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International Conference on Computing, Communication, Electrical and Biomedical Systems

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Preface

We are delighted to introduce the proceedings of the first edition of 2021 International Conference on Computing, Communication, Electrical and Biomedical Systems (ICCCEBS), which aims at exploring the interface between industry and real-time environment with state-of-the-art techniques. Also, high-quality research contributions describing original and unpublished results of conceptual, constructive, empirical, experimental, or theoretical work in all areas of computing, communication, electrical, and biomedical systems have been invited for presentation at the conference.

The 2021 International Conference on Computing, Communication, Electrical and Biomedical Systems aims to bring together leading academic scientists, researchers, industry representatives, postdoctoral fellows, and research scholars around the world to share their knowledge and research expertise; to discuss in the area of computing, communication, electrical, and biomedical Systems; as well as to create a prospective collaboration and networking on various areas. The proceedings include a selection of 55 papers from 354 papers submitted to the conference from academic institutions, universities, and industries all over the world. Coordination with the Chief Patron Dr. K.P. Ramasamy, Chairman, KPR group of Institutions, Coimbatore, India; Patron Dr. A.M. Natarajan, Chief Executive Officer, KPR Institute of Engineering and Technology, Coimbatore, India; and General Chair Dr. M. Akila, Principal, KPR Institute of Engineering and Technology, Coimbatore, India, was essential for the success of this conference. We thanks to our Chief Guest and Keynote Speaker Prof. Ir. Dr. Abu Sahmah Bin Mohd Supa'at, Professor and Chair, Innovative Engineering Research Alliance, Universiti Teknologi, Malaysia, for his constant support and guidance.

It was also a great pleasure to work with such an excellent organizing committee, and their hard work in organizing and supporting for the event is acknowledged. In particular, the Convener Dr. M. G. Sumithra, Professor and Head/CFRD, KPR Institute of Engineering and Technology, Coimbatore, India; Co-convener Dr. K. Mohanasundaram, Professor/EEE, KPR Institute of Engineering and Technology, Coimbatore, India; and Dr. K. Vishnu Kumar, Associate Professor/CSE, KPR Institute of Engineering and Technology, India.

The Conference Chairs Dr. N. Yuvaraj, Professor and Head/AI&DS, KPR Institute of Engineering and Technology, Coimbatore, India; Dr. D. Ganeshkumar, Professor and Head/BME, KPR Institute of Engineering and Technology, Coimbatore, India; Dr. P. Thangaraj, Professor and Head/CSE, KPR Institute of Engineering and Technology, Coimbatore, India; Dr. M. Kathirvelu, Professor and Head/ECE, KPR Institute of Engineering and Technology, India; and Dr. V. Kumar Chinnaiyan, Professor and Head/EEE, KPR Institute of Engineering and Technology, India, who have completed the peer-review process of technical papers and made a high-quality technical program.

The accepted papers were subjected to strict peer reviewing by three or four expert referees. The papers have been selected for this volume because of quality and the relevance to the topics. ICCCEBS 2021 would like to express sincere appreciation to all authors for their contributions to this work.

We would like to extend our thanks to all the referees for their constructive comments on all papers; we would especially like to thank the organizing committee for their hard work.

We wish to thank Eliška Vlčková, Managing Editor, European Alliance for Innovation (EAI), for her continuous support and encouragement. Finally, we would like to thank the EAI/Springer Innovations in Communications and Computing Book Series for producing this volume.

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Part I
Electrical, Computing and Communication Networks

Designing an ML-Based Congestion Detection Algorithm for Routing Data in MANETs

Konduri Sucharitha and R. Latha

Abstract A wireless communication system using the ad hoc network plays an important role in the telecommunication system. Each node in the ad hoc network is autonomous and configured its own nodes. The node is used to send, receive, and transmit the information from source to destination using the telecommunication system. In wireless communication, nodes move randomly and adapt themselves to any environment without any fixed infrastructure or centralized administration. All the nodes in MANETs can reconfigure inter-connections dynamically due to their arbitrary nature. The frequent topology changes in the mobile ad hoc network cause significant changes and competition in wireless communication channels. One of the most essential concerns for providing safe and reliable transmission between endpoints is recognizing and detecting network congestion. Many congestion control algorithms have been proposed for MANETs. This paper mainly focuses on designing and developing a Machine Learning-based model using the K-means clustering method that classifies the congestion into fewer nodes for packet transmission by considering the QoS parameters such as bandwidth, delay, throughput, packet delivery ratio, and network overhead.

Keywords MANET · Wireless sensor network · Ad hoc network · Packet delivery ratio · Trust score · AODV · DSDV · CEESRA

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1 Introduction

Ad hoc networking, through mobility, plays an important role in wireless sensors. The mobile ad hoc network is a network built on ad hoc with a volatile process. This mobile ad hoc network is made up of a variety of mobile nodes that function as independent units and are flexible in sending analogue data from one node to the next [1]. The infrastructure of the wireless sensor network is quick to deploy in the wireless environment and is implemented in the various domains of real-time applications.

Figure 1 represents the process of MANET.

The process of MANET involves a node, or router. Data is transmitted to the destination node from the source node. In a wireless sensor network, this is the node that sends and receives data. In a single-source shortest path problem, the router is primarily concerned with improving strategies for routing data from the source to the destination. These routers may break via the activities of the node transmission such as the data loaded on the network, bandwidth with insufficient data, and power insufficiency. MANET includes various categories of nodes through mobiles that are distributed with every node without existing hardware communication or commonly stored management. With the swift movement of these mobile nodes and frequent changes in the network topology, routing a packet is the greatest challenge for these kinds of networks [2]. Communication focused on wireless mobile includes MANETs, experiencing a layer focused on transport for transmitting data and providing proper attributes such as protocol to transfer data. The attributes used by the protocol on the transport layer are used to determine the traffic control process to determine the efficient allocation of the wireless network and optimize the network.

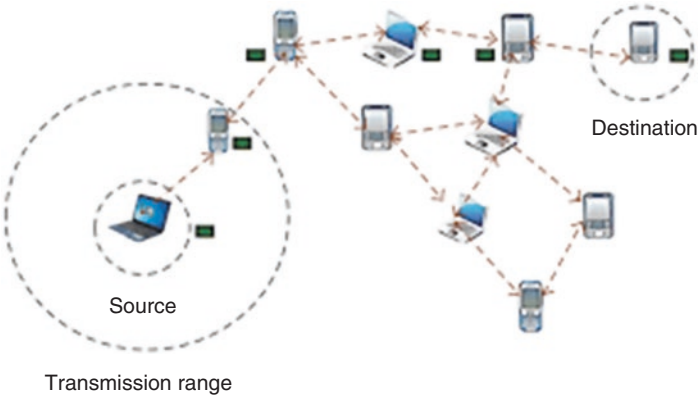

Fig. 1 Process of MANET

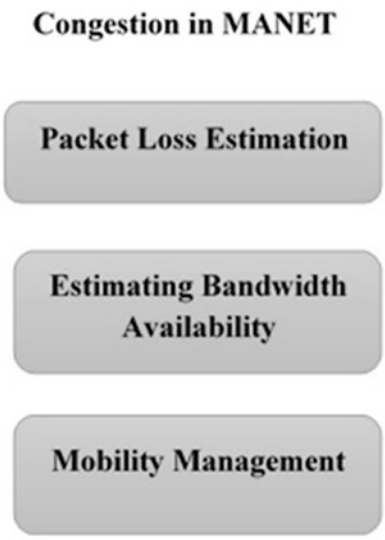

Fig. 2 Congestion in MANET

1.1 Congestion in MANET

Congestion control is a method that uses a wireless sensor network to control the entire telecommunications system. Congestion, such as traffic and data loss, can be avoided by collapsing the processing and capacities of intermediary nodes to reduce the number of steps involved in obtaining resources [3]. Various challenges in the transmission of data using congestion are referred to in Fig. 2.

Packet Loss Estimation: This is the packet that is sent by the sender, and the packet that may not be received by the receiver due to transmission.

The packets which focus on transport protocol traditionally lead to the packet loss which causes congestion. This process may lead to congestion in the degradation process of management.

Estimating Bandwidth Availability: According to the market, network condition estimation and congestion management [4] square measures are required within the transport layer for adverse combating of the information measure and delayed conditions in MANETS. To send prime quality media files, finding the network information (jitter, packet delivery quantitative relation, and delay) is extremely vital. As a result, in the market, information measurement is taken into account as part of the side concert for reliable information transmission.

Mobility Management: In MANETs, links between nodes are measured at [5] start and break because every node is mobile indiscriminately. The resulting routes are often extraordinarily volatile, creating winning circumstantial routes captivated with efficiency as they react to those topology changes. There are two forms of qual-

ity models: Entity quality models that represent the nodes' movements are from the square measure, free of every other.

- Nodes in cluster quality models represent movements whose square measure is captivated by one another. The model examines numerous parameters of a network, including node quantity, the dimension of the network, and the range of transmission radio.

1.2 Clustering Using K-Means

The cluster approach is a strategy for organizing knowledge into distinct categories with similar features. It is the most well-known bunch technique due to its ease of application and quick convergence. The growth knowledge clustering indicates if we will utilize the K-means cluster algorithmic program for the bunch. In the K-means algorithmic program, it is straightforward and quick, and it selects a K centre arbitrarily.

Hence, seeding of the centre is quick, but the information is slow. The drawback of K-means is that the user must outline the centre of mass purpose. This becomes even more important when managing document collections because each central purpose is represented by a word, and calculating the distance between words is not a simple task.

The procedures for implementing K-means clustering are as follows:

- Elect K nodes into the area incontestable by the objects that become clusters. These opted nodes are going to be designated as initial cluster centroids.
- Assign every object to the set that has the adjacent centre of mass.
- Despite everything, objects are allotted; estimate the placement of the K centroids.
- Repeat Steps 2 and 3 up to the centroids, which are now moving. This method segregates the objects into clusters based on the standards to be reduced.

1.3 Mobile Ad Hoc Networks Criteria

The mobile ad hoc networks have the following criteria as displayed in Fig. 3.

Throughput: It is best to use a wireless routing protocol that has the highest probability of knowledge delivery and the lowest probability of packet loss. As a result, the problem in wireless networks has always been focused on an end-to-end high capability path.

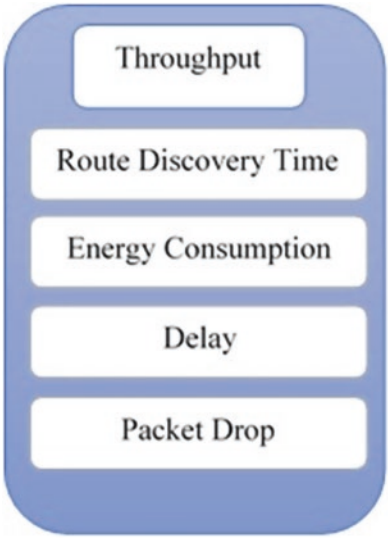

Fig. 3 Mobile ad hoc networks

Route Discovery Time: All route discovery mechanisms aim to construct, maintain, and repair methods between nodes in a very large network. In a MANET, overhead packets will be propagated to regions wherever they make no sense. However, they still consume inadequate network resources. Therefore, reducing the route discovery time means guarding against the ineffective use of network resources in MANETs.

Energy Consumption: Whereas battery life limits network node autonomy, energy consumption may be a major issue for all wireless networks. Choosing a non-optimized approach with an unreliable link would almost certainly result in increased delays, higher retransmission rates, and higher energy consumption. Most of the research focuses on the communication protocol style. For instance, the routing protocol uses a manipulated impromptu Ad Hoc On-demand Distance Vector (AODV) route to be applied by low-power devices.

Delay: It is intriguing to figure out which network path has the least amount of latency. The delay of a network path defines how long it takes a packet to go from one node or terminal to the destination node via the connection of host supply. It is generally done in fractions of a second. Depending on the precise position of the associated node's attempt, the delay might vary significantly.

Packet Drop: In MANETs, packet loss occurs when one or more packets of data traveling across an electronic network fail to reach their destination. Wireless link transmission errors, quality, and congestion are major reasons for packet drop.

2 Literature Survey

Researchers in [6] reported that client-to-client congestion management had been extensively studied for more than 30 years, mutually confirming the most important process for ensuring the economical, truthful distribution of network resources among users. Future networks were becoming increasingly complex. Errors and inefficiencies resulted from typical rule management congestion. Researchers began pushing their expertise towards the approach based on rules-based Machine Learning (ML) after seeing a significant advance in Machine Learning (ML), which proved to be a large-scale solvable problem. Either way, these facilitate the intermediate to create congestion focused on intelligent management calls, bringing home the bacon of increased performance.

Researchers in [7] described how intelligent data technology plays an important role in the document of trade four. Encapsulating IIoT with Machine Learning is critical to achieving industrial-based intelligence with the internet of things (IIoT). The heterogenous network based on IIoT has become dynamic and changeable as the number of terminals on a large scale has increased. This paper first proposes a CC-based IIoT design for intelligent IIoT services and expounds two ML strategies for analysis focused on IIoT with deep learning (DL) and reinforcement learning (RL). Second, applications on the advancement level and improvement trends in the CC are summarized in the industrial field. Challenges and improvements to the architecture of CC with analysis of IIoT are mentioned. Finally, this proposed paper aims to indicate the behavior of AI (Artificial Intelligence) on IIoT during the large read with data.

Researchers in [8] outline a method for distributing various metrics in a logical manner, based on far path performance. The prevailing protocol focused on the proactive protocol and the reactive protocol, that is, Ad-Hoc On-Demand Distance Vector (AODV) and optimized link-state routing protocol (OLSR). The AODV tends to provide a method for the route request which has yet to be modified, and a reply mechanism based on the route to get a path which is stable to mistreatment MCDM. The OLSR concept plays a vital role in the Totendency to modification strategy, which proposes an MPR choice formula to take care of topology focused on stable mistreatment MCDM. The proposed results show that the planned theme with routing reduces the overhead by V-day and 13, packet loss rate by the 12-tone system and Bastille Day, and peer-to-peer delay by 21st and 19 seconds. Researchers in [9] studied different schemes in routing, such as MCDM, OLSR, and AODV, based mostly on routing protocols on geographical information.

3 Proposed Optimization Scheme

The proposed research work consists of three phases: (a) selecting, (b) formulating, and (c) optimization of the path as shown in Fig. 4.

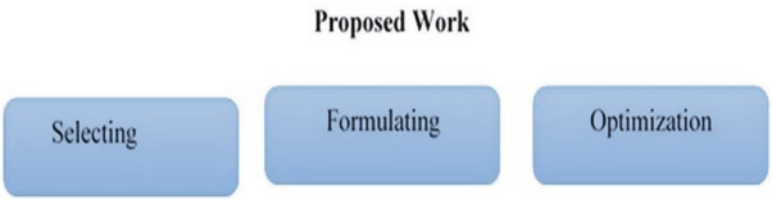

Fig. 4 Proposed optimization scheme

Phase 1: Selecting: The process of selecting the centre head initially starts by selecting random nodes in the network thereby applying the K-means clustering algorithm to find the cluster heads. Allocation of nearest nodes with minimum Euclidian distance in the network N to the clustering heads C is as follows.

$$D = \text{Sqrt}\left[x_2 - x_1\right]^2 + \left[y_2 - y_1\right]^2 \tag{1}$$

$$\text{Calculate Avg Min D}\left(x_i, c_j\right) \tag{2}$$

where

$$C = \sum i_{1\,\text{to}\,n}\, x_i \,/\, n$$

In the above formula, (1) and (2) calculate the new centroid for each cluster and assign the nearest node x_i to the cluster c_j by calculating the average minimum distance D for each cluster $j = 1, \ldots, K$.

Phase 2: Formulating: Formulating the objective function by considering the parameter to detect the congestion: Congestion aware parameter can be determined by K-means algorithm from each node by using the following parameters: explicit link failure notification, buffer availability, packet loss, notification, packet delay, round trip time, packet delivery ratio, and available bandwidth.

The average means of all clusters by considering the congestion awareness parameter *cwpiin*, the network N can be determined by the objective function $f(cwpi)$ for each cluster head as follows.

$$f\left(cwpi\right) = Avg\left(\min \sum j = 1 \sum j\, cwpi \left| xi - cj \right| 2\right) \tag{3}$$

Where, $cwpi = [cpw1, cpw2, \ldots, cpwk]$ is the congestion aware parameter for all the centroid (cluster heads) in the network N.

