The overall accuracy obtained in (Yao, Q et al. 2009) is 97.2Colour co-occurrence method is used for extracting the texture features from the leaves in (Singh, V and Misra, A.K 2017) and given as input to the support vector machine. Support vector machine classifier is built to identify various types of disease that occurs in leaves, such as scorch disease, sun burn, bacterial leaf spot and fungal diseases. Experimentation has been done with leaves from various plants. The average accuracy obtained is 97.6Classification of normal tomato leaves and healthy tomato leaves is made in (Mokhtar, U et al. 2014). Nine texture features are extracted and gray level co-occurence matrix is used for generating 36 texture features. The features are given as input to SVM and the highest accuracy obtained is 99.83In (Xiaoling Deng et al. 2019) Primary spectral data is considered as the input for the classification algorithms designed for classifying the Huanglongbing disease that occurs in the citrus fruit. Entropy distance band selection method and sequential backward selection is used for optimization the results of which are compared with the results obtained with principal component analysis. Three different datasets were created with different features and 6 different machine learning algorithms are applied for classification. The maximum accuracy is achieved in support vector machine with principal component analysis for feature selection. Citrus greening disease also known as huanglongbing is a commonly occurring disease in citrus plants. The preprocessing steps include removal of noise, calculation of vegetation index, incorporation of principal component analysis for feature compression and incorporating autoencoders for identifying the features. SVM, kNN, logistic regression (LR), naive Bayes and ensemble learning models are used .100% accuracy is achieved with adaboost in (Yubin Lan et al. 2020). In case of (Wan-Soo Kim et al. 2020) weakly supervised learning model is used for object localization as a pre processing step of identifying the onion downy disease. Class activation map is used by the authors for visualizing the classified objects. CNN is employed for identifying the symptom of disease. The available VGG16 model is used to create 5 different models that are classified by the number of weight layers. The highest mean average precision obtained is 87.2.

Though the survey does not provide a complete list of all the works it can be inferred that support vector machine is used in most of the works for leaf disease detection and provides better results. The following table 1 summarizes it. Future researchers and works can consider support vector machine for their work in disease detection.

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Table 1. summarization of usage of support vector machine

Support Vector Machine	
Leaves	**Diseases**
Citrus leaves	canker, Huanglongbing
Apple leaves	alternaria, miner pest
Banana leaves, Rose leaves, Lemon leaves, Beans leaves	early scorch, yellow spots, brown spots, late scorch, bacterial Diseases, fungal diseases
Cotton leaves	Southern green stink bug, Bacterial angular, Ascochyta blight
Grapes leaves	Scab, Rust
Potato leaves	Blight
Rice Plant	Rice bacterial leaf blight (RBLB), rice sheath blight (RSB), rice blast(RB)
Tomato and pomegranate leaves	infected and damaged region

4. Yield Prediction

Another application of precision agriculture is yield prediction. The following is the summary of the few works that concentrates on yield prediction [3–5]. Most of the works are based on the images taken from UAV. In (Linghua Meng et al. 2019) date information of each pixel of the image is integrated with the NVDI values. Two different time series products are obtained with the aid of flexible spatiotemporal data fusion. The author specifies that with this the spatial effectiveness and the temporal effectiveness of the images obtained from the satellite are improved. Linear regression model is applied for different reconstructed data. The coefficient of determination value differs from 0.77 to 0.84. Eight different features extracted from the images taken with three different types of camera mounted in the UAV are used for estimating the cotton yield in (Aijing Feng et al. 2020). The eight factors are experimented separately and in different combinations. The best value of the coefficient of determination with individual parameter is 0.90 and it is achieved with both plant height and the cotton fibre index. The best coefficient of determination with two feature models ranges in the values from 0.92 to 0.94.

In case of (Anna Mateo-Sanchis et al.2019), enhanced vegetation index and vegetation optical index are considered and combined to estimate the yield prediction of various crops. Two statistical models namely regularised linear regression and kernel ridge regression are used by the authors the results obtained varies depending on the crop and are considerably low. Maize yield prediction is made with the excess green colour feature in (Meina Zhang et al. 2020). Linear regression model is used for predicting the maize yield and the coefficient of determination obtained are less than 0.5. Six different features belonging to the vegetation indices and drought related indices are used as features for maize yield estimation in (Louise Leroux et al. 2019). With this features two models, multiple linear regression and random forest are employed for yield prediction. The performance of the Random forest model overcomes the performance of the multiple linear regression.

(Bo Li et al. 2020) used narrow band vegetation index as inputs for two different prediction models partial least square and random forest for predicting the potato yield. Rrelief feature selection algorithm is used for selecting two features among the different features. The prediction were made in two different time periods, one after 60 days of planting and another after 90 of planting . The performance parameters considered are

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coefficient of determination and RMSE . In case of partial least square the coefficient of determination obtained are 0.69 and 0.81. The RMSE value is 0.56 and 0.42. in case of random forest the values obtained for coefficient of determination is 0.44 and 0.63 and RMS is 0.73 and 0.63.

Rice yield estimation is done in (Md Nasim Reza et al. 2019) by combining K-means clustering and a graph cut algorithm. These two algorithms are combined to segment the area of rice grain. K-means clustering is obtained and form the clustered image rice grain area is extracted with the help of the shoelace algorithm. The coefficient of determination obtained is 0.98. In (Petteri Nevavuori et al. 2019) RGB data and NDVI data obtained from the UAV is used as inputs to the convolutional neural network for crop prediction. The model is optimized in various ways such as use of Adadelta training algorithm and employment of l2 regularisation .the mean absolute error of this model is 484.3kg/ha. The authors of (Maitiniyazi Maimaitijiang et al. 2020) Various features such as texture features, thermal features canopy spectral and structure are extracted from the images captured with UAV. various models such as random forest regression, Partial Least Squares Regression (PLSR), Support Vector Regression (SVR), input-level feature fusion and intermediate-level feature fusion based deep neural network models are employed for yield estimation. The last model performs well producing a coefficient of determination 0.720. Estimation of wheat ear is the task of (Simon Madec et al. 2019) and it is made with the help of R-CNN model .the capability of the deep learning model to learn the important features by itself is used by the authors in this model and the root mean square error in this prediction is approximately 6

5. UAV Image Analysis

This section describes the cameras used in the drone, their applications and description of how images acquired from the drones [7, 8] are processed.Each camera has its own specific purpose as specified in (Pasquale Daponte et.al 2019) and is summarised in the Table 2 The objective of this section is to study and summarize the cameras used in the

Table 2. Applications of different cameras in UAV

Camera	**Application**
Multispectral camera	Chlorophyll content, Leaf water content, Leaf area index, Normalized difference vegetation index
Thermal Camera	Water stress
RGB cameras and LiDAR systems	Digitizing the terrain surface

drones and the pre-processing steps made with it . In (Aijing Feng et al. 2020) Three cameras are used in the model. a RGB camera, a multispectral camera and an infrared camera. Geo referenced images acquired from them are used to generate digital surface model with the aid of a method called as structure from motion method. Mosaic blending model is used for generating the orthomosaic images. Following this, fine tuning is performed row by row and then different features are extracted for yield estimation. In (Meina Zhang et al. 2020) were maize yield prediction is made, RGB images were collected from the with a camera during three different growth stages, kernel development, grain filling and physiological maturity.the Gegraphical positioning system of the UAV

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is used for geo-referencing the sequential images. Stitched panoramic images are created in the cloud server called as drone deploy. Since this work also concentrates on the impact of variable rate nitrogen application, geo-registration of N application data and geo-referenced yield data is also made. Various colour features are extracted and given as input to the regression model for yield estimation.

Two kinds of images RGB images and Hyperspectral images are used in (Bo Li et al. 2020) are used for finding the biomass and yield estimation. From the RGB images, RGB digital surface model and digital elevation model is acquired. From the hyperspectral images, vegetation indices are derived. With this features, random forest model is used for yield estimation and biomass estimation. In (Md Nasim Reza et al. 2019) RGB images were collected from UAV .from the captured images, mosaicked image is created , for further processing, the mosaicked image is cropped into cell images, each cell image is divided into sub-cell image. For individual sub cell image k-means clustering along with graph cut algorithm is used for getting the segmented image which has the rice grain image from which the yield would be calculated. Parrot's NIR-capable SEQUIOA-sensor is used in (Petteri Nevavuori et al. 2019) for acquiring spectral images. Images were captured in 9 different fields. These images are combined with the yield data and provided as input to the convolutional neural network. The training set and the test set are created with the processing such as mosaicing, sub sampling and shuffling. Multisensory, thermal and RGB sensors are used in the UAV employed in (Maitiniyazi Maimaitijiang et al. 2020) and the corresponding images are captured in the soybean field. Image acquisition is followed by Orthorectification and mosaicing . The other pre-processing steps includes, multispectral images are converted to reflectance, thermal image calibration. Various features are extracted from this for yield prediction [6].

In (Yubin Lan et al. 2020) green multispectral image, red multispectral images and as well as near infrared multispectral images of a citrus field is acquired from the UAV. These images are later used for disease detection. the pre-processing steps include removal of noise by means of linear stretching and region of interest extraction. Vegetation indices are then calculated to various machine learning algorithms for detecting citrus greening disease. Disease detection in soybean leaves are identified in (Willian Paraguassu Amorim et al. 2019) with the help of the digital negative images that are captured from drone. Simple linear iterative clustering is used for segmenting each plantation. 3000 superpixel images are generated from this which contains images pertaining to different classes. These are given as input to the convolutional neural network for disease detection.

Multispectral camera is used in the UAV for the process of counting the number of tress in (Lucas Prado Osco et.al. 2020) The pre-processing steps include orthorectification with reference to 9 ground control points. Radiometric corrections were made on the images with reference to the radiance values of the reflectance plate. The result of these steps is the orthorectified surface reflectance image from which tree locations can be identified. Citrus rootstock evaluation is made in (Yiannis Ampatzidis et al. 2019) with the help of the images captured with multispectral camera with five bands red, green, blue, red edge and near infrared. The process includes radiometric calibration. Aerial maps of each band are stitched together and given as input to the convolutional neural network for further processing. Himanshu Agrawal et al. (2019) stated that there are many sensors in precision agriculture which continuously monitor the soil, wind speed, camera and drone in the field. In (Muhammad Adeel Hassan et.al 2019) monitoring of NDVI is

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made during the different growth stages of the wheat. With this grain yield prediction is made. Sequoia 4.0 multi-spectral sensor is used for taking the spectral images. It consists of four monochrome sensors. The pre-processing steps includes Geo-referencing, dense point cloud building generating digital surface model and orthomosaic images. From this various vegetation indexes generated and yield prediction is made.

6. Conclusion

From the study the following observations were made, Segmenting plants from the background soil or any other kind of background is the foremost step in most of the precision agriculture applications. though there are various methods that employs various features for this segmentation process it is observed that simple techniques that incorporate Euclidean distance produces almost 100% accuracy.In case of classifying weeds from the crops commonly used features such as colour, shape, texture and moment invariants results in high accuracy greater than 97%.Around 39% of the works studied for weed classification belongs to discriminant analysis models. In case of image analysis of the images acquired through UAV various image processing techniques are explored and the features obtained from them for various precision agriculture applications are studied. Most of the machine learning models that are explored in case of weed classification and leaf disease detection does not incorporate UAV. Few of the studies in yield prediction and studies made on image analysis reveals that a different image analysis process is incorporated in case of UAV image analysis which differs from the traditional ones. It is believed that combining these would help future research to extend the applications of precision agriculture and also in getting better results.

References

[1] Piron A, Leemans V, Lebeau F, Destain MF. Improving in-row weed detection in multispectral stereoscopic images. Computers and electronics in agriculture. 2009 Nov 1;69(1):73-9.

[2] Bandi SR, Varadharajan A, Chinnasamy A. Performance evaluation of various statistical classifiers in detecting the diseased citrus leaves. International Journal of Engineering Science and Technology. 2013 Feb;5(2):298-307.

[3] Reshma R, Sathiyavathi V, Sindhu T, Selvakumar K, SaiRamesh L. IoT based Classification Techniques for Soil Content Analysis and Crop Yield Prediction. In2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) 2020 Oct 7 (pp. 156-160). IEEE.

[4] Pandiyaraju V, Shunmuga Perumal P, Kannan A, Ramesh LS. Smart terrace gardening with intelligent roof control algorithm for water conservation. Pak. J. Agri. Sci. 2017 Jun 1;54(2):451-5.

[5] Reshma R, Sathiyavathi V, Sindhu T, Selvakumar K, SaiRamesh L. IoT based Classification Techniques for Soil Content Analysis and Crop Yield Prediction. In2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) 2020 Oct 7 (pp. 156-160). IEEE.

[6] Pandiyaraju V, Shunmuga Perumal P, Sai Ramesh L, Ganapathy S, Kannan A. Dynamic Waypoint Navigation Assisted Agricultural Flying Vehicle for Field Data Collection. Asian Journal of Research in Social Sciences and Humanities. 2016;6(12):448-57.

[7] Xu D. Agricultural climate change based on remote sensing image and emergency material supply management of agriculture, rural areas and farmers. Arabian Journal of Geosciences. 2021 May;14(10):1-8.

[8] Agrawal H, Dhall R, Iyer KS, Chetlapalli V. An improved energy efficient system for IoT enabled precision agriculture. Journal of Ambient Intelligence and Humanized Computing. 2019 Jun 18:1-2.

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IoT Based Shirodhara

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Abstract. The contemporary pandemic scenario of COVID- 19 has brought to surface the efficacy of old health care wisdom in inhibition and care of diseases where contemporary medicine deceptively wants a real cure. Undeniably, viral diseases for the fascinating vitality of their causal organisms, top this wish list. Ultimately the world seems to be enthusiastic to pay attention about old health care approaches to control viral pandemics if these are found well-intentioned in handling such situations. One such demand is to energetically or intelligently use the therapeutic devices especially the Shirodhara device, at the convenience, anytime, anywhere in a teleconsultation mode. The Shirodhara device design is to be in a manageable form without trailing the legitimacy and principals of Ayurveda. The main elements used in the device comprises of a sensor for perceiving the temperature, a pump for salvaging the medicine, programming device to control the temperature, and regulate the heater and a wavering pipe for free flow of the medicine. The device is premeditated in such a way to evade the faults and snags produced while doing the procedure Shirodhara. Hence, this device is built which is portable, cost effective; it provides a technologically enhanced Shirodhara instrument curtailing the practice of medicine and man power for the procedure.

Keywords. Shirodhara, oil, tele-consultation, portable, sensors.

1. Introduction

The term Shirodhara is taken from the duple Sanskrit words “shiro” (head) and “dhara” (flow). The traditional ayurvedic sacred scripture of Charak Samhita and Susruta Samhita says that Shirodhara is also called by innumerable other dialect names as: Shiro Sheka, Sirothara, Parisheka, Shiro Parisheka, Dhara, and Shirashe. From time immemorial, the ayurvedic treatment by name Shirodhara is used to lessen mental stress. The Shirodhara treatment is used to offer a calming feeling to the mind and physique. All the particulars related to the deployment of Shirodhara are elucidated in traditional texts such as ‘Dharakalpah’; wherein, some physical parameters like the altitude of drop, nature of fluid, the substantial of dhara pot etc. are endorsed [1].

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2. Types Of Shirodhara Massage

A judiciously selected liquid (based on the symptoms) at a fixed temperature is made to fall freely on the forehead unceasingly for a fixed amount of time and at a selected velocity to generate an impetus force. The liquid is made to drop down from a dhara pot held at a standard elevation of 4 angulas for dhara over head; for other build part, it is ended from a elevation of 12 angulas. If there is a progressive disease then, the normal procedure is done departed from above cited rules. Usually, 2-3 litres of the carefully chosen liquids are used for the 1-hour long session [2].

Types of Shirodhara Massage- The Shirodhara Massages are based on the various types of herbal oils or infusions, and it is classified into the following types:

- **Dugadha Dhara (Ksheerdhara):** In this type the key ingredient is milk.
- **Jala Dhara (Aqueous formulation):** To smoothen the Pitta imbalance in the body, coconut water is chiefly used.
- **Ksheer Dhara:** To smoothen the Vata and Pitta predominant headaches, stress, insomnia, and anxiety, milk infused with herbs are chiefly used.
- **Kwatha Dhara (Decoction):** built on the recognized condition or dosha imbalance, the main element in kwatha dhara encompasses the decoctions got from the numerous herbs.
- **Sneha Dhara or oil Shirodhara:** In this type herbal oils used are called tela or ghee.Herbal oils are mixed from various essential oils.Lakshadi oil or Chandan Bala Lakshadi oil is used to treat Pitta and Dhanwantaram is used to treat Vata disorders. To smoothen the Vata and Kapha imbalances, warm oil is chiefly used. To smoothen the Pitta imbalances, cool oils (room temperature) are chiefly used. Tepid herbal ghee or Saraswat ghee is used for the treatment of the Pitta that is accompanied by Vata vitiation.
- **Taila Dhara (Thaila Dhara):** In this type either only one oil or a combination of many ayurvedic oils are used.
- **Takra Dhara (Thakradhara):** To smoothen the aggravated Vata in the body, buttermilk infused with special herbs are chiefly used.

3. Types Of Oils Used In Shirodhara Massage

Liquids used in Shirodhara that are opted by consultants include are, Animal milk, buttermilk, Buttermilk processed with Indian Gooseberry, Chandanadi thailam, Clarified butter (ghee), Coconut oil, Coconut water, Decoctions of herbs, especially licorice, decoctions particularly those encompassing licorice and Dhanwantharam thailam, herbal ingredients, Karpasasthyadi thailam, kasaya (medicated water), Ksheer bala tailam (a mixture of Bala herb paste, sesame oil, and cow's milk), ksheerabala oil, mahanarayana oil, Milk only, milk processed with herbs and Narayana thailam, sesame oil, warm milk, water

3.1. Which Oil Is Best For Shirodhara?

Based on the physiological condition and Vatic imbalance of an individual. The kind of the liquid selected is subject to the patients' health condition. Even the basic sesame oil, or oils that are antioxidant rich and oils with energetic elements like sesamin, sesaminol

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and sesamol, induce not only the serotonin movement in the brain but also pacifies and quietness the head, discharges stressful settings and encourages slumber. The oils assorted with nervine herbs are also helpful for curing people with post-traumatic trauma syndrome.

4. Related Work

Divya et al. formulated a hypothesis concerning the system of Shirodhara. The hypothesis, talks about the conversion of latent potential energy (PE) in the liquid into kinetic energy (KE) during free drop. The authors also elucidate that the tumbling liquid over the patient's forehead, creates an impetus which causes an alteration in voltage which kindles the nerve compulsions or heightens the nerve compulsion conduction [3].

Uebaba et al. [4] characterized Shirodhara in an arbitrary and regulation cluster of subjects realized in the control prostrate position by the robotic system [5, 6]. The efficacy of Shirodhara is enumerated using physiological parameters such as heart rate, CO_2 output, blood pressure, electrocardiogram (ECG) and electroencephalogram (EEG) to quantity the electrical bustle of heart and brain [4, 5, 7].

Obviously, the machinery of Shirodhara is byzantine involving

- Creation of a force due to influence
- transformation of impression force into mechanical pressure waves
- conversion of mechanical pressures into neurological signals and
- change of neurological signals into enduring physiological effects like tranquillity of the patients.

Even though a mechanism of treatment is hypothesized by [3] and the efficiency of Shirodhara are documented by [5]; no significant literature exists in understanding the mechanics of process involved in Shirodhara.

5. Working Mechnaism

5.1. Reason For The Pouring Of Shirodhara Oil Onto The Forehead

The herbs or herbal ingredients, infused liquids are squirted on the forehead and scalp so that the muscles of the cranium, which have several peripheral nerves or numerous subtle nerve endings or energetic points that are right away linked to the hypothalamus of the brain get soothened. It further arouses the numerous energetic points all about the head and enhances the blood flow.

5.2. Treatment Procedure Of Shirodhara Massage

Step 1. The entire procedure is routed to steer the mind and body to indulge in a state of profound rest. Before 5 to 10 minutes properly knead the head and scalp using a right amount of oil/liquid.

Step 2. The patient lies in a prostrate position on droni/ Shirodhara table. If essential, place a small pad or cloth under the neck for correct support.

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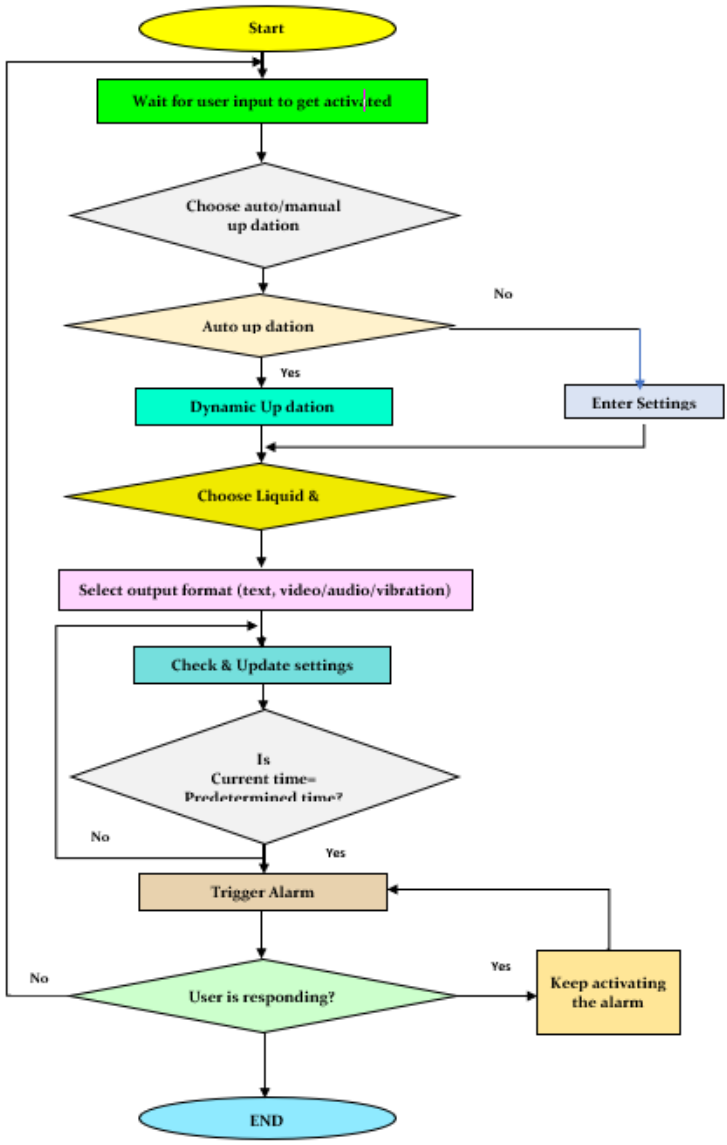

Figure 1. Flow chart -Steps performed Shirodhara process/procedure.

Step 2a. The dhara pot (which can be made of earthen/copper/brass material) has a pothole at the nethermost of about to the size of a little finger (standard size) hung above the subject [1, 8]. The wick assembly in the Shirodhara pot is akin around four angulas (approximately 7.5 cm) above, from the subject's forehead [1]. Shirodhara pot and the forehead distance ought to be about 10 cm. Perfect the Shirodhara pot or equipment so as to ensure that the liquid from the pot tumbles down straight onto the forehead.

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Step 3. Fill the Shirodhara pot , with the carefully selected oil, and necessary herbs; slowly open the nozzle and regulate the flow of the herbal oil or the herbal liquids over the head and forehead of the patient.

Step 4. As the oil drips/flows continuously over the forehead ask the patient to lessen and enjoy the feeling looming from the oil as it is dispersed over the head.

Step 5. Under the supervision of a curative assistant, the Shirodhara pot is equivocate or waver along the length of the forehead ensuring incessant flow; and the fluid should go from left to right, crosswise part of the forehead and vice versa.

Step 6. Accumulate the brimming superfluous oil from the forehead, on the table, rewarm it to endure the precise temperature of the Shirodhara oil. The liquid is heated/rewarmed to the patient's body temperature or to a temperature that is comfortable to the patient and spurted via Shirodhara pot along the length of the forehead [1,8].The warmed oil is poured back into the pot and this same way, it gets recycled till the end of the procedure.

Step 7. Upon completion of treatment, the patient is recommended to take rest.

Step 8. The procedure persists for about 20 to 30 minutes.

Step 9. A light head massage is also effected on the patient during the process.

Step 10. Upon accomplishment of the Shirodhara massage, wipe off the oil or fluids from the temple area of the patient.

Step 11. Recommend the patient to rest for 30 to 60 minutes, so that the oil slowly oozes deep inside the head.

6. What Is Shirodhara Good For?

The myriad healing paybacks of these herbal liquids used for the massage aids in the treatment of a host of vigor conditions (tranquil, restful, and comforting) and it is good for, Aids in Mental Focus and Concentration, Allergic rhinitis, Lowers High Blood Pressure, Cognitive Abilities. Depression -anti-stress, anti-depressive and anti-anxiety, Eye diseases and Vision Problems, Hair- Reduces the Hair Loss and Fatigue and greying of hair, Headaches - Relieves Chronic Headaches and Migraines, Hearing damage-minimises, Hypertension, Insomnia, Intuition, Rouses Intuition, Memory loss, Meniere's disease, Neurological disorders, psoriasis-like certain types of skin diseases, Reduces / Diminishes Anxiety, Relieves /Reduces Stress/ Post-Traumatic Stress Disorders, Sinusitis, Sleep Quality - Enhancing Sleep Quality –Soothes Vata Doshas -Stabilizes Nervous System, Tinnitus and Hearing loss, Tinnitus, Vertigo.

The treatment thus caters to the soothing, easing, restful effects on the mind, nurtures and calms the doshas but also expansively used for giving a numberless of vigor incongruities together with stress, despair, wakefulness, high blood pressure, hemicrania, etc. It also enhances the mystical alertness and aids to establish a recent linking to the inner soul.

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7. Proposed Smart Shirodhara

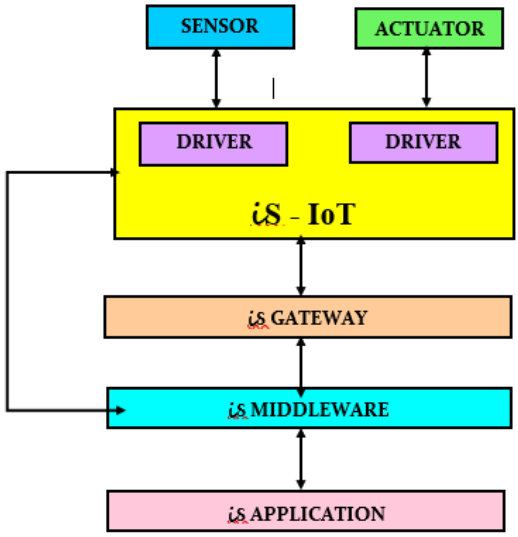

Figure 2. Layered block diagram of Integrated IoT based iS system

Figure 2 is a typical layered block diagram representation of the Integrated IoT based iS system, in accordance with the exemplary embodiment in the invention. The schematic of the Integrated IoT based iS system is shown in figure 3 and is also described in the ensuing sections.

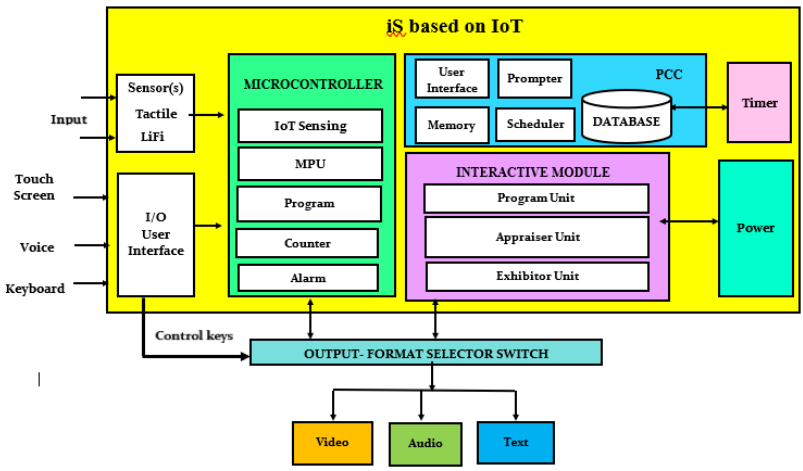

Figure 3. schematic representation of the integrated iS

Figure 3 shows a schematic representation of the integrated iS blocks with customization facility. There are four modules, namely, the water dispensing module, an

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Interactive (process/procedure) caller module, the display module and a sensing module, all of which are connected to a microcontroller (for process and control). It includes at the heart components like microcontroller, the MPU, RAM, ROM, sensor(s), an alarm, dispensation circuitry, and concerned modules.

(i) **iS central device** - iS device is a hardware component. The iS is linked to the Sensors and/or Actuators either by wire or wirelessly and it integrates all the components. iS is a processor with sufficient storage capacity to run the programmed software and to establish a link to the IoT Integration Middleware.

(ii) **Microcontroller** -This gives the iS system its behaviour and it has a small MPU that runs the software. The microcontroller may be an Arduino board, a raspberry pi, a beagle bone or the like.

(iii) **Micro Processing Unit (MPU)** - Micro processing unit (MPU) components are the ALU(arithmetic logic unit which is used to execute arithmetic and logical operations), and the CU (control unit which is used to extract instructions from memory, decode it and executes them, also calls the ALU as per necessity).

(iv) **Memory** - In the Micro-controller, more exactly, the MPU needs the programs to do a specific task which is a set of commands. The Microcontrollers memory is of 2 types, namely, Read-only memory (ROM) and random-access memory (RAM).

(v) **Bus** - Bus is used for the transfer of data and consist of 8, 16 or even more wires. The Address bus is 16-bit and is used to assign address and identify memory positions. The Data bus is 8 bits and is used to indicate an ASCII character and is used to carry on data.

(vi) **Oscillator** - The on-chip crystal oscillator (for stable oscillation) is the time source for CPU.

(vii) **Interrupts**- An interrupt is the signal to the processor directed by external hardware or software to show that an event needs immediate service in the process/procedure cycle.

(viii) **Gateway** - Gateway helps to link the Process/procedure Device to additional systems and it offers indispensable technologies and mechanisms to construe amongst the various protocols, communication technologies, and payload formats.

(ix) **IoT Integration Middleware**- The IoT Integration Middleware (IoTIM) provides a mixing layer for diverse varieties of Sensors, Actuators, Devices, and Applications. It is liable for (i) getting data from the connected Devices, (ii) processing the received data, (iii) providing the received data to linked Applications, and (iv) regulating Devices.

(x) **Application**- It is the software that runs the IoT Integration Middleware (i) to increase understanding into the physical environment via sensors and/or (ii) to deploy the physical world by controlling physical actions using Actuators. The invention discloses an iS , small, portable, smart, economical, employs only a limited number of sensors, diminishing the cost of posture recognition accuracy.

(xi) **Power**- The iS may also include a power source such as a battery which powers the microcontroller, the sensor(s), the alarm, timer.

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(xii) **Counter**- The counter for instance, is updated in response to a valid output signal, to create a visible signal (both audio, video).

(xiii) **Communication unit** bestows the iS with communication capabilities. It can be anything ranging from internal communications to options like Bluetooth and ZigBee's typically either a Bluetooth or ZigBee.

The iS may also include a power source such as a battery which powers the microcontroller, the sensor(s), the alarm and timer. The output signal from the sensor(s) may be analog or digital depending upon the microcontroller specifications.

8. Conclusion

The contemporary pandemic scenario has enforced people to stay indoors, has curtailed the frequent visits to the hospital and has encouraged to go for teleconsultations. But to tackle the steady rising number of COVID- 19 it is noticed that certain therapies cannot come to a standstill or be stopped for want of proximity of skilled professionals. Further to utilise the efficacy of old health care wisdom without any inhibition at will, anywhere, anyplace the device is proposed for real cure. One such demand is to energetically or intelligently use the therapeutic devices especially the Shirodhara device, at the convenience, anytime, anywhere in a teleconsultation mode. The Shirodhara device design is to be in a manageable form without trailing the legitimacy and principals of Ayurveda.

References

[1] Pavana J, Manoj S. Keraliya Chikitsa paddhati: Padmasri. DR. K. Rajagopalan ayurveda series-3. 2010.

[2] Soumita B. Shirodhara Massage: Benefits, Uses, Procedure, Oils, Treatment And Side Effects [Internet]. 2020 [cited 2020 Sep 20]. Available from: https://www.netmeds.com/health-library/post/shirodhara-massage-benefits-uses-procedure-oils-treatment-and-side-effects

[3] Divya K, Tripathi JS, Tiwari SK. An appraisal of the mechanism of action of shirodhara. Annals of Ayurvedic Medicine. 2013;2:114-7.

[4] Uebaba K, Xu FH, Tagawa M, Asakura R, Itou T, Tatsue T, Taguchi Y, Ogawa H, Shimabayashi M, Hisajima T. Using a healing robot for the scientific study of Shirodhara. IEEE engineering in medicine and biology magazine. 2005 Apr 4;24(2):69-78.

[5] Uebaba K, Xu FH, Ogawa H, Tatsuse T, Wang BH, Hisajima T, Venkatraman S. Psychoneuroimmunologic effects of Ayurvedic oil-dripping treatment. The journal of alternative and complementary medicine. 2008 Dec 1;14(10):1189-98.

[6] Xu F, Uebaba K, Ogawa H, Tatsuse T, Wang BH, Hisajima T, Venkatraman S. Pharmaco-physio-psychologic effect of Ayurvedic oil-dripping treatment using an essential oil from Lavendula angustifolia. The Journal of Alternative and Complementary Medicine. 2008 Oct 1;14(8):947-56.

[7] Dhuri KD, Bodhe PV, Vaidya AB. Shirodhara: A psycho-physiological profile in healthy volunteers. Journal of Ayurveda and integrative medicine. 2013 Jan;4(1):40-4.

[8] Lavekar GS, Menon TV. Practical handbook of Panchakarma procedures. 2009.

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Model for Refactoring a Software Using Feature Oriented Dependency (FOD)

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Abstract. Refactoring is the process of improving the code of the software without affecting the external behavior of the code only by reconstruct the internal structure . It makes code cleaner, clearer, simpler or in other words, clean up the code. It also improves the quality of code then it became more reliable and easy to maintain through lifecycle of software. Refactoring has become renowned concept in software development process. The IDE (Integrated Development Environment) highly prefer this technique. Researches on refactoring technique have improved now a day. Beyond that , this particular technique is used to improve different functions of application software. It mainly speed up the function and helps to get the output much faster. In this proposed work Feature Oriented Dependency (FOD) tool is created used for refactoring process established on a chemical reaction optimization meta heuristic approach to discover the appropriate refactoring resolutions.

Keywords. Refactoring, Restructuring, Re-engineering, Reverse engineering.

1. Introduction

FOD methodology utilized using refactoring as re-engineering technique, the main concept of the FOD is to mold a software system according to the structures it provides i.e divide and run them independently, the objective is to build well-structured software that can be personalized to the requirements of the user and the application.

From a set of features, various different software systems can be produced, to share common features and also to add different features, in any software development, the domain analysis method can be used, a problem is analyzed and the solution for the problem is also defined.

Outsized and composite software systems require a strong understanding of desired system features, capabilities of the software are mandatory to implement those structures, software refactoring, long promised enhancements will become feasible only when the features and aptitudes are common to systems, the systematic exploration of software systems to be defined cohesion is called domain analysis.

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2. Literature review

Kyo Kang [1] presented a domain analysis in which one technique that can be applied to meet this condition. By observing a class of related software systems and the common underlying theory of those systems, domain analysis can offer a reference model for describing the class. It can provide a basis for understanding and communication about the problem space addressed by software in the domain. Domain can also propose a set of architectural approaches for the execution of new systems.

John MCGregor [2] evaluated domain analysis, domain engineering, domain specific language and many other wildcard matches applies to the term domain. Domain may be thought of in several different ways. Many of the technical explanations view a domain as the subject for a family of programs. For example, telephone call switching systems. Domain based approach provides a context for software development that creates synergy with other business activities of the company generating strategically significant results.

Sukhdeep Kaur and Raman Maini [3] proposed that refactoring is a crucial process to improve the quality of software. Refactoring is a part of software engineering that expands more readability of program and maintainability of the software. Refactoring is a mostly used technique that gives the code simpler, cleaner, reusable, extendable, maintainable or other features by transforming a program. In programming language bad smell or code smell is a code or design problem that makes the software that specifies a problem, may be desired in it refactoring of code. In this paper some refactoring techniques discussed that are used to eradicate code smells from code or program.

Javier Perez et al. [4] presented a case study to evaluate the fitness of graph conversion tools for program refactoring. Adding quality for this purpose, a graph transformation system must be able to import a graph based on the models of java programs. Case study of this aims to enable comparison of various features of graph conversion tools, such as their expressiveness and their ability to interact with the user. The model of java programs is presented and some examples for translating JAVA source code into the model are provided.

Sangeetha [5] proposed refactoring id typically done in small stages. After every small steps we left with a working system that is functionally unchanged. So refactoring does not preclude changing functionality, it just says that it's a different activity from reorganizing code. It implies equivalence, the beginning and elegant or in other words. Refactoring is a well defined process that improves the quality of systems and allows developers to renovate the code that is becoming hard to maintain, without throwing away the existing source code and starting again. By careful application of refactoring the system behavior will remain the same, but return to a well structured design. FODA tools makes it more likely that the developer will perform the necessary refactoring, since the tools are much quicker and reduce the chance of introducing bugs.

U.Devi et al. [6] said refactoring is effectively known to remove the problem of code clones. Replicated code fragment in source code, usually known as code clones. Refactoring is a general and capable technique to remove the problem of code clones. Refactoring is the sequence of code changes which improve the quality of design (internal structure) without changing the behavior of software (external structure). Refactoring is usually a small change to the software. Code clones are categorized and detected based on certain established approach the tools which have been given are able to categorize

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code clones based on the approaches. Refactoring is one remedial measure to tackle with the problem of code clones.

William [7] presented software refactoring is the systematic practice of improving application code's structure without altering it behavior. Refactoring is somewhat that he as an knowledgeable developer naturally did to his code, without deliberately thinking about it. It's a core element of agile approaches, and most professional IDE's include refactoring tool. Although the invention of refactoring and it is implementation into professional practice were practically destined. Refactoring tools and software processes such as agile development, a project team can now more freely choose to invest in software design. Designers are no more omniscient that before, but refactoring investing early only in design that will surely pay off down. API will be used many subsystems while delaying other design investment until the issues become clears.