Phase 3: Optimization: To find the optimal path between the end nodes, two parameters are considered 1. The received signal strength (RSS) is denoted by 'r' 2. Link availability time (LAT) 'l' chooses the next node for transmitting the data. The

optimal node to carry the data can be determined by the K-means objective function $f(yi)$ for each cluster can be formulated as

$$f\left(yi\right) = \max \sum i = lrilj \tag{4}$$

4 Experimental Result

The proposed research work consists of selecting, formulating, and optimization techniques to determine the congestion detection system based on the Machine Learning system. A simulation experiment was conducted by the NS2 tools based on the ML-Based Congestion on Routing Algorithm. For the experimental results, a collection of 50 sample nodes was considered using the network simulator. This experiment determines the traffic of the network, the node used, and a model based on propagation and routing protocols using OTcl Scripts. Two files were considered for the simulation, such as a file for processing the data and a file for visualization using the NAM file. ML-CA routing protocol performance will be compared with conventional routing algorithms (AODTV, DSDV, and CEESRA).

Experiment Result 1: Packet Delivery Ratio (PDR)

Table 1 is generated with ML-Based Congestion Detection Algorithm (ML-CA) along with AODTV, DSDV, and CEESRA.

Table 1 represents the comparison of packet delivery ratio using the proposed algorithm (ML-CA) along with AODV, DSDV, and CEESRA algorithm.

Experimental Result 2: Average Trust Score in Percentage for Cluster

Table 2 is generated to determine the average trust score in determining the percentage of the cluster along with the proposed techniques.

Table 2 is estimated with the number of nodes and along with the clusters in determining the trust score of the proposed work.

Table 1 Comparison of PDR

Algorithm	PDR
ML-CA	97.65
AODV	94.52
DSDV	96.89
CEESRA	95.55

Table 2 Trust score of the proposed work

Number of nodes	Number of clusters	Trust score			
		MLCA	AODV	DSDA	CEESRA
100	5	87.25	85.62	84.22	86.34
200	10	89.66	88.43	88.95	87.26
300	15	84.26	81.89	79.65	82.43
400	20	91.35	89.6	85.4	88.76

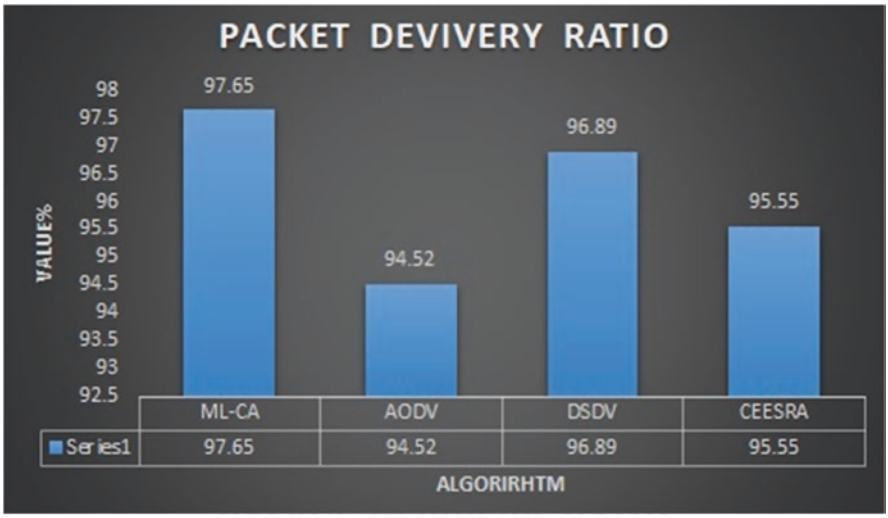

Fig. 5 Packet delivery ratio

5 Result and Analysis

Result Analysis-1: From the experimental result 1, the following graph is generated as shown below in Fig. 5.

According to Fig. 5, the proposed work proved (with the sample data) to have the highest packet ratio when compared with the existing algorithm. This proposed work has proven to be more efficient in the packet delivery ratio.

Result Analysis-2: From the experimental result 2, the following graph is generated as shown in Fig. 6.

The following graph represents that the trust score of the proposed work is more effective and efficient when compared with the existing algorithm, which is verified with the sample data taken for consideration.

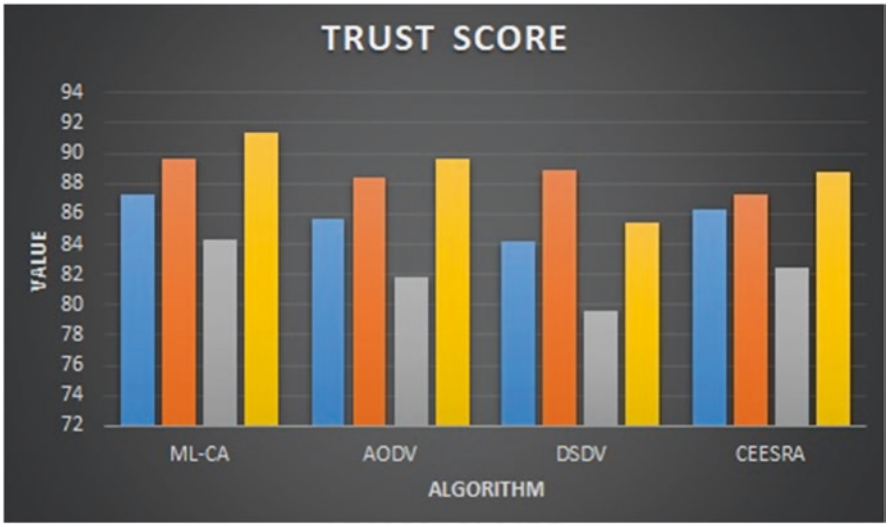

Fig. 6 Trust score

6 Conclusion

Designing an ML-Based Congestion Detection Algorithm (ML-CA) for Routing Data in MANETs is proposed. Due to the random mobility nature of the network, electing the cluster heads and determining the optimal node to transmit the data is a challenging task. In this paper, this challenge is addressed with the K-means clustering algorithm, which will result in a drastic change in increasing network flow by identifying the congestion-ware nodes and identifying the next probable node for transmitting the data. The performance of the proposed work (determined by the packet delivery ratio and average trust score of the packet data in the MANET) proved to be effective and efficient.

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Empirical Analysis of the Effect of Resampling on Supervised Learning Algorithms in Predicting the Types of Lung Cancer on Multiclass Imbalanced Microarray Gene Expression Data

S. Aruna and L. V. Nandakishore

Abstract Supervised learning algorithms need a sufficient number of labelled samples for training the model. The predictive power of the classifiers is affected if the class distribution is imbalanced, i.e. number of samples of each class is not equal. The class which has more number of samples is called as majority class, and the class which has less number of samples is called as minority class. Resampling is one of the pre-processing techniques that can be used to alter the number of samples of majority and minority classes. This study analyses the impact of resampling on supervised learning algorithms in identifying the types of lung cancer. The publicly available lung cancer microarray data set is used for the study. The lung cancer data set consists of 203 records of 12,600 genomic expression values belonging to five cancer types. The fractional proportion of each class type is 0.68, 0.08, 0.02, 0.10 and 0.09, respectively. The supervised learning algorithms, namely, support vector machines, Naive Bayes, k-nearest neighbour, decision tree classifier and multilayer perceptron, are used to predict the lung cancer types before and after resampling the lung cancer data set. The comparison of the results showed that the predictive power of the supervised learning algorithms has improved considerably after resampling the data set. The TOPSIS ranking of the resampling algorithms with respect to the classifiers showed that SVM-SMOTE is the best choice for resampling unbalanced multiclass data set.

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Keywords SVM-SMOTE · SVM · KNN · Naive Bayes · MLP · Random forest · TOPSIS

1 Introduction

Accurate and fast diagnosis of the disease is important for deciding the treatment strategy as more treatment options are available for early diagnosis of diseases. Manual diagnosis of diseases by the physicians is prone to some percentage of error and delayed when stress, increased number of patients, time constraints, immense work load and lot of tests are involved. Having an expert nearby all the time to assist in diagnosis process is a feasible solution. Clinical decision support systems (CDSS) using supervised learning algorithms help physicians in the challenging task of fast and accurate diagnosis of diseases. CDSS helps in reducing the cost of referring a human expert for secondary opinion and the need for additional diagnostic procedures in differential diagnosis of the disease. The performance of the CDSS depends on the framework of the model used for classification with supervised learning algorithms. If the data set used for model creation contains same distribution of class samples, then the data set is called balanced data set, otherwise called as imbalanced data set. The predictive power of the supervised learning algorithms is affected when imbalanced data sets are used for training the model. In imbalanced data set, the class with major distribution count is called majority class and with minor distribution count is called minority class. Imbalanced data set needs sufficient pre-processing techniques to balance the class distribution before framing the model.

Resampling is the commonly used pre-processing technique for balancing the class distribution. There are many resampling techniques available. The selection of resampling technique is a major dispute for many researchers while using multi-class imbalanced data set as the majority and minority classes vary in number in contrast with binary imbalance data set having only one majority and minority class. There is a need for identifying the best resampling technique which aid in improving the efficacy of the supervised learning algorithms with respect to multi-class data set.

This study analyses the impact of various resampling techniques on predictive power of supervised learning algorithms in detecting the types of lung cancer. The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method is used to rank the resampling models.

TOPSIS ranking helps identify the best, alternative and worst choice of the resampling techniques with respect to classifiers. Section 2 of the article gives the description about data set and the experimental model framework used for testing and evaluation, Sect. 3 presents the results and concluding remarks are given in Sect. 4.

2 Materials and Methods

2.1 Data Set Description

The lung cancer data set used in this study is publicly available in nucleotide microarray of transcript sequences of 12,600 mRNA expression levels taken from 186 lung tumour samples and 17 normal lung samples [1]. There are 203 instances in the data set labelled into five distinct classes, namely, class 1 of lung adenocarcinoma (LD), class 2 of normal lung (NL), class 3 of small-cell lung adenocarcinoma (SMCL), class 4 of squamous cell lung adenocarcinoma (SQ) and class 5 of pulmonary carcinoids (COID) with a count of 139, 17, 6, 21 and 20 instances, respectively. The fractional proportion of each class type is 0.68, 0.08, 0.02, 0.10 and 0.09, respectively. Table 1 presents the class count and its fractional proportion of lung cancer data set.

2.2 Supervised Learning Algorithms

Five supervised classifiers are used for the study. They are Naive Bayes, support vector machines (SVM) of kernel-type linear, k-nearest neighbour (KNN), multilayer perceptron (MLP) and random forest. Naive Bayes classifier is a statistical classifier based on the Bayes theorem with the assumption of class conditional independence, i.e. a feature value's effect on the given class is independent of the values of other features in making a decision [2]. Equation 1 shows the Naive Bayes classifier where P is the probability, C' is the class variable and F_1 through F_n are feature variables. The denominator is independent of C'. Due to the conditional independence of the attributes, only the variances of attributes for each class are determined instead of computing the entire covariance matrix [3]:

$$p\left(C|,F_1|,\ldots|,F_n\right) = \frac{p\left(C\right)p\left(F_1,|\ldots,|F_n,|C\right)}{p\left(F_1,\ldots,F_n\right)} \tag{1}$$

Table 1 Lung cancer data set description

Class number	Class name	No. of instances	Fractional proportion
1	Lung adenocarcinoma (LD)	139	0.68
2	Normal lung (NL)	17	0.08
3	Small-cell lung adenocarcinoma (SMCL)	6	0.02
4	Squamous cell lung carcinoma (SQ)	21	0.10
5	Pulmonary carcinoids (COID)	20	0.09

Support vector machines (SVM) are based on the principle of structural risk minimization (SRM) [4]. SVM has a number of advanced properties, including the ability to handle large dimensional data, effective avoidance of over fitting and information condensing for the studied data [5]. If there are dependent relationships among the variables, additional computations are made to understand the relationships, and this can be realized by a mapping (Eq. 2) through the kernel function [6]:

$$k(x,y) = \phi(x), \phi(y) \tag{2}$$

K-nearest neighbour classifier classifies each data point using the representation from *k*-nearest neighbours of the data point [7]. By calculating the distance between the data points and the *k*-nearest neighbours having maximum representation, the data point is assigned to a cluster or class having maximum of *k* similar data points. The *k* value depends on the data set used for classification [8].

A multilayer perceptron (MLP) has at least three layers of nodes such as input layer nodes, hidden layer nodes and output layer nodes. It is an artificial neural network similar to neurons in the nervous system. The nodes in one layer connect with the nodes of another layer using weighted activated function [9].

Random forest is a tree-type classifier that creates a tree during supervised learning process. It is an ensemble classifier based on a bagging concept which randomly splits the tree at each step of learning based on the correlation of the attributes with respect to their labels [10].

2.3 Resampling Techniques

Five resampling methods are used in this study. They are Random Oversampler, Adasyn, Smote, Svm-Smote and KMeans Smote. The sampling strategy used for resampling is not majority. Only minority class samples are resampled in this study. The Random Oversampler randomly selects the minority class samples and resamples them to balance to the count of majority class.

Adasyn is the adaptive synthetic sampling (ADASYN) [11]. Synthetic samples are generated for the minority classes. At each step it adapts to the new decision boundary by computing the k-nearest neighbours of each minority class sample. It is a modified technique based on SMOTE.

Smote is the synthetic minority oversampling technique (SMOTE) [12]. It generates synthetic samples for the minority classes by randomly selecting the samples of minority classes and finds its k-nearest neighbours. Calculating linear interpolation between them generates synthetic samples for the minority classes. The SVM-Smote [13] and KMeans Smote [14] are variations of smote. Smote method has overfitting problem. Svm-Smote and KMeans Smote are designed to overcome the overfitting problem.

2.4 Framework for the Experiment

The lung cancer data set used in the study is split into two sets: X as observations and Y as class labels of the corresponding observations. A set of resampling models R is created using the resampling models, namely, Random Oversampler, Adasyn, Smote, Svm-Smote and KMeans Smote. A set of classifiers C is created using the supervised learning algorithms such as Naive Bayes, Svm with kernel-type linear, *k*-nearest neighbour, multilayer perceptron and random forest. For each resampling model in R, sets X and Y are resampled using the model as Xres and Yres. The resampled data set Xres and Yres are split into training set Xtrain, Ytrain, Xtest and Ytest with a ratio of 70:30 as training and test sets. Each classifier in C training model CM is created using Xtrain and Ytrain. The CM is used for predicting the Xtest as Ypred. The Ypred is compared with Ytest, and the predictive measures such as accuracy, cohen-kappa, weighted precision score, weighted recall score and weighted f measure are computed. Accuracy is the percentage of predictions that are correct. The precision is the measure of accuracy provided a specific class has been predicted. Recall is the percentage of positive-labelled instances predicted as positive. Accuracy, precision score, recall score and f score are calculated using Eqs. (3), (4), (5) and (6), respectively, where the number of true positives is denoted by TP, the number of true negatives is denoted by TN, the number of false positives is denoted by FP and the number of false negatives is denoted by FN. Then the weighted precision score (wpr), weighted recall score (wrc) and weighted f1 score (wf1) are calculated by allocating weights according to the number of samples present in each class [15]:

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN} \tag{3}$$

$$\text{Precision} = \frac{TP}{TP + FP} \tag{4}$$

$$\text{Recall} = \frac{TP}{TP + FN} \tag{5}$$

$$F = 2 * \left(\text{precision} * \text{recall}\right) / \left(\text{precision} + \text{recall}\right) \tag{6}$$

The accuracy, cohen-kappa, wpr, wrc and wf1 are consolidated and tabulated for each classifier used in the study. A decision matrix is created from each table of consolidated results for the classifiers used in the study. The decision matrix is then normalized and the Euclidean distance from the ideal best and worst, performance score, ranking are computed using the Eqs. (7), (8), (9), (10) and (11) [16]. Figure 1 shows the steps in the framework for the experiment:

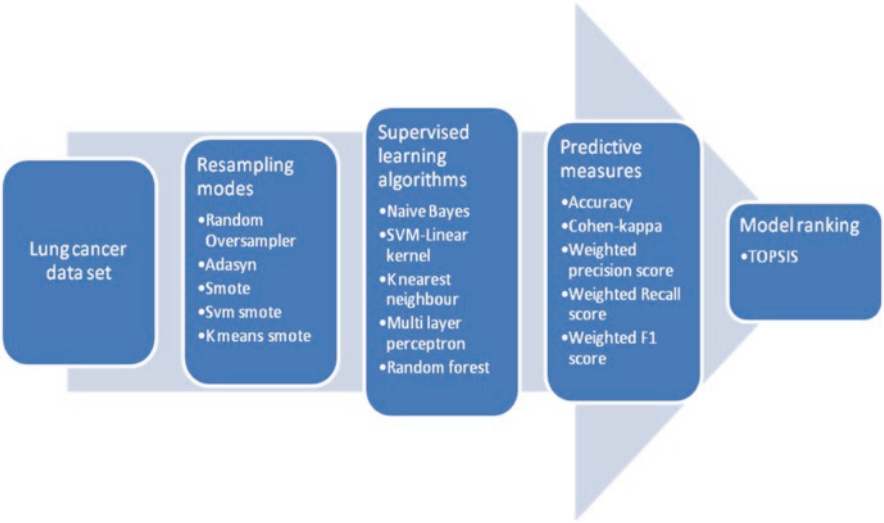

Fig. 1 Framework for the experiment

$$\overline{X_{ij}} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij}^2}} \tag{7}$$

$$M_{ij} = w_j * X_{ij} \tag{8}$$

$$d_i^+ = \sqrt{\sum_{j=1}^{n} \left(M_{ij} - M_j^+ \right)^2} \tag{9}$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(M_{ij} - M_j^- \right)^2} \tag{10}$$

$$P_i = \frac{d_i^-}{d_i^+ + d_i^-} \tag{11}$$

3 Results

The experiments for this study are carried out in python code written in Jupyter Notebook. The training set is created from 70% of samples, and testing set is created using 30% of samples of lung cancer data set. Table 2 shows the performance measures of the supervised learning algorithms used in the study without resampling the data set.

Figure 2 shows the class count of lung cancer data set before resampling. The imbalanced class count is balanced after resampling with sampling strategy not majority. Figure 3 shows the class count after random oversampling, Fig. 4 shows the class count after Adasyn resampling, Fig. 5 shows the class count after smote resampling, Fig. 6 shows the class count after Svm-Smote and Fig. 7 shows the class count after KMeans Smote resampling.

Consolidated results for the Naive Bayes, SVM with kernel-type linear, KNN, MLP and random forest classifiers are given in Tables 3, 4, 5, 6 and 7, respectively. The results showed that the performances of all the supervised learning algorithms used in the study are improved after balancing the data set using resampling techniques. TOPSIS ranking showed that the Svm-Smote is the best choice of resampling technique for the classifiers used in the study.

4 Conclusion

Clinical decision support systems (CDSS) developed using supervised learning algorithms assists the physicians in fast and accurate diagnosis of the diseases. The supervised algorithms use only the information from labelled instances to build the model. This model is used to predict the unlabelled instances. The predictive power of the supervised learning algorithms is affected when unbalanced instances are used for creating the learning model in CDSS. To improve the predictive power of the classifiers, the unbalanced instances have to be balanced using resampling

Table 2 Predictive measures for the classifiers without resampling

Algorithm	Accuracy	Cohen-kappa	wpr	wrc	wf1
Naive Bayes	0.91	0.83	0.92	0.92	0.92
SVM-Linear	0.90	0.80	0.91	0.90	0.90
KNN	0.90	0.79	0.91	0.90	0.89
MLP	0.91	0.83	0.92	0.92	0.92
Random forest	0.90	0.83	0.92	0.92	0.92

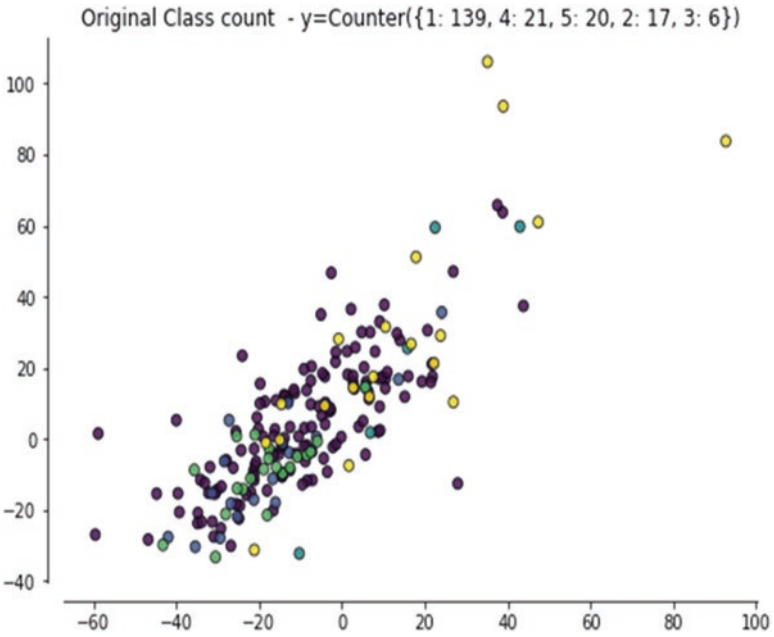

Fig. 2 Class count without resampling

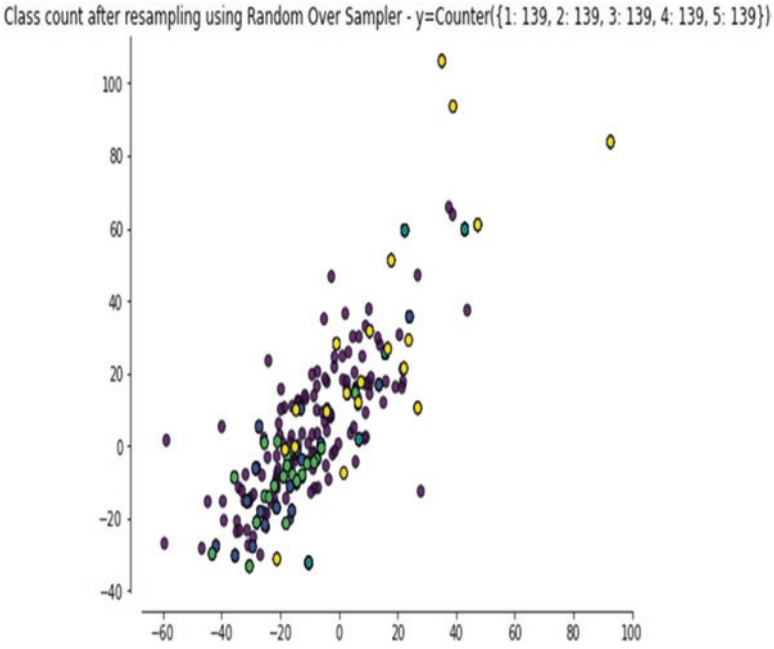

Fig. 3 Class count after resampling with Random Oversampler

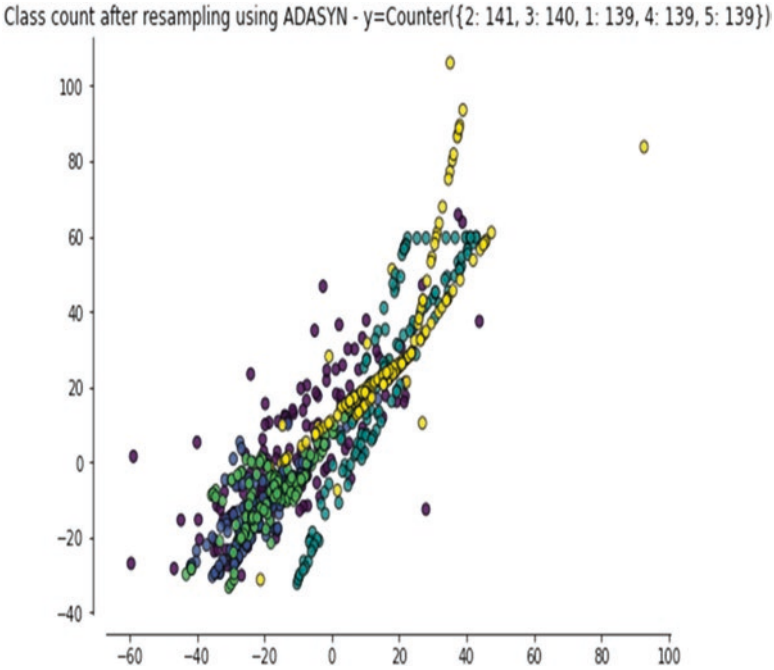

Fig. 4 Class count after resampling with Adasyn

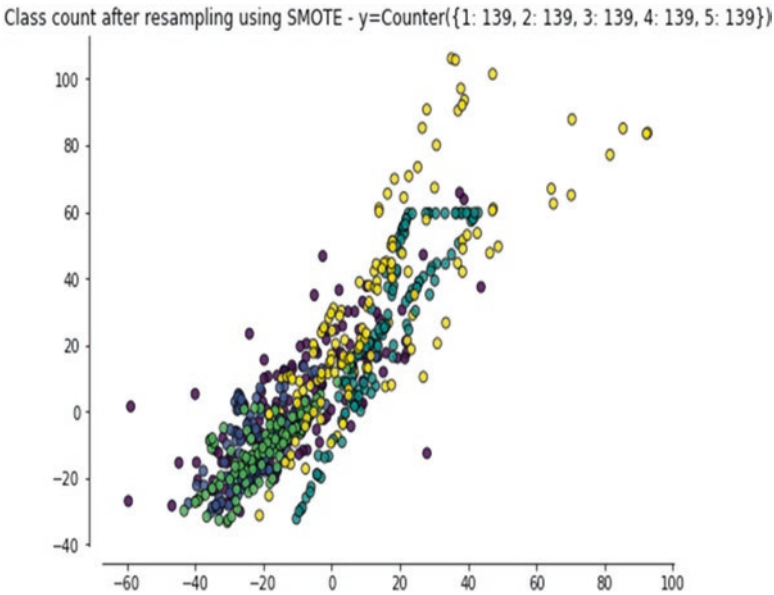

Fig. 5 Class count after resampling with smote

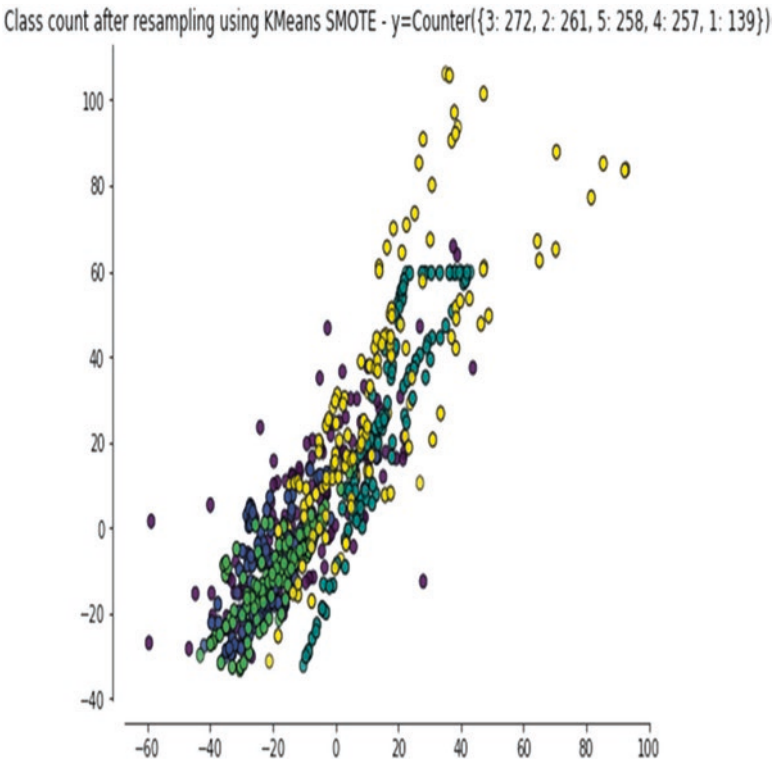

Fig. 6 Class count after resampling with SVM-Smote

techniques. Selection of proper resampling technique is a challenging task. The objective of the study is to find out the need for resampling the imbalanced data before preparing a model for learning. This study also aims to find out whether the resampling techniques behave same for all the supervised algorithms or its behaviour varies with the supervised algorithm used for learning. Publicly available lung cancer data set of 203 instances and 12,600 gene expression values with five distinct classes with fractional proportion of 0.68, 0.08, 0.02, 0.10 and 0.09 in class distribution is used for the study. A set of resampling techniques such as Random Oversampler, Adasyn, Smote, Svm-Smote and KMeans Smote are used for the experiment. These resampling techniques are experimented on five supervised learning algorithms, namely, Naive Bayes, support vector machines with kernel-type linear, k-nearest neighbour, multilayer perceptron and random forest classifiers. The predictive measures used for the study are accuracy score, cohen-kappa score, weighted precision score, weighted recall score and weighted F measure. The comparison of the results showed that the resampling techniques improved the predictive power of all the supervised learning algorithms used in this study. In an attempt to find out the goodness of the resampling techniques, TOPSIS ranking is

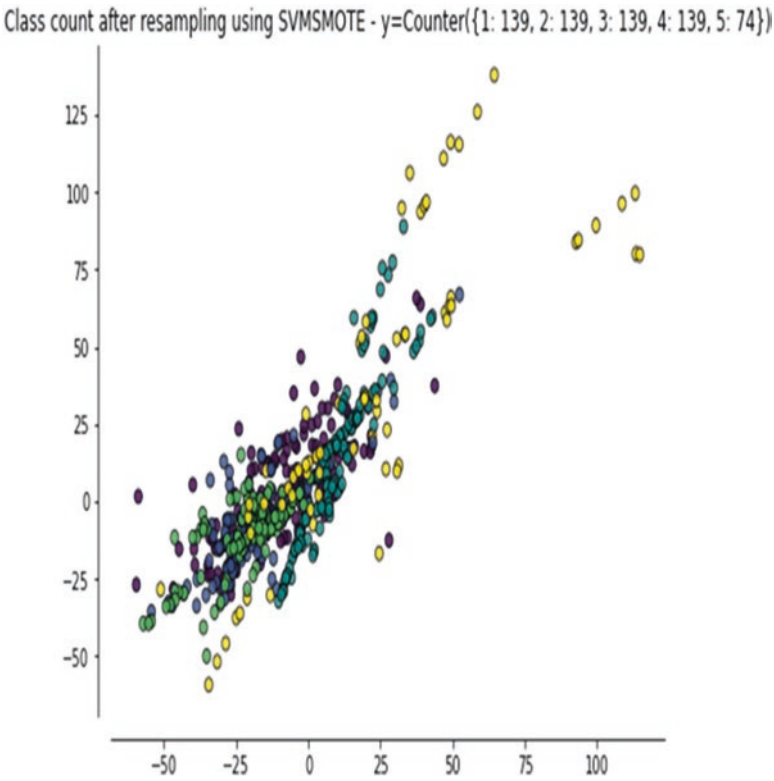

Fig. 7 Class count after resampling with KMeans Smote

Table 3 Results for Naive Bayes classifier after resampling

Resampling technique	Accuracy	Cohen-kappa	wpr	wrc	wf1	di^+	di^-	*Pi*	Rank
Random Oversampler	0.96	0.95	0.97	0.97	0.97	0.012	0.014	0.538	2
Adasyn	0.96	0.95	0.97	0.97	0.97	0.012	0.014	0.538	2
Smote	0.97	0.97	0.98	0.98	0.98	0.015	0.012	0.457	4
Svm-Smote	0.96	0.95	0.97	0.96	0.96	0.012	0.015	0.559	**1**
KMeans Smote	0.97	0.96	0.98	0.97	0.98	0.014	0.013	0.486	3

Table 4 Results for SVM-Linear kernel classifier

Resampling technique	Accuracy	Cohen-kappa	wpr	wrc	wf1	di^+	di^-	*Pi*	Rank
Random Oversampler	0.99	0.98	0.99	0.99	0.99	0.020	0.010	0.341	2
Adasyn	0.99	0.98	0.99	0.99	0.99	0.020	0.010	0.341	2
Smote	0.99	0.98	0.99	0.99	0.99	0.020	0.010	0.341	2
Svm-Smote	0.97	0.96	0.97	0.97	0.97	0.016	0.014	0.454	**1**
KMeans Smote	0.99	0.99	0.99	0.99	0.99	0.020	0.010	0.327	3

Table 5 Results for KNN classifier

Resampling technique	Accuracy	Cohen-kappa	wpr	wrc	wf1	di^+	di^-	Pi	Rank
Random Oversampler	0.95	0.94	0.96	0.96	0.96	0.015	0.011	0.420	3
Adasyn	0.95	0.94	0.96	0.95	0.95	0.015	0.012	0.443	2
Smote	0.96	0.95	0.97	0.97	0.97	0.017	0.009	0.355	4
Svm-Smote	0.94	0.93	0.95	0.95	0.95	0.014	0.013	0.484	**1**
KMeans Smote	0.97	0.97	0.98	0.98	0.98	0.019	0.007	0.272	5

Table 6 Results for multilayer perceptron classifier

Resampling technique	Accuracy	Cohen-kappa	wpr	wrc	wf1	di^+	di^-	Pi	Rank
Random Oversampler	0.99	0.98	0.99	0.99	0.99	0.016	0.010	0.385	3
Adasyn	0.99	0.98	0.99	0.99	0.99	0.016	0.010	0.385	3
Smote	0.98	0.98	0.99	0.99	0.99	0.016	0.011	0.397	2
Svm-Smote	0.95	0.94	0.95	0.95	0.95	0.010	0.017	0.631	**1**
KMeans Smote	0.99	0.99	0.99	0.99	0.99	0.017	0.010	0.369	4

Table 7 Results for random forest classifier

Resampling technique	Accuracy	Cohen-kappa	wpr	wrc	wf1	di^+	di^-	Pi	Rank
Random Oversampler	0.99	0.98	0.99	0.99	0.99	0.017	0.007	0.299	2
Adasyn	0.99	0.98	0.99	0.99	0.99	0.017	0.007	0.299	2
Smote	0.99	0.98	0.99	0.99	0.99	0.017	0.007	0.299	2
Svm-Smote	0.98	0.94	0.95	0.95	0.95	0.011	0.013	0.523	**1**
KMeans Smote	0.99	0.99	0.99	0.99	0.99	0.017	0.007	0.286	3

calculated for the resampling techniques with respect to classifiers used in the study. TOPSIS ranking helps find out the best, alternative and worst choice of resampling techniques with respect to the classifiers used in the study. In TOPSIS ranking Svm-Smote ranked top for all the supervised learning algorithms.