Ramalakshmi and Gayathri Devi [8] evaluated Refactoring is done to develop the quality of a software system's structure which tends to reduce as the system evolves. While manually determining useful refactoring is a challenging task search based techniques can automatically discover suitable refactoring. Refactoring approach uses the concept of pare to optimality which naturally applies to search based refactoring. Before refactoring is done, the test case should be generated. A formal written test case is considered by a known input and by an expected output, which is worked out before the test is performed.

Woo- Chang Shin and Jungkyn Rho [9] characterized a refactoring tool that can modify the internal structure of software to a more easily understandable and modifiable structure that enormously affects software maintenance productivity. This paper proposed a code model to support software maintenance tool developers to easily access and handle software source codes. Also it displayed the implementation method of the software refactoring operation.

John Grundy and John Hosking [10] proposed several tools that have been established to support automation in both narrow and broad domain ranging across Artificial Intelligence (AI) tool kits such as theorem proves and model checkers requirements, design coding and testing support tools. They verified various configuration management process enhancement and project management support tools and code generators, code analysis, visualization, refactoring and reverse engineering tools.

3. Software Refactoring

Process of altering a software system in such a way that it does not modify the external behaviour of the code , it develop the internal structure, such that it increases code quality, reliability and maintainability throughout life cycle, makes software easier to understand and improves maintainability

3.1. Feature modeling

Software consists of features such as A, B, C, D, E and F As per the need of customers,these needed features can be given to them through refactoring with the help of the FOD tool. FOD tool could help to divide and run the features as per the need by the customers

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4. Metrics of FOD

Table 1. Average Performance for FOD before and after Refactoring

Tools	Before Refactoring with KLOC	After Refactoring with KLOC
SPS	10	5
KAPTUR	15	10
CTA	20	10
DESIRE	6	5
FOD	5	3

Table 2. Average Performance of CBO and LSCC

TOOLS	CBO	LSCC
SPS	7.9	5.45
KAPTUR	8.8	3.8
CTA	3.5	3.02
DESIRE	3.5	1.7
FOD	10.5	9.5

The first, metric CBO (Coupling Between Object) classes symbolizes the number of classes combined to a given class. The coupling is achieved by the following factors such as method calls, field accesses, inheritance , arguments return types, and exceptions.

The second metric Low Level Class Cohesion (LLCC). Metric denotes the classes, Meaningful class coupling and cohesion metric helps object-oriented software developers identify class design weaknesses and refactoring classes consequently. The results show that LLCC is better than CBO metric.

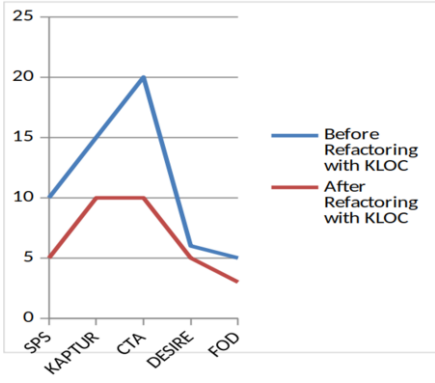

Figure 1. KLOC Vs Tools with Before and After Refactoring

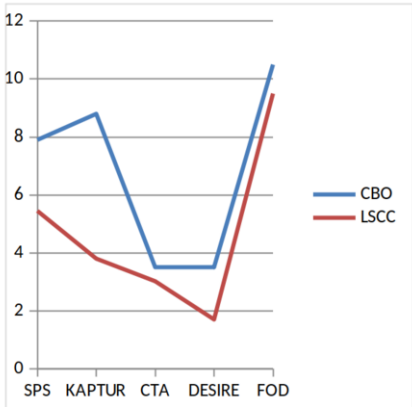

Figure 2. KLOC Vs Tools with CBO and LSCC

The advantage of the proposed system is to improve the code readability. Computational cost or Complexity is reduced by using the propose methods. It also improves the performance of the system. In Table 1 shows the average performance of FOD before

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and after refactoring. Some of the automobile spare parts project, comparing five different tools with FOD, The thousands of (Kilo) Lines Of Code (KLOC) is decreased in our proposed work as shown in the table. Table 2 shows average performance of FOD tool is compared with other tools. The FOD tool gives better results than other tools. Figure 1 shows the accuracy performance for FOD before and after refactoring, number of lines are reduced after refactoring. FOD tool provides better results compare to other tools. Figure 2 shows the accuracy performance for FOD before and after refactoring, number of lines are reduced after refactoring. FOD tool provides better results compare to other tools such as SPS, KAPTUR, CTA, DESIRE. It shows FOD tool gives better results than other tools, based on clarity of the code and speed of the execution.

5. Conclusion and Future work

This research work proposed to FOD Tool which is established and executed successfully. By this tool any application software is refactoring. Any application software is developed through FOD. Each modules separately given to the users and run independently. Our experimental results displays the efficiency of our approach compared with existing approaches and different others meta heuristic approaches. We plan to study and implement this model in several number of other mission critical applications, their features and different languages which could be possibly applied by FOD tool so as to create new applications, this extension would require the possibly of adding new features in the FOD tool, for example, economical decisions over the extended feature model and checking a product which cost less than others.

References

[1] Kang KC, Cohen SG, Hess JA, Novak WE, Peterson AS. Feature-oriented domain analysis (FODA) feasibility study. Carnegie-Mellon Univ Pittsburgh Pa Software Engineering Inst. 1990 Nov 1:01-94.
[2] John McGregor D. Journal of object technology. Chair of Software Engineering. 2004;3(7):71-81.
[3] Kaur S, Maini R. A comprehensive review of refactoring techniques. International Journal of Latest Technology in Engineering, Management & Applied Science. 2015 Oct;4(10):78-83.
[4] Pérez J, Crespo Y, Hoffmann B, Mens T. A case study to evaluate the suitability of graph transformation tools for program refactoring. International Journal on Software Tools for Technology Transfer. 2010 Jul;12(3):183-99.
[5] Sangeetha V, Sangeetha M. Fascinating Perspective of Code Refactoring. International journal of Advanced Research in Computer Science and Software Engineering. 2016 Jan;16:164-8.
[6] Devi U, Sharma A, Kesswani N. A Study on the Nature of Code Clone Occurrence Predominantly in Feature Oriented Programming and the Prospects of Refactoring. International Journal of Computer Applications. 2016;141(8):39-44.
[7] Griswold WG, Opdyke WF. The birth of refactoring: A retrospective on the nature of high-impact software engineering research. IEEE Software. 2015 Sep 23;32(6):30-8.
[8] Ramalakshmi B, Devi DG. An Efficient Sdmpc Metric Based Approach For Refactoring Software Code. International journal of Engineering and computer science. 2015 May;14:11733-42.
[9] Shin WC, Rho J. Implementation of software refactoring operation using a code Model. International journal of Software Engineering and its Applications. 2014;8(6):17-30.
[10] Grundy J, Hosking J. Guest editors introduction: special issue on innovative automated software engineering tools. Automated Software Engineering. 2013 Jun;20(2):137-9.

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Automatic Biometric System for Finger Knuckle Using Sparse Encoder Approaches

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Abstract. Biometric recognition is one of the effective authentication techniques which is utilized in various applications for making the individual identification process. During the verification and authentication process different biometric features such as signature, ear, iris, face, palm, finger knuckle details are used to perform this process. Due to the easy acceptance of the palm surface, fine textures and stable features characteristics are helps to choose the finger knuckle feature for biometric process in this work. First the finger biometric features are collected from PolyU finger knuckle database. After that, the noise present in the images are eliminated using weighted median filter and the knuckle region is located with the help of the variational approach. After that key point descriptors are extracted using sparse autoencoder approach. Finally, the specific features are trained using compositional networks and features matching is performed by Chebyshev distance. The matching process authenticate the user whether they are authorized person or not. At last efficiency of the system is evaluated using MATLAB based experimental results such as false acceptance rate, equal error rate and false rejection rate.

Keywords. Biometric recognition, individual identification, finger knuckle features, PolyU finger knuckle database, variational approach, Chebyshev distance.

1. Introduction

Biometric [1] is the process of identifying and authenticating the person according to their recognizable data. During the biometric authentication process, user personal characteristics and identifies are used to authenticate the user to access the application or data. The authenticated characteristics [2] are their physiological information such as retina, hand geometry, DNA, signature, face, palm veins, face features, hand print, finger knuckle information, voice, gait, rhythm and so on. These biometric features are providing the access permission and control the unauthorized activities.In solving these real-time problems, [3] the impact of soft computing techniques which employ cognitive skills is very high. Although this system has been commercialized, the scope for improvement is still plenty. In many scenarios, [4] this authentication is provided by

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biometric systems. Moreover, the threat of pandemic has made the people to think of hygienic systems which are non-invasive.

These biometric authentication-based security [5] processes are utilized in different application [6] such as schools, college, office, bank transaction, hospital, attendance maintenance system and so on. As discussed earlier, each biometric feature having specific characteristics among that, finger knuckle biometric feature [7] have several advantages such as fine texture information, stable features, contact less, acceptance easy, easy capturing also it does not change according to personal feelings and other aspects. Due to these reasons, in this work finger knuckle biometric features are used to create the effective authentication [8] system. In addition to this, the finger knuckle biometric feature establishes the higher security collated with the other biometric features. Here the sample finger knuckle biometric graphical representation is depicted in Figure 1. With the help of the knuckle biometric feature [9] different automatic biometric system is created by applying the machine learning and image processing techniques [10]. There are

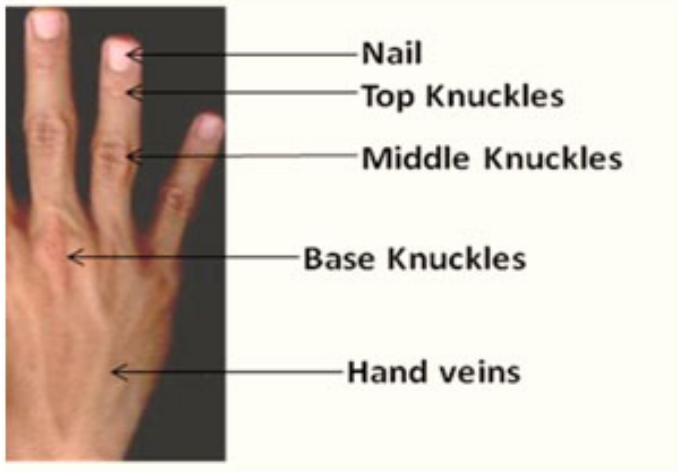

Figure 1. Sample Finger Knuckle Biometric Representation

several researchers uses the machine learning techniques to analyze the captured biometric image. Here few authors works are analyzed to get the knowledge about how the biometric images are processed. In [11] creating the multi model biometric system using deep learning techniques. Initially, finger knuckle print images are collected from user because, it is one of the effective, low cost and user-friendly biometric features. In [12] identifying and authenticating the user information using scale invariant feature transform and wavelet analysis. In this work fingerprint biometric features are getting from user which are decomposed into wavelet examination process. The wavelet approach decomposes the images into different sub image. After that scale invariant features are applied to extract the various descriptors. In [13] introducing parallel thinning approach to analyze the fingerprint approach. Initially, the fingerprint approach is captured, noise present in the images are removed with the help of median value. Then the thinning algorithm is applied to binarize the images. Then the thinning algorithm attains minimum execution time to authenticate the user effectively.In [14] creating the person authentication

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system using biometric features. During this process, knuckle print imaging information is collected which are processed using effectively machine learning techniques.

2. Variational and Sparse Autoencoder Approaches Based Biometric Authentication System

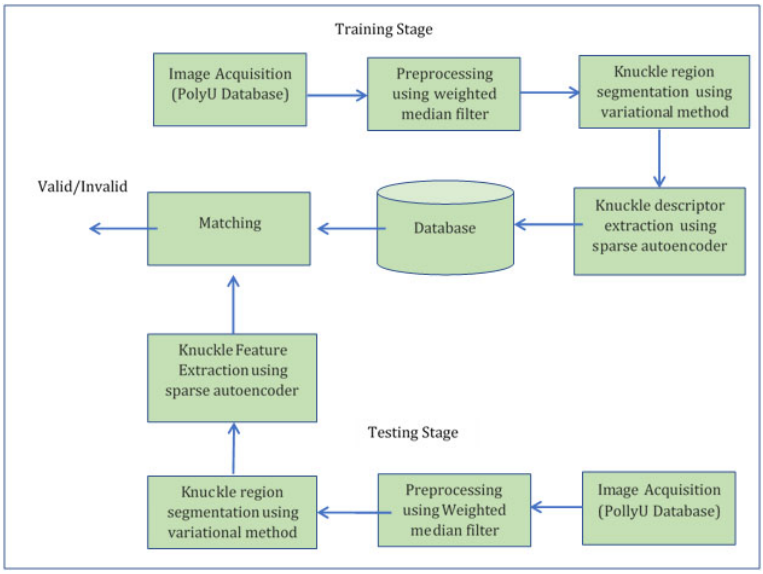

Figure 2. Automatic biometric authentication system structure

This section discuss about the variational and sparse autoencoder approach-based authentication system. The created system ability to recognize the users according to the personal traits for authenticating the credential and user information. For achieving the above discussed goal finger knuckle print biometric features [15] are used to authenticate each user while accessing the data from the application. In this work, polyU finger knuckle database images are used to process the introduced steps and methodologies. The system consists of different steps such as image collection, noise removal, knuckle region location, descriptor extraction and feature matching process which used to authenticate the user identifies. According to the list, the automatic biometric authentication system structure is depicted in Figure 2.

2.1. Finger Knuckler print image preprocessing

The first step of the work is to eliminate the noise from the image. The collected finger knuckle images having different type of noises due to the capturing process, name, image shake and so on. The inconsistent pixel details are reducing the authentications system and reduces the entire system security. So, the noise [16] present in the finger knuckle image must be removed by applying the weighted median filter. Initially, the pixels are checked against the threshold value. The threshold value is determined by analyzing the

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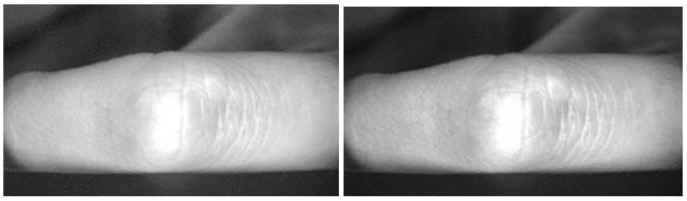
pixel range from the image. If the pixel value is deviated from the threshold value, it should be replaced by the weighted median value.



a b

Figure 3. a) original finger knuckle image, b) noise free knuckle image

During this process, the weighted value is allocated depending on the user choice. When the highest value is chosen, the image has been smoothened effectively. Then the median value [17] is computed to replace the noise pixel value. This process is repeated until to eliminate the noise present in the image completely and the sample result is depicted in Figure 3.

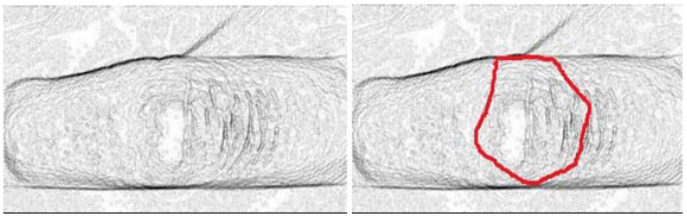
2.2. Knuckle Region Segmentation

The second step of the work is to extract the knuckle region which is done by using the variational approach. It selects the optimal pixels while performing grouping process also consume minimum deviation and resolve the non-convexity problem. Due to this reason, in this work variational approach [18] is used for segmentation. During the segmentation process pixel energy function is used to predict the exact location. The energy function includes the pixel fitness criteria and regularizing terms. Then the pixel energy function is computed using Eq. (1)

$$argmin_{uy}\|\nabla_{\mu}\|_{\int(\mu-f)^2dx} \tag{1}$$

In Eq. (1),μ represented as the piecewise constant image. The image energy function is relative between eh Chanvase and Mumford shah model that is written as follows.

$$argmin_{u}, Ky|K| + \int |\nabla\mu|^2 dx + \int (\mu - f)^2 dx \tag{2}$$



a b

Figure 4. a) edge detected finger knuckle image b) knuckle region located finger knuckle image

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The computed energy function value is addition of total length of the segmentation curve K,μ is represented as the smoothness f. So, the segmentation process includes the computation of the curve information, smoothness details and link between the curves are continuously examined. The identified similar smoothness related curves are grouped together. This process is repeated continuously until to locate the knuckle region from the noise removed image. According to the discussion, the sample knuckle segmented region is depicted in Figure 4.

2.3. Knuckle feature descriptor extraction

The third step of the work is to derive the descriptors [19] from the knuckle located image because, the key descriptors are used to match each person identities. The autoencoder utilizes the different layers such as input, hidden and output which helps to derive the features from located images unlike the autoencoder, sparse encoder [20] uses the greater number of hidden units compare to the input unit but minimum units are activated while extracting the features from the image. The feature extraction process includes the sparsity penalty concept in hidden layer h. The penalty process in layer h is mentioned as using Eq. (3).

$$L(x,x') + \Omega(h) \tag{3}$$

In eqn (3), h is computed using the pixel input, weight value and bias values that is represented as follows.

$$h = f(Wx + b) \tag{4}$$

The computed penalty value helps to determine the features in the knuckle image. During this process, each feature is extracted according to the activation function which is computed using the kullback-leiblerdivergence process. The activation function is computed using Eq. (5).

$$\rho_j - \frac{1}{m}\sum_{i-1}^{m}[h_j(x_i)] \tag{5}$$

According to the computed activation function each feature is analyzed continuously, then the minimum and maximum value of the located region is computed using Eq. (6).

$$D(x,y,\sigma) = L(x,y,K_i\sigma) - L(x,y,K_j\sigma) \tag{6}$$

in Eq. (6), knuckle region gaussian value is denoted as $D(x,y,\sigma)$, convolution of the knuckle region is represented as the $L(x,y,K\sigma)$ and the blur image is represented as the $I(x,y)$. By using these image details, key points are identified from the segmented region and the location of the key descriptors are identified with the help of the Taylor series that is computed using Eq. (7).

$$D(x) = D + \frac{\partial D^T}{\partial x}x + \frac{1}{2}x^T + \frac{\partial^2 D}{\partial x^2}x \tag{7}$$

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After that, key point orientation is identified according to the various orientation and magnitude which is done as using Eq. (8).

$$m(x,y) = \sqrt{(L(x+1,y) - L(x-1,y))^2 + (L(x,y+1) - L(x,y-1))^2} \tag{8}$$

in Eq. (8), magnitude of the key point is denoted as m (x, y) and orientation of the key point is determined as $\theta(x,y)$.

2.4. Matching process

The extracted features are trained by applying the compositional neural network [21] because it helps to improve the overall matching process. The network consists of multiple layers, which are trained based on activation function. In additionit also contains weight and bias values to improve the training process.

$$Netoutput = \sum_{i=1}^{N} x_i * w_i + b \tag{9}$$

In Eq. (9) x represented as the extracted features (input), w is weight value of the node and b is the bias values. This valueis processed according to eqn (9) and the net output value is computed. At the time of this process, following learning function is applied to train the features.

$$X_(k+1) = X_k + \left[J^T J + \mu I\right]]^{-1} J^T e \tag{10}$$

This process is applied to entire features in the feature list and the respective output value is computed. The resultant output is stored in the database as template which is used to matching process. When the incoming new user finger knuckle print is entered into the authentication system. The input image is processed is compared with the template features. The matching process is done by applying the Chebyshev distance [22] metric which detect the different between the two vectors. If the computed distance value is maximum, then it considered as the authorized or valid person else they are treated as unauthorized person. Then the Chebyshev distance value is computed using Eq. (11).

$$D_{chebyshev}(x,y) = max_i(|x_i - y_i|) \tag{11}$$

In Eq. (11) x is represented as the template feature and y is the testing finger knuckle features. According to the distance measure, the maximum relevant features are compared and identified effectively. In addition to this, once the feature similarity is identified, the feature value is further compared with the threshold value (0.3). If the computed feature value is maximum then the users are considered as the valid user else, they are terminated from access.

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3. Results and Discussions

In this section discusses about the variational and sparse autoencoder based automatic biometric authentication system efficiency. During this process system uses the polyU finger knuckle print image database. The database consists of 7920 images which are collected from 165 volunteers that includes 40 females and 125 male information. During the data collection process, index finger, right middle finger, left middle finger, right index finger and 660 different finger information is analyzed and recorded. Based on the discussion, the collected finger knuckle print image is depicted in Figure 5.

Figure 5. sample PolyU finger knuckle print images

After collecting the images, the above discussed steps are utilized to extract the knuckle region from the image. Once the region is extracted, respective features are derived which are trained and stored in database as template. Finally, the comparison process is performed according to the Chebyshev distance computation process. This discussed process is implemented using the MATLAB tool and the excellence of the system is determined using various performance metrics such as false acceptance rate, false rejection rate, equal error rate and authentication accuracy. False acceptance rate [17]- It is the important metrics, whether introduced system reject the false feature or false person into the system while analyzing the extracted features. The false acceptance rate is computed using Eq. (12).

$$FAR = \frac{Numberof\,featuresaccepted}{Numberof\,featurestested} * 100 \tag{12}$$

Based on the FAR computation process, the different finger knuckle print biometric images related false acceptance value is computed and the value is depicted in Table 1.

From the Table 1, it clearly depicted that the Autoencoder compositional network with Chebyshev distance (CAN+CD) approach having the minimum false acceptance rate compared to other classifiers such as Artificial Neural Network (ANN)[5], Multilayer Neural Network (MLP) [23], Back propagation Neural Network (BPNN)[24] and Deep Learning Neural Network (DNN)[25]. So, the false features are restricted to enter the system that is shown via the minimum false acceptance rate. Then the respective graphical analysis is depicted in Figure 6. The false acceptance rate of the Autoencoder compositional network with Chebyshev distance (CAN+CD) approach. From the analysis it clearly shows that CAN_CD (0.25%) of false acceptance rate compared to other ap-

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Table 1. False Acceptance Rate

S. No	Classifier Methods	FAR (%),Number of Images						
		100	200	300	400	500	600	700
1	Artificial Neural Network (ANN)	0.59	0.63	0.79	0.62	0.793	0.634	0.65
2	Multi-layer Neural Network (MLP)	0.45	0.59	0.64	0.76	0.63	0.693	0.7
3	Back propagation Neural Network (BPNN)	0.38	0.44	0.59	0.64	0.66	0.59	0.53
4	Deep Learning Neural Network (DNN)	0.26	0.36	0.34	0.41	0.38	0.424	0.431
5	Autoencoder compositional network with Chebyshev distance (CAN+CD)	0.189	0.249	0.254	0.275	0.289	0.21	0.29

proaches such as ANN(0.67%), MLP(0.63%), BPNN (0.54%) and DNN(0.372%). The effective computation of the knuckle print features, link between the features and matching process helps to reduces the false feature acceptance while accessing the data in the system.

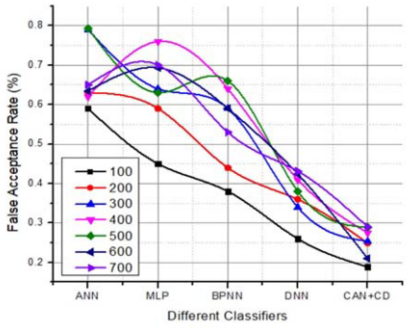

Figure 6. False Acceptance Rate (CAN+CD)

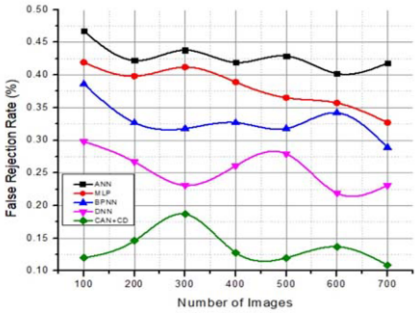

Figure 7. False Rejection Rate -CAN+CD

In addition to this, the system needs to reject only the false feature when it comes to access the data in the system. Then the false rejection rate [26] is estimated using Eq. (13).

$$FRR = \frac{Numberoforiginalfeaturesrejected}{Numberoforiginalfeaturestested} * 100 \tag{13}$$

According to the Eq. (13), the system efficiency is analyzed how effectively the system access the authorized user and incorrectly reject the authorized users in the list. Based on the computation, the estimated false rejection rate is depicted in Table 2.

From the Table 2, it clearly depicted that the Autoencoder compositional network with Chebyshev distance (CAN+CD) approach attains low false rejection rate compared to other classifiers such as Artificial Neural Network (ANN), Multi-layer Neural Network (MLP), Back propagation Neural Network (BPNN) and Deep Learning Neural Network (DNN). Then the respective graphical analysis is depicted in Figure 7.

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Table 2. False Rejection Rate

S. No	Classifier Methods	FAR (%),Number of Images						
		100	200	300	400	500	600	700
1	Artificial Neural Network (ANN)	0.467	0.422	0.438	0.419	0.429	0.402	0.418
2	Multi-layer Neural Network (MLP)	0.419	0.398	0.412	0.389	0.365	0.357	0.327
3	Back propagation Neural Network (BPNN)	0.386	0.327	0.318	0.327	0.318	0.342	0.289
4	Deep Learning Neural Network (DNN)	0.298	0.267	0.231	0.261	0.279	0.219	0.231
5	Autoencoder compositional network with Chebyshev distance (CAN+CD)	0.12	0.146	0.187	0.128	0.12	0.137	0.109

Figure 7 illustrated that the false rejection rate of the Autoencoder compositional network with Chebyshev distance (CAN+CD) approach. From the analysis it clearly shows that CAN_CD(0.134%) of false acceptance rate compared to other approaches such as ANN(0.42%), MLP(0.38%), BPNN (0.32%) and DNN(0.25%). The introduced CAN+CD approach examines the testing and training features using the effective distance measure, in addition to this, threshold-based comparison process also improves the overall authentication process. The effective computation process reduces the false rejection rate. Further efficiency of the system determined using the equal error rate [27] which is computed from the common value with the FAR and FRR. Then the computed equal error rate value is depicted in Figure 8. According to the above figure it clearly depicted that the (CAN+CD) approach attains minimum equal error rate value compared to other classifiers such as Artificial Neural Network (ANN), Multi-layer Neural Net-

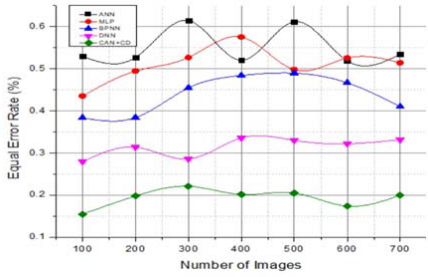

Figure 8. Equal Error Rate- CAN+CD

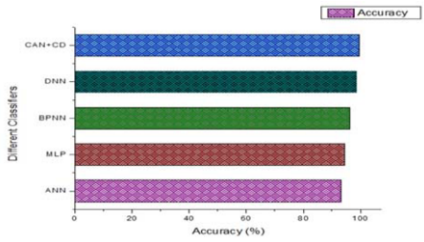

Figure 9. Authentication Accuracy

work (MLP), Back propagation Neural Network (BPNN) and Deep Learning Neural Network (DNN). The minimum error rate, false rejection value, false acceptance value directly indicates that the introduced CAN+CD system provide the security, authentication to the data while accessing the data. so, the overall recognition or matching rate is depicted in Figure 9. The (CAN+CD) approach ensures maximum authentication accuracy (99.52%) value compared to other classifiers such as Artificial Neural Network (ANN)(93.2%), Multi-layer Neural Network (MLP)(94.52%), Back propagation Neural Network (BPNN) (96.8%) and Deep Learning Neural Network (DNN)(98.7%). Thus the introduced Autoencoder compositional network with Chebyshev distance (CAN+CD)

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approach successfully ensure the security to the data by authenticating the users compared to other methods.

4. Conclusion

Thus, in this work creating the automatic biometric authentication system using the variationalAutoencoder compositional network with Chebyshev distance (CAN+CD) approach. Initially, finger knuckle print image is collected from the polyU finger knuckle image dataset. The collected images noise has been removed by computing the weighted median value. The method removes and smoothen the image effectively. Then the knuckle region is located by computing the pixel energy functionality value. Based on that information, region is located with the help of pixel link. After extracting the knuckle location, respective features are extracted by considering the sparse penalty value. Based on that information, autoencoder identify the features point, then the respective magnitude and key point orientation is derived. The derived features are trained and stored in the database as template. At last the matching process is performed by Chebyshev distance measure, in which maximum relevant features are considered as authenticated user else they are restricted to access the data. The efficiency of the system is evaluated using MATLAB based results in which system maintain the authentication up to 99.52% of accuracy with minimum error rate. In future, optimization techniques are used to select the best key point and improve the matching process using meta-heuristic techniques.

References

[1] Nagaraja S, Prabhakar CJ, Kumar PP. Extraction of texture based features of underwater images using RLBP descriptor. In Proceedings of the 3rd International Conference on Frontiers of Intelligent Computing: Theory and Applications (FICTA) 2014 2015 (pp. 263-272). Springer, Cham.

[2] Rabiul Islam M. Feature and score fusion based multiple classifier selection for iris recognition. Computational intelligence and neuroscience. 2014 Jul 10;2014:1-11.

[3] Winston JJ, Hemanth DJ. A comprehensive review on iris image-based biometric system. Soft Computing. 2019 Oct;23(19):9361-84.

[4] Jenkin Winston J, Turker GF, Kose U, Jude Hemanth D. Novel optimization based hybrid self-organizing map classifiers for Iris image recognition. International Journal of Computational Intelligence Systems. 2020 Aug;13(1):1048-58.

[5] Abiyev RH, Altunkaya K. Iris recognition for biometric personal identification using neural networks. In International Conference on Artificial Neural Networks 2007 Sep 9 (pp. 554-563). Springer, Berlin, Heidelberg.

[6] Kumar A, Ravikanth C. Personal authentication using finger knuckle surface. IEEE Transactions on Information Forensics and Security. 2009 Feb 10;4(1):98-110.

[7] He K, Zhang X, Ren S, Sun J. Deep residual learning for image recognition. In Proceedings of the IEEE conference on computer vision and pattern recognition 2016 (pp. 770-778).

[8] Maheshan CM, Kumar HP. Performance of image pre-processing filters for noise removal in transformer oil images at different temperatures. SN Applied Sciences. 2020 Jan;2(67):1-7.

[9] Krig S. Image Pre-Processing. Computer Vision Metrics. Apress, Berkeley, CA; 2014.

[10] Kuncheva LI, Faithfull WJ. Pca feature extraction for change detection in multidimensional unlabelled streaming data. InProceedings of the 21st International Conference on Pattern Recognition (ICPR2012) 2012 Nov 11 (pp. 1140-1143). IEEE.

[11] Faundez-Zanuy M. Biometric security technology. InEncyclopedia of Artificial Intelligence 2009 (pp. 262-269). IGI Global.

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[12] Obaidat MS, Rana SP, Maitra T, Giri D, Dutta S. Biometric security and internet of things (IoT). InBiometric-Based Physical and Cybersecurity Systems 2019 (pp. 477-509). Springer, Cham.
[13] Inan Y, Sekeroglu B. Signature Recognition Using Backpropagation Neural Network. In International Conference on Theory and Applications of Fuzzy Systems and Soft Computing 2018 Aug 26 (pp. 256-261). Springer, Cham.
[14] Dey A, Pal A, Mukherjee A, Bhattacharjee KG. An approach for identification using knuckle and fingerprint biometrics employing wavelet based image fusion and SIFT feature detection. In Advancements of Medical Electronics 2015 (pp. 149-159). Springer, New Delhi.
[15] Gogna A, Majumdar A. Discriminative autoencoder for feature extraction: Application to character recognition. Neural Processing Letters. 2019 Jun;49(3):1723-35.
[16] Chantaf S, Hilal A, Elsaleh R. Palm vein biometric authentication using convolutional neural networks. InInternational conference on the Sciences of Electronics, Technologies of Information and Telecommunications 2018 Dec 18 (pp. 352-363). Springer, Cham.
[17] Arulalan V, Balamurugan G, Premanand V. Multi Modal Biometric Recognition System using Palm print and Inner-Knuckle Print. International Journal of Applied Engineering Research. 2015;10(14):34748-51.
[18] Chlaoua R, Meraoumia A, Aiadi KE, Korichi M. Deep learning for finger-knuckle-print identification system based on PCANet and SVM classifier. Evolving Systems. 2019 Jun;10(2):261-72.
[19] Kumar A, Ravikanth C. Personal authentication using finger knuckle surface. IEEE Transactions on Information Forensics and Security. 2009 Feb 10;4(1):98-110.
[20] Zhai Y, Cao H, Cao L, Ma H, Gan J, Zeng J, Piuri V, Scotti F, Deng W, Zhi Y, Wang J. A novel finger-knuckle-print recognition based on batch-normalized CNN. InChinese conference on biometric recognition 2018 Aug 11 (pp. 11-21). Springer, Cham.
[21] Anand J, Sivachandar K. An edge vector and edge map based boundary detection in medical images. International Journal of Innovative Research in Computer and Communication Engineering. 2013 Jun;1(4):1050-55.
[22] Karczmarek P, Kiersztyn A, Pedrycz W. An application of graphic tools and analytic hierarchy process to the description of biometric features. In International Conference on Artificial Intelligence and Soft Computing 2018 Jun 3 (pp. 137-147). Springer, Cham.
[23] Belgacem N, Fournier R, Nait-Ali A, Bereksi-Reguig F. A novel biometric authentication approach using ECG and EMG signals. Journal of medical engineering & technology. 2015 May 19;39(4):226-38.
[24] Kwon JS. Improved parallel thinning algorithm to obtain unit-width skeleton. The International Journal of Multimedia & Its Applications. 2013 Apr 1;5(2):1-14.
[25] Ioffe S, Szegedy C. Batch normalization: Accelerating deep network training by reducing internal covariate shift. In International conference on machine learning 2015 Jun 1 (pp. 448-456). PMLR.
[26] Anand J, Sivachandar K, Yaseen MM. Contour-based Target Detection in Real-time Videos. International Journal of Computer Trends and Technology. 2013;4(8):2615-18.
[27] Sibia EV, Mareena G, Anand J. Content Based Image Retrieval Technique on Texture and Shape Analysis using Wavelet Feature and Clustering Model. International Journal of Enhanced Research in Science Technology & Engineering. 2014;3(8):224-9.

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Stock Market Prediction Using Machine Learning Techniques

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Abstract. Predicting the future in all the areas using machine learning techniques was the recent research in the current scenario. Stock market is one among them which needs the prediction future market to invest in the new enterprise or to sell their existing shares to get profit. This need the efficient prediction technique which studies the previous exchanges of stock market and gives the future prediction based on that. This article proposed the prediction system of stock market price based on the exchange takes place in previous scenario. The system studies the diversing effect of market price of product in a particular time gap and analyze its future trend whether it's loss or gain. During the system of thinking about diverse strategies and variables that should be taken into account, we observed out that strategies like random forest, Support vector machine and regression algorithm. Support vector regression is a beneficial and effective gadget gaining knowledge of approach to apprehend sample of time collection dataset. The data collected for the four years duration which was accumulated to get the expecting prices of the share of the firm. It can produce true prediction end result if the fee of essential parameters may be decided properly. It has been located that the guide vector regression version with RBF kernel indicates higher overall performance while in comparison with different models.

Keywords. Stock market, prediction, support vector machine, Random forest, Regression.

1. Introduction

Stock Securities trade forecast this is applied to expect destiny estimation of inventory price. Stock put it on the market expectation facilitates for each consumer and provider of inventory. The powerful forecast of a inventory's destiny fee should go back noteworthy gain for each consumer and seller. This might advocate that each one freely recognized statistic approximately an organization. Which surely contains its cost history, might as of now be contemplated with inside the gift value of the inventory. To foresee the inventory value of the precise organization we want get the chronicled inventory cost facts of that company. Using the verifiable facts we will expect the inventory open value of the day. Predicting the inventory fee in python application utilising system mastering algorithm. Support Vector Regression and Linear Regression calculation are applied to

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foresee the inventory price. Prediction is accomplished depending on real inventory fee of the company. The application will peruse the precise employer inventory records and make the forecast of the open fee of the day. The inventory trade is basically a conglomeration of various clients and sellers of inventory. The enterprise to determine the destiny estimation of the securities trade is called a monetary trade expectation. The expectation is relied upon to be hearty, actual and effective. The framework ought to paintings as in step with the real conditions and need to be suitable to genuine settings. The framework is moreover anticipated to don't forget all of the elements which can have an impact on the inventory's really well worth and execution.

Preparing the highlights of records makes the knowledgeable model. The manner towards shutting inventory price forecast is depicted with inside the accompanying phase and the one of a kind exams did to discover the presentation of the fashions are demonstrated.The direct linear regression and support vector relapse calculations are carried out for making ready the dataset and foresee the destiny inventory cost.

Supervised learning is frequently delineated as assignment organized on these lines. it's deeply targeted around a selected assignment, taking care of associate ever increasing range of guides to the calculation till it will exactly perform on it task. this is often the educational kind that you just can little doubt expertise.

Stock marketplace prediction is largely characterized as trying to determine the inventory really well worth and provide a lively concept for the people to recognize and assume the marketplace and the inventory costs. It is via way of means of and huge added using the quarterly financial percentage using the dataset. In this way, relying on a solitary dataset might not be good enough for the forecast and might supply an final results that is off base.

2. Related Works

This section says about the literature survey of Stock market prediction using machine learning.

Zhen Hu et al. [1] utilized the help of vector machine calculation to anticipate the financial exchange price. By utilizing this calculation, they have anticipated the precision result. SVM is utilized here to fathom the direct compelled quadratic programming issue. Utilizing the SVM the bring one-of-a-kind answers for the issue.

Mehak Usmani [2] done the work done in this paper to count on Karachi inventory exchange. This paper offers a Neural device and Support vector gadget calculation is Objective is to foresee the marketplace execution of Karachi inventory exchange (KSE).This paper precept purpose for current is simply to foresee the Karachi inventory exchange. The results of the using Gradient-Descendent to attain to perfect worth.

Tejas Mankar [3] done on this paper expectation depending on the social emotions utilizing device learning. The evaluation given with the aid of using humans in standard approximately the company. Based at the optimistic and destructive observation of open approximately the corporation they're foreseeing the economic exchange. Utilizing assumption research at the tweets collected utilising the Twitter API and moreover the give up estimations of various stocks, we attempt to bring together a framework that gauges the inventory price improvement of various organizations.