This study concentrated on evaluating the performance of the classifiers before and after resampling, finding out the goodness of resampling techniques as best, alternative and worst choice with respect to the classifiers used for the study for a single multiclass imbalanced data set. This study can be further extended with carrying out the analysis on the multiple imbalanced data sets and comparing the results of the performance of the classifiers with respect to resampling techniques and data set. This study can also be further extended to find out the optimum size of resampling with respect to participating classes used for supervised learning.

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Artificial Intelligence to Protect Cyber Security Attack on Cloud E-Learning Tools (AIPCE)

E. Arul and A. Punidha

Abstract e-Learning is associated with the usage of different network devices to ensure user educational performance. Its platforms are rising as digital media has reinvented business organisations. e-Learning options include warehouses for ever more learners with accessible and usable material. Consequently, e-learning remedies collect a garage. e-Learning projects are commonly supplied with cloud technology as a hybrid cloud/PaaS cloud environment. However, a variety of malicious software and attackers have been the obvious target for such famous e-learning programmes. Such cyber hackers try unauthorization from such not-so-reliable e-learning platforms to a variety of sensitive data including user names, address, credit/debit card identification, etc. Safeguarding of students and teachers from unlawful attacks is an essential component of e-learning. Identifying the evolving types of malware that target these cloud-based tech applications, with a focus on e-learning solutions that use Digital-supervised learning. The article also examines the important methods and techniques of both the assault and also some ideas for vulnerability scanning based on artificial intelligence with 92.77% of the outcomes.

Keywords IoT · Information security · Malware · API calls · Artificial intelligence · Cyber security · e-Learning · Cloud · Supervised learning

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1 Introduction

Suspect technologies were also harmful mobile apps designed to quickly develop viruses, worms or malware targeting remote servers, accessing multiple browsers, etc. [1]. FireEye has launched innovative tools for the detection of new cyber threats, safe consumer intelligence, sensitive details and corporate information. FireEye is a development software firm listed on the Nasdaq market.

From its ground station surveillance system, the company invented a new malware barricade remedy which is available for enhanced customer expenses.

In contrast to viruses, worms and Trojans, the definition of harmful malware is not transparent to the computer, so the disruptive payload of the program often comes from the direct order of the user [2].

Developer: Building company apps seek to produce brand new malicious software, Trojans. The heart, devices and/or harmful information of the program can be unsafe.

SHAT: Such programs are configured for the objectives of denial-of-service (DoS) attack and for user's computer. Several requests will be submitted by the program to the expected system endpoint, as well as a denial-of-service attack will be rendered if this computer is not able to manage such demands sufficiently [3].

Alert of leaking: Fraudsters also abuse the e-mail channels of such systems with meaningless e-mails.

Skulls: Other sites – like IRC – are also used by hackers for swamping.

Online messaging broadcasts with pointless IM: Hackers occasionally deluge irrelevant e-mails from these initiatives, including the ICQ, Myspace, AOL chat program, ask.com fax machine, WhatsApp, etc. [4].

Mails of inundation: Hackers have been known to utilise notice flooders to inundate ineffective e-mail channels [5]. The YouTube tutorial can be used to add new users to the visitor network list to remove computer logs information that mask malicious people's involvement. The initiatives of HackTool are used to target remote network machines by suspicious users [6].

Bollocks: Scam does not harm their Mac initiatives. Alternatively, they give you e-mails informing you whether damage has been done or is being achieved – or that a threat that probably doesn't really exist is cautioned against.

Fare evader spammer: Spoofer apps override the group e-mail that offers an acknowledgement or service request for several purposes to prevent the recipient being identified by the recipient troll programs which are not enabled by fare evader.

Simulated method: Those implementations can also be used to modify such ransomware and try and prevent a malware protection alternative from detecting detrimental software.

2 Related Work

J. O. Aslan – Spyware means malicious programs which are installed on a software system and which have no owner's permission [7]. It carries out harmful actions such as stolen sensitive data and is facilitated by digital installation. In the past, exploited software released a state-of-the-art technology that could bypass virus protection, IDS and web server implementation. This uncertainty is one of the biggest challenges in the field of cyber safety [8] due to communication systems and computer-based apps. This section provides a methodology used to research the common detecting and sensing method, apply certain approaches to good virus protection and benevolent software and contrast their data gathered. The study would in fact inform consumers about the analysis and identification of current and new viruses [9]. A research paper has been researched and stored in different web browsers, 100 spyware and 100 unhealthy application samples from different sources. It is apparent from the test results that only one device can hardly find malware. The combined precision and detection rate was doubled [10] thanks to dynamic and static management software.

B. N. Sanjay – Malicious software applies to any illegal technology-dangerous connections or server. Data mining has been a big subject besides advanced threat research, despite the occasional days with computers. Throughout the course of time, several different malware forms have been created to be searched for and overlooked by virus protection software [11]. Malicious software threats have traditionally passed to the device in a way that is done for the purpose of executing malicious operations, as we typically know. Fileless ransomware is built to exist in memory alone but rather to reach file posts. This is all designed to make coroner response infection difficult for an attacker. Currently, fingerprints can't allow this form of assault to be identified. This essay discusses in considerable depth of the technical features of fileless ransom-ware and related assaults.

A. Tyagi –The whole report seeks to reassure the purchaser of the application mechanism for 'URL network security'. The entire device stops users from falling victim to the move from uploading threats [12]. Because the domain name is accepted as a structure text file extension by this tool. It lists but also tests documents obtained by the malicious software detector online and obtains guidance for visualizing the server database. Such documents are illustrated graphically as malevolent knowledge. MD5 main is the device used. The article suggests five plugins for a more detailed computer study [13].

3 Theoretical Background

3.1 Artificial Intelligence to Protect Cyber Security Attack on Cloud E-Learning Tools (AiPCE)

Throughout the research, the vulnerability was discovered in a web server assigning the e-learning to server computers [14] and was taught unattended. There really is no feed reverse scheme in transferring classification to foretell the production of the training stage. The infrastructure itself learns any correlation among both structures such as similarity, crease, functionality and categorization Throughout the methods assigned to a Linux environment in the input executable, the infrastructure learns any link between two structures such as resemblance, crease, functionality, and categorisation [15]. Uncontrolled training can precisely introduce the different input sequence similar to the approach already learnt, and the system can understand progressively which functionalities are of benefit to the excellent binary format, such as grouping, evaluation of the main components and surveying of functions.

Consider a client has assembled an application with no security openings and is utilizing a PaaS supplier to host their application. Their application relies upon the parts of their PaaS provider to be functional. These conditions may straightforwardly include database, storage, a web server and a code container. The most common scenario would be a denial-of-service attack that makes communication with your application impossible because the provider's network has been overloaded. Another vector is being a victim of a denial-of-service attack. A cloud provider likely uses virtual machines which run on real physical hosts which actually means shared resources. The kinds of resources include systems which can get overloaded in some demanding situations. If the purpose of an assault is one consumer, it is very likely that a consumer would also suffer greatly from the same assault. Walmart's online services houses both a potentially contested domain and a secure e-news aggregation site leveraging common tools for purposes of analysis assume. When a broad community wishes to visit the web that has been attacked, any participant of that party sends proxy servers on a continuing basis before the website fulfils the criteria indefinitely. As the e-news aggregation site started hosting on a same natural machine, it is also a perpetrator and inaccessible. Suppliers can lessen the risk of such an assault by relatively allocating wealth and that of other customers or clients can also utilize various geographic sites (Multi-AZ is going to host). Cyber-attacks are straightforwardly multi-source DOS assaults and a bigger-scale attack. A side-channel attack, the whole style with attack, has the authority to satisfy two or more protected customers, rationally differentiating but just not physically, with most private clouds using vms. In case an attacker can determine and then get an unremarkable physical host assigned to one of everyone's window servers from the loss, they may be able to crack off from everyone's sandbox or to use unreasonable amounts of resources. This lack of energy will contribute to a reaction or unavailability of the

victim's network. The intruder will use minor vulnerabilities in an unfavourable circumstance to manipulate the quantum object and jeopardize the traffic of his hostages.

AI – quantum computing – is a highly reliable and rapidly growing approach to probability value tracking in the distributed cloud on video surveillance. The features of AI network-based are data analysis, creativity and innovation. Historically, intrusion prevention has been primarily extended to ANNs, foggy systems, automated immune cells, GA or expert systems. The following articles give a description of the uses of AI techniques for threat management and protection. This document outlines the techniques for mapping raw data into information through regulated training. It has used values that the supervisor has defined. A recurring algorithm (encoder-decoder) and a cognitive feed system (FFNN) were also two principal approaches of deep classification. The multi-layer feed forward (MLFF) NN and probability density function (RBF) are good instances of giving forward machine learning. The RBF categorization is based on the assessment of the location among both inserts and number of hidden centres. The RBF is best for broad cloud-based e-learning systems compared to the MLFF backward propagation (BP), since it is very fast. On the cloud software service running virtual host machines, Fig. 1 depicts the Artificial Intelligence to Protect Cyber Security Attack on Cloud E-Learning Tools (AIPCE) cross-malware detection flowchart.

Uncontrolled learning has no supervisor, and the course only uses extracted features. Unmonitored learning resembles a numerical grouping, where similarities are used to identify different input groups. Two widely known forms of transfer classification are SOM and the integrated amplification model. SOM is an outlier and a misappropriation-detection deacon-neural net technique. However, the study shows that ART has a greater detectability on both online and physical data, evaluated by comparing the vulnerability scanning premised to ART and SOM.

Semisupervised trying to learn: A mixture of controlled and unattended teaching strategies is used in droplet interference object tracking's supervised classification method. Many output layers are also presented in a dataset alongside classified data in this specific technique. This technique can also be used with less annotated images even before classification is affordable. The semi-controlled approach will function as a controlled or unregulated training depends on the cost with annotated images.

In order to never present the right input/output outfits, learning algorithm is inherently different from the typical monitored learning process. There is therefore clearly no punishment to suboptimal behaviour. The main emphasis is on online productivity, which requires a good equilibrium between existing data and unidentified region. The discovery and manipulation of the trade in enhancement education have been most extensively explored through the issue of multi-armed bandits and finite MDPs.

Pseudocode: Intelligence-supervised training to recognize vulnerabilities in SaaS method

Input to on-demand AI with supervised learning method anomaly detection method: data

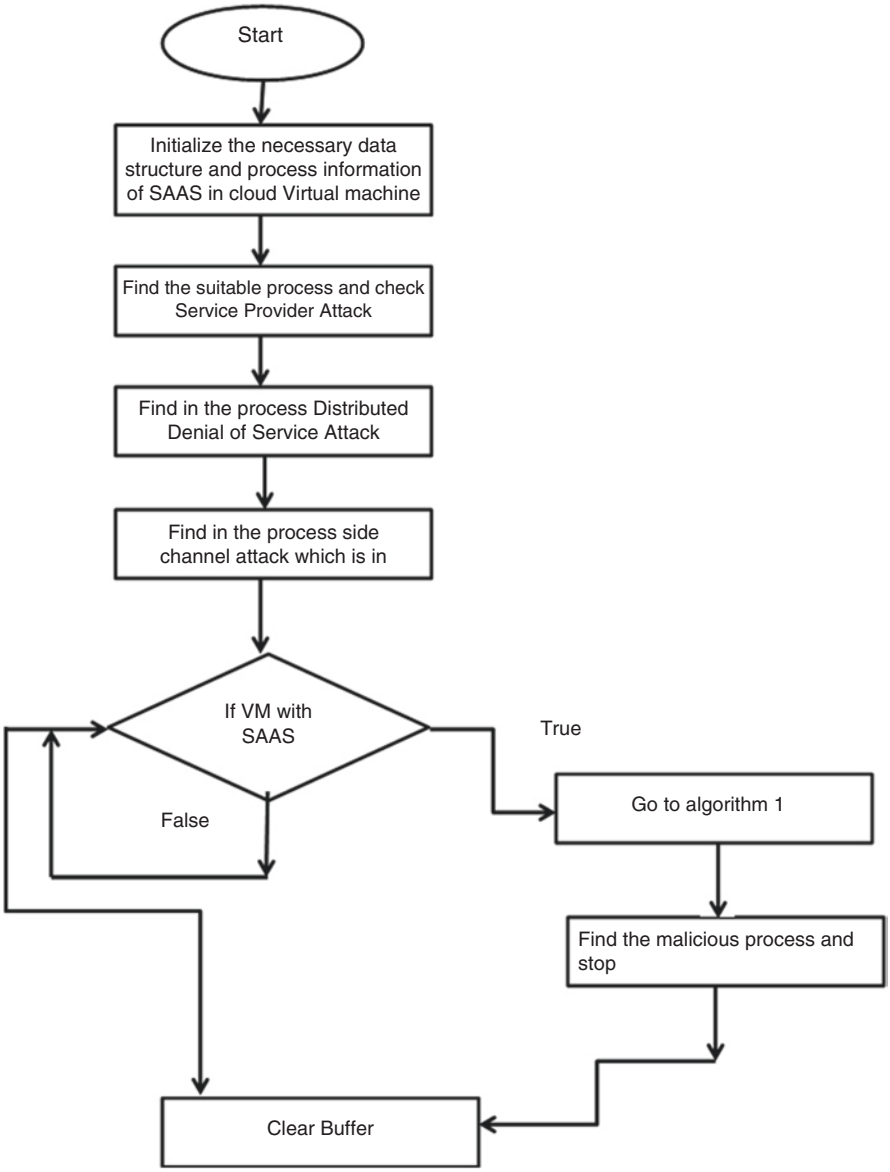

Fig. 1 Activity of AIPCE cross-malware detection flowchart on the cloud software service running virtual host machines

Application of data set with R features output – an array of R classification models of each application process

For each feature where i = 0, 1, 2….n to perform for each application.

If (PaaS - Process)
Change (.Process permission)
getAll (all available Threads on Selected Process)
If (open Thread)
Create new memory using virtual allocation
Identify all statements performing injection
Apply AI-supervised learning to find malicious thread move into array of process information tables
For each application process maintain separate row in database table
Else
Invalid application process
Else
No injection Found
Exist
End
For each
Return.

4 Results and Comparison

Cloud-based known attacks were briefly discussed. Cloud-based known attacks were briefly discussed. The centralized, transparent cloud computers and infrastructure system is an enticing option for intruders' future cyber-attacks. Thanks to their accessibility and their unique design, conventional vulnerability scanning (IDPS) is mostly ineffective. Detection techniques, explicitly training data, svm training, unattended education and strengthened trying to learn, are addressed in machine learning. The best usage for online e-learning as well as other PaaS/SaaS tools is accomplished by utilizing AI-IDS or other risk reduction programs. Insect Masters was such a technique to identify assaults against host-based technology.

It utilizes a sweet pot method for OS procedures not dependent on low-level OS specifics, and thus regular OS processes are exposed as a malicious software trap. Throughout Bee Master no disadvantages are apparent in the low-level OS-dependent strategies. Bee apprentice can also be quantitatively tested for independent OS detection. The harmful runtime obtained from clients of Community Ransomware Container Review Programs is checked and returned to clients in a place called a debugger. Such devices are rising substantially and provide an Internet access to obtain central control and download data. It involves risks which can be identified by attackers when using this structure as just a malware communication. The IP address of an online sandbox is revealed by an attacker who distributes the executable, distributes it to Blacklisted users, and uses it against the analysis system. Table 1 provides the malware identification in PaaS/SaaS using AI and supervised learning.

Table 1 Similarities of the suggested AI-controlled malicious software active learning to previous techniques

Correlations between AI-SP suggested and malicious software with conventional systems	Malicious software runtime quantity is observed	TP ratio (%)	FP detected	FP ratio (%)
O. Aslan	690	72.47	65	0.06
B. N. Sanjay	763	80.14	51	0.05
Proposed AIPCE malware	891	93.59	33	0.03

Malicious software system gross diagnostic taken: 952
Total number of normal file taken for analysis: 1425

5 Conclusion

Also in developed areas of the world, online shopping is growing regular. Thanks to its diverse design and existence, cloud based e-learning platforms pose a kind of obstacle to protect researchers. An efficient framework for vulnerability scanning is a crucial tool to secure the cloud from assaults. The usage of artificial technologies provides numerous benefits, owing to its capacity to learn and resilience. An IDS focused on artificial insight is adaptable to shifts in the world and equipped to identify even unexpected threats. The smart IDS will also operate in high-speed public cloud. Intelligence-supervised learning throughout this work has been used to allow users to upload in cloud SaaS methods. In addition, the study will be extended to classify potential attacks on diverse environments.

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Online OPD Management with Rating and Review System to Hospitals and Doctors

Chaitanya Garware, Ruturaj Sutar, and Krishna Londhe

Abstract The number of patients visiting hospitals increases everyday due to more health consciousness among people. Patient's fulfilment and solace are the needs of each emergency clinic. The Indian Health Governance Centers are also concentrating on the patient treatment as the key factor of hospital organization. Health Management Board has brought numerous upgrades through IT for patients that positively affect the patient involvement with clinics just as taking authoritative choices based on health indicators. The outpatient department (OPD) services of most of the hospitals are facing long waiting time problems which result in patient's dissatisfaction, and also it doesn't predict any quality measures for the selection of doctor as per the patients' need. Also, traditional OPD mechanisms have several limitations with respect to availability and quality of the doctors. Current investigations have discovered restricted proof for a relationship between specialist emotional intelligence (EI) and the patient-doctor relationship (PDR). Constant improvements in management of OPD through new policies are essential for better patient management and for proper utilization of skill, expertise, and time of senior doctors. It will be more convenient and preferable if the patients could receive the most efficient treatment plan along with the predicted waiting time of their consultation time to their corresponding doctors on their mobile applications in real time. Many sectors of the industry use "rating and review system" to make their service more reliable, scalable, efficient, and convenient to everyone. The proposed system describes a generalizable method that systematically combines hospitals, doctors, patients, and medicals in a single system providing "patient's reviews and rating to hospitals and doctors" which leads to "online OPD management." In today's world, we consider the doctor to be God, but does this idea apply to all doctors? We can't easily trust anyone especially regarding health issue, so the patient needs the best doctor as per annoyance. In this case, one can use the proposed system to find a good doctor or hospital for the molestation cure. Hospitals, doctors, patients, and chemists will first register themselves in this system with all the information. After the patient's check-up, the doctor will send the prescription of the patient's

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medicine to the chemist online. The patient will be able to give a rating and review to that doctor or hospital based on the quality of treatment experienced. This obviously means that physicians need to provide the best treatment to patients for good ratings and reviews. So, the proposed system can manage many tasks that are usually time-consuming and inconvenient with respect to doctors and patients also.

Keywords Health consciousness · OPD management · Health management · PDR · Patient management · Quality of treatment

1 Introduction

Today's world is a world of technology. In this world, there are different technologies to make people's daily life pleasant and healthy. But Android is the technology that is the most famous of all these technologies. Today at least one person in every family has a smartphone. So, improving the health system with the help of smartphones is a need of the hour. Today the world population is 7.8 billion, and there are currently 3.5 billion smartphone users in the world. From this we can understand that through the use of smartphones we can make people an integral and important part of the health system. The health industry is a very important and constantly growing industry.

If you want to go to the hospital today, first you must go to the hospital and make an appointment. Then you have to wait for your appointment. In all these procedures, a lot of patient time is wasted. At this point, if the patient makes an appointment online from his home, using his smartphone, and if he can know the approximate time of his appointment, it can save a lot of time for that patient. Suppose you are in an unfamiliar city and you want to go to a hospital, you cannot go to any hospital because you do not know which hospital or which doctor is right for which disease. So, if people know which doctor treats which disease with the help of smartphone, it will be convenient for the patient. In this too, it is not enough to know which doctor treats which disease but also which doctor treats the best for that disease. If the hospital or doctor is given a rating and review according to his treatment, then the new patient can find the right doctor using the rating and review for him.

In the current system, the compounder is the link between the doctor and the patient. As a result, the patient's information about the disease may be leaked. At this point, if the patient can interact directly with the doctor, his disease can be kept secret. Also, the rating and review system will require each clinic or doctor to treat it well to keep its rating high and good reviews. This will definitely improve the quality of health care. Also, in this system, the doctor will send the prescription of the patient's medicine online to the chemist, which will stop the use of the paper required for the prescription.

2 Literature Survey

A hospital information system (HIS) is used to recognize features capable of improving doctors' satisfaction levels. A prototype inclusive of system standard, information standard, and service standard related to a hospital information system is used to form antecedents of patient fulfilment [1].

Huge sufferers' lines at dispensaries and clinics are an issue that faces the probably glossy and fine surrounding in the UAE. As this occasionally prompts disappointment from visiting sufferers, we attempted to take care of this issue with extra useful capacities by building up the hospital-pharmacy management system. The basic role of this exploration is to build up a framework that joins the databases of a medical clinic and a drug store together for a superior incorporated framework that gives a superior lucid workplace [2].

In clinics, the way toward keeping up the record of patients and representatives working in the medical clinic, ascertaining bills, and so forth requires preparing and record-keeping in various divisions. Keeping in view a solid requirement for dealing with the above data quick and effectively, online hospital MIS has been structured and created. It is easy to understand and gives straightforward and productive approach to dealing with the working of medical clinics [3].

In the Taiwanese social healthcare insurance framework, clinics are confronting an undeniably serious medicinal services showcase. Clinic managers, considering this competition, are setting expanding significance on improving the nature of human health services so as to guarantee patients' fulfilment. By what means can service quality (SQ) be improved in medicinal services settings? This examination investigated how quality administration impacts representative impression of administration quality [4].

Human services is so intriguing for our general public. For the most part, hospital management information system (HMIS) is a computer-based framework that can organize all data for empowering human services suppliers to do their works successfully and effectively. As indicated by utilizing these frameworks over the globe, this requires a solid need to see such frameworks and its capacities [5].

To make index based secure access to patient's very own information and clinical records by utilizing RFID labels and web services with the assistance of equipment unit. This framework utilizes web administration interfaces to help standard electronic health records for patient record interoperability. Clients can view and update their own clinical data by means of the site, which flawlessly sync with each other. Since the framework is based on web administrations, it is anything but easy to refresh, adjust, and develop [6].

The paper built up a mechanized framework that is utilized to oversee understanding patient data and its organization. This was so as to take out the issue of unseemly information-keeping, incorrect reports, time wastage in putting away, handling, and recovering data experienced by the customary emergency clinic framework so as to improve the general effectiveness of the association [7].

In a social health insurance milieu, the utilization of NFC (near-field communication) innovation can be utilized for cutting down medicinal services costs as well as encourages robotizing and smoothing out patient's recognizable proof procedures in emergency clinics and utilization of cell phones like PDA, advanced cells, and for structuring a human services the board frameworks [8].

Quality in medicinal services administrations has gotten a subject of study, obtaining an uncommon undertone for both individual and aggregate well-being administrations [9].

The bleeding edge technology of the twenty-first age has demonstrated to surrender significant positive upgrades and has left an immense effect in current medication and human services. Smartphone is one of the most generally utilized gadgets in correspondence [10].

Clinic management framework is a healthy framework that oversees and robotizes the working in the emergency clinic. The framework is proposed to decrease the manual intercession to the most extreme level conceivable. This framework utilizes RFID labels to make sure about access. It likewise empowers proficient situating. Recognizable proof of patients who can't impart is done productively by the utilization of RFID cards [11].

This proposed system contains making the online appointments, getting online prescription of medicines, and giving rating and review to hospital/doctor. Giving rating and review to doctors or hospitals is the key feature of this proposed system.

3 Proposed System

The proposed system takes multiple inputs such as hospital details, doctor details, chemist details, and patients details as shown in Fig. 1. There are four modules in this system. All four modules are connected to each other in a special way. The four modules are:

1. Hospital Module
2. Doctor Module
3. Patient Module
4. Chemist Module

Hospital Module First of all, the hospital (i.e., hospital head) will register itself in the system. After registering the hospital staff (including doctors and nurses) will log in using the username and password of the hospital. This module is for hospitals with multiple doctors. The following are important functions for the hospital after logging in.

Hospital Appointment History The Hospital Appointment History function contains a register of the hospital's appointments to date. It has a list of the year's first. The list of years includes the list of months. And the list of months includes the list

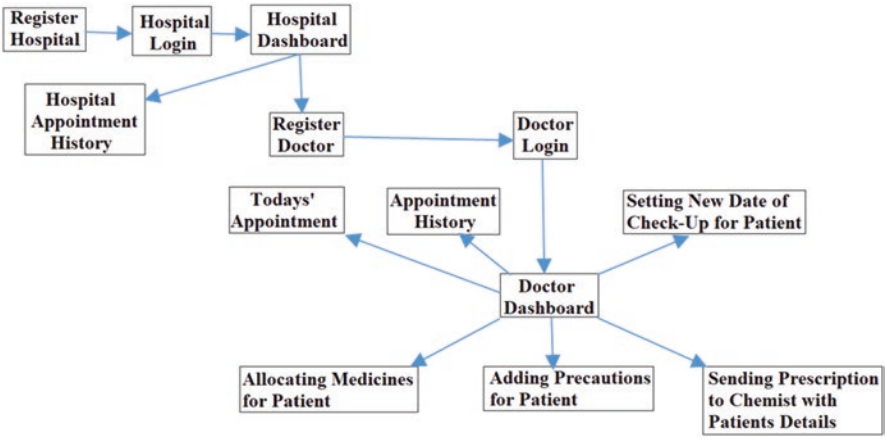

Fig. 1 Block diagram of hospital module

of days. This day's list contains all the appointments that came to that hospital that day.

Today's Appointment In the Today's Appointment function, the doctor will see a list of all the appointments made for him today.

Appointment History In the Appointment History function, the doctor will get a register of all his appointments till date. It will first have a list of years. The year list will have a list of months. And the list of months will have a list of days. This day list will include a list of all the appointments that came to that doctor that day.

Setting New Date of Check-Up for Patient In the Setting New Date of Check-Up for Patient function, the doctor can set the next date of examination for the patient. The patient will receive the notification on the specified day.

Allocating Medicines for Patient In the Allocating Medicines for Patient function, the doctor can examine the patient and select the medications he/she wants to prescribe and create a prescription.

Adding Precautions for Patient In the Adding Precautions for Patient function, the doctor can set the patient's account information on what care to take during drug treatment.

Sending Prescription to Chemist with Patients' Details In the Sending Prescription to Chemist with Patient Details function, the doctor can send the prescription prepared for the patient to the chemist online.

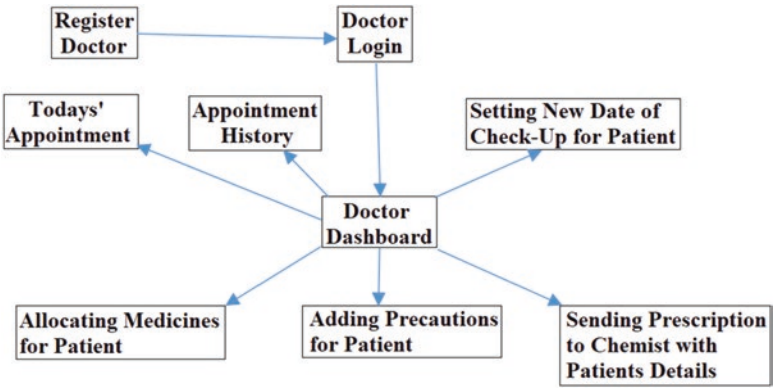

Fig. 2 Block diagram of doctor module

Doctor Module First of all, the doctor will register himself/herself in the system as shown in Fig. 2. After registering himself/herself, the doctor will log in using his/her registered username and password. There are six important functions for the doctor after logging in.

Today's Appointment In the Today's Appointment function, the doctor will see a list of all the appointments made for him today.

Appointment History In the Appointment History function, the doctor will get a register of all his appointments till date. It will first have a list of years. The year list will have a list of months. And the list of months will have a list of days. This day list will include a list of all the appointments that came to that doctor that day.

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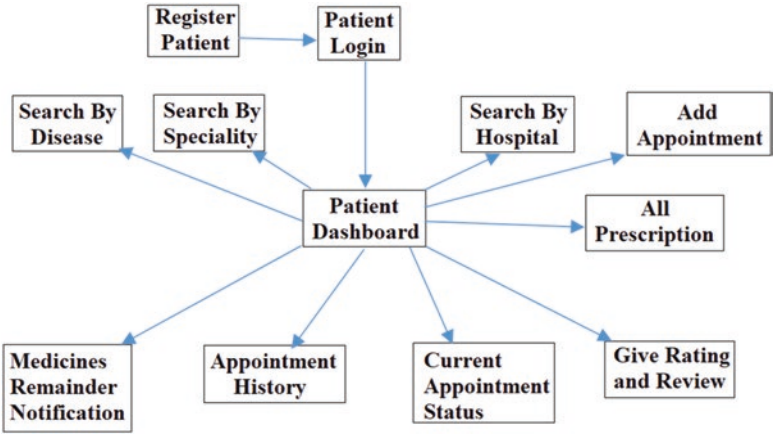

Fig. 3 Block diagram of patient module

Patient Module First of all, the patient will register himself/herself in the system as shown in Fig. 3. After registering himself/herself, the patient will log in using his/her registered username and password. There are nine important functions for the patient after logging in.

Search by Disease In the Search by Disease function, the patient can find a good doctor according to his illness.

Search by Specialty In the Search by Specialty function, the patient can find the good doctor he wants according to the doctor's specialty.

Search by Hospital In the Search by Hospital function, the patient can find a good doctor in that hospital according to his illness.

Add Appointment In the Add Appointment function, the patient can find the doctor he wants and set an appointment for that doctor.

All Prescriptions In the All Prescriptions function, the patient will get a list of all his prescriptions till date. It will first have a list of years. The year list will have a list of months. And the list of months will have a list of days. The list of these days will contain the information of the prescription received by the patient on that day.

Medicine Remainder Notification/Alarm In the Medicine Reminder Notification/Alarm function, the patient should take the medicine on time so that the patient will see the notification or alarm at the time when he wants to take the medicine as set by the chemist.

Appointment History The Appointment History function lists all the appointments the patient has made to date. It will first have a list of years. The year list will have a list of months. And the list of months will have a list of days. The list of these days will contain the details of which doctor the patient had made an appointment with that day.

Current Appointment Status Current Appointment Status will tell the patient how much longer it will take for his current appointment.

Give Rating and Review In the Give Rating and Review function, the patient can give rating and review to the doctor or the hospital on certain days after the treatment.

Chemist Module First of all, the chemist will register himself/herself in the system as shown in Fig. 4. After registering himself/herself, the chemist will log in using his/her registered username and password. There are three important functions for the chemist after logging in.

Prescription Register In this Prescription Register function, the chemist will get the prescription of all the medicines that have come in his medicine till date. It will first have a list of years. The year list will have a list of months. And in the list of months, it will be a list of days. This day list will include a list of all prescriptions received that day.

Today's Prescription The Today's Prescription function will list all the prescriptions received that today.