El Mehraz [4] paintings carried out in this paper foreseeing the securities alternate expectation utilising Hybrid technique which consolidates Support Vector Regression.

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Our goal on this exploration paintings is to advocate a half of and half of technique that joins bolster vector relapse (SVR) and Hodrick-Prescott channel (HP), for upgrading the forecast of inventory fee with the aid of using studying the recorded statistics of utilising our proposed model.

Haiying Huang [5] done on this paper suggests the appropriateness of a gadget that consolidates bolster vector relapse and Fourier alternate, for foreseeing the inventory price through gaining knowledge of the high-quality information. Fourier alternate is applied for clamor separating, and the assist vector relapse is for version preparing. Their proposed shape is a fantastic prescient equipment for inventory forecasts with inside the financial market.

Nonita Sharma [6] work done on this paper accomplished in this paper to expect the destiny monetary alternate report esteems depending on verifiable data. The take a look at evaluation relies upon on verifiable data of ten years of lists, specifically, CNX Nifty and SP Bombay Stock Exchange (BSE) Sensex from Indian monetary exchanges. In this paper they've applied LS assist this is applied as a practise misfortune ability to enhance the blunder gauges and therefore making it more and more more captivating to attend to the forecast issue. This paper facilities across the challenge of expecting destiny estimations of the economic trade records.

Shashank Tiwari [7] work done on this paper utilizing the information investigation and anticipate the stock cost. This paper proposes utilization of Data examination to be utilized in help with speculators for making right money related expectation so right choice on venture can be taken by Investors.

Top Bahadur Pun [8] work done on this paper in this paper to foresee the Nepal inventory alternate utilizing Support vector relapse and Neural system. Information precoping with is acted all collectively sign in a specific outcome. The data having an area with advertiser percentage and unwanted element are worn out from notion approximately data. The next data are standardized for higher execution, earlier than making use of the AI strategies. Min-Max and Z-rating standardization are applied for this reason.

Ramesh et al. [9] describes the prediction of user interest based on the feedback retrieved from the previous output. The stock market prediction needs the relevance feedback approach for price prediction. Selvakumar et la. [10] explains the evolution user groups by applying K- Means clustering approach. The buyer of stock can buy the stock which is similar to the user who bought the same firm stock. Sabena et al [11] provides the classification approach for multiple label which helps to classify the stock under different perspectives.

Aravind G et al [12] gives the knowledge representation model for design an hybrid system in prediction process. As fraud detection in stock market price is identified by filtering the fake reviews given for the firm stock as mentioned in [13]. Also the author form [14] and [15] used the machine learning approach for their application. The author [14] used machine learning soil environment preservation corpusand, in [15] used machine learning for english learning Translation. Both of which achieved good performance.

3. System Design

This section gives a complete overview of the system architecture shown in Figure 1 and the process flow diagram of the system gives in Figure 2 in detail with a diagram and

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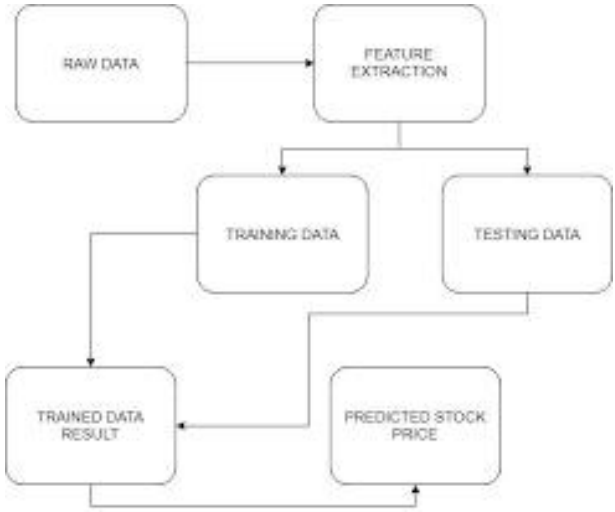

Figure 1. Architecture Of Stock Market Prediction

explanation. Quandl is on-line network for statistics evaluation and predictive modeling. It is likewise have dataset for distinctive fields. Various statistics scientist competes to create the nice fashions for predicting. It permits the consumer to gather the dataset for the predicting process. To resolve the actual time statistics technological know-how challenge. The dataset used on this challenge has been downloaded from quandl. The dataset accrued in uncooked format. Stock fee dataset of few agencies has been accrued. The first step is to gather the uncooked inventory charge facts and preprocess the facts

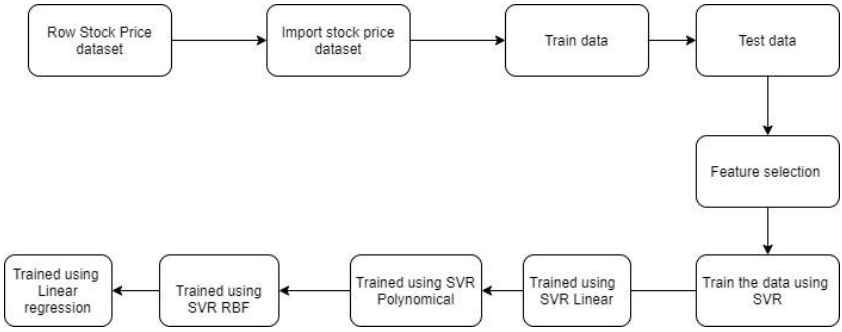

Figure 2. Flow Diagram

to test whether or not the dataset has any null values. And additionally doing function extraction due to the fact the uncooked facts amassed that might have a couple of characteristic however simplest few of these characteristic are used for the prediction. The characteristic extraction is observed via way of means of category manner. Where the information break up into wonderful segment. The category is manner to spotting which set of classes it belongs. The teach information is used to teach the model. Whereas the check information is used to check the accuracy of the prediction of inventory price. The splitting is performed as a consequence wherein the skilled information must be more

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than the check information. Using the SVR set of rules and linear regression skilled the anticipated end result and the cease provide the anticipated inventory fee. Our prediction end result provide the open fee of inventory fee of the day. Our intention is expect the end result the use of the ancient dataset. After its anticipated it'll display the open fee of the facts because the anticipated end result.

3.1. Data Collection

Data collection is the primary step and initial module for the project. Here it deals with collecting the right dataset for the project. They dataset has been collected from quandl. The right dataset is collected to predict the stock price. Our dataset collected from the historical data.

3.2. Feature Extraction

Feature Extraction is the system to pick the vital characteristic to are expecting the inventory price. Because the uncooked statistics is amassed they may have too many characteristic, however simplest the vital characteristic we want to are expecting the inventory price. So the usage of the random woodland set of rules choosing the vital characteristic. The random woodland set of rules classify the characteristic just like the tree shape and set up the vital characteristic on one facet and undesirable characteristic on different facet.The vital characteristic listing are displayed with the frequency price. Based at the frequency price the vital characteristic are arranged. In that dataset they vital characteristic are Close, Open, High, Low, Volume and Adj extent those are the vital characteristic to are expecting the inventory market.

3.3. Data Split

The dataset that use to are expecting the inventory rate is locate to break up into teach information and the take a look at information. The information is generally break up into schooling information and checking out information. The schooling set carries a recognized output and the version learns in this information on the way to be generalized to different information later on. They break up the teach information proposition is greater the take a look at information. The teach can be in 70 percentage, wherein the take a look at information can be in 30%. The schooling dataset is used to teach the version while the take a look at information is used to are expecting the accuracy of the version. The information break up accomplished through go validation.

3.4. Trained Data Result

The system of schooling the statistics the use of SVR and linear regression. The statistics is skilled with the aid of using assist vector regression and supply the anticipated end result. Using SVR schooling the end result statistics the prediction will supply suitable accuracy. The end result will anticipated the open inventory rate for the day.

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4. Implementation Methodology

Random forest algorithm have a set of rules is used for characteristic extraction. Random forests or random selection forests are an ensemble gaining knowledge of technique for category, regression and different duties that perform with the aid of using building a mess of selection bushes at training time and outputting the magnificence this is the mode of the instructions for category or imply prediction for regression of the person bushes.

Algorithm 1 Feature Extraction Procedure

Input: Data set as CSV file.
Output: Selected the important attribute Listed.

1: Read the dataset.
2: Import RandomForestClassifier from sklearn.ensemble.
3: Assign the RandomForestClassifier to local variable model.
4: Train Rfc =(nestimators=100,randomstate=0,njobs=-1).
5: Create clf =sfm(clf,threshold=0.15)
6: assign sfm to clf
7: get the important attribute

Using the random forest algorithm the data has been split.They split the data for training and testing using the cross validation.The are fit in Random forest algorithm and split using cross validation. The split the train data in 70 percentage and test in 30 percentage.

Algorithm 2 Data Train, Test Split Procedure

1: Read the dataset.
2: Import RandomForestClassifier from sklearn.ensemble.
3: Create Xtest,Xtrain,Ytest,Ytrain.
4: Create featable.
5: Assign Date,open,close inside featlable.
6: Assign traintestsplit(dfx, dfy, testsize=0.2, rs=0).
7: X,Y are fit using Randomforestclassifier.
8: create clf variable and fit randomforest in that variable
9: **for** feature in featlable **do**
10: Print feature
11: get the train data and test data

This algorithm is used create the independent data set X and store the data in the variable dates. Create the dependent data set y and store the data in the variable prices.Both can be done by appending the data to each of the lists.The independent data set we want only the day from the date, so use the split function to get just the day and cast it to an integer while appending the data to the dates list.

Support Vector Regression is used predict the result, using SVR train the dataset to get the accuracy of the prediction and linear regression is also used to approach to modeling the relationship between a scalar response or dependent variable and one or more explanatory variables or independent variables. Create a function that uses 3 different

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Algorithm 3 Ticker Data Processing Procedure

```
Read the dataset
Create the list dates and prices
for date in dates do
    dates append to date.split[o].
for prices in open do
    prices append to open
Print the dates
Print the prices
```

Support Vector Regression SVR models with three different kernels to see which one performs the best. The function will ave three parameters, the dates, prices, and the day that we want to do the prediction on to get the price. first I will create the three SVR models with three different kernels are linear, polynomial, radial basis function. Also add in the linear regression model.

Algorithm 4 Algorithm Evaluation Procedure

Input: The trained dataset
Output: The predicted open price for the day as the result

```
Read the dataset
import SVR from sklearn.SVM
import matplotlib.pyplot
Create the linear kernel
Create the polynomial kernel
Create the rbf kernel
Train the linear in dates,prices
Train the polynomial in dates,prices
Train the rbf in dates ,prices
Create the linear regression
Train the linear regression
plot the days in Xlabel
plot the price in Ylabel
plot dates and prices in poly and linear and rbf
Return rbf predicted result
```

5. Simulation Results & Discussions

This section contains the requirements for the project. The results obtained so far from executing the system and the scripts used to obtain these results are detailed below.

The dataset has been download from quandl as the csv file as given in Figure 3. And making the dataset to import in our project. Using pandas library importing the dataset in the project. After importing only able use the dataset for prediction purpose. Import the dataset into our project for the prediction process can import the entire dataset for further prediction of stock price. Prediction is based on using the historical data.

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Figure 3. Dataset

After the data as been imported data has been read in the console. we are reading first five rows and columns and last five rows and columns using head and tail comment. To print the first five columns using the head function in python can print the first five columns. To print the last five columns using the tail function in python can get last five columns and rows. Reading the dataset and print in the console for further prediction in stock market.

After reading the data, have to split the data. The data split has train data and the test data. Slicing the single data into train and tests huge sufficient to yield statistically significant results. Is consultant of the facts set as a whole. In different words, do not select out a take a look at set with one of a kind traits than the schooling set. Split the data using the library Sklearn model selection from Test train split function. Train data Proposition greater than the test data. From the entire dataset we split it for train and test process. Training and testing can be done by train split test that function is used to seperate the 70 percentage for train and 30 percentage for test.

Feature extraction selecting the important feature that used for prediction purpose. Using the random forest algorithm predicting the important attribute. Because the raw data has been collected that could have many attribute to avoid those attribute and get only important attribute using feature extraction process include extraction begins from. At the factor whilst the information facts to a calculation is just too massive to be in any manner dealt with and it's far suspected to be repetitive as an instance a comparable estimation with inside the toes and meters, or the redundancy of images added as pixels, at that factor it has a tendency to be modified right into a reduced association of highlights. Using the SVR and linear regression predicted the output. In SVR using three kernels to give the accuracy out of these three RBF gave the good accuracy. Predicted the open price by giving the date. Result will be in graphical formal with the prediction accuracy of three kernels. Predicted the stock price with RBF kernel using SVR. The open price of the day will be the result of this project. now I will predict the open price giving the models a value or day of 30. The best model from the graph below seems to be the RBF which is a Support Vector Regression model that uses a kernel called radial basis function.

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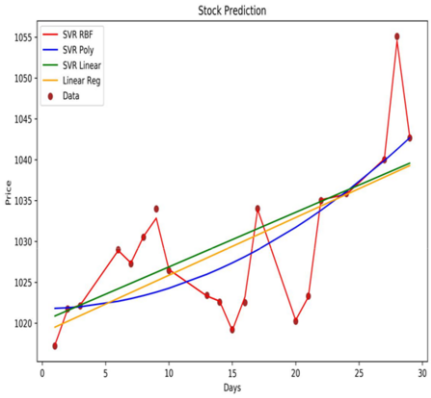

Figure 4. Predicted Output

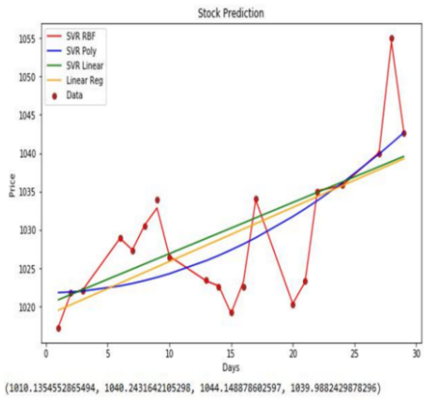

Figure 5. Predicted Output with open price

The Figure 4 will show which kernel performs absorbing the above figure we find out that SVR, RBF performs well its give the good prediction of open price compare to other kernel. The Figure 5 show the open price of stock for per day. Therefore, the final result of our stock open price of the day is been predicted. Thus the output has been shown the successful prediction in graph and show the open price of stock per day.

6. Conclusion

This work is concerned with prediction of stock price. Two techniques has been used in this proposed system which is Support vector regression and Linear regression have shown the improvement in accuracy of the prediction by using these two techniques. There by which leads to the positive result in the prediction. Using the proper algorithm able to predict the stock price with more accuracy. Using machine learning that leads to positive prediction of the stock price. There by which leads to the promising result in the prediction. Therefore, this project leads to the conclusion that can predict the stock market price with more accuracy using machine learning. In the future the stock market prediction can be further more improved by applying different algorithm to bring more accuracy. Use real time dataset than the dataset available on public repository that has been used in this work to predict. The more dataset is used our prediction will give more accuracy that can be improved in future work.

References

[1] Hu Z, Zhu J, Tse K. Stocks market prediction using support vector machine. In 2013 6th International Conference on Information Management, Innovation Management and Industrial Engineering 2013 Nov 23 (Vol. 2, pp. 115-118). IEEE.

[2] Usmani M, Adil SH, Raza K, Ali SS. Stock market prediction using machine learning techniques. In 2016 3rd international conference on computer and information sciences (ICCOINS) 2016 Aug 15 (pp. 322-327). IEEE.

[3] Mankar T, Hotchandani T, Madhwani M, Chidrawar A, Lifna CS. Stock market prediction based on social sentiments using machine learning. In 2018 International Conference on Smart City and Emerging Technology (ICSCET) 2018 Jan 5 (pp. 1-3). IEEE.

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[4] Ouahilal M, El Mohajir M, Chahhou M, El Mohajir BE. Optimizing stock market price prediction using a hybrid approach based on HP filter and support vector regression. In 2016 4th IEEE International Colloquium on Information Science and Technology (CiSt) 2016 Oct 24 (pp. 290-294). IEEE.

[5] Huang H, Zhang W, Deng G, Chen J. Predicting stock trend using fourier transform and support vector regression. In 2014 IEEE 17th International Conference on Computational Science and Engineering 2014 Dec 19 (pp. 213-216). IEEE.

[6] Sharma N, Juneja A. Combining of random forest estimates using LSboost for stock market index prediction. In 2017 2nd International conference for convergence in technology (I2CT) 2017 Apr 7 (pp. 1199-1202). IEEE.

[7] Tiwari S, Bharadwaj A, Gupta S. Stock price prediction using data analytics. In 2017 International Conference on Advances in Computing, Communication and Control (ICAC3) 2017 Dec 1 (pp. 1-5). IEEE.

[8] Pun TB, Shahi TB. Nepal stock exchange prediction using support vector regression and neural networks. In 2018 Second International Conference on Advances in Electronics, Computers and Communications (ICAECC) 2018 Feb 9 (pp. 1-6). IEEE.

[9] Ramesh LS, Ganapathy S, Bhuvaneshwari R, Kulothungan K, Pandiyaraju V, Kannan A. Prediction of user interests for providing relevant information using relevance feedback and re-ranking. International Journal of Intelligent Information Technologies (IJIIT). 2015 Oct 1;11(4):55-71.

[10] Selvakumar K, Ramesh LS, Kannan A. Enhanced K-means clustering algorithm for evolving user groups. Indian Journal of Science and Technology. 2015 Sep 1;8(24):1-8.

[11] Sabena S, Kalaiselvi S, Anusha B, Ramesh LS. An Multi-Label Classification with Label Correlation. Asian Journal of Research in Social Sciences and Humanities. 2016;6(9):373-86.

[12] Aravind G, Uma GV, SaiRamesh L. Knowledge Management Process Model using IHS based on Detecting Process with Less Energy Consumption. Journal of Electrical Engineering. 2020;20(1):1-7.

[13] SaiRamesh L, Ashok E, Sabena S, Ayyasamy A. Credit Card Fraud Detectıon in Retaıl Shopping Using Reinforcement Learning. In International Conference On Computational Vision and Bio Inspired Computing 2018 Nov 29 (pp. 1541-1549). Springer, Cham.

[14] Xu X. Machine learning-based prediction of urban soil environment and corpus translation teaching. Arabian Journal of Geosciences. 2021 Jun;14(11):1-5.

[15] Wang L. Urban land ecological evaluation and English translation model optimization based on machine learning. Arabian Journal of Geosciences. 2021 Jun;14(11):1-6.

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Smart Surveillance System for Abnormal Activity Detection Using CNN

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Abstract. Crime is the factor increases day by day and also needs the solution for identifying these activities in an efficient and quick manner. Many surveillance systems use artificial intelligence and image processing are incorporated with them to implement an intelligent surveillance system. But most of the systems are provided the alarm or identifies the crime after it happens. To solve this problem, camera footage-based theft detection will be used with the help of machine learning to detect theft occurrence. System will detect the human activity with the help of open-pose algorithm and convolution neural networks. Then the footage will be examined based on the pretrained model and it will be classified into three categories namely safe, abnormal or crime. Convolution neural network is used to classify the motion and an alert message will be sent to the owner along with captured image and options such as neglect or call the police.

Keywords. surveillance, convolution neural network, open pose, activity detection.

1. Introduction

In rapid movement of life, everyone can't get the time to monitor all the things happening around them. And everyone busy with their outside works and they don't even watch their own belongings or their house security in their daily routine activities. The only solution for this is continuous monitoring the behaviour or activities of people around as and to get the information about any abnormal activities. Smart surveillance is the solution for this which provides continuous monitoring of any one behaviour comes under the surveillance system. In general, surveillance system includes some electronic equipment like closed-circuit television (CCTV), sensors with alarms for identify unauthorized access, etc., In addition, surveillance system used for monitoring the behaviour of the people under surveillance and inform the admin about the behaviour of the people's come under the system installed for protection. Sometimes, this also used for negative purpose but we have to neglect that for further proceedings.

Many systems are in use currently to detect the crime activities before by identifies the new user to the place or by the identify the activity of the person which considers as

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abnormal one belonging to the place. Sometimes, false alarm also given by the system and that has to be avoided in the surveillance system. To overcome all these things, we need the system that provides continuous monitoring and detect the situation of crime before it happens. It also has not to give alarm publicly without identifies it properly.

The implementation of anti-theft environment with smart surveillance using CCTV which captures the live video and analysing the frames using machine learning approaches. This system gives the alarm to the admin if they found any suspicious activity which is not come under the normal behaviour of the people. The alarm sent with the captured image in which frame it find the activity was suspicious. The proposed system involves in real time crime detection which helps the people to protect their belongings in any kind of environment.

The overall objectives of this work are to detect the abnormal activity like theft in live video processing. This system also aims to notifying the respective person with image when user is online. Eliminating manual intervention and reduce the storage overhead for increasing security. The need for a system which automatically detects the crime and warns the admin / user is of great demand in current situation as in a fast-running world where trust is no more. The smart way is to get a instant notification about the abnormal activity in the place at absence of human. The existing system can detect the activity but not on real-time and it doesn't notify about the activity too.

2. Related Works

The literature survey was done regarding object detection, human activity detection and theft detection. Detection deals with the different objects which come in camera action with certain classes like immovable objects or movable objects like human, vehicles, animals, etc.,. The movement among the objects is detected through the frames and analysis carried out among them to identify the crime.

The system proposed by Bharath and Dhivya [1] detects moving object and it classifies and evaluates its parameters by alternating the algorithm in effective way. It tracks the object frame by frame and parameters like speed, velocity of the object are calculated. The system proposed by Edgar et al. [2] gives the systems that detect the overlapped objects in the frame. Their system considers both local and global cues using probabilistic top-down segmentation. Sharieff et al. [3] proposed the system for detect the hided image or object in the frame using inpainting technique.

Human activity detection deals with detecting various activities performed by human. Those activities include walking, talking, standing, sitting, doing some activities, etc., The system proposed by Xinyu et al. [4] can detect human abnormal behaviours from real-time video surveillance.

The system proposed by Gowsikhaa, Manjunath et al. [5] works on the sequence of frames form where the abnormal activity detected. The system proposed by Lazaros and Anastasios [6] helps to categorize the behaviour of the person is abnormal or not in a crowded environment. The system proposed by Debaditya and Krishna [7], detects snatch thefts using gaussian mixture model with a large number of mixtures known as universal attribute model to capture variations of attributes in diverse scenarios. The image retrieval is helps to extract the target objects from the available frames as mentioned [8,9].

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The system proposed by Anjum and Babu [10], detects theft using raspberry pi, using image processing on live video to detect theft using motion and also to highlight the area where motion occurred. The system proposed by Munagekar [11] detects theft taking place in an enclosed environment. It uses canny edge detection algorithm for detecting objects and to prevent theft. If there is any variation in the count of pixel then the system detects there is an intrusion. Then it raises an alarm. Ayyasamy et al. [12] using the image processing techniques to locate or trace the object using IClique Cloak approach which helps to locate the disabled object.

The system proposed by Rupesh and Nupur [13] deals with automation of video surveillance in ATM machines and detects any potential crimes. The captured video is fragmented into smaller frames and then the vector graphics and image processing techniques are implemented.

3. System Design

The system takes in live-video or recorded video as input as shown in Figure 1. The first step is to split the video into frames and process it for human's detection. The detected number of humans are displayed along with the number of Frames per Second (FPS) being processed. Individual human activity is detected and the points specific to the particular human is measured. The predicted points are stored and is given to the trained

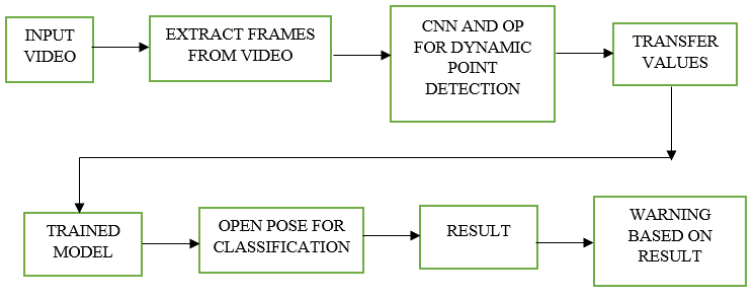

Figure 1. Architecture Diagram of Smart Surveillance for Theft Detection

model as input to detect the current activity based on the detected points it predicts the activity in the frame. At the end, the output on the screen is a classification of the video in real-time, a classification of the frame either safe, suspicious, or criminal activity. The system consists of the following modules:

- Input video Extract frames from video.
- CNN for image processing
- Open-pose algorithm for classification of activity Classified Result (Safe / Abnormal / Crime)
- Notifying the user / admin
- Sending the screenshot of the detected frame to user / admin

Each frame in the video will be taken and open-pose algorithm runs for human detection and then it plots the points on the human. The number of frames to be processed in a

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second can be defined. Less number of frames per second leads to more accuracy in activity detection. CNN identifies the pose of the human through the plotted points by open pose through the model which is got by training the points of various poses and it's displayed for user / admin. Once the identified activity is found to be theft, then the user / admin will be warned about it through a text message to his verified mobile number in in case that he is not connected to internet. If the admin / user has a live connection then the screenshot the frame that is identified to be theft will be send to him.

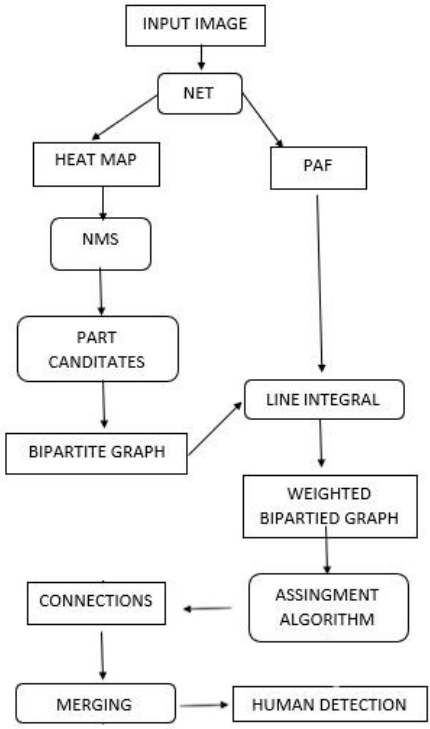

Figure 2. Flow of open-pose algorithm stimulation

4. Implementation Methodology

The dataset that is going to be trained in video format. A collection of videos for different types of theft is downloaded from online sources. The training phase takes data of about 2950 samples of about 5 classes. It also takes 329 samples to validate the data. The number of epochs given was 20. It shows, 20 number of times that the learning algorithm has gone through the entire training dataset. It also displays value accuracy, value loss at each step which are used to analyze the training phase and the efficiency. At the end of the training phase, a graph is generated to visualize the value loss, value accuracy, training accuracy and training loss.

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4.1. Human Pose Estimation

Open pose is a human pose estimation algorithm. Figure 2 shows the flow of open – pose algorithm which gets input image and generate the key points based on heat map for the human body. The bipartite graph generated through the heat map merged with the assignment algorithm to get the human structure. Goal is to extract the position of each of the body parts of every person appearing in a frame with no more sensors than a digital camera. Open-Pose is a library that allow us to do so.

4.2. Parts and Pairs

The human body are the combination of parts such as neck, shoulder hip and arm. There is pairs in between the parts to shoe that they are joint according to the specific pairs as shown in Figure 3. These pairs are used to identify the position of the human parts while doing any activities and to recognize the activity. A body part is an element of the body, like neck, left shoulder or right hip. A pair is a connection between parts. These skeletons show the indices of parts and pairs on the COCO dataset.

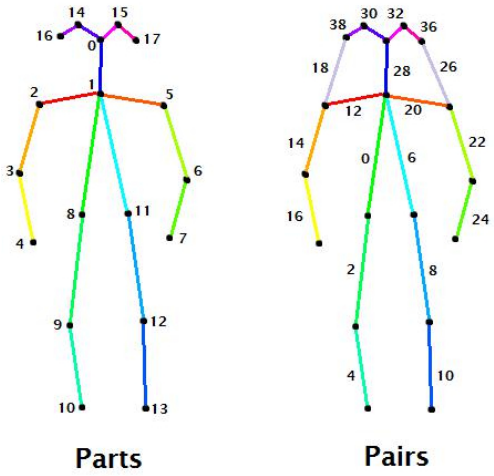

Figure 3. Difference Between Parts and Pairs

4.3. Pre-processing

In pre-processing each frame of the video is converted from [0, 255]to [-1, 1].

$$img = 1 + img(2:0) \tag{1}$$

4.4. Neural Network

The last operation of the neural network returns a tensor consisting of 57 matrices. However, this last operation is just a concatenation of two different tensors: heatmaps and Part Affinity Fields (PAFs). Here, heatmap stores the pixel values which one involved in pairs and parts of the body which given to the PAFs. From the associated PAFs the direction of the body part movement detected for activity detection.

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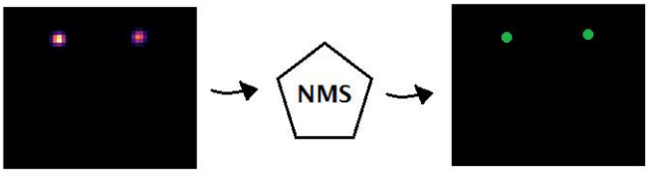

Figure 4. Non-Maximum Suppression

4.5. Non-Maximum Suppression

To extract parts locations out of a heatmap the local maximums should be needed. Then apply a non-maximum suppression (NMS) algorithm to get those peaks as shown in Figure 4. After all the process, the non-zero pixels denote the location of the part candidates.

Algorithm 1 Non-Maximum Suppression

Input: Blurred pixel images
Output: Sharp images

1: Start in the first pixel of the heatmap.
2: Surround the pixel with a window of side 5 and find the maximum value in that area.
3: Substitute the value of the centre pixel for that maximum.
4: Slide the window one pixel and repeat these steps after the entire heatmap is covered.
5: Compare the result with the original heatmap. The pixels with same value are the peaks and suppress the other pixels by setting them with a value of zero.

4.6. Bipartite graph

For connection of identified body parts to form pairs graph theory should be used (bipartite graph) as given in Figure 5. To find the best matching between vertices of a bipartite graph assignment problem should be used, each edge on the graph should have a weight.

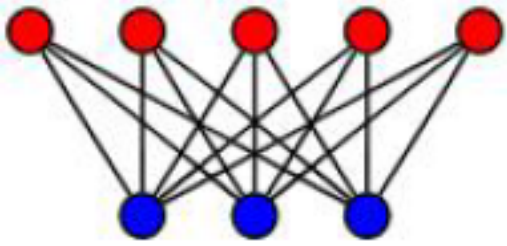

Figure 5. Bipartite graph for mapping body parts

4.7. Line Integral

The PAFs enter the pipeline. The line integral is computed along the segment connecting each couple of part candidates, over the corresponding PAFs (x and y) for that pair as

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given in Figure 6. A line integral measures the effect of a given field (Part Affinity Fields) along a given curve (possible connections between part candidates). The line integral will give each connection a score, that will be saved in a weighted bipartite graph and helps to solve the assignment problem.

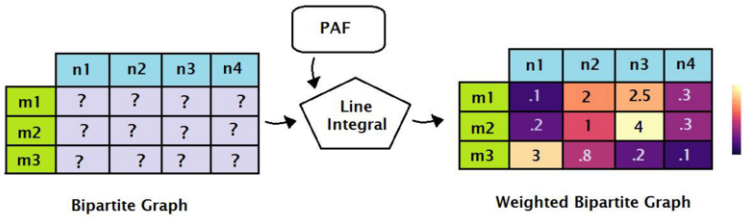

Figure 6. Updation of bipartite graph after line integral

Algorithm 2 Line Integral Algorithm

Input: An empty table of bipartite graph
Output: Weighted bipartite graph

1: dx = x2-x1
2: dy = y2-y1
3: normVec = $\sqrt{(dx^2 + dy^2)}$
4: vx = $\frac{dx}{normVec}$
5: vy = $\frac{dy}{normVec}$
6: numsamples = 10
7: xs = Create an evenly spaced numeric values (start=x1, end=x2) within an interval(dx/numsamples)
8: ys = Create an evenly spaced numeric values (start=y1, end=y2) within an interval(dy/numsamples)
9: pa f Xs = pafX[ys, xs]
10: pa fY s = pafY[ys, xs]
11: score = sum(pa f Xs*vx + pa fY s*vy) / numsample

4.8. Assignment

The weighted bipartite graph shows all possible connections between candidates of two parts, and holds a score for every connection. To find the connection the assignment problem should be solved.

4.9. Merging

The final step is to transform these detected connections into the final skeletons. Assume that every connection belongs to a different human. This way the number of humans is same as the connections. Let humans be a collection of sets H1, H2 and Hk. Each one of these sets that is, each human contains, at first, two parts (a pair). And let's describe a part as a tuple of an index, a coordinate in the x direction and a coordinate in the y

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Algorithm 3 Assignment Suppression Algorithm

Input: Points of human detected.

Output: Pairs connected from point Sort each possible connection by its score.

1: The connection with the highest score is indeed a final connection.
2: Move to next possible connection. If no parts of this connection have been assigned to a final connection before, this is a final connection.
3: Repeat the step 3 until we are done.

direction. If humans H1 and H2 share a part index with the same coordinates, they are sharing the same part! H1 and H2 are, therefore, the same humans. So, merge both sets into H1 and remove H2. Continue for every couple of humans until no couple share a part.

5. Simulation Results & Discussions

The trained model produces a graph which shows the training accuracy, training loss, value accuracy and value loss as mentioned in Figure 7. The model takes input for ac-

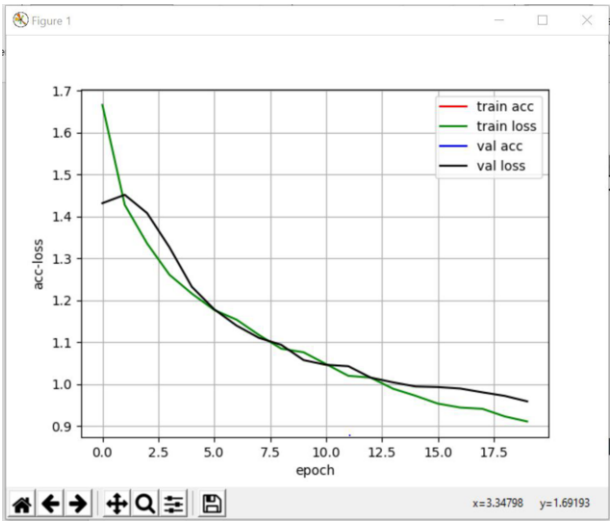

Figure 7. Analysis of Training

tivities likes walking, standing, sitting, operate and two member activity like handshaking, the train and a model is generated. The generated model is used to predict the activity. The generated model is loaded into the takes input video, and predicts and displays the type of activity it recognized in each frame in the live-video itself along with the frame number and the number of human detected in the frame. It recognizes activities like standing, walking, sitting, operate. It can also recognize two member interaction activity like handshake and theft activity. The result displays various body points for all the humans detected. Based on the points detected, the model recognizes which activity has been occurred in the frame. As the video proceeds, the result changes as per the recognized activity.

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References

[1] Bharath RR, Dhivya G. Moving object detection, classification and its parametric evaluation. InInternational Conference on Information Communication and Embedded Systems (ICICES2014) 2014 Feb 27 (pp. 1-6). IEEE.

[2] Leibe B, Seemann E, Schiele B. Pedestrian detection in crowded scenes. In2005 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'05) 2005 Jun 20 (Vol. 1, pp. 878-885). IEEE.

[3] Sharieff AH, Sabena S, Sathiyavathi V, SaiRamesh L. Intelligent framework for joint data hiding and compression using SMVQ and fast local image in-painting. Int. J. Sci Technol. Res. 2020;9(2):2267-71.

[4] Wu X, Ou Y, Qian H, Xu Y. A detection system for human abnormal behavior. In2005 IEEE/RSJ International Conference on Intelligent Robots and Systems 2005 Aug 2 (pp. 1204-1208). IEEE.

[5] Gowsikhaa D, Abirami S. Suspicious Human Activity Detection from Surveillance Videos. International Journal on Internet & Distributed Computing Systems. 2012 Jul 1;2(2):141–8.

[6] Lazaridis L, Dimou A, Daras P. Abnormal behavior detection in crowded scenes using density heatmaps and optical flow. In2018 26th European Signal Processing Conference (EUSIPCO) 2018 Sep 3 (pp. 2060-2064). IEEE.

[7] Roy D. Snatch theft detection in unconstrained surveillance videos using action attribute modelling. Pattern Recognition Letters. 2018 Jun 1;108:56-61.

[8] Sabena S, Yogesh P, SaiRamesh L. Image retrieval using canopy and improved K mean clustering. InInternational conference on emerging technology trends (ICETT) 2011 (pp. 15-19).

[9] Raghuraman G, Sabena S, Sairamesh L. Image retrieval using relative location of multiple ROIS. Asian Journal of Information Technology. 2016;15(4):772-5.

[10] Anjum U, Babu B. Iot based theft detection using raspberry pi. Int. J. Adv. Res. Ideas Innov. Technol. 2017;3(6):131-4.

[11] Munagekar MS. Smart Surveillance system for theft detection using image processing. International Research Journal of Engineering and Technology. 2018 Aug;5(8):232–4.

[12] Ayyasamy A, Ramesh LS, Sathiyavathi V. Iclique Cloak Approach for Protecting Privacy of Mobile Location with Image Processing Techniques. InInternational Conference on Image Processing and Capsule Networks 2020 May 6 (pp. 160-168). Springer, Cham.

[13] Mandal R, Choudhury N. Automatic video surveillance for theft detection in ATM machines: An enhanced approach. In2016 3rd International Conference on Computing for Sustainable Global Development (INDIACom) 2016 Mar 16 (pp. 2821-2826). IEEE.

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Increased Energy Conservation in Internet of Things (IoT) Related Wireless Networking

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Abstract. The key emergent technology named Internet of Things (IoT) is used in various industries and daily activities of individuals. The IoT sensors are a battery operated one that is connected with internet over various services than ranges between healthcare and industries. Energy conservation or energy efficiency of these sensors is an utmost concern since most of the IoT devices powered with battery may often die while transmitting the data between the other devices. Various researches are conducted to conserve the energy via energy conserving mechanism. In this paper, we develop a multi-objective optimization model to resolve the higher energy consumption by the IoT devices under different diverse environment. These IoT devices communicates wirelessly with other devices in terms of WiFi connectivity and hence the study analyses the efficacy of the model. The experimental results show that the multi-objective modelling of energy conservation shows a reduced consumption of battery power by the IoT devices than conventional mechanisms.