Adding Remainder on Patient's Prescription The Adding Reminder on Patient's Prescription function will record which medications are to be taken at what time and how much to be taken in the prescription given by the doctor.

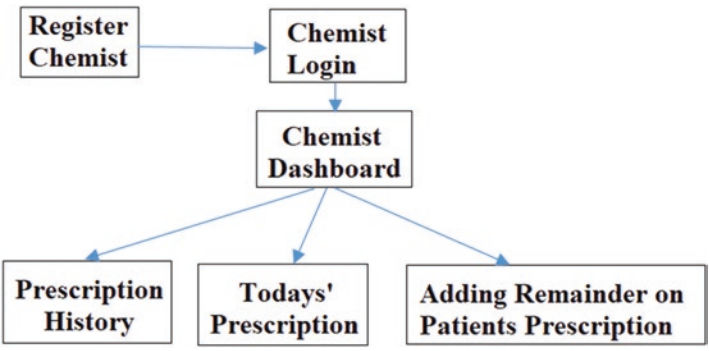

Fig. 4 Block diagram of chemist module

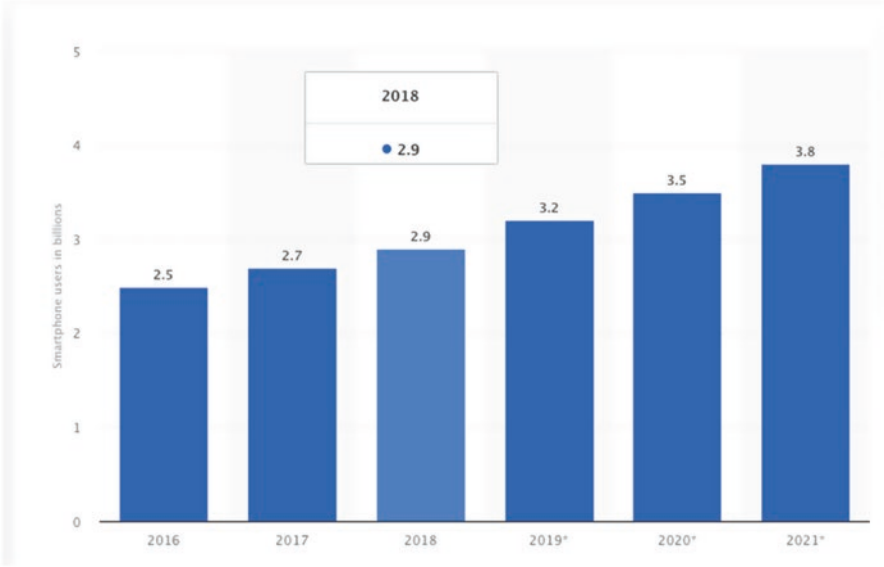

Fig. 5 The number of smartphone users worldwide from 2016 to 2021 (in billions)

Worldwide Smartphone Use The quantity of cell phone clients overall today outperforms 3 billion and is gauged to additionally develop by a few hundred millions in the next few years. China, India, and the United States are the nations with the most noteworthy number of cell phone clients, with every nation effectively outperforming the 100 million client mark in Fig. 5.

In the previous 5 years, about 1.4 billion cell phones were sold overall every year, reflecting stagnation in the cell phone market during the most recent couple of years. The cell phone market despite everything has high development potential; however, the cell phone penetration rate is still lower than 70% in numerous profoundly populated nations, specifically China and India. The income of the worldwide cell phone market kept on expanding in the course of the most recent couple of years, in spite of stagnating unit deals – because of a developing normal selling cost of cell phones. These statistics will show that smartphones are the most important and vastly growing technology.

Android Background Services Running assignments out of sight expends a gadget's constrained assets, similar to RAM and battery. This may bring about an awful client experience. For instance, foundation undertakings may debase the battery life of the gadget, or the client may encounter poor gadget execution now and again, for example, viewing a video, playing a game, and utilizing a camera. To improve battery life and give a superior client experience in Fig. 6, Android has advanced more than a few discharges to build up limits on foundation execution. This flowchart can assist you with settling on a choice.

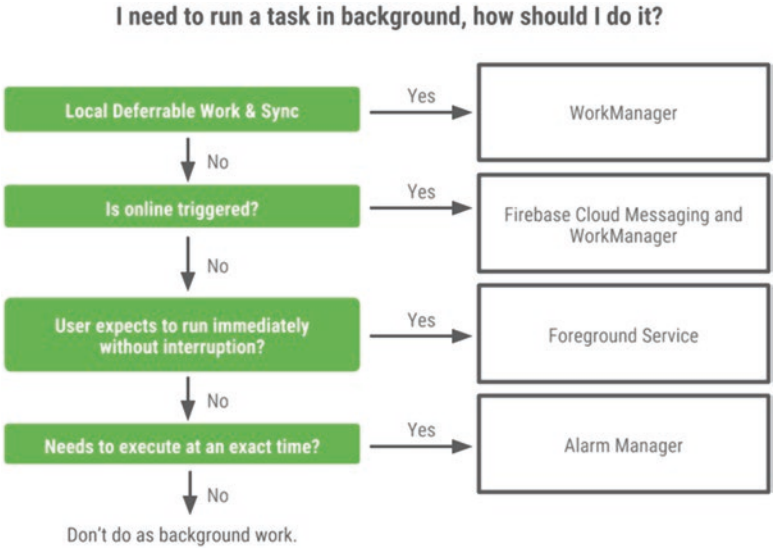

Fig. 6 How background services works in Android

Work Manager is the suggested answer for foundation execution, considering all OS foundation execution limits. You can likewise apply execution requirements to them, for example, activating when the gadget is inert or charging or executing when a substance supplier changes.

On the off chance that a long-running undertaking is to be planned for reaction to an outer occasion like matching up for new online substance, use Firebase Cloud Messaging to advise your application and afterward make a work demand with Work Manager to synchronize the substance. You can get familiar with this in "advising your clients with FCM."

In the event that the application needs to finish a client-started task without conceding regardless of whether the client leaves the application or turns off the screen, for example, on account of music/video playback or route, you should utilize a Foreground administration. The following blog entry in this arrangement plunges further into this utilization case in Table 1.

4 Conclusion

Using this system, you can save yourself a lot of time by making appointments online. Also, with the concept of e-prescription, we can save paper. Also due to the notifications and alarm system, in this system the patient can take his medicines on time. Also rating and review is a very important concept. This will definitely reduce corruption in the health sector, because doctors need to provide good services for good ratings and reviews.

Table 1 Modern background execution

Use case	Examples	Solution
Guaranteed execution of deferrable work	Upload logs to your server	Work Manager
	Encrypt/decrypt content to upload/download	
A task initiated in response to an external event	Syncing new online content like email	FCM + Work Manager
Continue user-initiated work that needs to run immediately even if the user leaves the app	Music player	Foreground Service
	Tracking activity	
	Transit navigation	
Trigger actions that involve user interactions, like notifications at an exact time	Alarm clock	Alarm manager
	Medicine reminder	
	Notification about a TV show that is about to start	

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Design and Analysis of Various Non-radiating Transmission Line Structures on a High-Speed PCBs

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Abstract Primary challenge in high-speed modern electronic designs is to maintain good signal integrity in the presence of intersymbol interference and crosstalk. Crosstalk is identified as one of the major factors which influence signal integrity on the printed circuit boards (PCBs). The main idea of this effort is to understand the interference between two non-radiating conductor transmission lines. Conventionally spaces between the traces are increased by means of introducing guard traces introduced to reduce crosstalk and to ensure signal integrity. Present concern is to design and evaluate non-radiating transmission line performance by changing the structure and parameters of the signal carrying transmission lines with minimal spacing between traces. To numerically analyse the best non-radiating conductor transmission lines, circuit simulation tool, Advanced System Design (ADS), is used. The simulated structural design is experimentally analysed and tested at double data rate (DDR) – 3 to 4 GHz, where its experimental results is compared with simulated result and tabulated. The best non-radiating structure is further analysed for crosstalk estimation on account of eye pattern, where the intersymbol interference is analysed for crosstalk estimation. Numerical solving of these non-radiating transmission lines is carried out with the digital transmission system with the date rate of 5G bits, and the eye diagram improves, which means that the method achieves better crosstalk cancelling effect, and implementation of it in multi-conductor transmission lines (MTLs) on PCBs is further recommended.

Keywords Signal integrity · Multi-conductor transmission line (MTL) · Crosstalk · Intersymbol interference · Near-field crosstalk (NXT) · Far-field crosstalk (FXT)

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1 Introduction

1.1 Transmission Line

In high-speed RF circuits, electromagnetic signal interference termed as coupling between adjointly placed signal conductor lines limits signal transmission performance, which becomes a bottleneck to improve the data rate of circuits. The transmission line is influenced by crosstalk, when it exposed to very high frequency (RF or MICROWAVE) as well as its performance is affected [1]. In multi-conductor transmission line system, transit signal leakage termed as surge in any one of the multi-conductors (generators) results in interference in other adjacent conductors (receptors). It's a general electromagnetic interference (EMI) phenomenon due to electromagnetic signal coupling between the conductors of the transmission lines. Crosstalk becomes the area of interest where more than one transmission lines are involved in signal carrying task from high-speed digital transmitter to the destination and runs closely parallel, as found in PCB's traces and data busses. Crosstalk is an intra-system interference that can negatively affect the operation of the product. Unlike the far field encountered in the radiated emissions, crosstalk involves near-field electromagnetic coupling [2]. Crosstalk is of two types: considerably radiative crosstalk and inductive crosstalk. The effect of interference cannot be avoided but can be handled by keeping the values minimum by employing defective ground structures. Estimation of crosstalk is carried out by calculating mutual capacitive coupling and mutual inductive coupling. Mutual capacitive coupling is contributed to the multi-conductor transmission lines by the trace capacitance of the conductors, whereas mutual inductive coupling is contributed by the series inductive property of the traces. Based on the capacitive and inductive coupling, signal transmission direction and reflection in the signal path along with the backward coupling of signals are studied. Crosstalk can be a significant functional problem with these PCBs as can the degradation of the intended signal transmission through attenuation, time delay and other effects [3]. Crosstalk is generally resulting due to the unwanted effect of bulk capacitance, inductance and coupling in terms of conductive nature of the visa and other conductors in the circuit. Multi-conductor transmission lines (MTLs) are victims of this crosstalk since its structure promotes conduction coupling to a greater extend. The electromagnetic interference (EI) issues happened in the infinite perfect electric conductor are more complicated than the other material in the environment. New efficient implementing approach for modelling EM-free multi-conductor transmission lines is proposed. Crosstalk is identified as the conduction effect of multi-conductor transmission lines (MLTs) since traces or MLTS are the largest and longest conducting element available in the high-speed RF systems.

Consider the traces illustrated here.

In Fig. 1 a simple transmission line of physical structure is shown, and MTLs consist of four ports, namely, A, B, C and D. In the shown MTLs, port A is considered as the source port. Port B is the destination port where the power fed in Port A

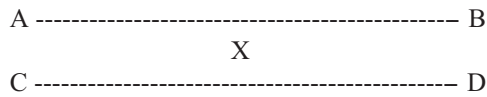

Fig. 1 Simple illustration of multi-conductor transmission lines

is expected to be delivered. Ports C and D are stand-by ports which expected to carry no signal power from the designated digital transmission source. Digital source is considered to be a high-frequency source, and the MTLs suffer from the interference of signal. Line AB is termed as crosstalk source, and CD is termed as victim. Signal power interference near Port A exactly at Port C is called as near-field crosstalk, and signal surge near Port D is termed as far-field crosstalk. In other words, the crosstalk that occurs within lambda/2 distance from source is called as near-field crosstalk, and greater than lambda/2 distance from the source is called as far-field crosstalk.

NXT and FXT Crosstalk Crosstalk is categorized into far-end (FXT) and near-end (NXT) crosstalk. In FXT, the source signal travels in the same direction as the victim signal. NXT, on the part, happens due to the coupling of the source signal to the victim and travelling in the opposite direction and in general is considered as a critical issue since the strong source signal can be added up into an attenuated victim signal in the connector or package located on the receiver side where the signal is already attenuated. Crosstalk is due to either capacitive or inductive coupling of two signal lines (likely to be more inductive in connectors). Crosstalk effect is relatively less at lower frequencies less than 1 GHz.

Crosstalk Prediction Estimation of crosstalk in MTLs is quite challenging in high-speed PCBs. Prediction of FXT and NXT is carried out by calculating even mode and odd mode impedance which inherence the MTL's physical dimensions [4]. Among the available conductors in a pair of conductors, one conductor acts as a prefect ground which exhibits a characteristic impedance Z to the signal conductor. When both conductors are supplied with same potential, then even mode impedance, Z_e, is estimated. Applying different potentials will result in the estimation of odd mode impedance, Z_o. The characteristic impedance is measured between an isolated conductor and a perfect ground which is Z. The conductors are terminated with perfect impedance that approximates their characteristic impedance, Z; thus the magnitudes Z_e and Z_o which are derived as shown in Eqs. (1), (2) and (3) are possible.

The odd and even mode impedances for a pair of conductors above are the perfect ground termed as the following equations [5]:

$$Z_e = 276\log\left(2Ds/d\right)\sqrt{1/1+\left(Ds/2h\right)^2} \tag{1}$$

$$Z_o = 69\log\left(4h/d\right)\sqrt{1/1+\left(2h/Ds\right)^2} \tag{2}$$

Where:

'*h*' is the height above the ground, 'Ds' is the distance between the conductors and '*d*' is the diameter of the conductor.

The The characteristics impedance of the transmission line to be found the relationship,

$$Z = \sqrt{Z_o Z_e} \tag{3}$$

Crosstalk calculation for applied voltages is done using the following equation:

$$C = \left(Z_e / Z_o - 1\right) / \left(Z_e / Z_o + 1\right) \tag{4}$$

Numerical solving of the proposed conductors is done by solving the above relations. In order to estimate all the crosstalk, the dimensions are considered.

Design Methods Initially the designed procedure is initiated by analysing the crosstalk by using a numerical circuit solver simulation tool Advance Design System (ADS). The solver supports the entire design process from layout design to schematics design with all sorts of parametric studies; it provides guidance and support for design rule checking (DRC) of high-frequency structures. It provides both method of moments (MoM) and field element method (FEM) analysis-based EM simulations. Computational electromagnetic field simulation provides the flexibility to the design engineer to fully characterize and optimize an RF design before implementation. Circuit solvers are the most innovative and commercially successfully technologies which include X-parameter, 3D EM simulator which finds wider applications in wireless communications, aerospace, networking and defence industries. ADS numerical solver has bundles like wireless libraries and circuit systems integrated with the EM simulation for the standard-based design and verification.

Eye Pattern MTLs are handling high-frequency digital transmission at the signalling rate of 5G bits per second. Interference in terms of crosstalk becomes more concern. Estimation of crosstalk can be done mathematically; in practice an ideal tool is used to estimate or visualize crosstalk termed as eye pattern. An eye pattern is a visualizing tool used at the receiving end or at the channel to understand the influence of crosstalk in the data stream transmitted. Eye pattern or eye diagram is obtained by the following methods: first the time period in terms of bit rate is fixed depending on the data rate. Streams of pulses are sliced and fit it to the 1-bit duration, and overlapping of data on a single bit time period will result in a pattern which resembles the human eye. Two parameters, namely, eye height and timing jitter, are used to characterize quantitatively the voltage and timing errors. The triggering edge may be positive or negative, but the displayed pulse that appears after a delay period may go either way; there is no way of knowing beforehand the value of an arbitrary bit. An eye diagrams would look like rectangular boxes. Differences in timing and amplitude from bit to bit cause the eye opening to shrink [6].

Intersymbol Interference [ISI] It is an effect observed in the digital transmission at high speed and considered to be the main reason for crosstalk in RF system design. One or more symbols can interfere with other symbols causing noise or a less reliable signal transmission. If intersymbol interference occurs within a system, the receiver output becomes distorted at the decision device. This is an unwanted effect which questions the integrity of the transmitted signal and the entire system design and needed to be addressed. Error rates from intersymbol interference are minimized through the use of adaptive equalization techniques and error-correcting codes [7].

1.1.1 Structure Modelling

Type A. Step-Shaped Conductor Transmission Line The step-shaped transmission line structure is designed and emphasizes the accuracy of the simulated results, and commercially available software package ADS have been used. Validation of the simulation result is performed by fabricating the proposed structure on commercially available fabricating material Fr4 substrate with thickness $h = 0.8$ *mm*. The proposed structure total length is about 0.06 cm, where the length (L) of step 0.05 cm, width (W) 0.0031 cm and space (S) 0.02 cm. The structure is proceeded with constant 50-ohm characteristic impedance with the frequency of 1–3 GHz. In the proposed system, the crosstalk is estimated by verifying insertion loss, return loss, smith chart analysis and radiation pattern.

Type B. Slant Step-Shaped Conductor Structure Figure 3 shows a slant step-shaped transmission line structure designed using ADS. The structures are proceeded with constant 50-ohm characteristic impedance with the frequency of 2–5 GHz. The crosstalk has been estimated by verifying insertion loss, return loss, impedance and radiation pattern.

Figures 2 and 3 show the configuration of proposed transmission lines with the respective dimension and spacing. The crosstalk is improved near 3 dB without any marginal changes in insertion and return loss which is further tabulated in Tables 1, 2 and 3. The three-dimensional radiation patterns are easy to plot and one of a

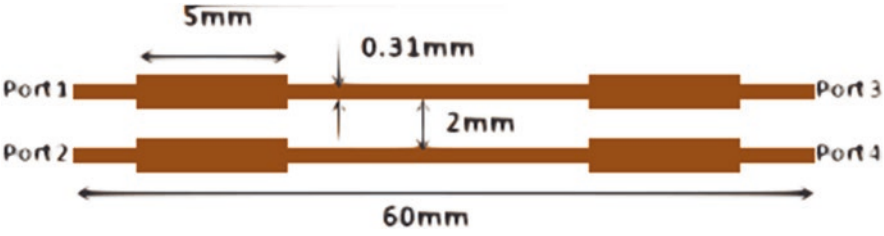

Fig. 2 Geometry of step-shaped transmission line conductor

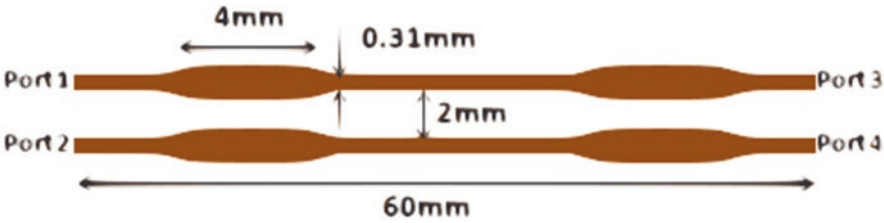

Fig. 3 The geometry of slant step-shaped conductor

Table 1 Physical dimension description

S. no.	Structure	Width (*W*)	Length (*L*)	Space (*S*)
1	Type A	0.31 mm	60 mm, 5 mm step	2 mm
2	Type B	0.31 mm	60 mm, 4 mm step	2 mm

Table 2 Parametric analysis table

S. no.	Structure	Insertion loss (dB)	Return loss (dB)	Characteristic impedance	Radiation pattern
1	Type A	−0.240	−38.029	Z0 = 49.022 + j0.012	Appearance of green colour
2	Type B	−0.585	−40.638	Z0 = 51.003 + j0.018	Spread of green colour

Characteristic impedance = 50 Ω

Table 3 Crosstalk estimation

Structure	Z_e in ohms	Z_o in ohms	Crosstalk
Type 1	157.18	−39.26	1.0523
Type 2	157.78	−39.26	1.0523

methods for identifying whether the conductor is radiating or not [8]. At 3 dB the radiation pattern infers that the step-shaped structure is a good non-radiating transmission line structure compared to the step-shaped transmission line conductor.

For uniform transmission line (in which γ is constant), the complex reflection coefficient of a standing wave varies according to the position on the line. If the line is loss (α is non-zero), this is represented on the smith chart by a spiral pattern. The impedance (Z0) and admittance (Y0) along reflection coefficient are estimated and have been tabulated in Table 1.

2 Conclusion

The design approach for the analysis of crosstalk in a complex structure of trace lines has been studied. The results discussed exhibits good reconciliation with simulated results and the measured results of the proposed system. The proposed approach satisfactorily estimates the crosstalk for multi-conductor transmission line model. The return loss of Type B is better than Type A and obtained the crosstalk as explained in the result comparison table. Thus, a stable return loss, insertion loss, is obtained for the Type B conductor structure and is found satisfied than Type A structure. The non-radiating structure is flexible and compatible to be implemented in multi-conductor transmission line of high-speed PCBs.

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Mediating Effect of Quality Enhancement Between ICT-Related Factors and Student Satisfaction in Open and Distance Education

Pushkar Dubey, Arvind Tiwari, and Kailash Kumar Sahu

Abstract Embedding information and communication technology in distance learning is a major initiative and is playing an important role in the overall development of learners and their learning effectiveness. The present research investigated the mediating role of quality enhancement between ICT-related factors and student satisfaction in distance learning institutions in Chhattisgarh state. The data were collected from 400 participants who were teachers and staffs engaged in open and distance learning (ODL) in higher educational institution. Purposive sampling technique was used for collecting the data. Results indicated that quality enhancement was found to be significant as a mediating role between ICT-related constructs (i.e. ICT in administration, online admission, attitude of teacher/educator towards ICT application and value and ethics) and student satisfaction, whereas quality enhancement didn't mediate between quality of support services and ICT-empowered teaching-learning process and student satisfaction.

Keywords Information and communication technology (ICT) · Quality enhancement · Student satisfaction · Open and distance education

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1 Introduction

Information and communication technology (ICT) is proven as being one of the major factors in creating new global economy. It is one of the causes of the rapid changes in the society. ICT has a big impact on various sectors like agriculture, medicine, business, engineering and many others. It also has the capability to change the entire education and its processes to deliver knowledge to various learners.

The role and usage of information and communication technology (ICT) in enhancing the quality of student support services in open and distance education is, now, a proven fact. The open and distance education system has positively and quickly responded to become a part of ICT revolution. This happened due to three reasons: first, to reduce the cost involved in providing education; second, to introduce need-based educational programmes to a large number of learners; and third, to reduce the time factor in sanctioning new programmes by smoothening the administrative processes.

In this paper, authors examine the mediating role of quality enhancement between ICT-related factors and student satisfaction in open and distance education in Chhattisgarh state.

2 Literature Review

The increased usage of information and communication technology (ICT) in order to deliver education through improving quality of content provided to all the learners belonging to different rural and remote areas is currently benefiting by overcoming geographical barriers [1].

Furthermore, teachers are the backbone of education, and their attitude is essential in improving the educational quality through the usage of information and communication technology (ICT). In this process, faculty has to realise that e-teaching-related field expertise and specific skill are needed [2] and learning courses and materials must be designed in a way of benefitting the students the most [3]. Thus, institutions are required to put more attention in providing extensive training to the newly user of technologies in order to enhance their skills in the ICT-based teaching-learning process in open and distance learning environment [4].

Modern information and communication technology (ICT) provides numerous opportunities for effective support services such as proper communication. Virtual learning environment facilitates more improved communication which creates more student centred and flexible conditions for every learner in comparison to traditional classrooms [5]. Previous literatures revealed that better quality and quantity of communication can enhance the overall perception and satisfaction of students [6]. However, Allen, Mabry, Mattrey, Bourhis, Titsworth and Burrell [7] argued that there is no evidence available that the introduction of ICT in education increased the learners' effectiveness.

3 Operational Definition

Operational definitions of all the variables used in the study:

3.1 ICT in Administration

ICT-enabled administration assists in proper utilisation of human and material resources and their application in the right manner [8].

3.2 Online Admission

It is defined as web-based software designed to administer all admission-related processes of an institution [9].

3.3 Attitude of Teacher/Educator Towards ICT Application

It is a subjective or mental preparation for a certain action. Teachers' attitude towards ICT application means their perspective and interest towards its effectiveness and utilisation.

3.4 Value and Ethics

Value is termed in the study as the significance of ICT in overall education. ICT's technology-enhanced environment creates more stimulating and engaging conditions for learning than the traditional method.

3.5 Quality of Support Services

Support services are the number of facilities and services provided in order to create a better learning environment for students' learning [10].

3.6 ICT-Empowered Teaching-Learning Process

ICT-empowered teaching-learning process can be said as ICT-based professional training provided to teachers to improve the learning process aiming to develop advanced knowledge and skills [11].

3.7 Quality Enhancement

Quality enhancement is the process of improvement or augmentation. The term is basically for the enhancement of individual learners' ability, knowledge, attributes, skill and potential which is the improvement of an institution as well as the offered programme [12].

3.8 Student Satisfaction

Student satisfaction is referred to a short-term attitude experienced through a course of time spent in receiving educational services and facilities [13].

4 Research Objective

The objective of the present study is to examine the mediating effect of quality enhancement between ICT-related constructs (i.e. ICT in administration, online admission, attitude of teacher/educator towards ICT application, value and ethics, quality of support services and ICT-empowered teaching-learning process) and student satisfaction in open and distance learning institutions in the state of Chhattisgarh.

5 Methodology

The constituted population of the study includes the teaching and administrative staffs of different distance learning institutions in the state of Chhattisgarh. Data were collected from altogether 400 sample respondents (teaching and administrative staffs) across three different educational institutions engaged in delivering open and distance learning in the state of Chhattisgarh. Purposive sampling technique was used to draw sample from the given population. The data were collected during July to December 2019 in Chhattisgarh.

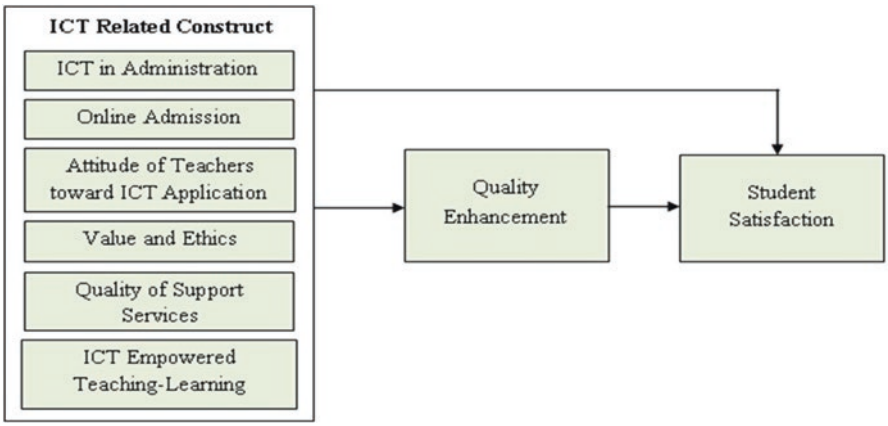

Fig. 1 Conceptual framework of the study

A self-structured questionnaire was formulated with eight different constructs, namely, ICT in administration (8 items $\alpha = 0.739$), online admission (3 items $\alpha = 0.751$), attitude of teachers towards ICT application (5 items $\alpha = 0.721$), value and ethics (3 items $\alpha = 0.71$), quality of support services (5 items $\alpha = 0.732$), ICT-empowered teaching-learning process (4 items $\alpha = 0.749$), quality enhancement (5 items $\alpha = 0.731$) and student satisfaction (3 items $\alpha = 0.745$).

The conceptual framework of the study is presented in Fig. 1. Altogether six different hypotheses were formulated to test whether quality enhancement mediates the relationship between ICT-related constructs and student satisfaction. To test the hypothesis, SPSS v25 software (licenced) was used to conduct regression analysis. In order to find the mediating effect of quality enhancement as a link between ICT related constructs and student satisfaction, 'process macro' in SPSS developed by Andrew Hayes was used [14].

5.1 Hypotheses

H1. Quality enhancement would positively mediate as a link between ICT in administration and student satisfaction.
H2. Quality enhancement would positively mediate as a link between online admission and student satisfaction.
H3. Quality enhancement would positively mediate as a link between attitude of teacher/educator towards ICT application and student satisfaction.
H4. Quality enhancement would positively mediate as a link between value and ethics and student satisfaction.
H5. Quality enhancement would positively mediate as a link between quality of support services and student satisfaction.

H6. Quality enhancement would positively mediate as a link between ICT-empowered teaching-learning process and student satisfaction.

6 Analysis and Result

6.1 Proposed Hypothesis 1

Model I proposes to find the mediating effect of quality enhancement as a link between ICT in administration and student satisfaction in open and distance education in Chhattisgarh as shown in Fig. 2 and Table 1.

Results indicated that ICT in administration was found as a significant indicator of quality enhancement, $\beta = 0.3559$, SE = 0.0368, $t = 9.66004$, $p < 0.05$, and that quality enhancement was found as a significant indicator of student satisfaction, $\beta = 0.1577$, SE = 0.0194, $t = 8.1195$, $p < 0.05$. The results supported the mediational hypothesis. After controlling the mediator, ICT in administration was found as a significant indicator of student satisfaction, $\beta = 0.1451$, SE = 0.0159, $t = 9.1477$, $p < 0.05$, and was also found consistent with partial mediation. The predictor noted approximately 39.99% of the variation in student satisfaction ($R^2 = 0.3999$). The percentile bootstrap estimation method was used for testing the indirect effect [15], as implemented with the 'process macro'. These outcomes showed the indirect coefficient was found to be significant, $\beta = 0.0561$, SE = 0.0296, CI = 0.0282–0.1384. Thus, ICT in administration is associated with student satisfaction and that it was partially mediated (0.0561) by quality enhancement.

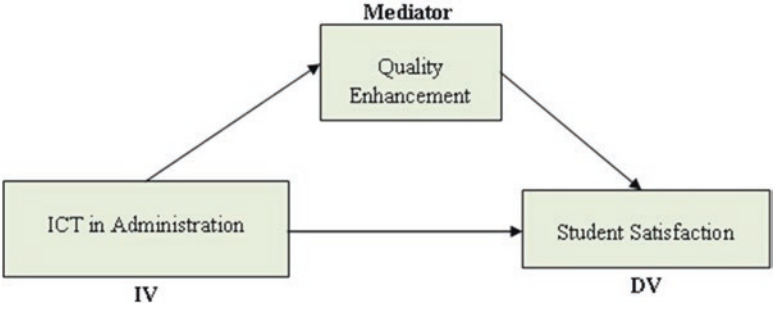

Fig. 2 Model I for Hypothesis 1

Table 1 Mediation table for Proposed Hypothesis 1

Quality enhancement						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*p*
0.4358	0.1899	13.763	93.3229	1	398	0.0000
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	9.0562	1.1357	7.9742	0.0000	6.8235	11.2889
ICT in administration	0.3559	0.0368	9.6604	0.0000	0.2835	0.4284
Student satisfaction						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*p*
0.6324	0.3999	2.0654	132.3042	2	397	0.0000
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	4.0718	0.4738	8.5941	0.0000	3.1403	5.0032
ICT in administration	0.1451	0.0159	9.1477	0.0000	0.1139	0.1762
Quality enhancement	0.1577	0.0194	8.1195	0.0000	0.1195	0.1958
Direct effect of ICT in administration on student satisfaction						
Effect	SE	*t*	*p*	LLCI	ULCI	
0.1451	0.0159	9.1477	0.0000	0.1139	0.1762	
Indirect effect of ICT in administration on student satisfaction						
	Effect	BootSE	BootLLCI	BootULCI		
Quality enhancement	0.0561	0.0296	0.0282	0.1384		
Level of confidence for all confidence intervals in output						
95						
Number of bootstrap samples for percentile bootstrap confidence intervals						
5000						

6.2 Proposed Hypothesis 2

Model II proposes to find the mediating effect of quality enhancement as a link between online admission and student satisfaction in open and distance education in Chhattisgarh as shown in Fig. 3 and Table 2.