Keywords. IoT, Wireless Networking, WiFi, energy conservation.

1. Introduction

IoT is a modern technology model that allows intelligent objects to interact, coordinate, communicate and endorse smart applications [1, 2]. More than 8 billion linked smart objects currently exist and year after year [3] will continue to rise drastically. The functionality, connectivity and tools of intelligent objects are heterogeneous. In general, intelligent objects, since they are battery operated devices, wireless sensors and cell phones, have very little resources for calculation and storage. With the advent and speed of service-defined creation, intelligent objects are seen as services that match their co-hosted functions [4–6]. In other words, a standard service can be used directly to provide each IoT smart entity with a feature. For this, the main enablers for IoT are service-oriented computing [6]. In order to build and encourage more complicated IoT applica-

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tions with advanced capabilities, it is essential to integrate and compose smart functions or their services. These systems are formed by the aggregation of atomic services to include a new feature which cannot be performed independently by any service [7]. This integration should be based on service quality (QoS) and energy efficiency of compositional artifacts.Take an example of a dynamic, large-scale IoT ecosystem. Where an intelligent device has lower energy than another smart object can be replaced, if any, with more energy and with a good degree of quality.

Various studies have previously explored the finding and composition of operation, as well as the development of numerous techniques [8]. These methods, however, only took into account and addressed functional and non-functional programs. As already discussed, the composition of IoT resources should not only consider QoS, but also energy utilization and the amount of residual energy [9] as a result of the existence of IoT and intelligent objects. Any reports on the composition of IoT services dealing with energy consumption [10]. A Pareto-optimum approach to QoS and the energy-aware IoT operation composition depending on customer or operator requirements is found in MSPO optimal solution.

2. Related Works

IoT uses service-oriented architecture (SOA) since it offers collaboration between heterogeneous, intelligent objects and is highly scalable in device integration. Smart objects may also, by service composition methods, be linked and composed. Much research has recently abstracted IoT devices to provide an accessible, coherent approach to and operation of IoT services [1, 11, 12]. The Web of Things (WoT) [13] is proposed to combine heterogeneous artifacts without difficulties. With existing Web-based technology like web-services and RESTful interfaces, WoT makes communication and interaction possible for objects. Sun et al. [14] suggested an IoT Platform for microservice to include an IoT-oriented generic architecture based on a module or multicomponent implementation rather than a monolithic one. The platform summarizes intelligent objects and IoT app components as utilities.

Cheng et al. [15] suggested an event-oriented IoT-based collaboration framework for SOA to deal with interoperability problems between large numbers of physical and heterogeneous IoT services. The author proposes a user-centered IoT Service-Oriented architecture that incorporates services that use IoT resources in an urban computing context. Another IoT service-orientated architecture [16] is described here. In [16] the user objectives are expressly defined as an activity coordination mission. Activities consist of abstract service configurations that may be instantiated by orchestrated service instances, which include those which may be operated by IoT devices or made up of more than one intelligent entity.

In several studies, the aim was to provide composite services through integration into wireless sensor networks (WSNs) [17–21]. A three-third party service-oriented architecture is suggested by Zhou et al. [4]. As a service in a service class, the work of each sensor is abstracted. In order to meet functional criteria and energy conservation, service classes are connected. Another dissertation was discussed in [22], which was service-oriented WSN.

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3. Proposed Multi-objective model

The suggested protocol guarantees that the cluster head (CH) is properly distributed and that different WSN node sizes can be enhanced. This would increase the energy conservation of the sensor node on the WSN [23–25]. Before this there have been little assumptions about the implementation of the sensor node given below:

- After deployment, the sensor nodes are dynamic
- After deployment, all nodes selected are static.
- Two types of nodes are available: temperature control and base station.
- Transmitting capacity at various degrees preferable to the remote node may be used via node.
- BS transmits a packet query from time to time to the cluster head for sample sensor data.
- Symmetrical links.

In clustering method, the algorithm for selecting the CH nodes and the routing algorithm for reducing the energy consumption and extending network life take into account first and foremost.

3.1. Network Model

Sensor nodes are randomly installed in a square region. The assumptions of the network environment are: sensor node has the same original energy and is uniform. The GPS or some other positioning device requires the node to know its location. After all sensor nodes are deployed, they are fixed. Both sensor nodes have well known the remaining energy and the distance of propagation. Sensor nodes will alter their energy consumption by the distance from the source. Each node has a special identifier. At the square edge, the BS is fixed and placed.

3.2. Energy Model

The use of nodes of resource is primarily done by the converter, amplifier and radio receiver. The architecture takes free space and fading flow according to the distance between the transmitter and the receiver. The sensor node energy consumption is directly proportional to the square distance between them d^2. This condition exists if the spreading distance d is less than the threshold distance d_0.The difference is, on the other hand, equal to d^4.

Eq. (1) sets the maximum amount of energy spent by the transmitter to the receiver for supplying a l-bit packet by a reference length.

$$E(l,d) = \begin{cases} lE_{elec} + l\varepsilon_{fs}d^2 \ d < d_0 \\ lE_{elec} + l\varepsilon_{mp}d^4 \ d \geq d_0 \end{cases} \tag{1}$$

Therefore the distance d_0 between the nodes is estimated as below:

$$d_0 = \sqrt{\frac{\varepsilon_{fs}}{\varepsilon_{mp}}} \tag{2}$$

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If $d < d_0$ is used, the energy consumption is based on the Free Space model where the amplifier used is ε_{fs}. When $d \geq d_0$, the sensor nodes' energy use uses the model of a multipath fading and the amplifier used here is the ε_{mp} parameter. The total node transmission length is not regulated in this section for reaching d0 so nodes in the same cluster are within the transmission field of the proposed uniform dynamic PSO-based clustering mechanism.

3.3. ABC Optimization Model

An optimization algorithm, based on the living frameworks of honey bees, is Artificial Bee Colony. Honey bees are the insects in large colonies, with around 50,000 colonies. The honey bee is a diffuse creature that can spread in many directions over many distances, to find a wide range of food sources and at the same time to find the best food source for the collection of food sources. For instance, more bees should be visited in floral areas where there is plenty of nectar or pollen to collect with less effort, while less nectar or pollen should be collected in areas with fewer bees.

The process of drilling in a colony starts with scouting bees being sent to find promising flower plots. Scout bees spontaneously hunt from patch to patch. If they return to the hive, they deposit nectar, pollen and go to the dance floor in a dance known as the waggle dance. They discovered patches that were above the threshold, calculated as a combination of certain elements such as sugar content. For colony communication, this dance involves three important information pieces on flower patches: its direction, the distance it is from the hive, and the quality it has to be measured. This knowledge guides bees in specifically finding the floral patches, without using charts or guides.

Each employee looks for a new source of food by interacting with a different bee. The employed bee memorizes this position instead of the old as a new better position is discovered. Then the viewing bees decide to use the knowledge provided by the employed bees to choose food sources for exploration. Again, the onlooker bee will memorize this position until a new better position is sought. The employed bee whose source of food for a period has been abandoned becomes a Scout Bee for the next quest cycle for the newly created location.

A swarm intelligence approach is the ABC. It was influenced by nature's drinking behavior. The food quest starts with a spontaneous food search in social life. Scout bees are finding new sources of food in their area and dancing waggle in front of the hive. The rhythm of the dance provides details on the distance from the food supply to the hive, nectar content and source nectar quantity. Viewing bees in the hive watch this move and opt to join the scout bees. When a bee joins a bee, it begins to feed and is considered a bee with followers. Each bee that gathers food performs dancing in order to provide details on the source of food. Bees thus fulfill the hive's need for food. This supply will be discarded, and scout bees will begin to search for new supplies until the food source is depleted. Each bee represents a solution if the behavior of a bee is suited to an optimizing problem and the algorithm begins with random initial solutions. These are used as Scout bees and, with the assistance of follower bees, the algorithm begins with neighborhood searches.

Numerous alternatives are subsequently produced in light of the previous relationships. While these solutions are created, the tasks are randomly sequenced and the previous relationships are not broken. The initial solutions are thus guaranteed to be developed

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very rapidly. The scout bee is assigned an LF value based on the maximum number of trials that can be performed without improvement. For all scout bees, the same procedures are carried out, and all the iterations remain in this cycle. Notice that improvements to efficiency can be achieved with a vast number of workstations requiring solutions. In reality, however, line managers favor designs that need fewer workstations. Therefore, when comparison of two solutions requiring different workstations takes place, regardless of the output benefit, a solution that needs fewer workstations is promoted.

3.4. Algorithm for Cluster Head Selection

Step 1: In this stage, when sensor nodes are installed in the field, network initialisation is carried out. Information on the nodes is also collected, including their distance to the base station and power status. By receiving the commercial message from each node on the network, the base station obtained this information. The base station then automatically chooses cluster heads from the nodes.

Step 2:By assigning an employee bee to each cluster head, the health of the randomly chosen cluster heads is assessed by BS. The bee of the worker measures the importance of the cluster head chosen

$$Fit_i = \eta e_i + \frac{\lambda}{n-1} \sum_{k=1\&k\neq i}^{n} e_k \| d_{ik} - d_{ave} \| \tag{3}$$

$$d_{ave} = \frac{1}{n} \sum_{i=1}^{n} \sum_{k=1\&k\neq i}^{n} d_{ik} \tag{4}$$

Step 3:The probability value is specified in the onlooker-bee process to pick the appropriate cluster heads from the randomly selected cluster heads. With bees visible on randomly chosen category heads, they share the details about their physical health. Anonlooker bee tests the fitness data of all bees and selects a cluster head with a fitness score associated with it.

$$P_i = \frac{F(\theta_i)}{\sum_{k=1}^{5} F(\theta_k)} \tag{5}$$

$$UpperRange = \frac{\sum_{i=1}^{n} fit_i}{n} \tag{6}$$

$$LowerRange = \sqrt{\frac{\sum_{i=1}^{n} fit_i}{n}} \tag{7}$$

The likelihood of choosing the cluster head is dependent on the nodes whose fitness spectrum lies between the lower and the upper limits. Then the cluster heads as optimum cluster heads would be chosen. The cluster head selection process takes place in each round, meaning that each sensor node in the network transmits its data to the discharge through its cluster heads.

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4. Results and Discussions

This section discusses the various MPSO models to determine the possible routing performance with cluster formation in IoT networks. The proposed ABC is compared with particle swarm optimisation (PSO), Ant Colony Optimization (ACO) and Genetic Algorithm (GA). Figure 1 shows the results of Packet Delivery Ratio, where the ABC obtains

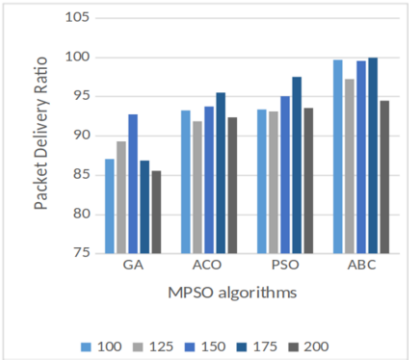

Figure 1. Packet Delivery Ratio

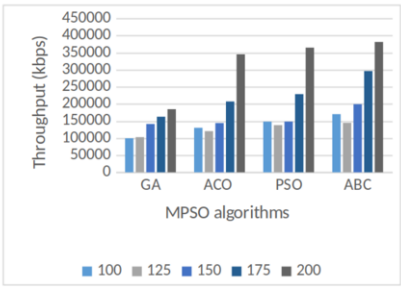

Figure 2. Throughput

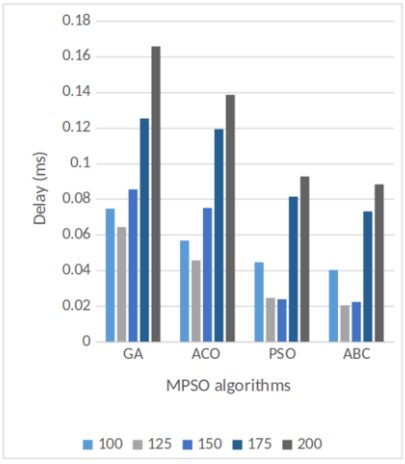

Figure 3. Delay

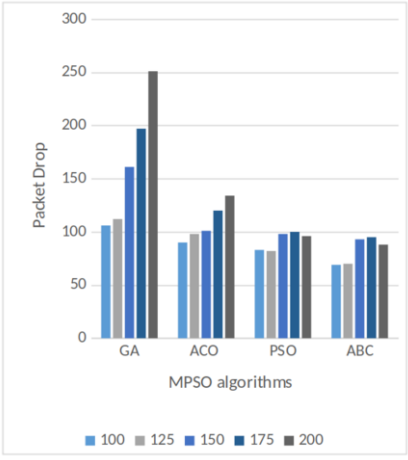

Figure 4. Packet drop

improved PDR than other methods on all sensor node density. Figure 2 shows the results of network throughput, where the ABC obtains improved PDR than other methods on all sensor node density.Figure 3 shows the results of Delay, where the ABC obtains reduced delay than other methods on all sensor node density.Figure 4 shows the results of Packet drop, where the ABC obtains reduced packet drop than other methods on all sensor node density.

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5. Conclusion

In this paper, we develop a multi-objective optimization model to resolve the higher energy consumption by the IoT devices under different diverse environment. These IoT devices communicates wirelessly with other devices in terms of WiFi connectivity and hence the study analyses the efficacy of the model. The experimental results show that the multi-objective modelling of energy conservation shows a reduced consumption of battery power by the IoT devices than conventional mechanisms. Our proposed model Multi-objective Modelling of energy conservation can be achieved for all devices with the help of IOT.

References

[1] Hu W, Li H, Yao W, Hu Y. Energy optimization for wsn in ubiquitous power internet of things. International Journal of Computers Communications & Control. 2019 Aug 5;14(4):503-17.

[2] Mazumdar N, Nag A, Nandi S. HDDS: Hierarchical Data Dissemination Strategy for energy optimization in dynamic wireless sensor network under harsh environments. Ad Hoc Networks. 2021 Feb 1;111:102348.

[3] Zhao Z, Shi D, Hui G, Zhang X. An energy-optimization clustering routing protocol based on dynamic hierarchical clustering in 3D WSNs. IEEE Access. 2019 Jun 19;7:80159-73.

[4] Kannan S, Dhiman G, Natarajan Y, Sharma A, Mohanty SN, Soni M, Easwaran U, Ghorbani H, Asheralieva A, Gheisari M. Ubiquitous vehicular ad-hoc network computing using deep neural network with iot-based bat agents for traffic management. Electronics. 2021 Jan;10(785):1-16.

[5] Ren X, Li J, Wu Y, Chen Y, Sun H, Shi Z. An enhanced energy optimization routing protocol for WSNs. Annals of Telecommunications. 2021 Mar 16:1-12.

[6] Yuvaraj N, Srihari K, Dhiman G, Somasundaram K, Sharma A, Rajeskannan S, Soni M, Gaba GS, AlZain MA, Masud M. Nature-inspired-based approach for automated cyberbullying classification on multimedia social networking. Mathematical Problems in Engineering. 2021 Feb 23;2021:1-12.

[7] Yadav AK, Rajpoot P, Kumar P, Dubey K, Singh SH, Verma KR. Multi Parameters Based Heterogeneous Clustering Algorithm for Energy Optimization in WSN. In2019 9th International Conference on Cloud Computing, Data Science & Engineering (Confluence) 2019 Jan 10 (pp. 587-592). IEEE.

[8] Anand J, Sivachandar K. Diverse Sorting Algorithm Analysis for ACSFD in Wireless Sensor Networks. International Journal of Engineering and Advanced Technology. 2013;2(3):57-9.

[9] Yadav AK, Rajpoot P, Kumar P, Dubey K, Singh SH, Verma KR. Multi Parameters Based Heterogeneous Clustering Algorithm for Energy Optimization in WSN. In2019 9th International Conference on Cloud Computing, Data Science & Engineering (Confluence) 2019 Jan 10 (pp. 587-592). IEEE.

[10] Yuvaraj N, Karthikeyan T, Praghash K. An improved task allocation scheme in Serverless computing using gray wolf optimization (GWO) based Reinforcement Learning (RIL) approach. Wireless Personal Communications. 2021 Apr;117(3):2403-21.

[11] Govindaraj S, Deepa SN. Network Energy Optimization of IOTs in Wireless Sensor Networks Using Capsule Neural Network Learning Model. Wireless Personal Communications. 2020 Dec;115(3):2415-36.

[12] Sivaram M, Porkodi V, Mohammed AS, Manikandan V, Yuvaraj N. Retransmission DBTMA protocol with fast retransmission strategy to improve the performance of MANETs. IEEE Access. 2019 May 23;7:85098-109.

[13] Yuvaraj N, Raja RA, Karthikeyan T, Kousik NV. Improved Privacy Preservation Framework for Cloud-Based Internet of Things. InInternet of Things 2020 Dec 29 (pp. 165-174). CRC Press.

[14] Wu D, Geng S, Cai X, Zhang G, Xue F. A many-objective optimization WSN energy balance model. KSII Transactions on Internet and Information Systems (TIIS). 2020;14(2):514-37.

[15] Dhondiyal SA, Aeri M, Gulati P, Rana DS, Singh S. Energy Optimization in WSN Using Evolutionary Bacteria Foraging Optimization Method. InProceedings of International Conference on Intelligent Computing, Information and Control Systems 2021 (pp. 485-495). Springer, Singapore.

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[16] Anand J, Jones A, Sandhya TK, Besna K. Preserving national animal using wireless sensor network based hotspot algorithm. In2013 International Conference on Green High Performance Computing (ICGHPC) 2013 Mar 14 (pp. 1-6). IEEE.

[17] Yuvaraj N, Kalaiselvi R. A Multi-hop Wireless Multicast Broadcast Service Using An Adaptive Network Code. i-Manager's Journal on Software Engineering. 2011 Oct 1;6(2):36-40.

[18] Agbehadji IE, Millham RC, Fong SJ, Jung JJ, Bui KH, Abayomi A. Multi-stage clustering algorithm for energy optimization in wireless sensor networks. InInternational Conference on Soft Computing in Data Science 2019 Aug 28 (pp. 223-238). Springer, Singapore.

[19] Anand J, Jeevaratinam RP, Deivasigamani M. Performance of Optimized Routing in Biomedical Wireless Sensor Networks Using Evolutionary Algorithms. Comptes rendus de l'Académie bulgare des Sciences. 2015 Aug 1;68(8):1049-55.

[20] Al-Khayyat AT, Ibrahim A. Energy Optimization In Wsn Routing By Using The K-Means Clustering Algorithm And Ant Colony Algorithm. In2020 4th International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT) 2020 Oct 22 (pp. 1-4). IEEE.

[21] Xu C, Xiong Z, Zhao G, Yu S. An energy-efficient region source routing protocol for lifetime maximization in WSN. IEEE Access. 2019 Sep 19;7:135277-89.

[22] Vinitha A, Rukmini MS. Secure and energy aware multi-hop routing protocol in WSN using Taylor-based hybrid optimization algorithm. Journal of King Saud University-Computer and Information Sciences. 2019 Nov 21:1-12.

[23] Chu KC, Horng DJ, Chang KC. Numerical optimization of the energy consumption for wireless sensor networks based on an improved ant colony algorithm. IEEE Access. 2019 Jul 22;7:105562-71.

[24] Lu W, Xu X, Huang G, Li B, Wu Y, Zhao N, Yu FR. Energy efficiency optimization in SWIPT enabled WSNs for smart agriculture. IEEE Transactions on Industrial Informatics. 2020 May 22;17(6):4335-44.

[25] Sheriba ST, Rajesh DH. Energy-efficient clustering protocol for WSN based on improved black widow optimization and fuzzy logic. Telecommunication Systems. 2021 May;77(1):213-30.

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Multi-Scale Fish Segmentation Refinement Using Contour Based Segmentation

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Abstract. Image processing and the analysis techniques are the increasing attention when they have enabled the non-extractive and the non-lethal approach for the collection of fisheries data. The data collection includes the following requirements such as fish size, catch estimation, regulatory compliance, species recognition and population counting. The main process that is used to measure the size of fish accurately is image segmentation. The challenges that can affect the segmentation of images include the blurring of the image areas due to the water droplets on the camera lens and the fish bodies which are out of the camera view. This project describes the automatic segmentation of fish for underwater images This segmentation algorithm implemented for identify the shape of the fish contour-based segmentation is implemented in this project. The project describes about the issues with an effective contour-based segmentation from an initial segmentation. The refinement is processed from coarse level to fine level. At the coarse level, the entire fish is aligned for the contour of the initial segmentation with trained representative contours by using iteratively reweighted least squares (IRLS). At finer levels, the refinement of contour segments is done to represent poorly segmented or missing shape parts. This method addresses the problems listed above and generates promising results with highly robust segmentation performance and length measurement.

Keywords. Contour Plot, Image Processing, Image Segmentation.

1. Introduction

The tracking up of the fishes and listing the total count of fishes that are observed from the dataset collected from the underwater systems. The operation is done based on the tracking up of the frames by the various detection method. The main objective of this framework is to detect the number of wishes by using online detector systems. Even though the use of online detectors is used there might be some changes that can occur

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from outside the field of view. Hence in order to observe the new objects that occur randomly within the field of view a predefined tracking system has to be detected. Hence two important challenges are needed to be improved namely the tracking system and the calculation system. One is that how the high level of falsehoods and false positives are reduced due to the unreliable detection. The changes in the fish diversity, the color of fishes and the background of the fish data plays a major role in tracking up of the fishes which causes the errors while determining the tracking the fishes.

The ability to use automated image processing systems in fishing environments has attracted the attention of both the industrial and marine sciences. Counting, measuring and classifications of catches is often done directly on fishing vessels. The offline process takes much time to finish the task and also it won't be more efficient for the collection of data in research field. The automatic fish monitoring system can classify the body of the fish by measuring the length. Therefore, the development of classification standards and measuring techniques is useful and will accelerate this critical process in fishing stream. Hence the image processing techniques can help in categorization of fishes in marine regions. This was the major advantage in using image segmentation process [1]. Some of the difficulties that are faced during the Chute camera demonstrations are

1. There may be the drastic disasters and therefore there will be limitation in visibility.
2. There may be the water droplets occurred in the camera which can cause reduction in capturing clear images.
3. The body parts of the fish are not captured using infrared sensor when the view of camera is moved.

The parts of the fish's body especially tail part is not appropriate on the surface of the chute. Hence it is necessary to improve the method of classifying the strong parts and the method of measuring the fish bodies.

2. Related works

This gives the overview of literature surveys. It represents some of the relevant work done by the researchers. Many existing techniques have been studied by the researchers on trust evaluation; few of them are discussed below

The vision of computers has major importance on the super pixels. It is unnecessary to keep the perfect super pixel algorithms. Alippi et al. [2] compared five parts of super pixel to identify the image capabilities, memory and the performance of the section. Networks is the method to convert the most powerful visual methods. It has shown convolutional network train by pixel to pixel, providing semantic phase art. The main aim of Huang et al. [3] is to take the large size of the input images and giving back the correct size of the images in return. The main aim of Shelhamer et al. [4] is to focus on the global features in the image data instead of focusing the local images. It deals with the graph partition problem and develop it as a global technique by using image segmentation.

Chuang et al. [5] developed a new method to find the comparative segmentation of the dimensional images. The pixels are represented in the form of objects or backgrounds to produce the barriers of segmentation. Long et al. [6] proposed two main problems in the visual computer namely contour detection and the image segmentation. It states the

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algorithms of both the problems. The contour detector is the combination of number of local cues and the global framework depending upon the clustering. similarly [7] applied classification method based on image histogram segmentation which divides the entire pixel into a region having similar properties according to the gradation level. Each area after separation will match the real object, and each area will have the same internal properties, and this property is different from the surrounding area. Kanchev et al. [8] Implemented the model for the image dataset with the local shape variations in the images. This project involves the lighting and shading of the images with the use of illuminating inter image. Zivkovic et al. [9] taken the eco-friendly region as the source for the analyzation. In the year of 2009 the rules and the factors indicate the performance of both physical and chemical index of water including pH, DO etc. The results are obtained with the standard and the high range of values for TN and COD.

Mathiassena et al. [10] The behaviour of the fish mainly depends upon the water level and its quality. Hence the environment should be monitored frequently to check the cleanliness of the resources. The relation between the mirror and the camera is to calculate the routine basis of the fish behaviour. This method takes three fish for observation. Water quality bio-monitoring utilizes close links between living organisms and the aquatic environment in which aquatic organisms rely on to complete monitoring [11]. Based on the analysis of the relationship between aquatic organisms and water quality environment. The behavior of the fewer number of fish populations are very difficult to measure correctly. To get the accurate measurements [12], a cheap price vision- based system should be built to analyze the behavior of fish in aquatic tanks. Radhakrishna Achanta et al. [13] The drinking water is the important factor for the survival of the human resources. But there is no proper purified water available in most of the regions. Considering the drinking water quality issue certain methodologies has been developed for taking the toxic tests with accuracy. Mehdi Ravanbakhsh et al. [14] done the measurement of fishes using underwater stereo video systems. But somehow the performance of the stereo video measurement has been limited due to the operational system.

Erik Rodner et al. [15] This method depends upon the convolutional neural networks that is done on the objects in order to detect and also for the classification of species. Here the removal of background is proposed which are filtered using the binary SVM classifier for the classification of fishes. Marc Chaumont et al. [16] presented two supervised machine learning methods which detects and recognizes the coral fishes in automated manner by using the underwater HD videos. Imaging technology applications plays a vital role to participate in many important areas in research and industry. These includes the process of optimization, automatic filtering and capture, and automation sorting and so on [17]. Meng-Che Chuang et al. [18] There is no limitation in the abundance of fish with the help of visual analysis that has been attracted for increasing attention. Unstable lighting, ubiquitous noise, and low frame rate (LFR) video capture in the underwater world produces the standard tracking methods that are unreliable. Kresimir Williams et al. [19] mainly shows an automatic fish segmentation algorithm to obtain the trawl based underwater camera system. The main problem that is obtained while capturing is very low brightness between the fishes and the dynamic change in the underwater background.

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3. System Design

3.1. Software Description

The execution stage regarding the task is that the complete aim is essentially changed keen on running code. Intended regarding the stage is towards interpreting the aim keen on a finest likely result within an appropriate programming language. In this section, it covers up the execution phase concerning the task, providing particulars regarding the programming language as well as improvement background employed. It as well provides a general idea about the important sections regarding the task by means of its bit by bit course. The execution phase involves the following tasks:

1. Cautious scheduling.
2. Examination regarding structure as well as constraints.
3. Aim concerning the techniques towards accomplishing the conversion.
4. Assessment concerning the conversion technique.
5. Accurate judgment about the choosing of the proposal.
6. Suitable choosing regarding the language intended for function growth.

3.2. Design Methodologies

Globally, there is an increasing emphasis on enhancing the efficiency of traffic management systems. Road safety, congestion control and security are the three important factors being considered, while regulating the traffic system. In the existing system, a new entity centric trust framework using decision tree classification and artificial neural networks. The proposed entity centric trust model, uses a versatile new direct and recommended trust evaluation strategy to compute trust values. In the proposed system, an efficient model that uses the self-trained network. In the proposed system, design of trust evaluation is implemented using the deep neural network model as part of improving the proposed trust evaluation better. Preprocessing the raw IOT data uses linear discriminant analysis (LDA).The neural network utilizes the self-organized mapping model with that decision making algorithm produces accurate trust evaluation

3.3. Proposed System

This proposed system doesn't require a greater number of datasets for training. Apart from neural network method, this proposed method gives the advantage on the data mainly focus on the fish shape. Thus, only fewer samples are required for the shape modelling. The process of removing the impurities is done mainly on the blurred segmentations. The refinement process is done and any of the segmented image taken as the input is displayed. The image taken as input does not showed in the complete accurate form. The inaccuracy is mainly due to the water droplets and the changes occurred due to lighting and also the rough contour is obtained. The refinement has been conducted based on any of the coarse to fine based system on three levels. The coarse level of each model has the alignment of the basic segmented mask whereas the local features are developed at the fine level. The segmentation of the image carries out the refinement when the region of fish is placed outside the view of camera. The usage of this method helps to recover the shape of fish easily.

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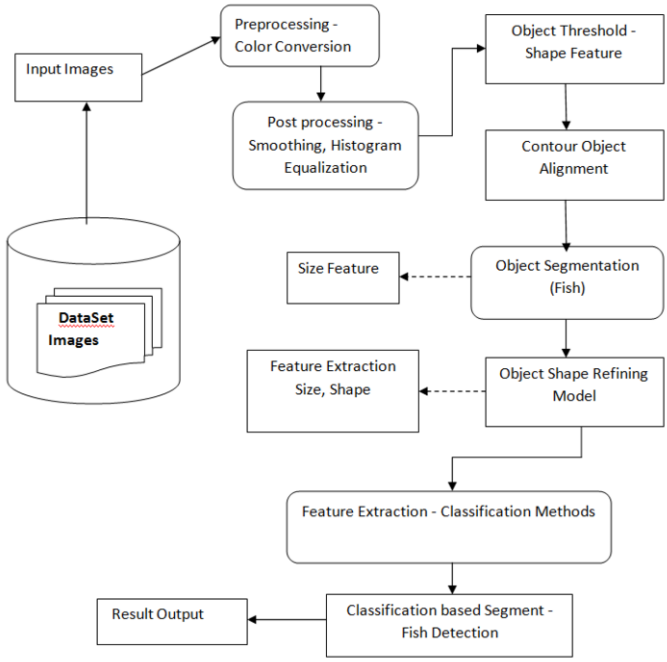

Figure 1. Architecture diagram

3.4. Existing System

The traditional system that contains the manual measurement consisting of the build specimens for the development of fish, monitoring and capturing the lively images of the fishes being observed and processed.

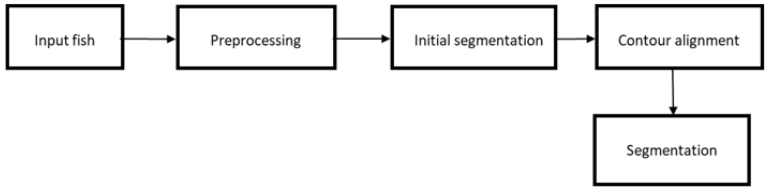

Figure 2. Dataflow diagram

4. Implementation Methodology

4.1. Input Image

The input image is read or the data is obtained from the specified file location, has specified name that changes the file format based on the contents. The file name given contains multiple number of images the function imread is used to retrieve the very first image from the file based on the size of the given image. To change or modify the size of the image in pixels, the values can be added to change the shape of given data set.

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4.2. Image Aquitition

The proposed system is performed by taking a recorded video and then converting the video into a number of images in order to perform the segmentation. The images that are obtained from the video is in JPG format. The high-resolution camera is mainly used for the fish ID based system. The first example is the design of development of software, collection of data and the testing of field is used in the infrared camera is used. The resolution of the RGB images permit the fishes for the easy separation from its background. The red plate is used in order to enhance the color contrast. The first system that was brought up to the development was the detection and tracking.

4.3. Preprocessing

At the beginning stage, the number of contour point is drawn to address the appearance of the fish. To implement this method, a contour-tracing which are related to the Pavlidis are used in a binary input image. This algorithm removes ”holes” in that case that provide a sequential order of mountain pixel values. This type of tracking algorithm system is used in very easy and efficient manner for the usage of the pixel selection table in current pixel area to test and decide how it should be tested for tracking. In this second step, the points evenly spread with the extraction of curves in the form of contour pixel. This type of category is necessary to arrange points are equally arranged between two points.

4.4. Initial Segmentation

Obviously, the movement of the circuit from the current place in the picture, otherwise or resize it couldn't disturb the status analysis. As status of centroid is inconsistent change, rotate and measure, using solving location of translation problem. In a quiet way, the object curve is moved to location of the centroid on the links (0,0). Scale increases are usually found. This type of accessible translation and measurement can be obtained by the use of regular times. In the program presented all the lower order the necessary times for body composition taken from the boundary points. This method is very fast comparison with the calculation times from the mean measurement. The same method for detection of the location (m00) of the status with the simple code of chain method is used here. The route is developed at intervals of m01 and m10. The regular moment mpq is explained as

$$m_{pq} = \int \int x^p y^q f(x,y) dxdy \tag{1}$$

The algorithm goes from one side of the point to the other side of the clock of the mount. The times are obtained with the additional method of the correct times of the trapezoids is produced from the both the position of the contour and with the x axis. The trapezoid has the vertices of (x(c), y(c)), (x(p), y(p)), (x(p),0) and (x(c),0) where c and p develop the present and past location of a line. From the above equation time formulae for lower trapezoid t order which is the function of the vertices can be found

$$m'_{00} = \frac{1}{2}[x(p) - x(c)][y(c) + y(p)] \tag{2}$$

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$$m_{10}^{t} = \frac{1}{4}[x(p) - x(c)][x(c) + x(P)][y(c) + y(p)] \tag{3}$$

$$m_{01}^{t} = \frac{1}{4}[y(c) - y(p)][x(c) + x(P)][y(c) + y(p)] \tag{4}$$

Note that mt 00 and mt 10 have negative values of vertices from the upper boundary of the state (subtraction element) and positive values of vertices from the lower boundary (partial addition). Similarly, mt 01 has negative values on the left side of the shape and positive values on the right part. The method of lower order times of all shapes is obtained with the sum of the times of trapezoids

$$m_{pq} = \sum_{\forall\, t \varepsilon v} m_{pq}^{t} \tag{5}$$

when V defines all of the vertical vertices. Finally, the translation and measurement of line frequency is brought by change of the contour points of the contour according to the following variation:

$$x'(s) = \frac{x(s) - x_c}{\alpha} \quad y's = \frac{y(s) - y_c}{\alpha} \tag{6}$$

where [xc,yc] defines a centroid connection calculated as:

$$x_c = \frac{m_{10}}{m_{00}} \quad y_c = \frac{m_{01}}{m_{00}} \tag{7}$$

and α means a measurement object defined as:

$$\alpha = \sqrt{\frac{m_{00}}{AREA}} \tag{8}$$

where AREA remains selected - the same in all cases by comparison. The rest of this project, use of (x(s), y(s)) in order to define the translation and measure the standard line.

4.5. Contour Allignment

Altering the position of an object or changing a point where it is found to be following a regional boundary should not affect the analysis of the situation. In order to avoid a test of the variability of all possible points of the first point and to maintain the strength of the defect standing it is suggested to remove a small set of points that may begin to form each point. The similarity / contrast ratio is only checked by two of the first selected locations. The accuracy and speed of searching for the right turn- based game is of the initial points selected. The method used to take the first points and the process is done for pairing the first points of the difference test can be adjusted in the given application. In this project, it was proposed a follow-up plan to remove the original location sets.

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4.6. Segmentation

CLAHE is operated at all of smaller locations of the image, known as tiles, rather than taking the whole image. The adapthisteq is used to calculate the contrast transformed function for every tile independently. Each one of the tiles which is contrasted is in form of enhancement. The histogram of the given output region will more or less matches the histogram mentioned by the 'Distribution' value. The nearest tiles are together formed by the use of bilinear interpolation that eliminates externally induced boundaries. The contrast, that is in homogeneous areas, might be reduce to minimize the amplification of the noise which may or may not present in the image.

5. Simulation Results & Discussions

5.1. Video Frames

This process takes the video frames in terms of *mp4 and is get converted into number of frames. The numbers of frames are obtained to be in the form of images. The images can be given as jpg. From the given images the very first data collected from the video frame is taken as the input image and is used for further process. The image is taken from the folder where the number of video frames are stored. It is loaded by converting the video frame into image. The size can be changed in the form of pixels.

5.2. Preprocessing

The input image is being processed by converting the original RGB image into the Grey scale image. The image is being enhanced by using the Adaptive Histogram Equalization technique. It is the type of technique which involves the quality of the image that is given as the input that identifies the object present in an image. The Figure 3 represents the improvement of the quality of the image which enhances the entire image and calculates the contrast transform for each tile individually. The main purpose of this algorithm is to combine the neighboring tiles by using bilinear interpolation to eliminate artificial boundaries.

5.3. Color To Grey Conversion

The grey scale image is the one which each one of the pixels is represented using the amount of light alone. It is different from every single black and white image in terms of computer imaging. The main purpose of the conversion of color to grey image is that to reduce the total time taken for the performance of the image. The RGB image takes more time when compared to the grey scale image. A grayscale image, represented in the Figure 4 is a data matrix which the values are represented in the intensities of one image pixel. While grayscale images are rarely saved with a color map, MATLAB uses a color map to display them.

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Figure 3. Input image

Figure 4. Grey scale Image

5.3.1. Histogram

Histograms is the type of bar plot for numeric data that is represented in the Figure 5 is data into bins. This can identify the changes of the image that is loaded and the output that is taken. This is used for quick modification of the properties of the bins or changing the display.

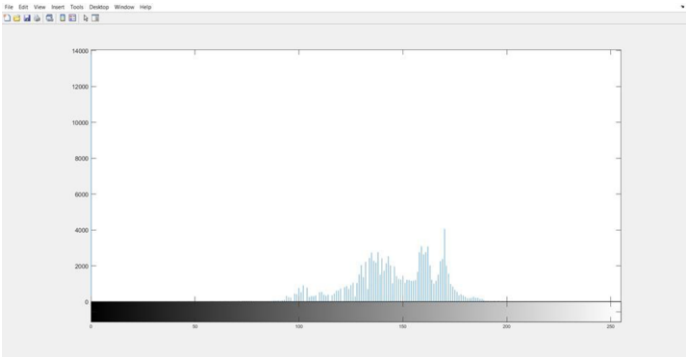

Figure 5. Histogram of grey scale image

5.4. Contour Plot

Contour plot represented in Figure 6 is the set of x and y values which indicates the 2d image of given input frame. The values are given in Table 1. The third column represents the depth of the image which recognizes the object representation in the following plain surface.

5.5. Image Segmentation

Image segmentation is a technique which is used in the digital image processing and analysis in order to partition each one of the images into multiple parts or regions, that is based on the characteristics of the pixels in the image. Image segmentation could involve the separation of the foreground from the background, or clustering regions of pixels that is similar to the color or shape.

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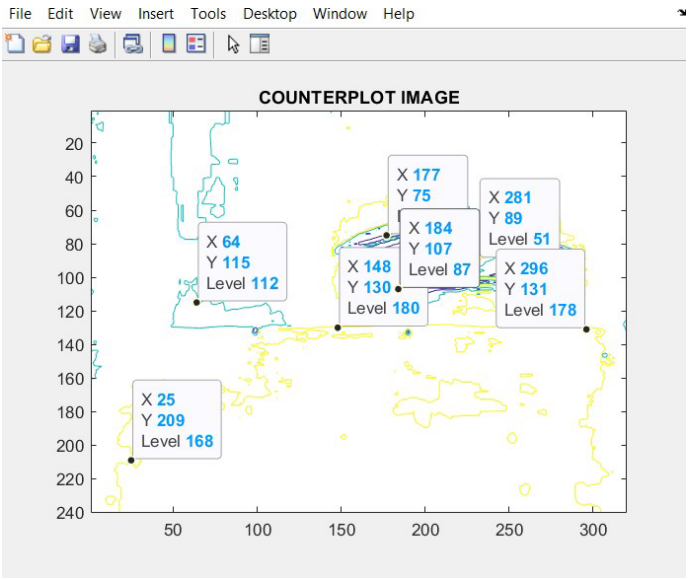

Figure 6. Contour Plot

Table 1. Analysis of Contour plot

X Axis	Y Axis	Levels
25	209	168
64	115	112
148	130	180
177	75	44
184	107	87
281	89	51
296	131	176

5.5.1. Bounding Box

In object detection, the use a bounding box is to represent the target location. The bounding box is a rectangular box that can be represented in Figure 7 is in the form of the axis coordinates. The origin of the coordinates in the above image is the center of the image. The image represents the identification of the fish within the Bounding Box. It involves the conversion of the images into a collection of regions of pixels that are represented in the form of a mask or a labeled image. By dividing an image into segments, the process can be done by only the important segments of the image rather than processing the entire image.

5.5.2. Histogram for CLAHE image

The Figure 8 represents the implementation of the grey scale conversion and the adaptive equalization technique. It states that the total time required for the image to retrieve the output is faster while compared to the blurry input image.

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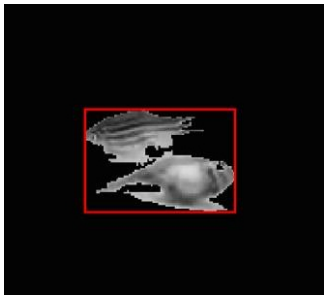

Figure 7. Segmented result

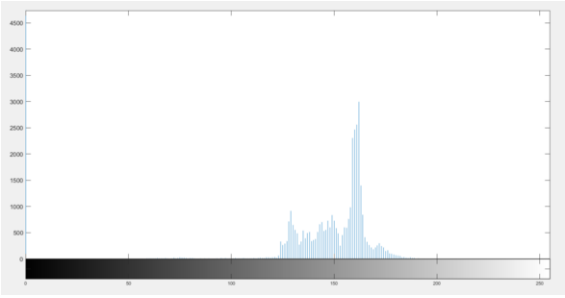

Figure 8. Histogram of the output image

6. Conclusion

An efficient approach for similarity calculation between closed contours is proposed. The approach can deal with noisy and distorted shapes and is invariant to translation, scale change and rotation. The proposed dissimilarity measure is based on the geometrical distances between corresponding contour points. The coarse to fine contour-based segmentation refinement is proposed to deal with segmentation challenges in fish measurement. There are three key components for the proposed refinement. It is refined for the segmentation from the coarse level to the fine level to deal with variant fish shapes. The refinement is processed iteratively via affine transforms. Shape models provide rich prior knowledge when estimating the segmentation contours.

References

[1] Villon S, Chaumont M, Subsol G, Villéger S, Claverie T, Mouillot D. Coral reef fish detection and recognition in underwater videos by supervised machine learning: Comparison between Deep Learning and HOG+ SVM methods. In International Conference on Advanced Concepts for Intelligent Vision Systems 2016 Oct 24 (pp. 160-171). Springer, Cham.

[2] Alippi C, Boracchi G, Camplani R, Roveri M. Detecting external disturbances on the camera lens in wireless multimedia sensor networks. IEEE Transactions on Instrumentation and Measurement. 2010 May 6;59(11):2982-90.

[3] Huang TW, Hwang JN, Rose CS. Chute based automated fish length measurement and water drop detection. In 2016 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2016 Mar 20 (pp. 1906-1910). IEEE.

[4] Shelhamer E, Long J, Darrell T. Fully Convolutional Networks for Semantic Segmentation. IEEE Transactions on Pattern Analysis and Machine Intelligence. 1 April 2017 April 1;39(4):640-51.

[5] Chuang MC, Hwang JN, Williams K, Towler R. Automatic fish segmentation via double local thresholding for trawl-based underwater camera systems. In 2011 18th IEEE International Conference on Image Processing 2011 Sep 11 (pp. 3145-3148). IEEE.

[6] Long J, Shelhamer E, Darrell T. Fully convolutional networks for semantic segmentation. In Proceedings of the IEEE conference on computer vision and pattern recognition 2015 (pp. 3431-3440).

[7] Yan T. Cultural changes in coral community based on image segmentation and travel public service in coastal areas. Arabian Journal of Geosciences. 2021 Aug;14(15):1-4.

[8] Wang N, Er MJ, Han M. Generalized single-hidden layer feedforward networks for regression problems. IEEE transactions on neural networks and learning systems. 2014 Jul 15;26(6):1161-76.

[9] Kanchev V, Tonchev K, Boumbarov O. Blurred image regions detection using wavelet-based histograms and SVM. In Proceedings of the 6th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems 2011 Sep 15 (Vol. 1, pp. 457-461). IEEE.

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[10] Mathiassen JR, Misimi E, Bondø M, Veliyulin E, Østvik SO. Trends in application of imaging technologies to inspection of fish and fish products. Trends in Food Science & Technology. 2011 Jun 1;22(6):257-75.

[11] Chuang MC, Hwang JN, Williams K, Towler R. Tracking live fish from low-contrast and low-frame-rate stereo videos. IEEE Transactions on Circuits and Systems for Video Technology. 2014 Sep 12;25(1):167-79.

[12] Liu R, Li Z, Jia J. Image partial blur detection and classification. In 2008 IEEE conference on computer vision and pattern recognition 2008 Jun 23 (pp. 1-8). IEEE.

[13] Achanta R, Shaji A, Smith K, Lucchi A, Fua P, Süsstrunk S. SLIC superpixels compared to state-of-the-art superpixel methods. IEEE transactions on pattern analysis and machine intelligence. 2012 May 29;34(11):2274-82.

[14] Chuang MC, Hwang JN, Williams K, Towler R. Automatic fish segmentation via double local thresholding for trawl-based underwater camera systems. In2011 18th IEEE International Conference on Image Processing 2011 Sep 11 (pp. 3145-3148). IEEE.

[15] Ravanbakhsh M, Shortis MR, Shafait F, Mian A, Harvey ES, Seager JW. Automated Fish Detection in Underwater Images Using Shape-Based Level Sets. The Photogrammetric Record. 2015 Mar;30(149):46-62.

[16] Jäger J, Rodner E, Denzler J, Wolff V, Fricke-Neuderth K. Object Proposal Classification for Fish Detection in Underwater Videos. InCLEF (working notes) 2016 (pp. 481-489).

[17] Zivkovic Z, Van Der Heijden F. Efficient adaptive density estimation per image pixel for the task of background subtraction. Pattern recognition letters. 2006 May 1;27(7):773-80.

[18] Mathiassen JR, Misimi E, Bondø M, Veliyulin E, Østvik SO. Trends in application of imaging technologies to inspection of fish and fish products. Trends in Food Science & Technology. 2011 Jun 1;22(6):257-75.

[19] Chuang MC, Hwang JN, Williams K, Towler R. Tracking live fish from low-contrast and low-frame-rate stereo videos. IEEE Transactions on Circuits and Systems for Video Technology. 2014 Sep 12;25(1):167-79.

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Heart Disease Prediction Using Hybrid Random Forest Model Integrated with Linear Model

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Abstract. The objective of the paper is to throw light on few existing heart disease predicting approaches and proposes a Hybrid Random Forest Model Integrated with Linear Model (HRFMILM) for predicting and identifying the HDs at an early stage. Even though the linear model has simple estimation procedure, it is very sensitive to outliers and may lead to overfitting process. On the other hand, averaging in Random Forest Model (RFM) improves the overall accuracy and reduces the possibility of overfitting. The dataset is collected from standard UCI repository. Experimental results concluded that the integration of Linear Model with RFM makes the simple estimation procedure with improved overall accuracy than the respective models. Further, the proposed method compares the prediction performance of few existing approaches in terms of parameters, namely, precision, recall and F1-score.

Keywords. Heart Disease, Linear Model, Random Forest Model, Hybrid Model, prediction parameters.

1. Introduction

The intervention of a cardiologist arises if a patient suffers from all or any of the following symptoms - shortness in breathing, chest discomfort, nausea and fatigue or any of this kind. The prevailing medical society utters heart disease to be an essential reason for death. Without the discrimination of age or gender, cardiovascular disease crop up for many reasons such as family history, smoking, high blood pressure and cholesterol levels, obesity, poor hygiene and stress [1, 2]. Further, a thorough medical history of the patient's family and the patient plays a vital in this discussion. Based on the reports, the doctor decides either initiate the treatment or to perform the invasive test (coronary cardiography, catheterization, electrophysiology study) [3–5]. Heart diseases are categorized as congenital, arrhythmia, coronary artery, dilated cardiomyopathy, hypertrophic cardiomyopathy, heart failure, pulmonary stenosis, mitral reurgitation based on the organs they affect [1]. The symptoms of heart disease vary for elderly and diabetic patients. Henceforth, an MRI reduces the dimensionality of the heart disease by depicting

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the structure of the heart including valves, muscles, chambers other vessels and analyzes the blood flow, narrow or blocked arteries.

Nevertheless, the disease, when recognized earlier, makes the treatment unconstrained forasmuch as identification, a challenging task depends solely on the medical community. The affordability to treat such disease needs to be in the limits of the patient. Data mining is modest as data is readily available. Figure 1 depicts the conventional data mining architecture. The responsibility of pattern evaluation module is to measure the patterns based on the threshold value and interacts with users and data mining engine. The knowledge base provides input to data mining engine for tuning the performance of data mining process.

2. Decision Support Systems

Decision making is an intellectual task with complexity. Using internet and other web tools people acquire knowledge to take smart decisions. Moreover, the list of mentor – friend, colleague is expanded as subject specific. Decision Support Systems are computer based systems intended to help in effective decision making through the data and the models. A decision support system has three integrants i) knowledge ii) inference engine iii) user support. The medical domain has cuddled new information and communication technology through data mining and DSS, to provide economically feasible quality healthcare services for the patients in demand.

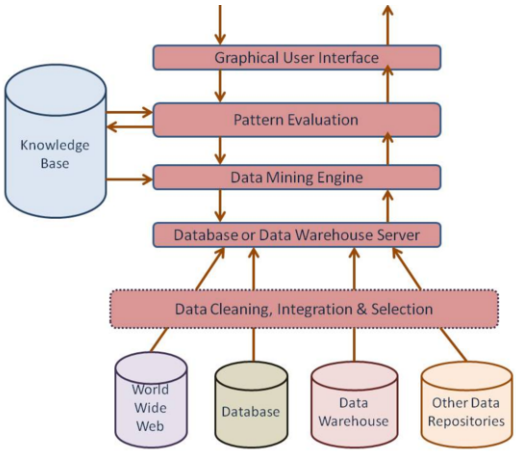

Figure 1. Data Mining Architecture

Foremost, the knowledge in DSS though typified in four forms - logical conditions, rules, graphs and structures, with respect to DSS in diagnosis and treatment, Guideline Interchange Format (GLIF), Clinical Terminology System, SNOMED CT (Systematized Nomenclature of Medicine Clinical Terminology) can be utilized.

The following section illustrates few existing DSS that were adopted for HD predictions and the proposed HD prediction approach.

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3. Literature Survey

Vennemann et al. [6] used detection algorithms along with machine learning to diagnose the heart valve degradation based on blood flow data in the heart. They acclaim the diagnosis process as automatic that reduced the frequent visits to clinical checkups and utilized computer-oriented diagnostics and telemedicine for improved patient care. The novelty detection algorithm exhibited high sensitivity of Model Compliance Index (MCI) with respect to Aortic regurgitation, a common heart valve disease where the valve doesn't close completely. The datamining approach for disease prediction provides flexiblity and availability of symptoms checker for wide variety of audience [7]. Thomford et al. [8] reviewed various heart prediction papers that used techniques Artificial Intelligence and digital health system with limited resources settings especially with respect to Sub-Saharan African (SSA) countries. Swapna et al. [9] detected cardiac arrhythmia through automatic detection technique using deep learning. The abnormality of heart beats, cardiac arrhythmia was detected with techniques such as Convolutional Neural Network (CNN), recurrent neural network (RNN), gated recurrent unit, long short-term memory (LSTM) and hybrid of CNN and recurrent structures.

Alarsan and Younes [10] used machine learning algorithms such as Decision tree, Random Forest (RF) and Gradient Boost algorithms (GDB) to classify and analyze heart diseases based on ECG signals. ECG signals of MIT-BIH arrhythmia and MIT-BIH Supra ventricular arrhythmia were processed using Spark-Scala tools to extract features. Choi et al. [11] evaluated the diagnostic accuracy of Artificial intelligence based Clinical decision support system in diagnosing heart failures. The pilot study with a dataset of 97 patients investigated based on knowledge acquisitions - expert driven, data driven also a hybrid of both.

Nashif et al. [12] diagnosed heart diseases utilizing machine learning algorithms with an exclusive health monitoring system for cardiac diseases. The machine learning algorithm, Support Vector Machine (SVM) showed 97.53% in 10 fold cross validation on Cleveland Heart Disease dataset with 303 records along with Statlog dataset with 270 records having 13 similar features. Latha and Jeeva [13] applied ensemble classification technique to improve the accuracy of heart disease prediction. Ensemble classification which uses multiple algorithms overcomes the prediction accuracy of weak classifiers in addition to disease prediction at infancy state itself.

Sharanyaa et al. [14] diagnosed the heart diseases by applying Machine Learning (ML) algorithms such as K-Nearest Neighbor (KNN), Random Forest (RF), Decision Tree (DT), Support Vector Machine (SVM) and finally a hybrid of all afore mentioned techniques on a public dataset repository, UCI. The investigation showed hybrid of ML techniques exhibited 94% accuracy in heart disease prediction. Jackins et al. [15] depicted smart clinical disease prediction through ML techniques Naïve Bayes (NB) and Random Forest (RF) classifiers. The study was examined on three different datasets with clinical disease such as diabetes, coronary heart disease and breast cancer. Also study by Jabbar et al. [16] on heart disease prediction system using random forest produced good results. Alotaibi [17] implemented a machine learning model to predict heart failure disease accurately. The investigation was conducted on Cleveland dataset with 14 attributes. The ML algorithms considered for the study are NB, DT, SVM, Logistic Regression, and RF. The class precision and class recall for the ML algorithms as confusion matrix form were tabulated and compared. Comparative results depicted DT outperformed other four models.

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4. Proposed Approach

The proposed work integrates the Linear Model (LM) and Random Forest (RF) to form a hybrid approach, namely Hybrid Random Forest Integrated with Linear Model (HRFMILM) for predicting and identifying the Heart Diseases at an early stage. The Cleveland HD dataset is downloaded from UCI repository for evaluating the proposed work. The dataset comprises of 76 attributes collected from 303 individuals. Various attributes collected from the individuals considered in the proposed method are (1) Age (2) Sex (3) Type of the chest pain (4) Blood pressure at rest (5) Serum cholesterol (6) Blood sugar at fasting (7) ECG at rest (8) Maximum Heart Rate (HR) (9) Exercise induced during angina (10) ST depression created due to exercise (11) ST level at peak exercise (12) Major vessels count (13) Thal and (14) HD diagnosed result.

The following section illustrates the steps for HD prediction using Linear Model.

Step 1 : Input the dataset
Step 2 : Handling the missing values
Step 3 : Splitting the dataset for training and testing purposes. In this approach, 75% and 25% ratio of dataset is adopted for training and testing processes respectively.
Step 4 : Feature Scaling is carried out for standardizing the independent features in the dataset for training and testing samples.
Step 5 : Fitting the LM classifier (in this case, the K-Nearest Neighbour (KNN) with neighbour (n)=3)
Step 6 : Predicting the classifier performance

The following section illustrates the steps for HD prediction using RFM approach.

Step 1 : Import the dataset
Step 2 : Handling the missing values
Step 3 : Splitting the dataset for training and testing purposes. In this approach, 75% and 25% ratio of dataset is adopted for training and testing processes respectively.
Step 4 : Feature Scaling is carried out for standardizing the independent features in the dataset for training and testing samples.
Step 5 : Fitting the RFM classifier with the number of estimator equals to twenty.
Step 6 : Predicting the classifier performance.

5. Results And Discussion

The proposed method is evaluated on the Cleveland HD dataset downloaded from UCI repository. The various parameters used to evaluate the proposed method are Precision, Recall, F1-score and accuracy. The Precision (P), Recall (r), F1-score and Accuracy (A) are determined using the Eqs. (1), (2), (3) and (4), respectively.

$$Precision(P) = \frac{TP}{(TP+FP)} \tag{1}$$

$$Recall(r) = \frac{TP}{(TP+FN)} \tag{2}$$

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$$F1\ score = 2 * \frac{Precision * Recall}{Precision + Recall} \tag{3}$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \tag{4}$$

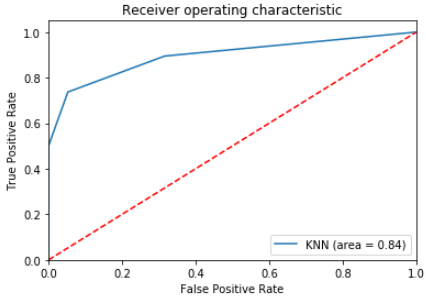

Figure 2. ROC for LM (KNN)

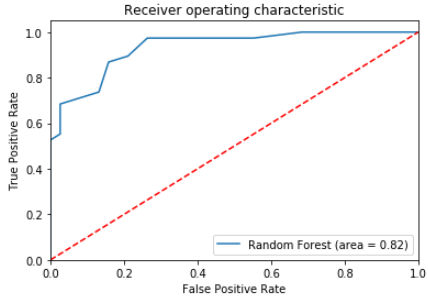

Figure 3. ROC for RFM

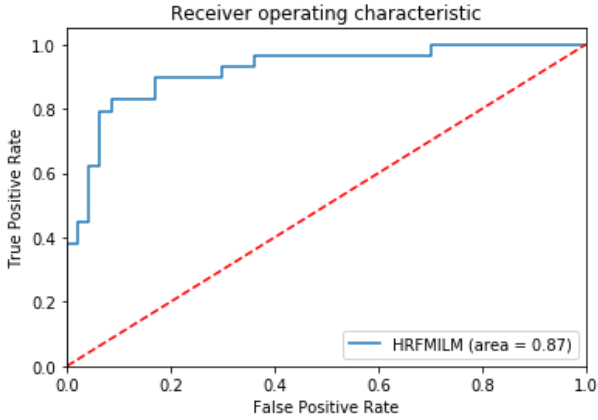

Figure 4. ROC for proposed HRFMILM

Figure 2, 3 and 4 illustrate the performance of LM, RFM and proposed HRFMILM respectively regarding the Receiver Operating Characteristics (ROC) curve. The ROC curve is defined as the plot drawn between the two parameters, namely, True Positive Rate (TPR) and False Positive Rate (FPR). TPR is also referred as recall (r) and FPR is defined using the Eq. (5). Table 1 illustrates the performance comparison of LM, RFM and proposed HRFMILM.

$$FPR = \frac{FP}{(FP + TN)} \tag{5}$$

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Table 1. Performance comparison

Name of the Method	Precision (P)	Recall (r)	F1-score	Accuracy in %
LM	0.85	0.85	0.84	84
RFM	0.83	0.82	0.81	82
Proposed HRFMILM	0.83	0.82	0.81	87

6. Conclusion

To summarize, the paper presented a HD prediction approach using Hybrid Random Forest Model Integrated with Linear Model (HRFMILM). The present work is evaluated on Cleveland dataset collected from UCI repository. When compared to the performance of the conventional machine learning approaches regarding HD prediction, the integration of those traditional approaches resulted in improved and reliable HD prediction accuracy. Henceforth, the proposed approach has probable of diagnosing the HD to aid cardiologists. As a part of future work, proposed work can be integrated with few other traditional machine learning approaches and evaluated for performances and even with other datasets.

References

[1] Peter TJ, Somasundaram K. An empirical study on prediction of heart disease using classification data mining techniques. InIEEE-International conference on advances in engineering, science and management (ICAESM-2012) 2012 Mar 30 (pp. 514-518). IEEE.

[2] Everything you need to know about heart disease, - Heart Disease: Types, Causes, And Treatments [Internet]. 2020 Sep 03 [cited 2020 Dec 31]. Available from: https://www.medicalnewstoday.com/ articles/237191.

[3] Mayo Clinic. Heart Disease - Symptoms And Causes [Internet]. 2021 Jan 12 [cited 2020 Dec 30]. Available from: https://www.mayoclinic.org/diseases-conditions/heart-disease/symptoms-causes/syc-20353118.

[4] Magnetic Resonance Imaging (MRI) [Internet]. [cited 2020 Dec 30]. Available from: https://www.heart.org/en/health-topics/heart-attack/diagnosing-a-heart-attack/magnetic-resonance-imaging-mri.

[5] Booma PM, Prabhakaran S, Dhanalakshmi R. An Improved Pearson's Correlation Proximity-Based Hierarchical Clustering for Mining Biological Association between Genes. The Scientific World Journal. 2014 Jan 1;2014:1-10.

[6] Vennemann B, Obrist D, Rösgen T. Automated diagnosis of heart valve degradation using novelty detection algorithms and machine learning. PloS one. 2019 Sep 26;14(9):e0222983.

[7] Wideskills. Data Mining Architecture, Data Mining Tutorial [Internet]. [cited 2020 Dec 31]. Available from: https://www.wideskills.com/data-mining-tutorial/data-mining-architecture.

[8] Thomford NE, Bope CD, Agamah FE, Dzobo K, Owusu Ateko R, Chimusa E, Mazandu GK, Ntumba SB, Dandara C, Wonkam A. Implementing artificial intelligence and digital health in resource-limited settings? Top 10 lessons we learned in congenital heart defects and cardiology. Omics: a journal of integrative biology. 2020 May 1;24(5):264-77.

[9] Swapna G, Soman KP, Vinayakumar R. Automated detection of cardiac arrhythmia using deep learning techniques. Procedia computer science. 2018 Jan 1;132:1192-201.

[10] Alarsan FI, Younes M. Analysis and classification of heart diseases using heartbeat features and machine learning algorithms. Journal of Big Data. 2019 Dec;6(1):1-15.

[11] Choi DJ, Park JJ, Ali T, Lee S. Artificial intelligence for the diagnosis of heart failure. NPJ digital medicine. 2020 Apr 8;3(1):1-6.

[12] Nashif S, Raihan MR, Islam MR, Imam MH. Heart disease detection by using machine learning algorithms and a real-time cardiovascular health monitoring system. World Journal of Engineering and Technology. 2018 Sep 12;6(4):854-73.

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[13] Latha CB, Jeeva SC. Improving the accuracy of prediction of heart disease risk based on ensemble classification techniques. Informatics in Medicine Unlocked. 2019 Jan 1;16(100203):1-9.
[14] Sharanyaa S, Lavanya S, Chandhini MR, Bharathi R, Madhulekha K. Hybrid Machine Learning Techniques for Heart Disease Prediction. International Journal of Advanced Engineering Research and Science. 2020;7(3):44-8.
[15] Jackins V, Vimal S, Kaliappan M, Lee MY. AI-based smart prediction of clinical disease using random forest classifier and Naive Bayes. The Journal of Supercomputing. 2021 May;77(5):5198-219.
[16] Jabbar MA, Deekshatulu BL, Chandra P. Intelligent heart disease prediction system using random forest and evolutionary approach. Journal of network and innovative computing. 2016 Apr;4(2016):175-84.
[17] Alotaibi FS. Implementation of machine learning model to predict heart failure disease. International Journal of Advanced Computer Science and Applications. 2019;10(6):261-8.

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Heart Disease Prediction Using Convolutional Neural Network

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Abstract. The group of diseases related to heart and blood vessels are commonly known as Cardio vascular diseases. Considering today's lifestyle, they are the major cause of deaths globally. So early identification of the diseases can give us a fair chance of effective treatment and proper precautions for a healthy life. The proposed novel model is created using convolutional neural networks in combination with random forest algorithm and there will be 12 factors that help to predict the heart disease and chest X-rays will also be used as one of the parameters.

Keywords. Cardiovascular diseases, convolutional neural networks, Random forest algorithm.

1. Introduction

With digitalization around the world, technology plays a massive role in our daily tasks. But today's technological advancements implemented in the healthcare sector are dominating small devices to huge equipment. The rapid introduction of technology in the medical domain can deliver an accurate diagnosis, promising cure and effective medications and treatments with an increased preciseness. According to WHO, Cardiovascular diseases are the major cause of death globally. In a recent survey, an approximate of 17.9 million premature people (under the age of 70) died due to the heart diseases. In the proposed novel method, we are focused on getting an accurate prediction of the heart disease of the user using Convolutional neural networks (which are known for its human-like processing) and the classification model. Heart diseases like Arrhythmias, Cardiomyopathy, Ischemic heart disease, inflammatory heart disease can be identified using their respective symptoms [1–7]. The input from the user will be preprocessed, tested and an appropriate report will be generated with the necessary steps that are needed to be taken by the patient. The application can be deployed in the hospitals for a quicker and an accurate diagnosis instead of the manual diagnosis. The report can be used as a reliable source for the doctor in the further diagnosis.

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2. Literature Survey

Senthil Kumar et al. [8] provided a prediction model of hybridization of random forest with a linear model (HRFLM) was developed. It was a computer aided decision support system which could be used for the prediction(yes or no). HRFLM is a multilayer perception of neural networks. A combination of artificial neural network and back propagation technique and recurrent fuzzy networks were used to enhance accuracy in diagnosis.

Ram Prakash et al. [9] provided a prediction model of Deep Neural Network, χ^2 - statistical model where used to overcome the under fitting and over fitting issues faced in the previous model using artificial neural networks. The dataset was divided into training and testing datasets. As neural networks is made up of layers with the activation function. The input layer is fed with the training features and hidden layer is fed with the actual process data with weighed connection. Hypothesis was generated using the data in the trained model. Hypothesis was formulated with forward propagation .

The authors of [10] done research to improve the accuracy of the existing models of machine learning techniques naïve bayes, Random forest algorithm and support vector machine by combining it with the feature selection approach. An optimum amount of dataset was chosen, Rapid miner was used for data cleaning step. It was used to find the missing values. The outlier detection was applied along with rapid miner operator and distance method.

Maruf et al. [11] proposed an idea for prediction of heart diseases based on external factors such as taking drugs, smoking, diabetes, hereditary, shortness of breath, gender, unusual stress regularity of exercise, blood pressure, dizziness, age, tightness in chest using six distinct classifiers of ML (decision tree, random forest, naive bayes, support vector, quadratic discriminant, logistic regression). The confusion matrixes of prediction results were obtained. Support vector machine showed the best results.

3. System Architecture

The architecture of proposed model using convolutional neural network consists many components. The first component is where the input for every prediction takes place; we need an input dataset based on which the prediction takes place for the given input. The patient details are converted in the form of dataset and it is combined with the input dataset both acts an input for data acquisition which is the process of the systems to perform the tasks such as conversion of data, storage of data, transmission of data and processing of data. Once data acquisition is over, the output of this is given to the preprocessing component where the data is processed and this result is given to the classification module. The chest X-ray which is taken as one of the attribute is processed using convolutional neural network. The classification module is built using Random Forest algorithm. All the outputs for the processing are fed into the module. The prediction of heart disease is done. The generated report can be a reliable document for the doctor for the further diagnosis.

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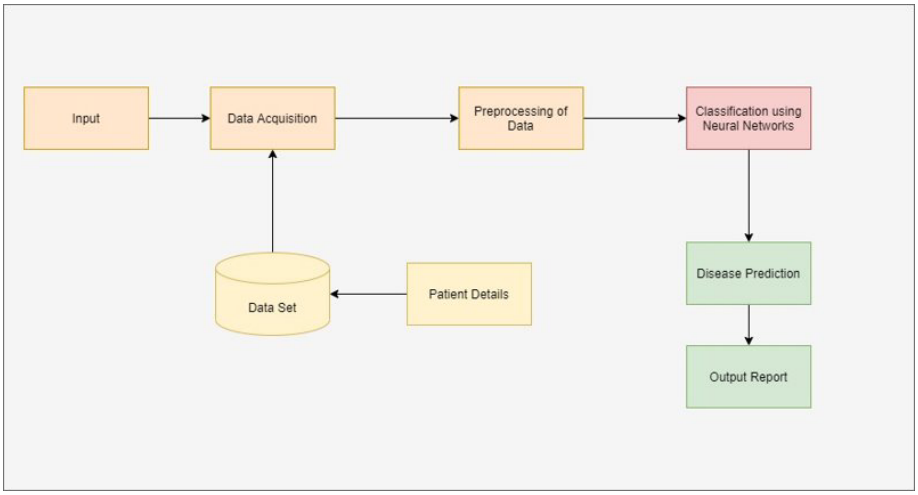

Figure 1. Heart Disease Prediction System

4. Implementation

4.1. GUI & Preprocessing Module

In this interface, the user or patient interacts with the application .This User interface is built in a simple way to make it user-friendly. This is the module in which the user enters the input parameters such as Age, Triceps skin fold thickness, Plasma glucose concentration, Insulin, Diabetes pedigree function(DPI), Diastolic blood pressure, Number of times pregnant, Body mass index, FBS, Cp, Old Peak, Thal and X-ray image. The dataset is obtained from the UCI repository 90% data is utilized in training the machine and 10% is utilized used to test the machine.

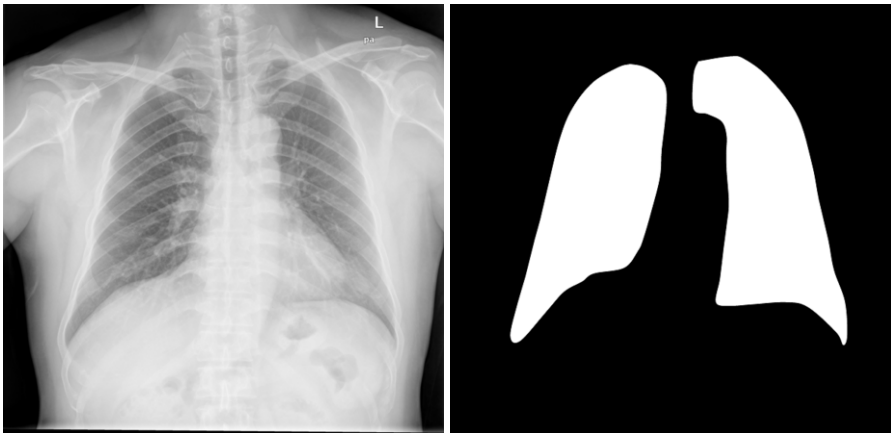

Figure 2. X-ray Image Before and After Processing

Data preprocessing is done where data is cleaned and missing values are filled in by the mean value to avoid mishandles in the prediction. A 2D Convolutional neural network

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is created using keras.layers.convolutional.The chest X-ray obtained from the user is also processed by convolutional neural network as it is best suited for the image classification. ImageDatagenerator, shear range, rotation range are performed to transform the data into machine understandable form. Xception model architecture used to create the model. These input parameters are trained well in order to obtain a high accuracy. The features and quality of labeling process of the data utilized during the training period quantify the correctness of the outcome of the model.

4.2. Data visualization and correlation matrix

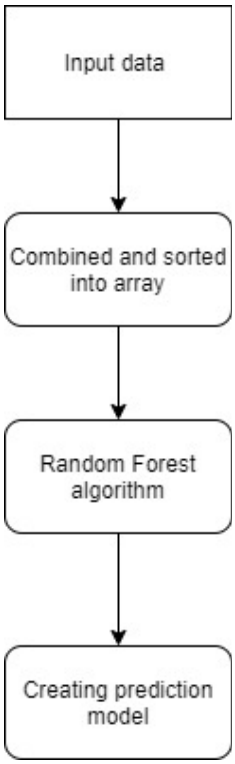

Figure 3. Data Flow Diagram

Correlation matrix is formed which establishes the relationship between each factor. It is formed used Mathplotlib library function. The matrix formed after applying linear regression to the data. Pickling is done to serialize the data and transport to the network. From sklearn.ensemble RandomForestClassifieris imported. The prediction model thus built is used to envisage the type of the cardiac disease the person is suffering from. Random Forest classifier gives the maximum accuracy.

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4.3. Classification and prediction

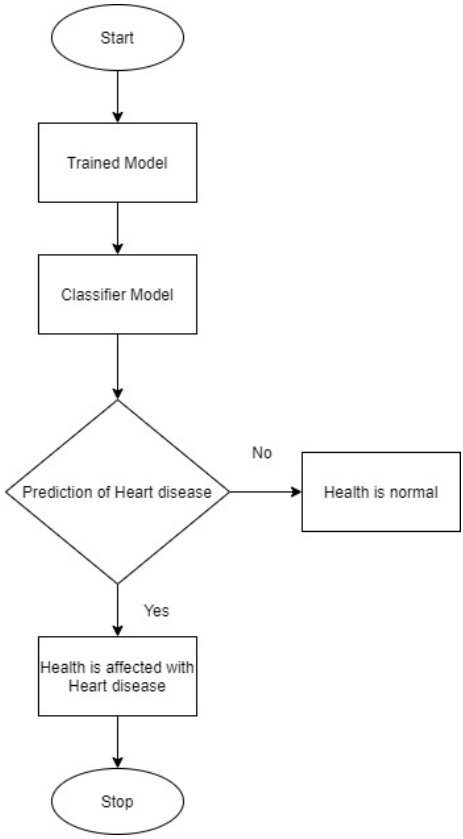

Figure 4. Proposed System Working Procedure

The noticed values are utilized to get some conclusions in this module. If inputs are given in this module, the values of results are foreseen. Labels of the results are applied to a dataset. The trained model is then used for classification based on the input parameters, this module will generate a value, based on this value, and the heart disease is being predicted.

5. Performance Analysis

The prevalent datasets were partitioned in 90:10 ratio for training and testing the model at each stage. After evaluation, as convolutional neural networks are the best for image classification, the accuracy obtained for CNN was 90% and the classification model built using random forest algorithm was obtained an accuracy of 87%. The Linear regression used to train the model using dataset has a success rate of 83%. The proposed model obtained a highest accuracy of 88%.

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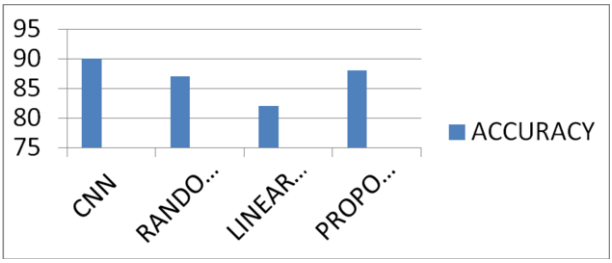

Figure 5. Comparison Graph of the Proposed Model

6. Conclusion And Future Works

There is an alarming increase in the number of cardiac deaths globally. Analysisation and utilization of the prevalent raw data can help us build technological advanced systems which will be needful in times of an emergency. As, we know the early detection is the best prevention. This paper proposes a model to predict and classify the heart diseases by getting the chest x-ray and details of the patient. In comparison with the previous models, the proposed model has shown a significant improvement in the accuracy and obtained an accuracy 87%.If the proposed model could be implemented in large scale, we can reduce the uncertainty in the heart failures. In future, the prescription of medicines can also be included in the report based on the disease and more factors such as Electrocardiography can be added.

References

[1] Tamal MA, Islam MS, Ahmmed MJ, Aziz MA, Miah P, Rezaul KM. Heart disease prediction based on external factors: A machine learning approach. International Journal of Advanced Computer Science and Applications (IJACSA). 2019;10(12):446-51.

[2] Jagtap A, Malewadkar P, Baswat O, Rambade H. Heart disease prediction using machine learning. International Journal of Research in Engineering, Science and Management. 2019;2(2):352-5.

[3] Raza A, Mehmood A, Ullah S, Ahmad M, Choi GS, On BW. Heartbeat sound signal classification using deep learning. Sensors. 2019 Jan;19(4819):1-15.

[4] Patel J, TejalUpadhyay D, Patel S. Heart disease prediction using machine learning and data mining technique. International Journal of Computer Science & Communication. 2015 Sep;7(1):129-37.

[5] Ajay H, Rao AR, Balavanan M, Lalit R. A Novel Cardiac Arrest Alerting System using IoT. International Journal of Science Technology & Engineering. 2017;3(10):78-83.

[6] Dangare CS, Apte SS. Improved study of heart disease prediction system using data mining classification techniques. International Journal of Computer Applications. 2012 Jun;47(10):44-8.

[7] Bhanumathi M, Priyanka JP, Murali Krishna J, Namrata. A Cardinal Approach for crack detection in a bridge using Automatic Pixel-level Technique. International Journal of Grid and distributed Computing. 2020;13(1):1011-7.

[8] Mohan S, Thirumalai C, Srivastava G. Effective heart disease prediction using hybrid machine learning techniques. IEEE access. 2019 Jun 19;7:81542-54.

[9] Ramprakash P, Sarumathi R, Mowriya R, Nithyavishnupriya S. Heart Disease Prediction Using Deep Neural Network. In2020 International Conference on Inventive Computation Technologies (ICICT) 2020 Feb 26 (pp. 666-670). IEEE.

[10] Alotaibi FS. Implementation of machine learning model to predict heart failure disease. International Journal of Advanced Computer Science and Applications. 2019;10(6):261-8.

[11] Golande A, Pavan Kumar T. Heart disease prediction using effective machine learning techniques. International Journal of Recent Technology and Engineering (IJRTE). 2019 Jun;8(1):944-50.

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Ensuring the Survivablity of the Trekker Using Drone and RFID Technology

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Abstract. Amature trekkers venturing into the forest often tend to lose their path and find it difficult to return back to their origin or destination. It is important for the rescuers and volunteers to promptly find the trekker in order to increase the probability of survival. Imparting confidence and providing proper guidance to the trekker is also an important part in search and rescue missions. Drones can be used to locate the trekker promptly using RFID technology and global positioning system (GPS) and provide communication systems between the trekker and the rescue team using LoRa.

Keywords. Drone, RFID Technology, Global Positioning System (GPS), LoRa.

1. Introduction

Mass migration towards cities has happened in recent years, yet people love the forest and its surroundings. This has led to rise in forest based tourism all around the world. Trekking is the most exciting and preferred activity. Trekking also has dangers associated with it. One of the basic dangers is losing the path and being unable to reach the destination or return back to the starting point. For ammeture trekkers the situation can turn dangerous without any guidance. With every moving minute, the probability of survival decreases. Due to the anxiety and fear the victim might make wrong decisions which may lead the trekker to more grievous situations. In this modern age, the world is betting on drones for tackling all kinds of situations, from national security to survey to delivering products. Due to the aerial navigation of drones, it can reach any point promptly. Such promptness can be used to search through the forest and locate the missing person. The aerial vehicle can use advanced technology of radio frequency identification to accurately locate the person. Global navigation systems have grown in large to help the aerial vehicle to navigate and to send the location of the missing person to the rescue teams. The aerial vehicles can be equipped with modern long range communication devices for transfer of data and to establish communication.

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2. Literature sources

Rohei et al [1] proposed a system in which the RFID system is used to detect the humans in the indoor environment. The RFID proposed in this system is operated through IOT, where all the data of the RFID is stored in the internet. This system also proposes the use of RFID embedded cloth tags or even bracelets, keychains etc., which can be used to track people using this technology. It is highly inefficient since it can be used only indoors and due to using passive RFID the range is less.

Buffi et al. [2] proposed a system in which they use Multilateration algorithm to locate the distance of the tag from reader. The presence of the tag is found by the backscattered signal from the tag which is sensed by the RFID reader. It also uses SAR based localisation algorithm to investigate uncertainty in measurement related to reader antenna trajectory and UHF-RFID Reader which improves the measurement accuracy of the system. It has a major issue that it requires communication lines between the distant receivers and transmitters.

Albanese et al. [3] proposed a system in which the use autonomous drones with high penetration signal to find mobile phones which intern can be used to find people. The main disadvantage is that it works only when the mobile phone is present in undamaged condition and it requires high resolution cameras in order to find the victim of locating the phone.

Rohman et al. [4] proposed a system to use multiple sensors like UWB radar, microphone array, camera and RFID reader assembled in a drone to detect and geo localise the survivor in post disaster environments. This system is interconnected with a main server and a mission ground control , when the location of an survivor is detected in the disaster environment by the drone , the real time location data is shared with the main server which is monitored by the rescue team.To improve accuracy of this system, sensors with high specialisation are required which makes operational cost higher. G. Castellano and etal [5] proposed a system with Drones that uses UAV equipped with high resolution camera and TinyYOLOv3 for object detection to automatically detect victims in Rescue scene.The dataset designed for search and rescue operation is small which can be used only for testing and evaluation purpose. To implement this system in real time, larger dataset will be required. High resolution cameras increase the cost of the project.

Jhunjhunwala et al. [6] proposed a system that discusses the application of RFID equipped in the drone for product scanning and stock management in a warehouse. The drone uses sampling based algorithm to choose between multiple paths. The stability of the drone during vibration test need to be improved. Li et al. [7] proposed a system with a RFID based tracking system for I constrained indoor environment. Particle swarm optimisation algorithm is used by the system to determine the initial position, there after a dynamic correction method for trajectory prediction is used for Continuous tracking of the object. RFID technology based localisation approaches can be affected greatly by the random moving objects in the field due to signal fluctuation and multi-path effect, which in turn can reduce the accuracy. It also limits the further development of RFID-based indoor positioning technology.

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3. Existing Technology

3.1. Radio frequency identification system

Radio frequency tags are used to track humans in an indoor environment, with the help of multiple radio frequency identification scanners. [1]

3.2. High signal penetration with computer vision

High signal penetration is used to find the mobile phones that are present near the victims. Then the computer vision is used to identify the human. [3]

3.3. High resolution cameras

High resolution cameras along with TinyYOLO are used for object detection and then to detect the humans.

4. Proposed System

The proposed system aims to use a quadcopter [8], which can fly in the predefined path on its own using a global positioning system, magnetic compass, barometer and accelerometer. The quadcopter also consists of the radio frequency identification (RFID) scanner to scan the radio frequency identification (RFID) tag which will be present with the trekker, thereby accurate location of the trekker can be found promptly and accurately [9–11]. On finding the trekker the coordinates of the location is obtained by the quadcopter using a global positioning system. The coordinates are transmitted back to the base station and the rescue team using LoRa, a long range communication device [12]. The drone is also equipped with communication devices namely speakers and microphone to enable dual way communication between the trekker, rescue team and the base station [13, 14].

5. Architecture

5.1. Drone

The Drone is provided with four carbon blades of dimension 10 X 4.5 to provide greater stability. These four wings are mounted on the four 1000 KV motors respectively, which can provide a 2000 RPM to 6000 RPM. The speed of these four motors are controlled by four electronic speed controllers respectively, which are rated at 30A. Electronic speed controllers are controlled by the arduino based controller which is equipped with a global positioning system to provide the current location and move to upcoming coordinates, a magnetic compass to provide the sense of moving direction to quadcopter, a barometer to provide the quadcopter with current altitude so as to maintain the height, an accelerometer to provide the sense of acceleration applied to the quadcopter and a gyroscope to determine the changes in position and movement. The quadcopter controller and the electronic speed controllers are powered by 3 lithium ion batteries each with 2500 mAh, which are lighter in weight and has more capacity.

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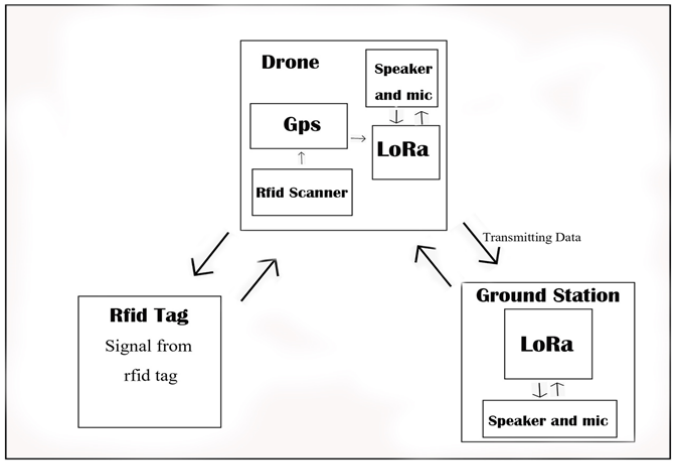

Figure 1. Architecture of the Proposed System

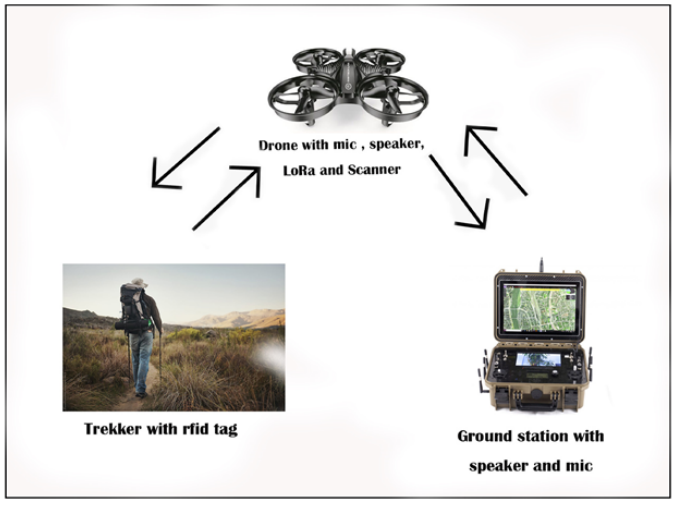

Figure 2. Proposed System

5.2. Location Identification System

The quadcopter will have the radio frequency identification (RFID) scanner, which will be programmed with an arduino to scan for active radio frequency identification tag. Once the scanner receives a signal back from the RFID tag, the GPS coordinates of the

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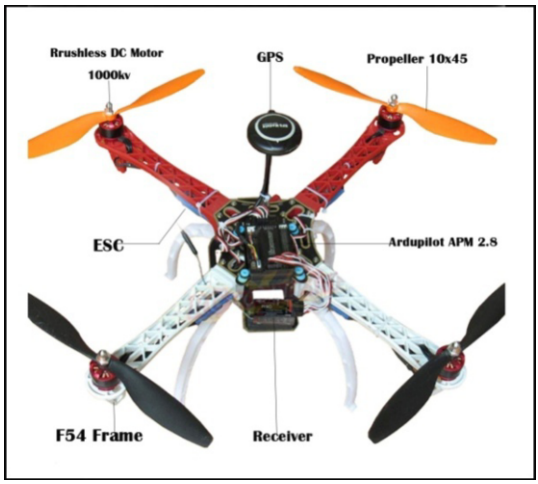

Figure 3. Drone

main loop{

- Get raw GPS, gyroscope, accelerometer, barometer and magnetic compass data
- Update estimate of location, pitch, roll and yaw
- PID controllers: Calculate a desired gyro velocity for each angle based on the difference between the current quadcopter pitch/roll/yaw and the desired pitch/roll/yaw (i.e. gyro_pitch_desired = (desired_pitch - actual_pitch) * Kp) Using the calculated desired angular rotation rates and the actual angular rotation rates, use PID controllers to produce an output to mix with the throttle for the motors.
- Calculate motor PWM using the output from the pitch, roll and yaw PID controllers.
- Send PWM pulses to ESCs.
- }

Figure 4. Pseudocode

same location are obtained and the same is transferred back to the base station and rescue team using a long range communication system called LoRa. The drone stays in the same location until the help arrives.

5.3. Communication System

Establishing communication is an important part of ensuring survivability of the trekker. Therefore quadcopter is equipped with speakers and mic to establish dual way communication systems. The sounds can be transferred via LoRa to the base station and the rescue team.

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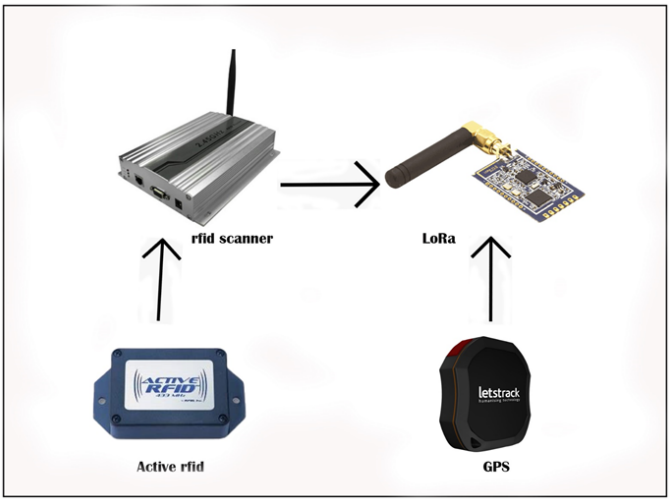

Figure 5. Location Identification System

Figure 6. Location Identification System (Flow diagram)

6. Result

The quadcopter moves on its predefined path when deployed and scans for the radio frequency identification tag. Once spotted the quadcopter gets the GPS location and relays it back to the base station. The interaction between the base station and the missing trekker can also be done.

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Figure 7. Dual way communication System

Figure 8. Drone- Ready to Test.

Figure 9. Drone – Testing.

Figure 8 shows the drone that is ready to fly on the requirement. It can be deployed at anyplace. The search co-ordinates need to be fed via mission planner. Figure 9 shows the drone that is flying in via specified co-ordinates in search of the missing person. Figure 10 shows the path that is covered by the drone. Figure 11 shows the page that display the the co-ordinaries of the missing person found by the drone . Mic button can be used to talk to the missing person via drones communication system.

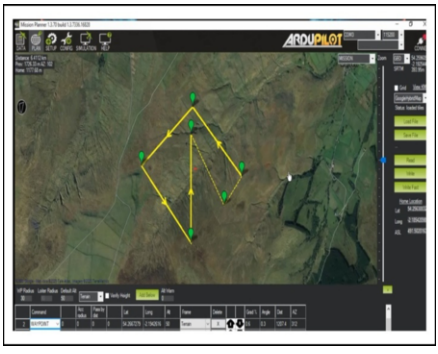

Figure 10. Ground Console.

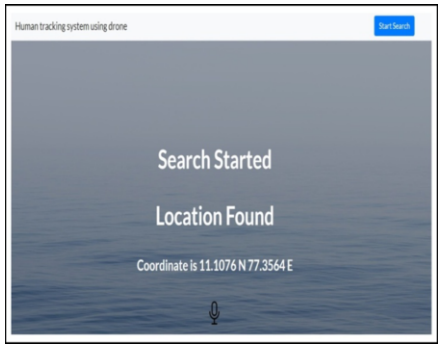

Figure 11. Output.

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7. Conclusion And Future Work

Thus the quadcopter system created can be promptly deployed for the identification of the missing person and to provide support through voice communication, thereby increasing the survivability of the person. The quadcopter operation does not require any specialisation. In future the quadcopter can be programmed to use cameras and artificial intelligence technology to pick up the trails of the missing person from the last known location thereby reducing the time to find the missing person. Also the quadcopter can be allowed to get the last known location of the person, thereby allowing itself to program in such a way to find the most probable path the person might have chosen. Introducing a camera in a quadcopter will also allow the rescue team to identify situations in time of uncertainty.

References

[1] Rohei MS, Salwana E, Shah NB, Kakar AS. Design and testing of an epidermal rfid mechanism in a smart indoor human tracking system. IEEE Sensors Journal. 2020 Nov 5;21(4):5476-86.

[2] Buffi A, Tellini B. Measuring UHF-RFID tag position via unmanned aerial vehicle in outdoor scenario. In2018 IEEE 4th International Forum on Research and Technology for Society and Industry (RTSI) 2018 Sep 10 (pp. 1-6). IEEE.

[3] Albanese A, Sciancalepore V, Costa-Pérez X. SARDO: An automated search-and-rescue drone-based solution for victims localization. IEEE Transactions on Mobile Computing. 2020 Mar 12:1-13.

[4] Rohman BP, Andra MB, Putra HF, Fandiantoro DH, Nishimoto M. Multisensory surveillance drone for survivor detection and geolocalization in complex post-disaster environment. In IGARSS 2019-2019 IEEE International Geoscience and Remote Sensing Symposium 2019 Jul 28 (pp. 9368-9371). IEEE.

[5] Castellano G, Castiello C, Mencar C, Vessio G. Preliminary Evaluation of TinyYOLO on a New Dataset for Search-and-Rescue with Drones. In 2020 7th International Conference on Soft Computing & Machine Intelligence (ISCMI) 2020 Nov 14 (pp. 163-166). IEEE.

[6] Jhunjhunwala P, Shriya M, Rufus E. Development of hardware based inventory management system using uav and rfid. In 2019 International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN) 2019 Mar 30 (pp. 1-5). IEEE.

[7] Li J, Feng G, Wei W, Luo C, Cheng L, Wang H, Song H, Ming Z. PSOTrack: A RFID-based system for random moving objects tracking in unconstrained indoor environment. IEEE Internet of Things Journal. 2018 Jan 22;5(6):4632-41.

[8] Kwak J, Sung Y. Autonomous UAV flight control for GPS-based navigation. IEEE Access. 2018 Jul 10;6:37947-55.

[9] Hutabarat DP, Hendry H, Pranoto JA, Kurniawan A. Human tracking in certain indoor and outdoor area by combining the use of RFID and GPS. In 2016 IEEE Asia Pacific Conference on Wireless and Mobile (APWiMob) 2016 Sep 13 (pp. 59-62). IEEE.

[10] Subedi S, Pauls E, Zhang YD. Accurate localization and tracking of a passive RFID reader based on RSSI measurements. IEEE Journal of Radio Frequency Identification. 2017 Oct 23;1(2):144-54.

[11] Çavur M, Demir E. Real-time localization methodology with RFID technology in closed area. In 2017 25th Signal Processing and Communications Applications Conference (SIU) 2017 May 15 (pp. 1-4). IEEE.

[12] Alshareef HN, Grigoras D. Multi-service cloud of drones for multi-purpose applications. In 2017 16th International Symposium on Parallel and Distributed Computing (ISPDC) 2017 Jul 3 (pp. 165-174). IEEE.

[13] Olejnik A, Kiszkowiak Ł, Rogólski R, Chmaj G, Radomski M, Majcher M, Omen Ł. Precise remote sensing using unmanned helicopter. In 2019 IEEE 5th International Workshop on Metrology for AeroSpace (MetroAeroSpace) 2019 Jun 19 (pp. 544-548). IEEE.

[14] Alotaibi ET, Alqefari SS, Koubaa A. Lsar: Multi-uav collaboration for search and rescue missions. IEEE Access. 2019 Apr 22;7:55817-32.

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IoT Based Smart Electrolytic Bottle Monitoring

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Abstract. In hospitals, Electrolyte is fed to patients in many ways. One of the important functions is in the form of saline to treat dehydration and thus improve the healthiness. In contemporary health care procedures, whenever a saline is nursed to any persevering, the persevering is unceasingly observed by a nurse or any custodian. Monitoring the Saline level in a bottle attached to a patients' body is one of the most important tasks for a Nurse/caretaker. In cases involving ignorance or carelessness, the bottle may get empty and blood can start flowing reverse into the bottle from patients' body. This is a risky situation and needs a better solution. We are developing an IoT based bottle level monitoring system that will detect the saline bottle level at all instances by sending an alert to monitoring room of hospital when the bottle content reaches below threshold level. The proposed system is not electrolyte specific and can monitor any fluid. The system can be incorporated with existing bottle stands so it has an added advantage of flexibility and modularity. The app interface will be easy to operate and understand so that anyone with basic technical knowledge will be able to use it. As of now, it can operate for monitoring purposes and we have added automatic flow stop control to improve it further. In case of power failures, the system will still function as its battery powered but database updates will not be updated, so a physical alert solution like a beeper is also being planned will be incorporated.

1. Introduction

Due to rapid advancements in technology in recent times, humans have become totally dependent on the electronic gadgets for reducing their workload to make their life easier in many ways. India is sited 154 position in healthcare amongst 195 developing countries globally. This is one of the biggest employment source and a largest socio-economic growth on the Nation. After that the improvement of health parameters are imbalanced throughout the country. Hospitals have a simple electrolyte bottes with no indications and will create issues to the patients and flow will start in reverse direction. In this situation the blood from the human body will flow towards the bottle. In hospital all the sec-

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tions such as OPD, CCU, ICU NICU requires similar kind of intelligent automated and displaying unit. Our paper proposes a system to provide an automatic monitoring and flow stopping system to minimize the work load of the care taker and prevent the above difficulties faced. If still not taken care of might even lead to some medical accidents. so constant observation of saline level in the electrolytic bottle is very important. We calculate the initial weight of the bottle connected with our load sensor and save it in the database. The sensor continuously senses the weight until it reaches to 30% of the initial weight. That is where the critical level of the bottle is. We send an alert to the application user at 30% to change the bottle. If no one responds, and the bottle goes even below to 20% we send a control signal to the monitoring person's device. We wait for the monitor to respond, and if no one responds it will stop the flow to save patient's life. This system not only replaces the need of caretaker but also keeps a database of all bottles connected to the bed. we have also taken in consideration, the distinguishing of different beds in hospital with huge number of beds to avoid confusion between systems. we are using NodeMCU 1.0 v3 as the primary microcontroller and for wireless communication and load sensor for sensing the weight and database is designed using firebase.

2. Related Works

This section describes the work and findings made so far related to monitoring systems for saline/electrolytic solutions used for infusion and healthcare in general. An Internet of Things based saline level intensive care and spontaneous alert device [1] proposed a system for monitoring and halting the flow of IV solution based on Arduino. Also, their system is not designed to be modular and needs the entire set to function. IoT based drips monitoring at hospitals [2, 3] only performed monitoring drips but instead of Bluetooth, they are using gsm module for connectivity with which they can send SMS alerts to the person monitoring. A complete pervasive healthcare explanation on an Android mobile based system [4], that brings in the concept of Wireless sensor networks to health care. Patient monitoring is done using sensor nodes with ZigBee based connections. These connect to Android based devices through which the patients are monitored. The required data is deposited and loaded on an online database for access from any device. This system solves the shortcomings of using GSM and Bluetooth based wireless connections and moreover enables devices to access the data from any Android device [5]. The disadvantage here is that the system being exclusive to Android devices. The causes are of Asthma are prejudiced by genetic and environmental factors, in which environmental factors have a great impact [6]. This paper provided a portable device integrated with an android app that monitors the environmental factors faced by asthma patients as well as their health parameters and transmits this data to the cloud. In the care taker organizations, the care taker is responsible for the monitoring of electrolyte bottle level of the patient [7, 8]. Many times the care taker will forget to remember the timing of the bottle scheduled to the patient. Thus the places such as CCU, OT and ICU needs an intelligent monitoring and alert indication system. Care taker organizations are emerging day by day and a solution for better medical guidelines and representations are made for the current life style of the people [9, 10]. In the busy world for the health care organizations a remote drip infusion monitoring and control system is proposed [11] with infusion monitoring device using IR and a central monitoring system which displays the

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necessary information in the workstation. The existing system used for health care are getting up due to population and the manual time requirement is time-consuming [12] and the intervention requirement with low cost in urban and rural areas. The system eliminates the continuous monitoring of physical staffs and are automated using sensors and a wireless module CC2500. A device to monitor the crucial level of saline bottle level is designed and developed [13] which automatically stop the flow of liquid when the liquid in the bottle is going to become empty. A device to monitor the patients care organization to power OFF the unused commercial devices using a combination of sensor and IoT technology is developed [14, 15]. In order to convey the patient's physiobiological information to remote controlling station optimized routing protocols are used in [16, 17]. A device to monitor heartbeat and temperature using ZigBee technology for the Indian patients mainly affected by heart attack and they lose their life because of the timely help is mentioned in [18, 19]. An automated device using sensors are developed to feed the saline to the patients and to indicate the emergency situation and if there is a change in drop rate, the system can be used in both hospitals and homes [20, 21]. A device in rural public hospital beds to correctly monitor the saline droplet statuses delivered to the patients with a warning system with different colour lights are developed as a low cost comfortable system for the care taker [22]. By the evolution of sophisticated advancements in technology in the field of medical electronics smart drip monitoring system is developed for critical patients using Arduino controller and an ultrasonic sensor. The sensor is used to monitor the level of the fluid and to reduce the workload of the care taker in the hospital [23].

3. Proposed System

Our Fluid Level monitoring system is an loT based project that replaces the need of a Nurse/caretaker to constantly keep an eye on the electrolyte bottle used. It uses ESP8266 12E NodeMCU 1.0 v3 as the microcontroller and utilizes the inbuilt WiFi module for connection to the internet, through which the device sends data to the online database. The load cell with HX711 amplifier is used to detect the weight of the bottle. Power is

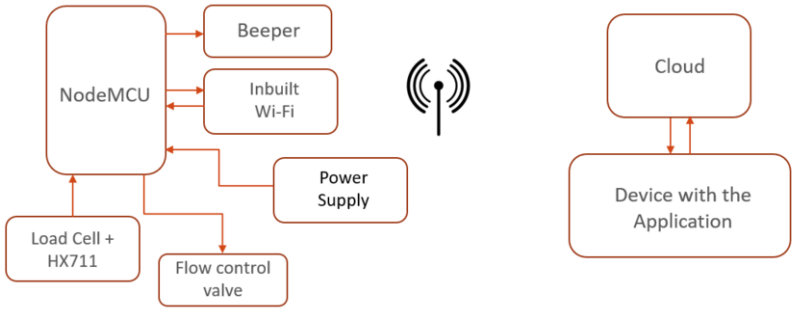

Figure 1. System Diagram

supplied to the system by a 9V battery. An 8mm electric flow control solenoid valve is used for stopping the fluid flow. From the database, the web app interface retrieves data

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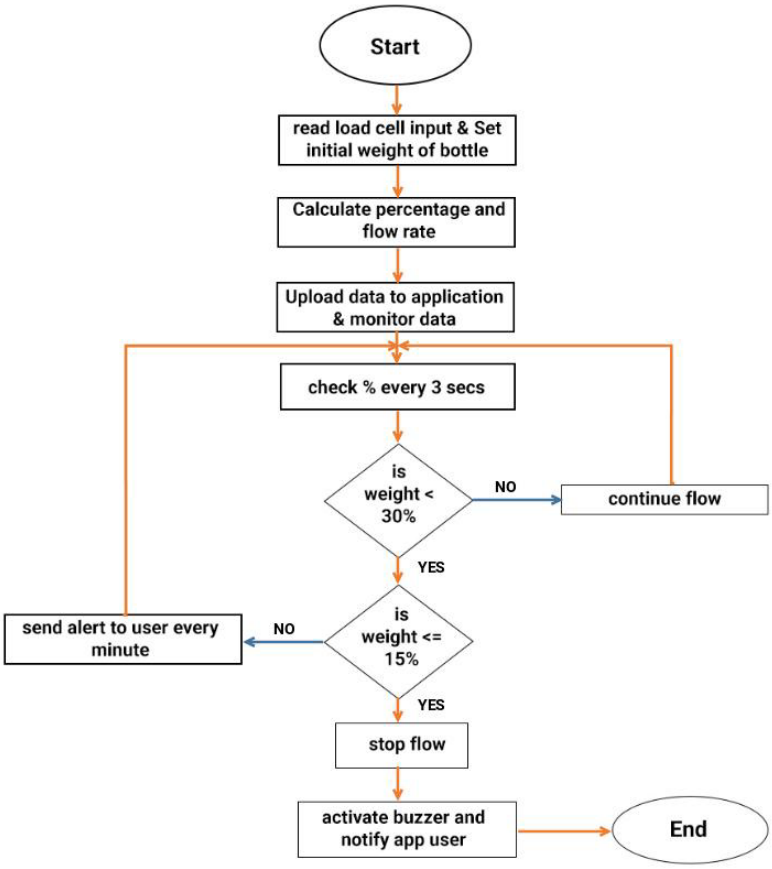

Figure 2. Process Flow Diagram

through which the monitoring is done. The system calculates the initial weight of the bottle connected with our load sensor and saves it in the database. The sensor continuously senses the weight sends data to the microcontroller which detects if has reached a threshold level. That is where the critical level of the bottle begins. Figure 1 shows the block diagram of the proposed system and the processed diagram is illustrated in Figure 2.

System sends an alert to the care takers at threshold, for example 30%, to change the bottle. If no one responds, and the bottle goes even below to 20% we send an alert again to the app user. We wait for the nurse or caretaker to respond, if there is no response it will automatically stop the flow with help of a flow valve.

- The default and minimum threshold value will be 25%. Higher value can be set by user if required.
- If there are any abnormalities in the flow due to any leakages an emergency alert will be sent to the user.

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- To save battery values in the database will be updated every 3 or 5 minutes depending on the flow rate.
- There will also be a buzzer present in the system to provide sound alert in case of network failure.
- After the threshold level, continuous alerts and beeps will be given to prevent complications as soon as possible. If the flow is still not stopped the flow control valve will automatically halt the flow of the fluid.

This entire system can be used with already existing IV bottle stands and does not require any exclusive setup. The outcome of the project is given below.

- In this model, the patient was given some analyses by doctor in some portion of the hospital
- This will transfer the required information from the sender and receiver wirelessly with the use of transceiver.
- The complete health monitoring unit, that was proposed is combined into a minor compact unit as slight as a cell phone.

Initially the initial weight has to be calculated using load cell and hx711, the weight has been stored in the application for calibration also fix the critical level and threshold level weight of the bottle is noted and the reading is recorded continuously at all instances of time and if the bottle weight reaches the fixed critical level the alert message is sent to the doctor or caretaker also if no one responses and the weight is reaches below my critical level it will stop the flow of saline solution. Load cell is a transducer which converts

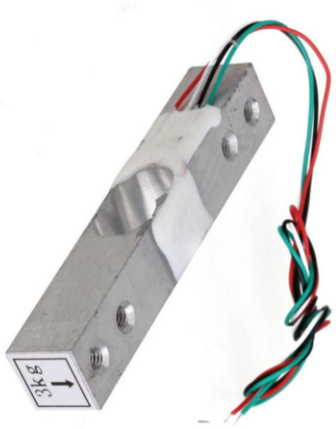

Figure 3. Load Cell

physical force, pressure or compression into electrical signals. The electrical signal from the load cell is directly proportional to the pressure applied to the load cell. When the weight or the Strain increases accordingly the electric signal also increases. The output from the load cell is measured using four coloured wires namely black, white, red and green. Red wire represents excitation + or Vcc, Black wire represents excitation – or GND, White wire Represents output + or Signal +, Green wire represents output – or signal - . 3kg load cell is used in our project and since the output voltage from the load

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cell is low hx711 (load cell amp) is used to amplify the signal before feeding the data to the microcontroller. Figure 3 shows the load cell used in this system. HX711 is a

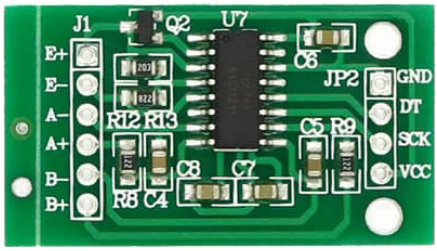

Figure 4. HX711 Component Side

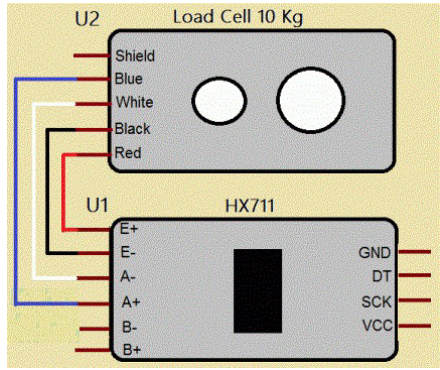

Figure 5. HX711 Layout

Dual-Channel 24-bit A/D weight pressure sensor load cell amplifier and ADC module. HX711 is a weighing sensor that uses a two-wire interface; one for clock and one for data communication. For controller the GPIO pins are used for read the data from HX711. The output from the load cell is fed to the hx711. It has combination of 8 pins and act as a interface between the load cell sensor and the microcontroller. The four pins is used to get the input from the load cell sensor and it can able to amplify the voltage to the certain extend and feed as a input to the microcontroller which can able to sense the voltage from the sensor, so it act as backbone of data processing section and sensing the weight of the bottle accordingly. Figure 4 and 5 shows the HX711 board.

The main code of the system is dumped into the NodeMCU which is the primary microcontroller. It is programmed to obtain the data from the components used and process them. Using the data obtained from the load cell, it calculates the flow rate and remaining time through which it finds the threshold level at which the flow of the solution should be halted. These data are also uploaded to the online database, based on Firebase's Realtime Database service. The weight of the bottle is updated locally and online constantly, whereas the flow rate is calculated every minute. Utilizing the data uploaded to the database, the web application displays the current level, remaining time left for emptying of the bottle. It also starts sending notifications to the app user as soon as the threshold level is reached, until the flow is stopped. Figure 6 shows the screen shot of the database and Figure 7 shows the screenshot of app prototype.

The stand is an essential part of our project, all the components of our project are being fixed on it. Load cell is being fixed with the stand to remove and replace the saline bottle on it whenever required and also for accurate readings. Our stand is designed in a way such that it can be fitted to any of the existing drip stands in the hospitals. Portability and modularity are given the first preference. Initially the prototype was made of wood. Currently we are testing it in PVC and metal pipes, according to the further process and considering various factors like durability, rigidity and strength, the material going to be used will be finalized. Figure 7 shows the model stand designed and developed. The same will be developed using stainless steel material with a height of seven feet and proper holding mechanisms for the saline bottle to be hold on the stand and all the electronic

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components will be packed within a small box and is fixed on the stand itself. The power requirement and the wiring for the device will be kept inside the pipe, so that it will not create any disturbance to the patient.

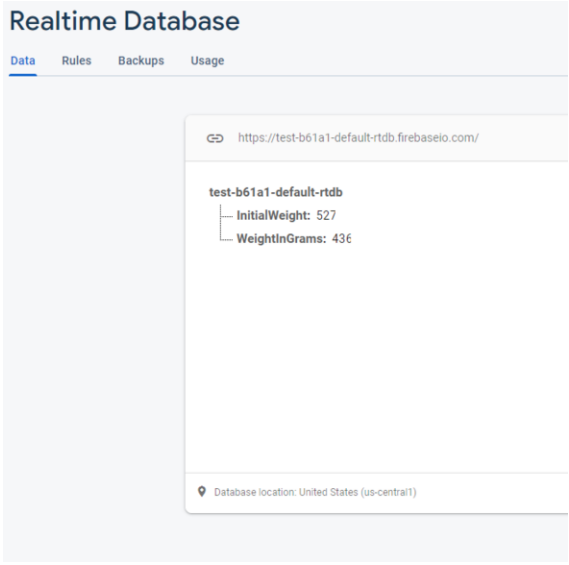

Figure 6. Realtime Database Screen Shot

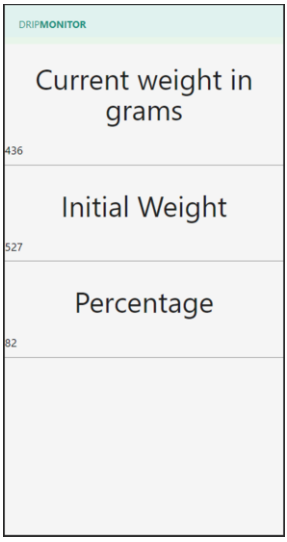

Figure 7. App prototype

NodeMCU, ESP12E is a low cost open source IoT platform. The microcontroller is considered as the heart of the IoT based projects. In this project we use ESP12E microcontroller which can act as an interface between the sensors and cloud. It has an inbuilt Wi-fi module which can send and receive data wirelessly. It is a micro controller with an availability for Wi-Fi module for the proposed system. Apart from the other microcontrollers, it has maximum code efficiency which can achieve the desired output with minimum number of code lines. It supports a wide range of libraries for numerous components so the effective way of getting a chance for desired output is maximized. Figure 8 shows this module.

A solenoid valve is an electrically managed valve. The valve is used to forestall the float of liquid thru the valve. The valve has a solenoid, that's an electric powered coil with a movable ferromagnetic core(plunger) in its center. In the relaxation position, the plunger closes off a small orifice. Electric contemporary thru the coil creates a magnetic subject. The magnetic subject exerts an upwards pressure at the plunger starting the orifice. This is the simple precept this is used to open and near solenoid valves. Figure 9 indicates the solenoid valve. The final structure will be displayed in stainless steel material. In our project the working of micro- controllers has multiple functions involved. It is able to get the input from the load cell connected with the load cell amplifier (HX711), and upload into the hospital's database which can be viewed later, this microcontroller will perform two fundamental operations 1. Get the input from the load cell at all instances of time 2. The input from the load cell is being uploaded into the cloud database which was designed using Firebase. This micro-controller is not purely dependent on the internet, it can function effectively without any internet facility (especially in rural village hospi-

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Figure 8. ESP12E

Figure 9. Solenoid Valve

tals), but since in our project we are developing a system that can function universally (in any hospital), working with the internet facility is required for uploading data in the database. The NodeMCU and the rest of the setup will be powered by a 9V replaceable battery, with the help of a driver shield.

4. Conclusion

Thus, our solution provides a modular system that can be used with existing IV bottles to monitor IV fluids being injected to patients. Since it is a web app-based monitoring system it can be accessed on any device with an internet connection. Complications due to lack of attention and reverse blood flow can be prevented or minimized at least with the functioning of this system in a flexible and cost-effective way.

References

[1] Dharmale AA, Mehare RR, Bharti AR, Meshram SR, Deshmukh SV. IoT Based Saline Level Monitoring & Automatic Alert System. International Journal of Advanced Research in Computer and Communication Engineering. 2019 April;8(4):72-6.

[2] Sanjay B, Sanju Vikasini RM. IoT Based Drips Monitoring at Hospitals. International Research Journal of Engineering and Technology (IRJET). 2020 April;7(04):1352-4.

[3] Anand J, Flora A. TG: Emergency traffic management for ambulance using wireless communication. IPASJ Int. J. Electron. Commun.(IIJEC). 2014;2(7):1-4.

[4] Hii PC, Chung WY. A comprehensive ubiquitous healthcare solution on an Android™ mobile device. Sensors. 2011 Jul;11(7):6799-815.

[5] Swain MK, Mallick SK, Sabat RR. Smart saline level indicatorcum controller. International Journal of Application or Innovation in Engineering & Management (IJAIEM). 2015 Mar;4(3):299-301.

[6] Niranjana S, Hareshaa SK, Irene Zibiah Basker, Jose Anand. Smart Monitoring System for Asthama Patients. SSRG International Journal of Electronics and Communication Engineering (SSRG-IJECE). 2020 May;7(5):5-9.

[7] Sanjay S, Saravanan S, Satheesh S, Yaziniyan R, Sandhya VP. IoT Based Saline Infusion Monitoring and Control System. International Journal of Advance Research and Innovative Ideas in Education (IJARIIE). 2020;6(2):126-31.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[8] Natarajan K, Prasath B, Kokila P. Smart health care system using internet of things. Journal of Network Communications and Emerging Technologies (JNCET). 2016 Mar;6(3):37-42.

[9] Figueredo MV, Dias JS. Mobile telemedicine system for home care and patient monitoring. InThe 26th Annual International Conference of the IEEE Engineering in Medicine and Biology Society 2004 Sep 1 (Vol. 2, pp. 3387-3390). IEEE.

[10] Gadekar DP, Singh DY. Efficiently Identification of Misrepresentation inSocial Media Based onRake Algorithm. International Journal of Engineering & Technology. 2018;7(4):471-4.

[11] Yadav S, Jain P. Real time cost effective e-saline monitoring and control system. In2016 International Conference on Control, Computing, Communication and Materials (ICCCCM) 2016 Oct 21 (pp. 1-4). IEEE.

[12] Chidgopkar MG, Phatale AP. Automatic and low cost saline level monitoring system using Wireless Bluetooth module and CC2500 Transreceiver. International Journal of Research in Engineering and Technology. 2015 Sep;4(09):274-6.

[13] Vasuki R, Dennis C, Chander HP. Designing a portable monitoring device to measure the drips rate. Middle East J. Sci. Res. 2011;1:29-35.

[14] Kanase P, Gaikwad S. Smart hospitals using internet of things (iot). International Research Journal of Engineering and Technology (IRJET). 2016 Mar;3(03):1735-7.

[15] Deshmukh R, Jadhav K, Borude T, Lanke H, Wagholi JI, Darokar PM. A Survey Paper on Patient Health and Saline Level Monitoring System using IoT. IJERT. 2019;8(11):807-9.

[16] Anand J, Perinbam J, Meganathan D. Design of GA-based Routing in Biomedical Wireless Sensor Networks. International Journal of Applied Engineering Research (IJAER). 2015;10(4):9281-92.

[17] Anand J, Jeevaratinam RP, Deivasigamani M. Performance of Optimized Routing in Biomedical Wireless Sensor Networks Using Evolutionary Algorithms. Comptes rendus de l'Académie bulgare des Sciences. 2015 Aug 1;68(8):1049-55.

[18] Shelar M. Wireless Patient Health Monitoring System. International Journal of Computer Applications. 2013 Jan;62(6):1-5.

[19] Tawade IS, Pendse MS, Chaudhari HP. Design and development of saline flow rate monitoring system using flow sensor, microcontroller and rf zigbee module. International Journal Of Engineering Research And General Science. 2015 May;3(3):472-8.

[20] Priyadharshini R, Mithuna S, Kumar UV, Devi SK, Vanitha NS. Automatic intravenous fluid level indication system for hospitals. International Journal for Research in Applied Science & Engineering Technology (IJRASET). 2015 Aug;3(8):427-32.

[21] Yadav S, Shinde A, Junavane P, Mate T. Smart IV fluid and oxygen control system. International Research Journal of Engineering and Technology (IRJET). 2018 Feb;05(02):314-7.

[22] Rangsee P, Suebsombut P, Boonyanant P. Low-cost saline droplet measurement system using for common patient room in rural public hospital. InThe 4th Joint International Conference on Information and Communication Technology, Electronic and Electrical Engineering (JICTEE) 2014 Mar 5 (pp. 1-5). IEEE.

[23] Aravind R, Ahmed SM. Design of Family Health Care Monitoring System Using Wireless Communication Technology. International Journal of Advanced Research in Computer and Communication Engineering. 2013 Sep;2(9):3666-71.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

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Smartphone Controlled Fingerprint Door Look System (SCFDLS)

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Abstract. Currently, the entire globe is infected with COVID 19, and everyone is doing everything they can do to avoid contracting this serious sickness by adhering to social segregation, wearing coverings, using credit-only exchanges, and refraining from contacting anything to prevent the spread of germs. With the advancement of technology, traditional locks are becoming relics of the past, while new biometric-based locks and Radio Frequency Identification (RFID)-based locks are becoming increasingly in common. The unique finger impression based locks, as well as participation record-keeping devices, are used in the vast majority of offices and universities, however due to the pandemic, it is no longer appropriate to do so. As a result, the proposed system use a solenoid lock to make the door lock. Aside from the equipment, a mobile application is used to inspect and double-check the finger impression and send the confirmation, as well as an id, to Arduino through Bluetooth. The entry way lock will be bolted and opened using the smartphone fingerprint sensor.

Keywords. Arduino, Bluetooth, Fingerprint, Solenoid Lock, Android Application

1. Introduction

This paper focused on the importance to have home security in the current situation. Every activity can be completed remotely in a modern home with many facilities and technology accessibility. Because burglaries and thefts are becoming more common these days, new home automation systems help to keep homes safe. These depict incorporates with technology plays a critical part in maintaining and improving the security of one's assets. As a result, the project's concept is to use Bluetooth technology in a tiny region of the most useful position, the door lock. This project shows a prototype of a smart door lock that can be used to improve the door's security. This project will employ Bluetooth characteristics in the mobile phone application to open the door automatically, allowing your phone to sync directly with the lock. It looks for the user and when it detects their presence, it immediately unlocks the door without the need to reach for the phone. There is also an Android app that may be used to control the door lock. It will detect the

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person automatically. The door will open after a set amount of time has passed, and it will automatically close after that period has passed. In wireless houses, a safety answer primarily based totally on Internet of Things (IoT) and the HC-05 Bluetooth module is interfaced with an Arduino UNO that connects to the phone's Bluetooth. Each user's login credentials are stored in the Firebase database, that is a cloud-hosted database. Users can get right of entry to the door lock after their credentials had been established with the database over the net the use of clever gadgets which includes cellular telephones which have the app mounted and linked with the lock via Bluetooth with the aid of using transmitting signals.

2. Literature Survey

Few related articles are studied and the inference on the same is discussed below. Sriskanthan et al. [1] discussed numerous methods on sophisticated technology that can be taken. home automation is one of revolutionary technology nowadays toward realizing home automation, home appliance is made as easy as possible to be controlled by user several work of controlling home appliance has been done, such as door lock and unlock via smartphone door lock system. A home automation system using android application is designed and implemented [2]. Toschi et. al., discussed the creation of a mobile application and the integration of home automation [3]. AI-Ali, et. al. discussed a wireless technology-based home automation, several ways are used, such as a solenoid lock device [4]. A finger vein based security system is explained and implemented in [5]. Savita discussed about the Bluetooth Module (HC-05) [6], Shanthini et al. discussed about Buzzer [7], Arduino UNO, android application, M. Udin Harun Al Rasyid discussed on the database [8]. Cekada et al. have similar situations can be found at schools and universities. University students are increasingly technologically literate in today's world [9]. As a result, their focus in their environment and manual-primarily based totally sports are step by step declining. The aim of this venture is to apply Bluetooth generation with an Android platform [10]. Home automation is the begin of the usage of domestic generation to enhance human being's lives through supplying offerings along with multimedia amusement and strength efficiency. To placed it some other way, domestic automation specializes in the adaption of virtual gadgets to offer customers with real consolation whilst additionally preserving terrific security [11]. According to reports, a standard home automation system in prior years included a control digital device for heating and shading [12]. All of these features are included in the advantages of a home automation system. Security, illumination, electricity, weather control, irrigation, and entertain shows are all areas where a home automation system can be used, and the world is becoming more updated with the entertainment system over time [13]. An eemergency management system for medical application is used using microcontroller and a wireless communication technology [14]. Also a microcontroller based irrigation system application is used a mathematical system [15]. A security based door automation using infrared sensors and an authenticated users based on voice command [16]. A smart calendar device using Raspberry Pi is discussed in [17]. Sensor based embedded devices are implemented for healthcare application [18], stress detection [19], and smart monitoring device [20].

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3. Proposed System

3.1. Functions of Proposed Design

The number one aim of this look at is to enhance the door locking system's security. The cautioned system's hardware and software program necessities are proven in discern 1. The cell tool could be sending the sign thru Bluetooth to the Arduino circuit that acts as the relationship among the smartphones, and the Solenoid after the right authentication is furnished the use of the database. The usage of Bluetooth on cell phones allows for easier access while also providing greater security than a traditional key. Table 1 list the

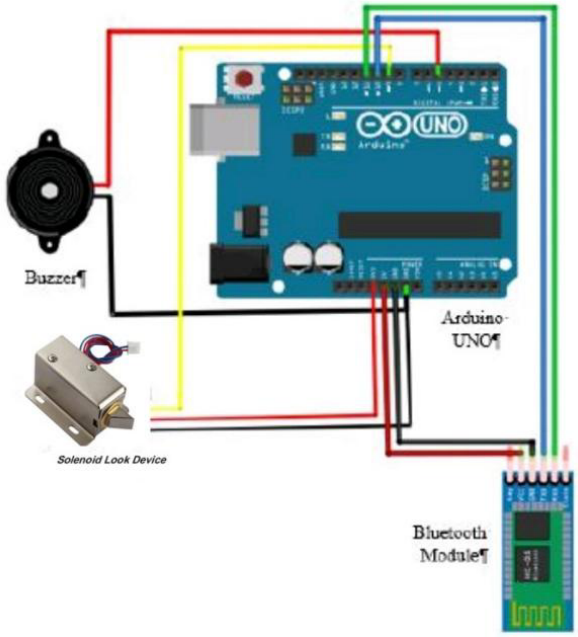

Figure 1. Hardware circuit connection of SCFDLS

requirements for hardware and software.

Table 1. H/W and S/W Requirement

Hardware	Software
1) Arduino Port	Android Application
2) Bluetooth Module(HC05)	Kodular.Io (frame work)
3) Solenoid look device	Embedded C
4) Buzzer	Google Firebase

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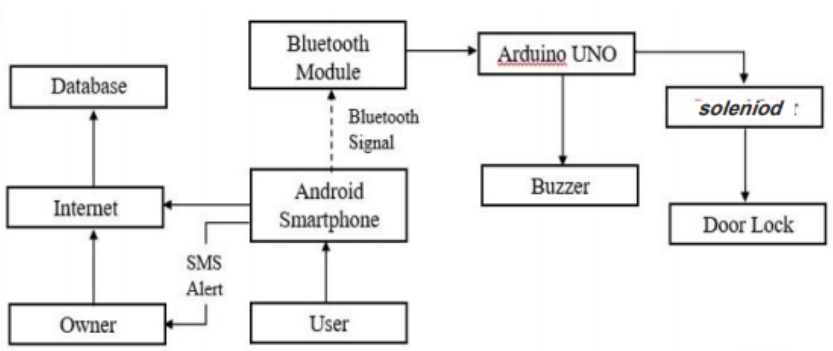
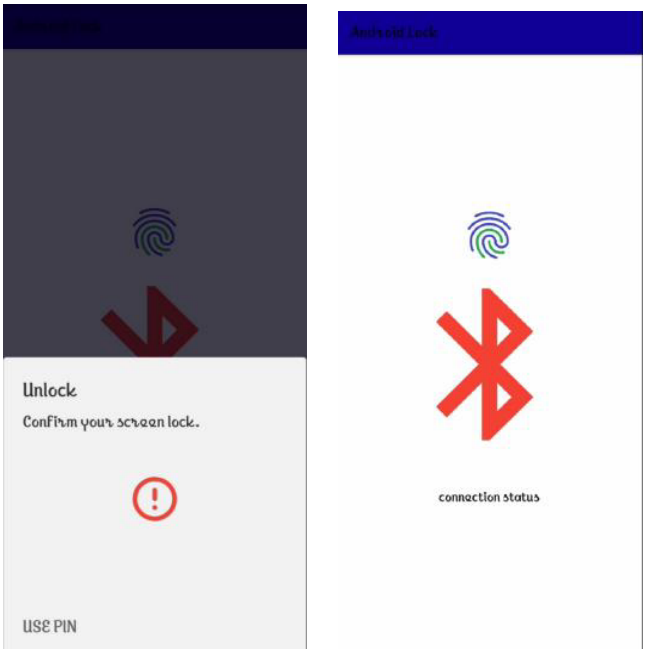


Figure 2. Block diagram of the proposed system

3.2. Implementation of the proposed system



(a) (b)

Figure 3. App Open and Unlock

Hardware circuit connection of the proposed system is shown in figure. Shows the square graph of the mechanized the entryway security framework utilizing the Android application. The circuit associations of the proposed the framework are shown in Figure 1. Interface the board to the PC utilizing the USB link. The USB the affiliation with the PC is vital to software the board, and moreover to the pressure it up. The UNO board therefore is managed from both the USB or the outer pressure supply. In the IDE (Integrated Development Environment) of Arduino, under the tool's menu, pick out the board

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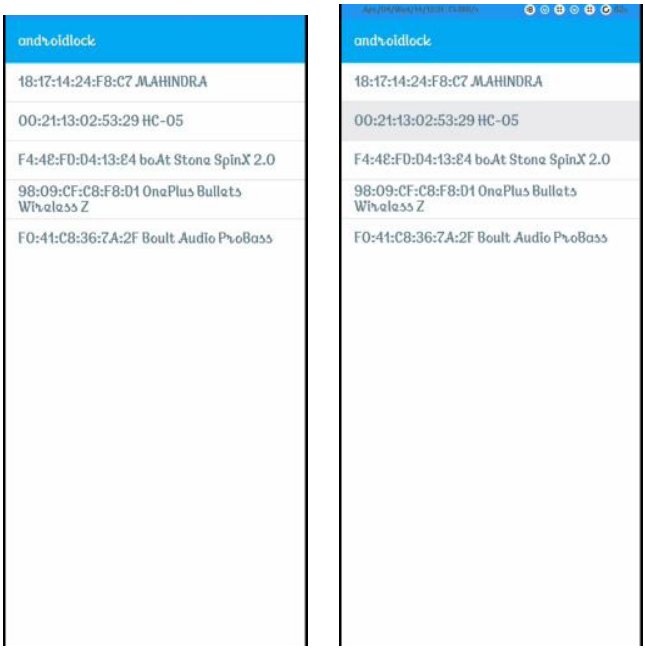
as Arduino UNO and the port as Arduino UNO (COM3). The Arduino cartoon written in Embedded is uploaded to the Arduino UNO from the IDE... Next, the Android utility is hooked up at the cellular based smartphone and the Bluetooth gadgets is paired (join the smartphone and HC-05). Once the Bluetooth module is paired with the smartphone, the person can begin the usage of the app.

Figure 3 Open the android application and the unlock the confirm screen lock click on the fingerprint Connection is the success full then displaying the connection status.

Figure 4 Then click on Bluetooth Symbol Select Door Lock HC-05 from the listing of paired Bluetooth gadgets that seem at the display The consumer credentials are saved in the database. The proprietor can replace or has to alter the consumer credentials in the fire base database and registers the app with the database. After getting into the statistics click on at the login. The entered statistics is tested with the aid of using retrieving the consumer credentials from the database over the internet.



(a) (b)

Figure 4. Click on Bluetooth and HC-05

The verification may be monitored through shooting the requests, and responses which are despatched and obtained through the software the usage of the Wireshark software, the community protocol examine which captures community packets and presentations it as human-readable. If the credentials (the fingerprint) are correct, the buttons to manipulate the door lock. The LOCK and the UNLOCK buttons may be enabled for the person at the screen.

Figure 5 if UNLOCK button is clicked and enabled by the user, if finger print authentication is succeeded, a 12V current will be sent to a Bluetooth module(HC05). Then the current will be passed through a Buzzer and to an Arduino UNO and finally it reaches the Solenoid Lock Device. At last, the circuit checks for the current and the lock open.

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Figure 5. Click UNLock and Successful Authentication

Figure 6. Click on Lock and Failed Authentication

Figure 6 Likewise If the LOCK button is enabled or clicked by the user, If the finger print authentication is Failed, the 12v current will be sent to the Bluetooth module(HC-05). Then the current will be passed through Buzzer and to Arduino UNO and finally it reaches the Solenoid Lock Device. At last, the circuit checks for the current, and the lock Close. If the fingerprint isn't matched the person will now no longer be enabled with the buttons to govern the door lock and a sign could be despatched to the buzzer that makes it ring in conjunction with which an alert SMS could be despatched from the person's smartphone range to the owner's smartphone. A caution notification additionally pops up at the display to the person.

3.3. System Safety

Rather than the use of the bodily key, this device makes use of the sign this is introduced digitally thru Bluetooth from any telephone or different cell devices. The proposed the device has the specific fingerprint for every person maintained inside the database, which makes it strong within any of the robbery case or the safety breach of the cell device. If the person enters the incorrect person credentials, the device will generate the popup caution notification to suggest the invalid person credentials and could alert the neighbour with the buzzer ring and additionally intimate, the residence proprietor with the alert SMS. These capabilities decorate the overall protection of the device.

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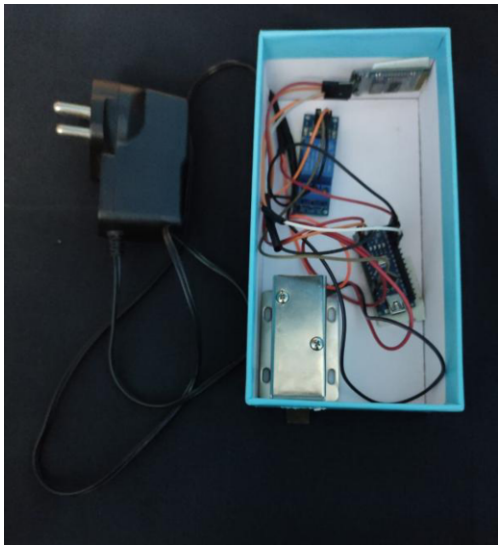

Figure 7. SCFDLS Prototype

4. Conclusion

In this paper, a clever domestic automation gadget particularly a virtual door lock is proposed to offer security. The gadget doesn't require any bodily keys to fasten or free up the door, instead, an android utility is established on clever devices, and credentials are used for the same. The consumer credentials are confirmed with the aid of using the database. If invalid credentials are furnished within the utility, a buzzer alarm is produced with an SMS alert to the residence proprietor together with a popup caution notification to the consumer. This complements the safety of the proposed method. It is a versatile gadget that is easy to put in at a low fee without any overhead like drafting and creation works.

References

[1] Sriskanthan N, Tan F, Karande A. Bluetooth based home automation system. Microprocessors and microsystems. 2002 Aug 10;26(6):281-9.

[2] Magar S, Saste V, Lahane A, Konde S, Madne S. Smart home automation by GSM using android application. In2017 International conference on information communication and embedded systems (ICICES) 2017 Feb 23 (pp. 1-4). IEEE.

[3] Toschi GM, Campos LB, Cugnasca CE. Home automation networks: A survey. Computer Standards & Interfaces. 2017 Feb 1;50:42-54.

[4] Al-Ali A, Qasaimeh M, Al-Mardini M, Radder S, Zualkernan IA. ZigBee-based irrigation system for home gardens. In2015 International Conference on Communications, Signal Processing, and their Applications (ICCSPA'15) 2015 Feb 17 (pp. 1-5). IEEE.

[5] Anand J, Flora TA, Philip AS. Finger-vein based biometric security system. International Journal of Research in Engineering and Technology eISSN. 2013 Dec:197-200.

[6] Savita KS, Razip MM, Mehat M, Muniandy M. Bluetooth drawer (BD) lock system for student's residential. In 2017 IEEE Conference on e-Learning, e-Management and e-Services (IC3e) 2017 Nov 16 (pp. 18-23). IEEE.

EBSCOhost - printed on 2/9/2023 6:44 AM via . All use subject to https://www.ebsco.com/terms-of-use

[7] Shanthini M, Vidya G, Arun R. IoT Enhanced Smart Door Locking System. In 2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT) 2020 Aug 20 (pp. 92-96). IEEE.

[8] Al Rasyid MU, Saputra FA, Prasetiyo A. I-on smart controller: Portable smart home solution based on arduino and raspberry pi. In2018 International Conference on Applied Science and Technology (ICAST) 2018 Oct 26 (pp. 161-164). IEEE.

[9] Cekada TL. Training a multigenerational workforce: Understanding key needs & learning styles. Professional Safety. 2012 Mar 1;57(03):40-4.

[10] Reilly P. Understanding and Teaching Generation Y. InEnglish teaching forum 2012 (Vol. 50, No. 1, pp. 2-11). US Department of State. Bureau of Educational and Cultural Affairs, Office of English Language Programs, SA-5, 2200 C Street NW 4th Floor, Washington, DC 20037.

[11] Gurek A, Gur C, Gurakin C, Akdeniz M, Metin SK, Korkmaz I. An Android based home automation system. In 2013 High Capacity Optical Networks and Emerging/Enabling Technologies 2013 Dec 11 (pp. 121-125). IEEE.

[12] Pawar P, Avhad P, Nalawade H, Gofane D, Kadam S. Android Supported Smart Home Automation for Indoor and Outdoor Environments. International Journal of Computer Applications.2016;2016(6):19-22.

[13] Takayama L, Pantofaru C, Robson D, Soto B, Barry M. Making technology homey: finding sources of satisfaction and meaning in home automation. InProceedings of the 2012 ACM conference on ubiquitous computing 2012 Sep 5 (pp. 511-520).

[14] Anand J, Flora A. TG: Emergency traffic management for ambulance using wireless communication. IPASJ Int. J. Electron. Commun.(IIJEC). 2014;2(7):1-4.

[15] Anand J, Perinbam JR. Automatic Irrigation System using Fuzzy Logic. AE International Journal of Multidisciplinary Research. 2014 Aug;2(8):1-9.

[16] Ganesh S, Prem Kumar R. Implementation of Secure Door Automation Systems using Infrared Sensors. International Journal of Trendy Research in Engineering and Technology. 2020 Oct;4(6):1-5.

[17] Vijayakumar P, Nandini N, Sai Ganesh N, Lawand RS, Bharadwaja AV, Tamizhselvan C, Aukush YK. Smart Calendar Device for Differently Abled Person. International Journal of Innovative Technology and Exploring Engineering. 2019 May;8(7):1410-4.

[18] Ajay H, Rao AR, Balavanan M, Lalit R. A Novel Cardiac Arrest Alerting System using IoT. International Journal of Science Technology & Engineering. 2017;3(10):78-83.

[19] Anand J, Dhanalakshmi M, Raja Paul Perinpam J. Smart Indication System for Spinal Cord Stress Detection. International Journal of Recent Technology and Engineering. 2019 Sep;8(3):6164-8.

[20] Niranjana S, Hareshaa SK, Irene ZB, Anand J. Smart Monitoring System for Asthma Patients. International Journal of Electronics and Communication Engineering. 2020 May;7(5):5-9.

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Effective Cataloging over Diverse Algorithms for Automatic Text Summarization and Its Survey

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Abstract. In these days, the measure of information and data accessible over the web is gigantic which prompted the making of automatic text summarization. Text Summarization is the route toward obtaining eminent information from a substantial text record. Automatic Text summarization is being a need of great importance and a fascinating theme with regards to NLP. Given the expansion in size and number of archives accessible on the web, an effective automatic text summarizer is significant. The fundamental test is to cause the computer to comprehend the report given with any expansion and create the outline as the primary rationale. The fundamental main impetus behind this work is to diminish the time and exertion spent by the client on perusing the whole document to understand what is the issue here. Subsequently the paper focuses on procedures accessible in delivering the significant rundown by utilizing different abstractive and extractive techniques

Keywords. Text Summarization, NLP, Text Classification, Deep Learning, Word Cloud.

1. Introduction

Over the years, there is a sensational development of the world's population. Consequently, it builds information on the web. The accessibility of the information is expanding step by step. Information can either be organized or unstructured, so the most ideal approach to explore is, look and decrease the outcome into shortening structure. So, there is an incredible need to abbreviate the text information by catching the salient features and this process is called Text summarization. The base pillar behind the Text summarization is Natural language processing(NLP) is a subfield of etymology, software engineering, and man-made thinking stressed over the associations among PCs and human language, explicitly how to program PCs to gauge and look at a great deal of basic language data [1].

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NLP has had an uncommon development lately in the field of creation, one such innovation is automatic Text Summarization. It is comprehensively named Abstractive Text Summarization (ATS) and Extractive Text Summarization(ETS). Extractive text summarization is a clear method of shortening the original text content. The rundown is made by duplicating the pertinent sentence/words from the input text document though Abstractive Text summarization recreates significant context after understanding and assessment of the text utilizing advanced natural language strategies to produce a synopsis that passes on the most critical information from the original document [2].

This paper momentarily explains on various methodologies and strategies utilized in Text summarization and coordinated as follows. Section II portrays the elaborated literature survey; Section paper III gives the details analysis of the algorithms surveyed with a comparison table. Lastly, we concluded this paper with some future work that might be incorporated in our future work.

2. Literature Survey

Over the years there were numerous text summarization algorithms have been advanced. Each has its own advantages and disadvantages. In this literature survey, the most recognizable and broadly utilized summing up algorithms have been contemplated. Figure 1 below shows a summed-up block diagram for each one of those algorithms.

Anusha Pai [3] has proposed a framework for text summarization that is a combination of both statistical and linguistic examination of text reports. Linguistic summarizers use data about the language (grammar/semantics/use, etc.) to summarize a chronicle. Statistical summarizers work on word recurrence. The methodology has three fundamental parts: pre-processing, analysis, and selection. The framework has three segments: User who utilizes the framework, Summarizer which produces the outline, Database where there are isolated tables for putting away sentences, words, word recurrence, and sentence weight. Rundown age includes pre-processing, Word recurrence estimation, Plural resolution, Abbreviation resolution, Linguistic analysis, Sentence weight calculation, and normalization.

Outline created is superior to simple statistical summarizers that produce rundown dependent on word recurrence computation. The addition of plural resolution and abbreviation resolution adds more precision to the synopsis. Idea of standardization presented here causes sentences to get their weight simply dependent on the worth of its content words and not on the quantity of words it has.

Hongyan Jing [4] presents a novel sentence reduction framework for summarization purposes. The English Slot Grammar (ESG) parser is utilized to break down the syntactic construction of an information sentence and produce a sentence parse tree. In the reduction program, the parse tree is created which is annotated on with additional data. Grammar check is done dependent on basic, linguistic standards. The framework at that point distinguishes the words that are generally identified with the primary subject and the words that are connected to it and afterward processes a significance score.

The program utilizes corpus proof to figure how likely people eliminate a specific expression. In light of these various probabilities are processed: the likelihood that an expression is eliminated, the likelihood that an expression is decreased, and the likelihood that an expression is unaltered by any means. These corpus probabilities are computed

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beforehand using a training corpus. The system navigates the sentence parse tree and chooses which subtrees ought to be taken out, diminished, or unaltered. A subtree (i.e., aphrase) is taken out just in the event that it isn't syntactically compulsory, and it isn't the focal point of the local context. Dima Suleiman and Arafat Awajan [5] suggesed that text abstraction can be categorized into a few main classes dependent on genre, function, outline context, kind of summarizer, and the report style. This work actually gives an brief explanation about the methods, tuning metrics, datasets and the problem of DL dependencies over the abstractive Text summarization. DL endeavors to behave like what the human thinking can accomplish by taking out features at various levels of shrinking the text. Also Deep learning is been in application for a few language processing undertakings as it works with the observed facts of different level depictions of knowledge utilization in few processing multiple sections of non-linear units.

Pratibha Devihosur and Naseer [6] performed semantic unsupervised learning, so far and the effects are great as per them. The most important key take away in a sentence that belong to a information content is briefed by Lesk and wordnet, a language database for finding the connection among the words is efficiently utilized. Also this has been in Lesk's marking that it is been in connecting with every other word form to find the guarantee of every sentence. This is the most notable stage; texts are added with some prefixed weights and are managed in concaving requesting with their well-mean weights. All weighed out sentences are clearing to give meaning the total meaning as shown in the percentange of results.

Song et al. [7] carried out the Abstractive text summarization utilizing a deep learning system. In this system, the information is taken care of as a summary construction. This framework contains 3 stages information pre-processing, phrase processing, and text generation. The information pre-processing utilizes the core NLP to handle the passage since core NLP utilizes numerous linguistics tools. The processed text will be entered into the phrase process where phrases of the original summary are decreased the phrase decrease is finished utilizing Multiple Order Semantic Parsing (MOSP). The yield of the phrase cycle will be another phrase arrangement from which the text generation happens. The text summarization measure takes up the LSTM-CNN encoding and decoding method and, in this manner,summary is produced. Many key issues of text summarization are tackled in the LSTM-CNN model. The present ETS models are concerned about syntactic structure, while present ATS models are worried concerned semantics. ATSDL system outflanks the top tier models with respect to both semantics and syntactic development and achieves genuine results on manual linguistic quality assessment.

Nandhini and Balasundaram [8] have introduced a separate method called cohesive summary to monitor reading difficulties with the help of GA. The motive with this piece of work is to make the deletion over accurate mix of sentences that could grow thoughtful over the sentences and how they got bonding using GA. The information text is preprocessed using sentence segmentation, tokenization, stop words removal, and stemming is made to create feature extraction. The informative score, similarity of sentences, enhancement is made. Chromosome encoding is an important strategy in the genetic algorithm where chromosome refers to the order of sentences the chromosome size will be fixed and the summary will be compressed this in turn given to the fitness solution where fitness function, crossover mutation, and other works will occur. Finally, the summary will be generated. Genetic Algorithm based methodologies will be so helpful in learning

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how to do text abstraction for life science related texts. Also this helps in solving many legal statements to get summarized.

Deepa Nagalavi and Hanumanthappa [9] recommended multi-document summarization executed by a blend of qualitative and quantitative strategies on query-based. The input to the model is the articles and the query. It produces the summary in a few lines based on named entities. It works in three stages, first is named entity recognition model is utilized to distinguish and extricate the entities, then create the summed-up sentence utilizing entities as keywords and finally, joins the outline of various articles of a comparative topic. The query analyzer works by recognizing the key entities, which gives the data of area (event of an occasion) trailed by distinguishing the reliance or the relationship with previously recognized data. In the accompanying stage, by using the composed reliance strategy the reason for the event is perceived. Accordingly, the dependency relations and key entities are created by utilizing the Stanford parser [10] and regexner annotator [11]. Utilizing this data, a multi-document rundown is created in this methodology.

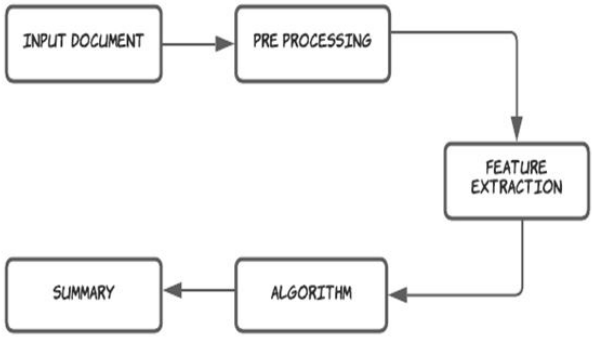

Figure 1. General Architecture Diagram for Text Summarization Algorithm

Prachi Shah and Nikita [12] proposed a model named Automatic Text Summarization Techniques for Indian and Foreign Languages. This is fundamentally centered around various languages in India. Each language has a different arrangement of documents for comprehension and summarization. It uses linguistic procedures to analyze and decipher the text and subsequently to find the novel thoughts and terms to best portray it by creating new more restricted text that passes on the main data from the original text document. The strategy it utilizes for all languages is text pre-processing, utilizing segmentation, tokenization, stop words removal and feature extraction is done. The sentences are ranked and the highest level are taken into consideration. It functions admirably for foreign dialects and automatic summarization for the Indian language is inadequate.

3. Analysis

So far in the past section, we have seen the different methodologies for Text Summarization algorithms, and now let us examine a few laurels about these algorithms and

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relative analysis about these algorithms. This segment additionally shows few applicable scenarios of these algorithms through Table 1 where these can put forth a valiant effort.

3.1. Single vs multi-document analysis

The automatic text summarization can be characterized dependent on the quantity of input documents. It is classified as single document text summarization and multi-document text summarization. In single document summarization, the synopsis is created from the single document though a multi-document summarizer contains numerous documents and delivers a single outline. Multi-document summarization is moderately more troublesome than single-document summarization as it includes composing numerous documents, extracting the significant context from each document, and delivering the cohesive summary.

3.2. Approaches

The accompanying methodologies have been recognized as the best methodologies under Extractive-based text summarization. The extract from the paper and the examination are given beneath.

3.2.1. Extractive based text summarization

Corpus-based Approach: Corpus linguistics is a quickly developing methodology that utilizes the statistical analysis of enormous assortments of composed or spoken information (corpora) to explore linguistic wonders. Corpus is a predefined assortment of words or wordnet [13] of different domains. The corpus-based methodology compares the sentence of the first content with the connected corpus and discovers the significance between them by utilizing the TF-IDF(term frequency-inverse document frequency). The most regularly utilized corpus in NLP is ”brown corpus” which comprises 500 English language text samples and 1 million words. This corpus is utilized for parts of speech tag(POS). For instance, the word “students” would have a set of words in the word net-like “school” “college” “books” etc.

Cohesion Based Approach: Corpus-based approaches neglect to represent relations between sentences in an archive. Text cohesion alludes to the connection between words that are utilized while creating a summary instead of just relying upon the corpus. It helps in creating significant and organized Graph-Based Approach: For the situation of graph-based methodology each archive or each sentence is portrayed as a node and the relation between them as edges. Edges are utilized to interface any two nodes sharing common data. Sentence scoring is finished by introducing weightage to the nodes of the graph. The likeness between those nodes is addressed as the edge score. For the most part utilized calculations are for the rundown. Cohesion is guaranteed utilizing lexical chains. These chains have related and subordinate words together in a solitary chain. These chains are then assessed and scored based on their sort and connection in the text.

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Table 1. Analysis of various Text Summarization Algorithms

S No	Title	Author	Observation	Evaluation Metrics
1	Text Summarizer Using Abstractive and Extractive Method	Ms. Anusha pai May 2014	The proposed approach culminates both linguistic and statistical analysis which provided an efficient result	The document containing 10 sentences (sentence 1 to sentence 10) and summary size is 40% in this approach
2	Sentence Reduction for Automatic Text Summarization	Hongya Jing 2016	The system uses a parse tree to find the dependency between words and take reduction decisions.	The program achieved an average success rate of 81.3% using anfivefold approach
3	Deep Learning Based Abstractive TextSummarization: Approaches, Datasets, Evaluation.	Dima Suleiman and Arafat Awajan Aug 2020	The abstractive summarization using Deep learning techniques and evaluated against various measures.	Quantitative approach (ROGUE) and Qualitative approach(Human evaluation) is used to evaluate the summary which ensures readability, relevancy and fluency.
4	Automatic Text Summarization using NLP	Pratibha Devihosur and Naseer R Aug 2017	LESK algorithms did its excellence in this approach and word net corpus was used.	ROGUE method is used to validate the summary generated by the system and the human generated summary
5	Abstractive Text Summarization using Deep Learning	Shengli Song Haitao Huang Feb 2018	Text summarization using ETS based on deep learning techniques such as LSTM,CNN,Seq 2 Seq model.	In this approach ROGUE method is used to evaluate the summary and it has become successful.
6	Use of Genetic Algorithm for Cohesive Summary Extraction to Assist Reading Difficulties	K. Nandhini and S. R. Balasundaram June 2013	The main purpose is to take out the possible combination of sentences that could not only increase readability but improves the bonding over the related.	Intrinsic method is used to evaluate the precision, recall and F-measure while extrinsic method is used to evaluate the readability and usability of the summary generated.
7	The NLP Techniques for Automatic Multi-article News Summarization Based on Abstract Meaning Representation	Deepa Nagalavi and M. Hanumanthappa Nov 2013	Combined approach of qualitative and quantitative on query based using regexneranno-tater and stanford parser.	The proposed approach is evaluated by employing both qualitative and quantitative evaluation metrics.
8	Automatic Text Summarization Techniques for Indian and Foriegn Languages	Prachi Shah and Nikita P. Desai 2016	It emphasizes all about the survey and performance analysis of different language.Automatic summarizer is more successful for foreign language than compared to indian language.	Initially manual testing was done. Later LibSVM was used for evaluation and accuracy of 75% was achieved.

These scores are subsequently used to produce the genuine summary. For the most part utilized calculations for the graph based-approach are the Text-Rank and Google's

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Page-Rank calculation [14]. Text-Rank calculation ascertains the sentence similitude based on the TF-IDF mode and the sentences are ranked while Page-Rank is utilized to compute the importance between the reports under comparable substance. The graph-based methodology has been the productive methodology for extractive-based text summarization as the summary generated is more cohesive and based on both frequency and similarity.

3.2.2. Abstractive based text summarization

Seq2Seq Model: Seq2Seq is utilized to take care of issues on sequential data. The abstractive summary can be produced utilizing a many-to-many seq2seq model where the input is a long sequence of words and yield is a summary. This model has two parts specifically i) Encoder ii)Decoder each of which is an RNN. The encoder peruses a single word per timestamp and measures the word. It at that point catches the relevant data present in the input sequence. The decoder examines the entire target progression word-by-word and predicts a similar arrangement balance in one timestamp. The decoder is an

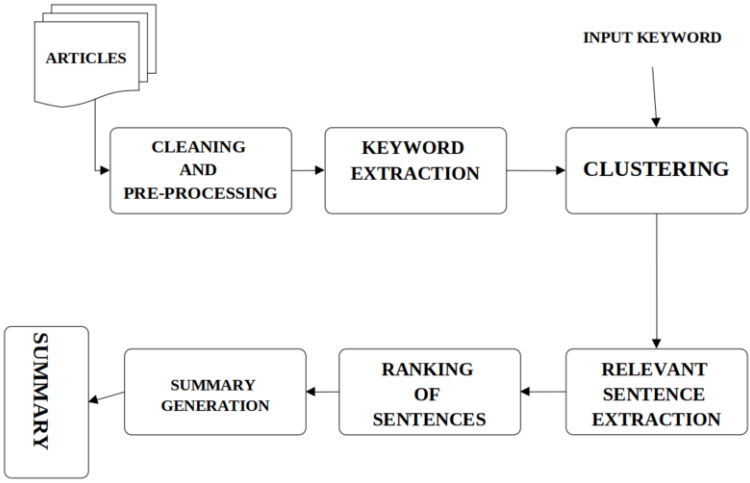

Figure 2. An Improvised Architecture Diagram for Text Summarization

idea to anticipate the next word in the sequence, given the previous work. In any case, this model has the restriction over the more drawn-out sequence of words as it is hard for the encoder to remember long sequences into a fixed-length vector [15]. Attention Mechanism: Considering the impediments in the Seq2Seq model, attention mechanisms have come into play. It plans to foresee a word by taking a gander at a couple of explicit pieces of the sequence instead of the whole sequence. The context vector can be determined by utilizing global attention as well as local attention [16]. Global attention considers every one of the secret states though Local attention thinks about just the chosen covered up states. Consequently, it is utilized particularly when the sequence is enormous. In light of the examination, a framework can be proposed as demonstrated in Figure 2 by bunching the articles, and keywords are extricated from each bunch utilizing topic modeling at that point by getting an information keyword from the client the pertinent group and applicable articles are gathered and a multi-record synopsis is produced. Consequently, for any keyword given, an outline is produced.

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4. Conclusion

In this paper various techniques used for text summarization were discussed. It can be concluded that an extractive summary can be generated on any domain irrespective of the corpus available but it doesn't provide an anthropocentric summary, whereas abstractive summary is more of anthropocentric but limits to the corpus available. Hence the combination of both extractive and abstractive techniques can be incorporated in producing a more meaningful summary. This will be incorporated in our future work and according to the model architecture depicted above a model will be implemented with different data size and various evaluation metrics.

References

[1] Wikipedia, The Free Encyclopedia. Natural language processing [Internet]. [updated 2021 Mar 25; cited 2021 Mar 30]. Available from: https://en.wikipedia.org/wiki/Natural_language_processing.
[2] Wikipedia, The Free Encyclopedia. Automatic summarization [Internet]. [updated 2021 Mar 9; cited 2021 Mar 30]. Available from: https://en.wikipedia.org/wiki/Automatic_summarization.
[3] Pai A. Text Summarizer Using Abstractive and Extractive Method. International Journal of Engineering Research & Technology. 2014;3(5):2278-0181.
[4] Jing H. Sentence reduction for automatic text summarization. InSixth Applied Natural Language Processing Conference 2000 Apr (pp. 310-315).
[5] Suleiman D, Awajan A. Deep learning based abstractive text summarization: Approaches, datasets, evaluation measures, and challenges. Mathematical Problems in Engineering. 2020 Aug 24;2020:202-9.
[6] Devihosur P, Naseer R. Automatic text summarization using natural language processing. International Research Journal of Engineering and Technology (IRJET). 2017;4(08):667-73.
[7] Song S, Huang H, Ruan T. Abstractive text summarization using LSTM-CNN based deep learning. Multimedia Tools and Applications. 2019 Jan;78(1):857-75.
[8] Nandhini K, Balasundaram SR. Use of genetic algorithm for cohesive summary extraction to assist reading difficulties. Applied Computational Intelligence and Soft Computing. 2013 Jan 1;2013:412-20.
[9] Nagalavi D, Hanumanthappa M. The NLP Techniques for Automatic Multi-article News Summarization Based on Abstract Meaning Representation. InEmerging Trends in Expert Applications and Security 2019 (pp. 253-260). Springer, Singapore.
[10] De Marneffe MC, Manning CD. Stanford typed dependencies manual. Technical report, Stanford University; 2008 Sep:880-8.
[11] Sarkar D. Semantic analysis. InText Analytics with Python 2019 (pp. 519-566). Apress, Berkeley, CA.
[12] Shah P, Desai NP. A survey of automatic text summarization techniques for Indian and foreign languages. In2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT) 2016 Mar 3 (pp. 4598-4601). IEEE.
[13] Kulshreshtha RK, Srivastava A, Bhardwaj M. A Survey Paper on Text Summarization Methods. International Research journal of Engineering and Technology (IRJET). 2018 Nov;5(11):97-104.
[14] Moawad IF, Aref M. Semantic graph reduction approach for abstractive Text Summarization. In2012 Seventh International Conference on Computer Engineering & Systems (ICCES) 2012 Nov 27 (pp. 132-138). IEEE.
[15] Pai A. Comprehensive guide to text summarisation using deep learning in Python. Blog, Analytics Vidhya, June. 2019;10:456-462.
[16] A Comprehensive Guide to Attention Mechanism in Deep Learning for Everyone. American Express. 2019 Nov:557-63.

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Prospective Classification over Various Handwritten Character Recognition Algorithms – A Survey

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Abstract. Handwritten Character Recognition is comprehensively used to scrutinize and appreciate characters from pictures and secret them to cutting edge substance. Character recognition is head, yet for the most part testing in the field of model recognition with a colossal number of significant applications. It has been a genuine field of investigation since the start of programming since it being a characteristic strategy for associations among PCs and individuals. Even more accurately Character recognition is the route toward recognizing and seeing characters from the data picture and converts it into ASCII or another similar machine editable design.

Keywords. Handwritten Character Recognition, OCR, PTR, CNN, Perceptron.

1. Introduction

Understanding the characters written manually or created reports is simple for humans as we can learn. A comparative upper limit can be whipped up to the machines in that manner by the usage of ML or DL in AI. The field which focuses with this issue is called as OCR. It is a place to study among various fields, for example seeing of various model, like manner image vision and furthermore AI. This is the area for changing the electronically and picturing text into high level character which need to be deduced by the machines [1]. By the time, we use for entering the data and the same way additional space is required by the files can be momentously diminished by the use of OCR or towards the day end, it will be demised rapidly. With the help of OCR in the financial field, actual situations where we need to handle social documents and for many critical and time sensitive documents will be handled very fast without human intervention. Optical Character Recognition will be triggered by substance and file getting and this will be happening as two distinct manners. Moreover, on the positive side that we contemplate the substance kind, OCR is of two sorts, HCR – astute recognition of handwritten substance

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and PCR. All we need a high identifying limit on the chances of changing handwriting of individuals. Many on various occasions, the similar individuals had different making style from period to period. Then as far as OCR is concerned, the two designs which are characterized are Offline and Online recognition which could reliant upon getting the details of the reports. Detached System figures out how to see the pre-made report acquired through various data strategies. However, in the Online seeing system, the creating is seen the subsequent it is composed. The device used for the online structure is an Electric pen where it is used for creating the letters or words on the device called a digitizer and dependent on the pen improvement the data is recorded. This investigation gives an extensive connection between's different machine learning and significant learning estimations with the ultimate objective of handwritten character recognition while using the Support Vector Machine, Multilayer Perceptron, and Convolutional Neural Network for a comparative explanation The relationship between's these computations is done dependent on their exactness, bungles, and testing-getting ready time supported by plots and charts that have been assembled using matplotlib for portrayal. Hence this paper figures out how to give an assessment of different computations subject to their accuracy so the most definite estimation with insignificant chances of bumbles can be used in various usages of handwritten character recognition.

This paper gives a reasonable understanding of machine learning and significant learning computations like SVM, CNN, and MLP for handwritten character recognition. It other than gives you the information about which computation is successful in playing out the errand of character recognition. In extra spaces of this paper will inspect the associated work that has been done in this field followed by the technique and execution of the huge number of three estimations for a more charming understanding of them. At that point, it presents the end and result supported by various diagrams. Moreover, it will similarly give information about some potential future upgrades that ought to be conceivable in this field. Figure 1 underneath is a summed up block outline that portrays the overall work process of all Handwritten Recognition Algorithms.

2. Literature Survey

Many Algorithms have evolved according to the type of written data. These algorithms have been studied for their pros and cons for analyzing them and the core points about those are given below. Proper analysis in the world of text recognition is one of the favorite from Grimsdale in 1959 and it has become the main purpose for many researchers to start evolve many handwritten character recognition. During 1960's to 1965's the main examinations proved that use of appraisal was proposed by Eden in 1969. He proved that handwritten character are subjected to few schematic and semantic highlights and his theory was widely utilized as a work of basics of all traditional methods for approaching in space of character identification [1].

Gaurav and Bhatia [2], have suggested various pre-processing machines for being recognizable with the identification of the characters. This approach went off from different source to source in the form of picture-based report to colored and kept for change including the base one. Various systems of pre-processing and standard metrics like separate chaining, slant fix and different other methods are stated.

Salvador España-Boqueria [3], the authors have suggested that the genetic breed or half-concealed HMM to observe the handwritten substance in different modes. The

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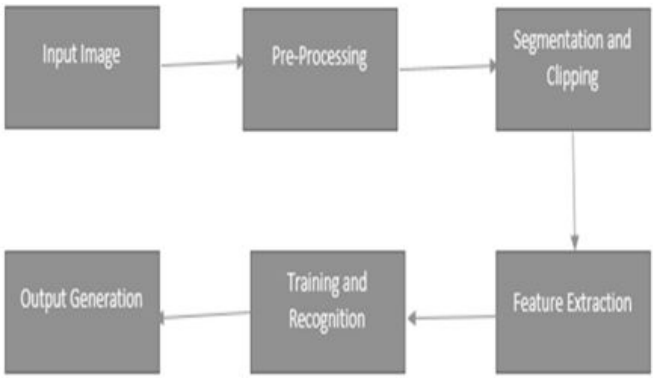

Figure 1. General Block Diagram for Recognition Algorithms

optical model's most important part was to set up with Markov and multilayer perceptron was then used to measure the possibilities.

In [4], to watch the emotionally detached handwritten letters of six noticeable Indian dialects, a modified quadratic classifier is used. A new comparable paper moreover finds out where to see the English letter and how to see them all together. For all of these, a multilayer perceptron was there and two entities were used for segment extraction such as boundary following and fourier descriptors. By checking the shape and look at their features with a glance, those characters were brought to knowledge.

Bajaj et al. [5], were on the other hand collecting artifacts about Devanangari numerals with their features like clear part, moment features, thickness are taken into consideration. To set the identification limit, this one has shared a multi classifier with purposeful quality for handwritten Devanangari numerals. Sandhya Arora in [6] clearly provided as four important features like shadow, crossing point, histogram of chain and level line fitting features being shown as metrics. In these, the shadow was projected as all around for picture character, the rest three were prepared by sharing the character picture into few mentioned segments.

Nafiz et al. [7] suggested the strategy in which it is less demanding to hold an essential removal from the pre handling stage and thereby reducing the deficiency of basic and needed information. The best of all proposed was the estimation of cable division. Same way, various methods were always giving their continuous support to this calculation with the help of maxima and minima of neighborhood. When we use the one-dimensional depiction of a character which has two dimensions it immensely starts to build the energy wave of HMM for shape seeing.

In [8], a proposal was given to see the unique Tamil written character by stroke collections. The arrangement of strokes or shape based expression is meant for addressing a line of shape features. Using this approach, one can differentiate the non identified strokes and the dataset of others by string arrangement techniques in a model which is highly adaptable. Using this, every individual character was identified by recognizing all of the strokes [9].

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3. Analysis

The comparison of the algorithms (Support vector machines, Multi-layered perceptron & Convolutional neural network) is based on the characteristic chart of each algorithm on common grounds like dataset, complexity of the algorithm, accuracy of each algorithm, specification of the device used to execute the program and runtime of the algorithm, under ideal condition. The common classification over HCR algorithms are given below in Figure 2.

3.1. Support Vector Machine

Support Vector Machine (SVM) is a managed machine learning calculation that can be utilized in high-dimensional spaces. Character recognition utilizing SVM is generally memory-effective and additionally time-proficient [10]. In SVM, the information things are plotted in n-dimensional space where n is the quantity of highlights, and a specific arrange addresses the worth of an element, grouping is performed by finding the hyper-plane which is utilized to recognize the two classes. In the wake of plotting, the hyper-plane which is utilized to recognize the classes is distinguished. There are primarily two kinds of SVMs, linear and non-linear SVM. The SVM in scikit-learn can support both thick and meager example vectors as info. LinearSVC is utilized in this paper for the order of MNIST datasets that utilize a Linear portion carried out with the assistance of LIBLINEAR. Different sci-unit learn libraries like NumPy, matplotlib, pandas, Sklearn and seaborn have been utilized in the execution. First and foremost, MNIST datasets are download, trailed by stacking them and perusing those CSV documents utilizing pandas. After this, a few examples are plotted and changed over to a grid followed by standardization and scaling of highlights. At long last, make a linear SVM model and disarray network is utilized to gauge the precision of the model.

3.2. Multilayer Perception

These limit cases are called support vectors, and thusly, the calculation is named a Support Vector Machine. A multilayer perceptron (MLP) is a class of feedforward artificial neural networks (ANN). It is isolated into three layers: input layer, covered up layer and yield layer. Each layer is characterized as an assortment of a few hubs that are alluded to as neurons and every hub is interconnected to each and every hub in the following layer. In fundamental MLP there are 3 layers yet the quantity of covered up layers can increment to any number according to the issue with no limitation on the quantity of hubs. The quantity of hubs in the information and yield layer fluctuates dependent on the quantity of qualities and obvious classes that are in the dataset. The specific number of covered up layers or number of hubs in the secret layer is hard to decide because of this current model's whimsical nature and accordingly must be chosen tentatively. Each secret layer of the model can have an alternate enactment work that is utilized for preparing. For learning purposes, a directed learning strategy called backpropagation is utilized. In the MLP, the idea of weight is utilized in the association of the hubs which gets acclimated to synchronize with every association in the preparation cycle of the model.[10]. The execution of Handwritten Character Recognition by Multilayer perceptron, otherwise called feedforward artificial neural network, is finished with the assistance of Keras

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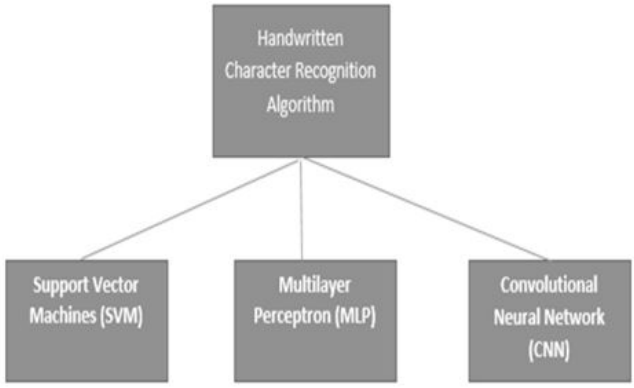

Figure 2. Classification of HCR Algorithms

module to make a MLP model of Sequential class and add individual secret layers with various actuation capacity to take a picture of 28x28 pixel size as information. When preparing and test information are free, one can follow these means to prepare a neural network in Keras. This paper utilizes a neural network with 4 secret layers and a yield layer with 62 units . The quantity of units in the mysterious layers is kept to be 512. The examination among the talked about algorithms is classified beneath in Table 1. In the Sequential model, anybody can simply pile up layers by adding the ideal layer individually. This paper utilized the Dense layer, moreover called a completely associated layer since it is building a feedforward network in which every one of the neurons from one layer are associated with the neurons in the past layer. Aside from the Dense layer, the ReLU initiation work is added, which is needed to acquaint non-linearity with the model. Through this, non-linear choice limits are learned by the network. As it is a multiclass characterization issue, the last layer is a softmax [11] layer.

3.3. Convolutional Neural Network

Convolutional Neural Network is a profound learning calculation that is generally utilized for picture recognition and arrangement. It is a class of profound neural networks that require least pre-processing [12]. In CNN, the picture is contribution to the type of little lumps instead of contributing a solitary pixel at a time, so the network can recognize dubious examples (edges) in the picture all the more proficiently. CNN comprises principally of 3 layers, an info layer, a yield layer, and numerous secret layers which incorporate Convolutional layers, pooling layers (Max and Average pooling), completely associated layers (FC), and standardization layers [13]. CNN utilizes a channel (piece) which is a variety of loads that are utilized to extricate highlights from the info picture. CNN utilizes distinctive activation capacities at each layer to add some non-linearity [14]. Further, it tends to be seen that the stature and width decline while the quantity of channels increments. At long last, the created segment lattice is utilized to foresee the output [15]. The execution of handwritten character recognition by Convolutional Neural Networks done by utilizing Keras. Utilizing Keras, a model is made layer by layer by utilizing sequential classes. The component of the info picture is set to 28(Height),

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28(Width), 1(Number of channels). After this, the model is made with the Convolutional layer as the primary layer. This layer utilizes a framework to convolve around the info information across its stature and width and concentrate highlights from it. This network is known as a Filter or Kernel. In this layer, the Depth (number of channels) of the yield picture is equivalent to the quantity of channels utilized. To build the non-linearity, an activation work that is ReLU [16] is utilized. After this, another convolutional layer is utilized in which 64 channels of similar measurements (3, 3) with a step of 1 and the Relu work is applied.

Table 1.: Analysis of various Handwritten Recognition Algorithms

S No	Title	Author	Technique Used	Evaluation Metrics (%)	Remarks
1	Handwritten Digits Recognition Using Machine learning	ShikharTandon, Shadab Akhter, VaibhavPratap Singh Nizam Uddin Khan, 2019	Describes the recognition of handwritten scanned digits using Machine Learning methods with the help of TensorFlow.	Training:98 Testing: 97	-
2	A Literature Survey on Handwritten Character Recognition	AyushPurohit , Shardul Singh Chauhan,2016	Provides a comparision on how recognition is used on different characters based on language with different techniques	Accuracy: 98.4	This paper does not provide concrete methods on how the recognition is performed but provides an overview on different techniques that can be used
3	Handwritten Digit Recognition using Machine and Deep Learning Algorithms	Ritik Dixit, RishikaKushwah, SamayPashine, 2020	Provides different algorithms that are used to perform digit recognition and compares their accuracies	SVM Training:99.98 Testing 94.05 MLP Training:99.92 Testing 98.85 CNN Training:99.53 Testing 99.31	-
4	Handwritten Character Recognition using Neural Network and Tensor Flow	Megha Agarwal, Shalika, Vinam-Tomar, Priyanka Gupta,2019	It clearly states how CNN and Tensor can identify different offline handwritten character.	Training:94 Testing: 90.5	Performs digit recognition but accuracy is not very high

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5	Improved Handwritten Digit Recognition Using Convolutional Neural Networks (CNN)	SavitaAhlawat, Amit Choudhary, AnandNayyar, Saurabh Singh and Byungun Yoon,2020	CNNs are very effective in perceiving the structure of handwritten characters/words in ways that help in automatic extraction of distinct features and make CNN the most suitable approach for solving handwriting recognition problems.	Training:99.87 Testing: 99.89	It is not very time-efficient and performance of algorithm decreases when time used for execution is decreased
6	Handwritten Optical Character Recognition (OCR): A Comprehensive Systematic Literature Review (SLR)	JamshedMemon, Maira Sami, Rizwan Ahmed-Khan,Mueen Uddin, 2020	Provides analysis based on articles and the collected data is analysed and synthesized.	Accuracy: 99.6	Provides an overview of optical character recognition but does not provide solution for the problems
6	Handwritten Optical Character Recognition (OCR): A Comprehensive Systematic Literature Review (SLR)	JamshedMemon, Maira Sami, Rizwan Ahmed-Khan,Mueen Uddin, 2020	Provides analysis based on articles and the collected data is analysed and synthesized.	Accuracy: 99.6	Provides an overview of optical character recognition but does not provide solution for the problems

Then, the components of the picture and calculation in the network are decreased by utilizing the pooling layer. Besides, MAX-pooling is utilized in which just the most extreme worth from a pool is kept. Besides, in this layer, the profundity of the network stays unaltered. The pool-size (2,2) is kept with a step of 2, so every 4 pixels will turn into a solitary pixel. To stay away from overfitting in the model, the Dropout layer is utilized which drops a few neurons which are picked randomly so the model can be streamlined. The likelihood of a hub getting exited is set to 0.25 or 25%. Following it, Flatten Layer is utilized which includes producing a segment grid (vector) from the 2-dimensional framework. This section vector will be taken care of into the completely associated layer [15]. This layer comprises of 128 neurons with a dropout likelihood of 0.5 or half. Subsequent to applying the ReLu activation work, the yield is taken care of into the last layer of the model.

4. Conclusion

This paper differentiates their exactness and execution time and the help of exploratory outlines for a perspicuous course of action. In the wake of executing all of the models, it has been found that SVM has the most raised precision on getting ready information while on testing dataset CNN accomplishes the most limited exactness. Moreover, it has contrasted the execution time with acquiring understanding into the working of the algo-

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rithms. The SVM gave a proficient preparing exactness with a testing precision of over 90%. In any case, to simply ensure that the model is impeccable, this paper rearranges the dataset by utilizing a train test split and it actually gives the precision over 90% making the model great. Therefore this paper incorporates one of the correctnesses given by the SVM. The future improvement of uses dependent on algorithms of deep and machine learning is basically vast. Later on, work on a denser or half and half algorithm than the current arrangement of algorithms with more complex information to accomplish the answers for some issues should be possible [17]. Later on, the utilization of these algorithms lies from the general population to undeniable level authorities. These algorithms can be utilized in clinics application for clinical treatment and monitoring the patients. The progression in this field can assist with establishing a environment of wellbeing, mindfulness, and comfort by utilizing these algorithms in the everyday application.

References

[1] Agarwal M, Shalika VT, Gupta P. Handwritten character recognition using neural network and tensor flow. International Journal of Innovative Technology and Exploring Engineering (IJITEE). 2019 Apr;8(6S4):1445-8.

[2] Kumar G, Bhatia PK, Banger I. Analytical review of preprocessing techniques for offline handwritten character recognition. International Journal of Advances in Engineering Sciences. 2013 Jul;3(3):14-22.

[3] Espana-Boquera S, Castro-Bleda MJ, Gorbe-Moya J, Zamora-Martinez F. Improving offline handwritten text recognition with hybrid HMM/ANN models. IEEE transactions on pattern analysis and machine intelligence. 2010 Aug 19;33(4):767-79.

[4] Pal U, Sharma N, Wakabayashi T, Kimura F. Handwritten numeral recognition of six popular Indian scripts. InNinth International Conference on Document Analysis and Recognition (ICDAR 2007) 2007 Sep 23 (Vol. 2, pp. 749-753). IEEE.

[5] Bajaj R, Dey L, Chaudhury S. Devnagari numeral recognition by combining decision of multiple connectionist classifiers. Sadhana. 2002 Feb;27(1):59-72.

[6] Arora S, Bhattacharjee D, Nasipuri M, Basu DK, Kundu M. Combining multiple feature extraction techniques for handwritten Devnagari character recognition. In2008 IEEE Region 10 and the Third International Conference on Industrial and Information Systems 2008 Dec 8 (pp. 1-6). IEEE.

[7] Arica N, Yarman-Vural FT. Optical character recognition for cursive handwriting. IEEE transactions on pattern analysis and machine intelligence. 2002 Aug 7;24(6):801-13.

[8] Aparna KH, Subramanian V, Kasirajan M, Prakash GV, Chakravarthy VS, Madhvanath S. Online handwriting recognition for Tamil. InNinth international workshop on frontiers in handwriting recognition 2004 Oct 26 (pp. 438-443). IEEE.

[9] Purohit A, Chauhan SS. A literature survey on handwritten character recognition. IJCSIT) International Journal of Computer Science and Information Technologies. 2016;7(1):1-5.

[10] Shamim SM, Miah MB, Angona Sarker MR, Al Jobair A. Handwritten digit recognition using machine learning algorithms. Global Journal Of Computer Science And Technology. 2018 Apr 13;18(1):17-23.

[11] Ali I, Ali I, Subhash AK, Raza SA, Hassan B, Bhatti P. Sindhi Handwritten-Digits Recognition Using Machine Learning Techniques. Int. J. Comput. Sci. Netw. Secur. 2019 May;19:195-202.

[12] Ahlawat S, Choudhary A, Nayyar A, Singh S, Yoon B. Improved handwritten digit recognition using convolutional neural networks (CNN). Sensors. 2020 Jan;20(12):3344-50.

[13] O'Shea K, Nash R. An introduction to convolutional neural networks. arXiv preprint arXiv:1511.08458. 2015 Nov 26:274-82.

[14] Nwankpa C, Ijomah W, Gachagan A, Marshall S. Activation functions: Comparison of trends in practice and research for deep learning. arXiv preprint arXiv:1811.03378. 2018 Nov 8:422-8.

[15] Udofia U. Basic overview of convolutional neural network (cnn). Retrieved May. 2018;27: 578-85.

[16] Brownlee J. How do convolutional layers work in deep learning neural networks?. Machine Learning Mastery. 2020 Feb:313-9.

[17] Memon J, Sami M, Khan RA, Uddin M. Handwritten optical character recognition (OCR): A comprehensive systematic literature review (SLR). IEEE Access. 2020 Jul 28;8:142642-68.

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E-Society – A Financial and Event Management System

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Abstract. E-society – a financial and event management system, a web based application which leverage waterfall development model for managing the financial operations typically done in a house society and also provides the facility to create, organize and prioritize events and raise funds for the same. At present these details were maintained in a spreadsheet, and it has its own issues when comes to calculations, human introduced data error, missing required precession etc. Due to the manual maintenance of financial records, getting a spending report is become too tedious and difficult to extract in a given amount of time.This system is exclusively used by a small group or an organization allows people to keep track of the transaction between members of the society, admin and the workers working for that organization or society. By using this we can reduce the manual calculations and human errors while computation of expenditure. The system allows the retrieving and updating facilities to authorized persons.To bring in the transparency in expenses of the society's funds, the application allows every user to generate a report to know about the expenses and funds collected between a given date range.

Keywords. Create events, House Society, Transactions, Expenditure, Tracking, Transparency.

1. Introduction

The fountainhead of e-payment is, of policy, clicked to the nascence of the internet, which revolutionized the people like shrimp before . After all, if there were no people fat mesh, there would n't live online hoards and e-services. The chronicle of the internet starts in 1969 with ARPANET, the martial net which lived aimed to live a dispatch net in the Vietnam War epoch . But the main turning juncture passed in 1989 when Tim Berners - Lee mounted the answer of framing data royal to print and penetrate on the internet by harnessing the thereupon - sounded off " positions " or " go-betweens ". In the nascence, the main instrumentalists on the e-payment demand were Millicent (pioneered in 1995), ECash or CyberCoin (both in 1996) . The adultness of the original online indulgences were harnessing micro remitment complexes and their quotidian point lived the stab to enforce the electronic cash preferences (parallel as e-money, digital cash or remem-

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brances) [1]. besides, in 1994, Amazon is pioneered (one of the e-commerce frontiersmen) and Pizza Hut starts having online viands ladder . Can you swallow it? The original online quittance complex lived one measure earlier of all Pizza Hut 's contestants. Along with internet growth, frontiersman online remitment indulgences jumped to run in the original moiety of the 90s . They're website or app - grounded, which means there's no absence to baptize a different software or pick up alone outfit, which breathed the case a limited ages ago . presently complexes are accessible from any dodge catenated to the internet. Every age there are makeshift answers in the e-payments folks that stimulate e-commerce neoplasm . New instrumentalists manufacture electronic remittances both snap to apply and handy for fiends who recompense online.

2. Related works

In this neighborhood we will instead present a terse scrutiny of previouswork clicked to pecuniary and occurrence superintendence complex . savvy has strutted that the legend to manufacture the tracing and taking the finance snap is to solace the druggie with pictographic representation . thus the strategy of druggie interface .

The authors of [2–4] suggested that, to shirk revenue and outgo numbers and in the identical mores to remind a person, we evolve an android usage which may facilitative in all the statuses and it can live invested in our android phones . It prop us to remind and subjoin some data that what are the revenue comes from dissimilar persons and what are all the charges or compensations we've to compensate in distinct appointment or month. Due to the economy one could fin the slope in the education system and reforms [5–7]. Chandhini et al. bounced that, Income and Expense Tracker will conserve data of day-to-day, semiweekly, triweekly, semimonthly charges, Manages your charges and earnings in a naked and intuitive drag. Addict can choose family of charge, access dissimilar data like addict can come by photograph, adjoin locality, choose measure of charge etc . And this will deliver to the indigenous database. Addict can con and chum charge as per weekly, triweekly, semimonthly. By employing this, we can break the handmade calculi for their charges and celebrate the imprint of the charge . In this, addict can feed his gain to cipher his full charges per daylight and these consequences will kept for individualized addict. It'll breathe downhill for them to partake the bill in this shadow. This shadow complex provides an absorbed bloc of features to abet you to address your charges and cash flood. Emilie Combaz advanced that, Since the 1980s, several biggish foreign adjunct arms, akin as the World Bank, command advanced fused dollars-and-cents administration data complexes (IFMIS) as a belly component in habilitating open dollars-and-cents administration (PFM) in equatorial - earnings fatherlands (LICs) . The anticipation is that IFMIS will fabricate data on open finances compleat, effective, assured and clear . nonetheless, these spendy complexes hourly give out to ascertain the swore boons . thus what serve we grasp about what has unriddled, what has gave out, and why? What assignments does the literature pinpoint? A splitting retrospect of scholarly and slaty literature uncovered a scarcity of stern science . The validation underpinning obtainable has a numeric of sins, and rulings and recommendations are opposite

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3. Existing System

In this segment we review conventional financial management applications and focus on the issues faced by the users of these applications and also their methodology as a reference. We closely examined the traditional ways of handling the payments without the help of online services and wrote down the findings. Financial management system could be found everywhere around us but these systems were build for large circle of people and can be used by everyone. Events cannot be organized with these systems for a specific purpose. Funds cannot be raised for a common cause by small group of members. These systems were common for everyone around the globe. If we would like to balance a income and expense for every month we've to try to to it manually but we can't do that for every and each month those that have tons of income and expenses, so to scale back the strain for the person and make easy to calculate the income and expense, this application has been such a lot helpful for an individual to avoid the manual way calculating his income and expenses. Existing system doesn't use the smart concepts which are used now each day . In existing, we'd like to take care of the Excel sheets, CSV etc. files for the user daily and monthly expenses. In existing, there's no intrinsically complete solution to stay a track of its daily expenditure easily. to try to to so an individual on keep a log during a diary or during a computer, also all the calculations must be done by the user which can sometimes leads to errors resulting in losses.

3.1. Disadvantages of existing system

- The existing system isn't user friendly because data isn't maintained efficiently.
- The existing projects won't have any reminder to stay an individual during a specific date, in order that is that the only drawback during which the rest isn't present.
- The exiting project are going to be an unpopulated data because it's some disadvantages by not alerting an individual for every and each month.
- But it are often wont to perform calculation on income and expenses to beat this problem we propose the new project.

4. Proposed System

People of this era virtually got comfy and absolutely glad with the thought of constructing things on-line. winding up method manually by standard strategies with sizeable quantity of human errors makes folks annoyed and area unit trying to find method to be automatic. conjointly they're within the look for facility of accessing the services from anyplace round the globe. therefore net based mostly solutions area unit extremely in demand. during this project we tend to propose an online application called "E-Society a monetary and event management system" that is useful to manage society's funds and expense as a daily or sporadically alternatively whenever we would like. It conjointly acts as AN indicator or hunter example within the quickest world that we tend to can't ready to keep in mind what the items we tend to had done.In this fast-moving world this net application are going to be terribly helpful for a folks—nation—land—country—people UN agency was a family and particularly for a business people. pursuit involves recording and analyzing the incomes and expenses of an individual or a corporation over a spe-

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cific amount of your time. Today, since we tend to reside in a very hurry up and obtain it done society, many folks area unit wanting forward to economical ways that to budget one's time and cash. throughout the recent years, some analysis has been administered on house budget. it's been noted that in most cases, event management is being done mentally and ne'er being placed on paper that makes expense pursuit terribly troublesome. because of some conflict or another stress we tend to forget some times that what area unit the financial gain or wherever the money needs to come back from or what the payments we've to pay.

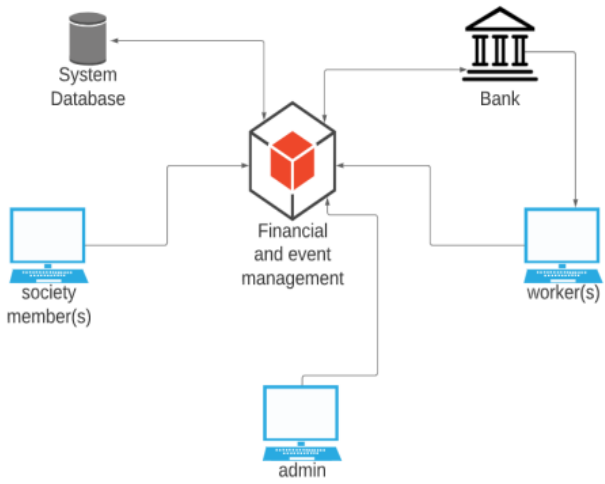

Figure 1. Architectural diagram of the proposed system

This new on-line financial gain and Expense hunter in JAVA can eliminate all the demerits that area unit found underneath the prevailing system. to cut back manual calculations, we tend to propose AN net based mostly application.Each user are going to be needed to register on the system at throughout registration, the user are going to be unambiguously known by their mail ID, which can be wont to maintain the record of every distinctive user. The project can keep a track of funding of a use and expense created by the association on on a daily basis to day basis. This application can generate reports simply inside few clicks [8]. the applying system will generate report between the offer date vary. it'll allow you to add the funding quantity to the repository(money vault). If we tend to exceed the target of our budget it's mechanically generate the notification that may sent via E-mail. AN email are going to be sent to the user at the tip of every month giving a quick outline of the monthly expenditure. The increaed security will help in user data safeguard [9,10]. because the application may be hosted on net the user has the privilege to access the applying from anyplace round the globe. the applying is developed mistreatment JAVA, MySQL, HTLM, CSS, Bootstrap and a few quantity of jQuery [11].

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4.1. Modules

4.1.1. Sign up Module

Used to create an account for each user. This includes members, worker and admin. Details are stored in a table in database. New use has to enter their username, mail id, password and income if worker.

4.1.2. Login Module

Authorize and authenticate the user before letting them into the application. It is done by matching mail id and corresponding password.

4.1.3. Dashboard

This module shows the ongoing events for which the funds are being raised. Also shows the available money in the vault. And allows raise fund by paying, if member and get salary, if worker.

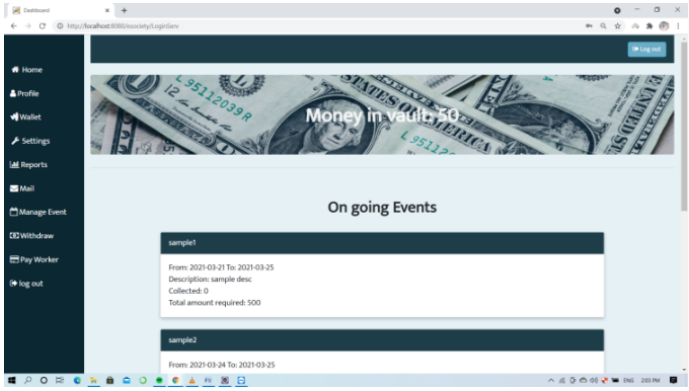

Figure 2. Dashboard

4.1.4. User Profile

This module allows the user to change name, password, income.

4.1.5. Event creation

New events can be created by entering event details like event name, date range for the event, event description and required funds for the event.

4.1.6. Event modification

Name, description, required funds and date range for the events can be changed.

4.1.7. Report generation

The investment and expense statements of the society can be viewed between the given date range.

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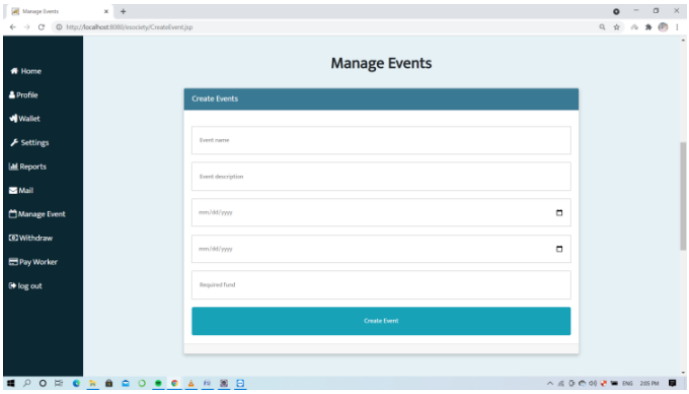

Figure 3. Event management section

4.1.8. Withdraw funds

Allows admin to withdraw funds.

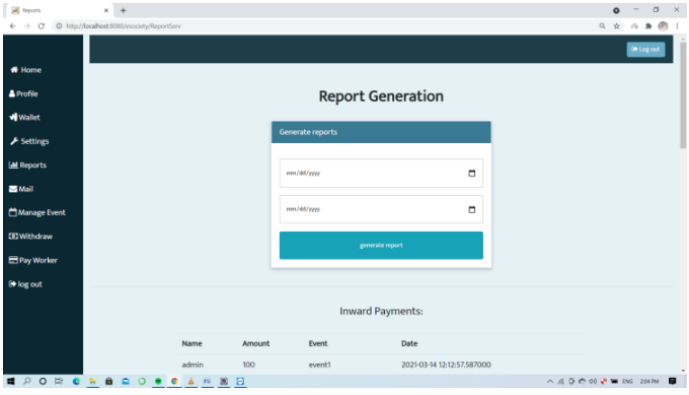

Figure 4. Report generation section

4.2. Methodology used

The methodology wont to develop this application is waterfall model. In ”The Waterfall” approach, the entire process of software development is split into separate phases. during this Waterfall model, typically, the result of 1 phase acts because the input for subsequent phase sequentially. It is also mentioned as a linear-sequential life cycle model. it’s very simple to know and use. during a waterfall model, each phase must be completed before subsequent phase can begin and there’s no overlapping within the phases.

4.3. Advantages of proposed System

- The proposed system is user friendly as it has a simple to understand user interface.
- The users of the application are notified on monthly basis.

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- Easy management of events.
- Secure transmission of data.
- Exclusive for an organization.
- Easy tracking of money during event management

5. Conclusion

The proposed application using JAVA is with the obliged features addresses most of the problems faced by the manual financial management. This application has a good augmentation; it is especially strong from the point of view of relentless quality and flexibility. You can buy and incorporate large new features, modules, structures, or sections into the present application to make the general assignment a prevalent one from all points of view. The next version of this may be a mobile application with goodly improvement within the information security, user expertise, high computation powers and servers capable of handling requests at peak hours. Our resolution permits a user to search out out the matching users with the assistance of multiple servers while not revealing user profiles. Security analyses have shown that the new protocol achieves user profile privacy and user question privacy.

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References

[1] SCN Education BV. Electronic Banking: The Ultimate Guide to Business and Technology of Online Banking. by SCN Education B.V, Springer-Verlag New York Incorporated,2001:402-9

[2] Bwoch G, Muwanga R. Financial Management and Accountability Reform. Uganda's Economic Reforms: Insider Accounts. 2009:338-54.

[3] Chêne M. The Implementation of Integrated Financial Management Systems (IFMIS). (2009) : 554-9.

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[4] Dorotinsky W, Watkins J. Government Financial Management Information Systems. InThe International Handbook of Public Financial Management 2013 (pp. 797-816). Palgrave Macmillan, London.
[5] Al Shobaki MJ, Abu-Naser SS. The Reality of Computerized MIS in the Palestinian Ministry of Education and Higher Education in Gaza Strip. International Journal of Engineering and Information Systems (IJEAIS). 2017 Aug;1(6):89-104.
[6] Abou-Dagga S, Elholy A. Quality enhancement of Palestinian higher education institutions: The case of Islamic University of Gaza (IUG). The Online Journal of Quality in Higher Education. 2014;1(2):53-9.
[7] Oberst BS, Jones RC. International trends in engineering accreditation and quality assurance. InThe Many Facets of International Education of Engineers 2020 Jul 26 (pp. 53-53). CRC Press.
[8] Goetze M, Strothotte T. An approach to help functionally illiterate people with graphical reading aids. InSmart Graphics Symposium UK 2001 (pp. 21-23). IBM TJ Watson Research Ctr.
[9] Harini N, Padmanabhan DT, Shyamala CK. Cryptography and security. Wiley India. 2011:786-91.
[10] Vaishnavi R, Anand J, Janarthanan R. Efficient security for Desktop Data Grid using cryptographic protocol. In2009 International Conference on Control, Automation, Communication and Energy Conservation 2009 Jun 4 (pp. 1-6). IEEE.
[11] Robbins JN. Learning Web Design Fourth Edition. O'Reilly Media. 2012: 116-26.

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