Result indicated that online admission was found as a significant indicator of quality enhancement, $\beta = 0.6122$, SE = 0.0930, $t = 6.5812$, $p < 0.05$, and that quality enhancement was found as a significant indicator of student satisfaction, $\beta = 0.2101$, SE = 0.0199, $t = 10.5848$, $p < 0.05$. The result supports the mediational hypothesis. After controlling the mediator, online admission was found as a significant indicator of student satisfaction, $\beta = 0.1557$, SE = 0.0388, $t = 4.0128$, $p < 0.05$, and was also found consistent with partial mediation. The predictor noted approximately 30.18% of the variation in student satisfaction ($R^2 = 0.3018$). The percentile bootstrap estimation method was used for testing the indirect effect, as implemented with the 'process macro'. These outcomes showed the indirect coefficient was found to be

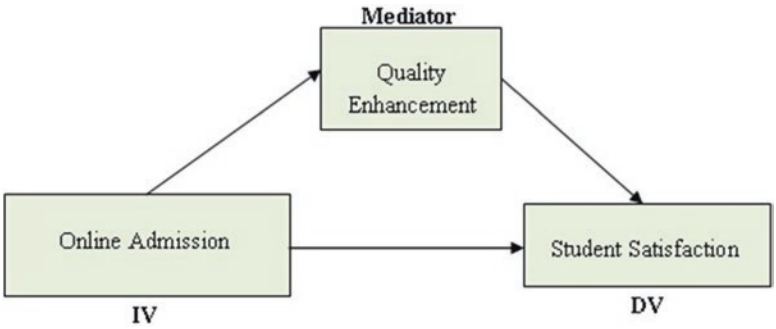

Fig. 3 Model II for Hypothesis 2

Table 2 Mediation table of Proposed Hypothesis 2

Quality enhancement						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*p*
0.3133	0.0981	15.3230	43.3121	1	398	0.0000
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	12.5198	1.1354	11.0272	0.0000	10.2878	14.7519
Online admission	0.6122	0.0930	6.5812	0.0000	0.4293	0.7951
Student satisfaction						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*p*
0.5494	0.3018	2.4033	85.7972	2.0000	397	0.0000
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	5.5688	0.5138	10.8395	0.0000	4.5588	6.5788
Online admission	0.1557	0.0388	4.0128	0.0001	0.0794	0.2319
Quality enhancement	0.2101	0.0199	10.5848	0.0000	0.1711	0.2491
Direct effect of online admission on student satisfaction						
Effect	SE	*t*	*p*	LLCI	ULCI	
0.1557	0.0388	4.0128	0.0001	0.0794	0.2319	
Indirect effect of online admission on student satisfaction						
	Effect	BootSE	BootLLCI	BootULCI		
Quality enhancement	0.1286	0.0616	0.0640	0.2977		
Level of confidence for all confidence intervals in output						
95						
Number of bootstrap samples for percentile bootstrap confidence intervals						
5000						

significant, $\beta = 0.1286$, SE = 0.0616, CI = 0.0640–0.2977. Thus, online admission is associated with student satisfaction and that it was partially mediated (0. 1286) by quality enhancement.

6.3 Proposed Hypothesis 3

Model III proposes to find the mediating effect of quality enhancement as a link between attitude of teacher/educator towards ICT application and student satisfaction in open and distance education in Chhattisgarh as shown in Fig. 4 and Table 3.

Result indicated that attitude of teacher/educator towards ICT application was found as a significant indicator of quality enhancement, $\beta = 0.1331$, SE = 0.0494, $t = 2.6977$, $p < 0.05$, and that quality enhancement was found as a significant indicator of student satisfaction, $\beta = 0.2231$, SE = 0.0189, $t = 11.8167$, $p < 0.05$. The results supported the mediational hypothesis. After controlling the mediator, attitude of teacher/educator towards ICT application was found as a significant indicator of student satisfaction, $\beta = 0.0886$, SE = 0.0188, $t = 4.7232$, $p < 0.05$, and was also found consistent with partial mediation. The predictor noted approximately 31.21% of the variation in student satisfaction ($R^2 = 0.3121$). The percentile bootstrap estimation method was used for testing the indirect effect, as implemented with the 'process macro'. These outcomes showed the indirect coefficient was found to be significant, $\beta = 0.0297$, SE = 0.02, 95% CI = 0.0067–0.0848. Thus, attitude of teacher/educator towards ICT application is associated with student satisfaction and that it was partially mediated (0.0297) by quality enhancement.

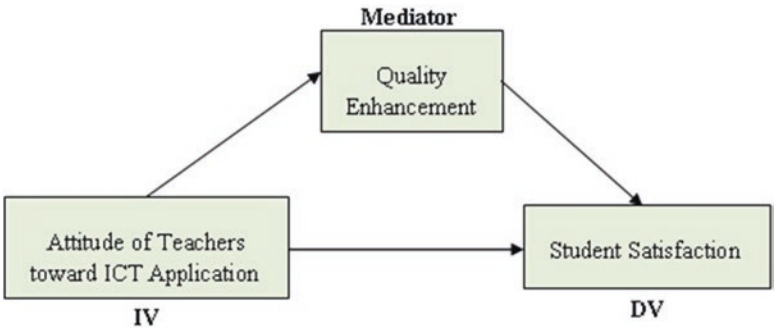

Fig. 4 Model III for Hypothesis 3

Table 3 Mediation table for Proposed Hypothesis 3

Quality enhancement						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*p*
0.1340	0.0180	16.6855	7.2775	1	398	0.0073
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	17.3447	0.9617	18.0346	0.0000	15.4540	19.2354
Attitude of teacher towards ICT application	0.1331	0.0494	2.6977	0.0000	0.0361	0.2302
Student satisfaction						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*p*
0.5587	0.3121	2.3677	90.0684	2.0000	397	0.0000
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	5.4944	0.4884	11.2504	0.0000	4.5343	6.4545
Attitude of teacher towards ICT application	0.0886	0.0188	4.7232	0.0000	0.0517	0.1255
Quality enhancement	0.2231	0.0189	11.8167	0.0000	0.1860	0.2602
Direct effect of attitude of teacher towards ICT application on student satisfaction						
Effect	SE	*t*	*p*	LLCI	ULCI	
0.0886	0.0188	4.7232	0.0000	0.0517	0.1255	
Indirect effect of attitude of teacher towards ICT application on student satisfaction						
	Effect	BootSE	BootLLCI	BootULCI		
Quality enhancement	0.0297	0.0200	0.0067	0.0848		
Level of confidence for all confidence intervals in output						
95						
Number of bootstrap samples for percentile bootstrap confidence intervals						
5000						

6.4 Proposed Hypothesis 4

Model IV proposes to find the mediating effect of quality enhancement as a link between value and ethics and student satisfaction in open and distance education in Chhattisgarh as shown in Fig. 5 and Table 4.

Results indicated that value and ethics was found as a significant indicator of quality enhancement, $\beta = 0.2367$, SE = 0.0488, $t = 4.8483$, $p < 0.05$, and that quality enhancement was found as a significant indicator of student satisfaction, $\beta = 0.2237$, SE = 0.0196, $t = 11.3895$, $p < 0.05$. The results supported the mediational hypothesis. After controlling the mediator, value and ethics was found as a significant indicator of student satisfaction, $\beta = 0.0482$, SE = 0.0197, $t = 2.4491$, $p < 0.05$, and was also found consistent with partial mediation. The predictor noted approximately 28.43% of the variation in student satisfaction ($R^2 = 0.2843$). The percentile

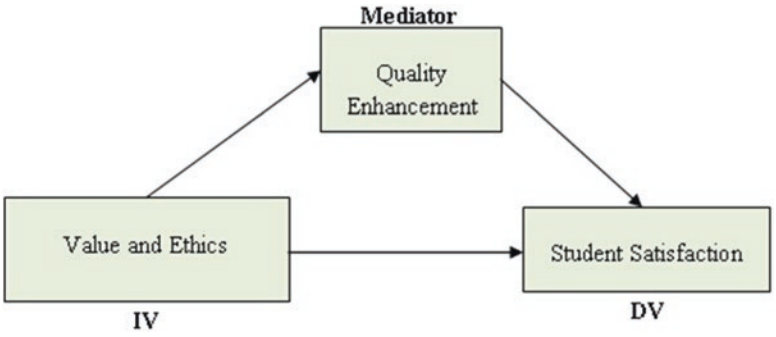

Fig. 5 Model IV for Hypothesis 4

Table 4 Mediation table for Proposed Hypothesis 4

Quality enhancement						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*P*
0.2361	0.0558	16.0431	23.5058	1	398	0.0000
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	17.0241	0.6222	27.3627	0.0000	15.8010	18.2473
Value and ethics	0.2367	0.0488	4.8483	0.0000	0.1407	0.3327
Student satisfaction						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*P*
0.5332	0.2843	2.4635	78.8433	2.0000	397	0.0000
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	6.5883	0.4138	15.9200	0.0000	5.7747	7.4018
Value and ethics	0.0482	0.0197	2.4491	0.0148	0.0095	0.0869
Quality enhancement	0.2237	0.0196	11.3895	0.0000	0.1851	0.2623
Direct effect of value and ethics on student satisfaction						
Effect	SE	*t*	*p*	LLCI	ULCI	
0.0482	0.0197	2.4491	0.0148	0.0095	0.0869	
Indirect effect of value and ethics on student satisfaction						
	Effect	BootSE	BootLLCI	BootULCI		
Quality enhancement	0.0530	0.0760	0.0224	0.3011		
Level of confidence for all confidence intervals in output						
95						
Number of bootstrap samples for percentile bootstrap confidence intervals						
5000						

bootstrap estimation method was used for testing the indirect effect, as implemented with the 'process macro'. These outcomes showed the indirect coefficient was

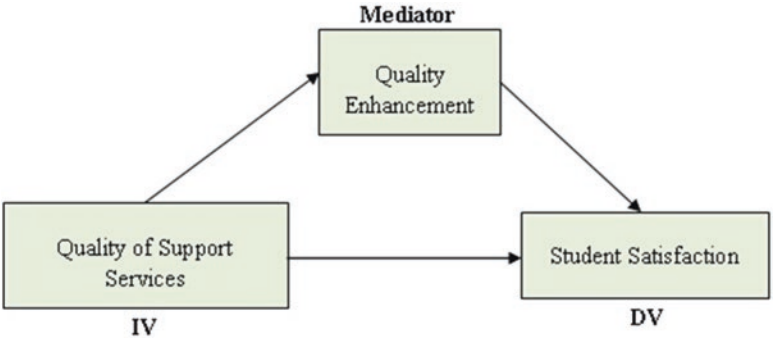

Fig. 6 Model V for Hypothesis 5

found to be significant, $\beta = 0.0530$, SE = 0.0760, CI = 0.0224–0.3011. Thus, value and ethics is associated with student satisfaction and that it was partially mediated (0.053) by quality enhancement.

6.5 Proposed Hypothesis 5

Model V proposes to find the mediating effect of quality enhancement as a link between quality of support services and student satisfaction in open and distance education in Chhattisgarh as shown in Fig. 6.

Table 5 explains that the direct effect of quality of support services on student satisfaction was not significant, $\beta = 0.1319$, SE = 0.0226, $t = 1.8378$, $p > 0.05$, and also there is no significant relation between quality enhancement and student satisfaction, $\beta = 0.1947$, SE = 0.0197, $t = 1.8776$, $p > 0.05$. Hence, quality enhancement does not mediate the relation between quality of support services and student satisfaction.

6.6 Proposed Hypothesis 6

Model VI proposes to find the mediating effect of quality enhancement as a link between ICT-empowered teaching-learning process and student satisfaction in open and distance education in Chhattisgarh as shown in Fig. 7.

Table 6 explains that there is no significant relation found between ICT-empowered teaching-learning process and quality enhancement, $\beta = 0.6182$, SE = 0.0836, $t = 1.5958$, $p > 0.05$, and also no significant connection is found between ICT-empowered teaching-learning process and student satisfaction, $\beta = 0.1596$, SE = 0.0356, $t = 1.4855$, $p > 0.05$. Hence, quality enhancement has no

Table 5 Mediation table for Proposed Hypothesis 5

Quality enhancement						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*p*
0.3511	0.1233	14.8962	55.9575	1	398	0.0000
Model						
	Coeff	SE	*t*	*P*	LLCI	ULCI
Constant	12.2508	1.0380	11.8026	0.0000	10.2102	14.2914
Quality of support services	0.4025	0.0538	7.4805	0.0000	0.2968	0.5083
Student satisfaction						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*p*
0.5752	0.3309	2.3030	98.1687	2.0000	397	0.0670
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	5.2471	0.4742	7.0649	0.0670	4.3148	6.1793
Quality of support services	0.1319	0.0226	1.8378	0.0790	0.0875	0.1763
Quality enhancement	0.1947	0.0197	1.8776	0.0670	0.1559	0.2334
Direct effect of quality of support services on student satisfaction						
Effect	SE	*t*	*p*	LLCI	ULCI	
0.1319	0.0226	1.8378	0.0790	0.0875	0.1763	
Indirect effect of quality of support services on student satisfaction						
	Effect	BootSE	BootLLCI	BootULCI		
Quality enhancement	0.0784	0.0356	0.0413	0.1789		
Level of confidence for all confidence intervals in output						
95						
Number of bootstrap samples for percentile bootstrap confidence intervals						
5000						

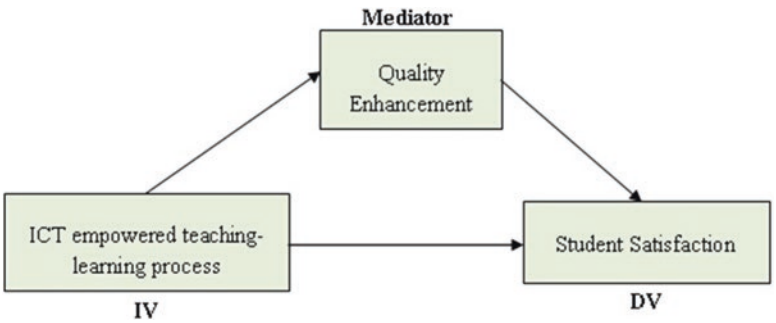

Fig. 7 Model VI for Hypothesis 6

place to play a mediating role between ICT-empowered teaching-learning process and student satisfaction in Table 6.

Table 6 Mediation table for Proposed Hypothesis 6

Quality enhancement						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*p*
0.3476	0.1208	14.9377	54.6977	1	398	0.0750
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	9.4004	1.4301	2.5733	0.0750	6.5889	12.2118
ICT-empowered teaching-learning process	0.6182	0.0836	1.5958	0.0750	0.4539	0.7825
Student satisfaction						
Model summary						
R	*R*-sq	MSE	*F*	df1	df2	*p*
0.5554	0.3085	2.3801	88.5617	2.0000	397	0.0000
Model						
	Coeff	SE	*t*	*p*	LLCI	ULCI
Constant	4.8586	0.6010	8.0837	0.0000	3.6770	6.0402
ICT-empowered teaching-learning process	0.1596	0.0356	1.4855	0.0820	0.0897	0.2296
Quality enhancement	0.2039	0.0200	10.1896	0.0000	0.1645	0.2432
Direct effect of ICT-empowered teaching-learning process on student satisfaction						
Effect	SE	*t*	*p*	LLCI	ULCI	
0.1596	0.0356	1.4855	0.0820	0.0897	0.2296	
Indirect effect of ICT-empowered teaching-learning process on student satisfaction						
	Effect	BootSE	BootLLCI	BootULCI		
Quality enhancement	0.1260	0.0694	0.0588	0.3150		
Level of confidence for all confidence intervals in output						
95						
Number of bootstrap samples for percentile bootstrap confidence intervals						
5000						

7 Discussion

The result of the first hypothesis concluded that quality enhancement is found partially mediated between ICT in administration and student satisfaction, and the hypothesis is accepted. Thus, it can also be said that quality enhancement has created a positive relation with both ICT in administration and student satisfaction which explains that the more ICT in administrative functions, the more improved the institution would be and the more improved and enhanced the institution and its processes, the higher the satisfaction of students.

The result of the second hypothesis revealed that quality enhancement has significantly and partially mediated between online admission and student satisfaction, and the hypothesis is accepted. The results indicated that quality enhancement is significantly connected to both online admission and student satisfaction because

Table 7 Outcome of the proposed hypothesis of the study

Hypothesis	Statement	Result
H1	Quality enhancement would positively influence as a link between ICT in administration and student satisfaction	Accepted
H2	Quality enhancement would positively influence as a link between online admission and student satisfaction	Accepted
H3	Quality enhancement would positively influence as a link between attitude of teacher/educator towards ICT application and student satisfaction	Accepted
H4	Quality enhancement would positively influence as a link between value and ethics and student satisfaction	Accepted
H5	Quality enhancement would positively influence as a link between quality of support services and student satisfaction	Rejected
H6	Quality enhancement would positively influence as a link between ICT-empowered teaching-learning process and student satisfaction	Rejected

quality can be enhanced through inviting online applications for admission, and with that the students will be more motivated and satisfied by saving their cost, time and energy.

The result of the third hypothesis concluded that quality enhancement is found positive and significant mediation between attitude of teacher/educator towards ICT application and student satisfaction, and the hypothesis is accepted. The results indicated that quality enhancement is positively associated with both variables, i.e. attitude of teacher/educator towards ICT application and student satisfaction. Quality enhancement would increase by changing the attitude of teacher/educator towards using ICT application in their teaching process, and when the quality improves in the institution, the satisfaction among students would also increases.

The result of the fourth hypothesis reported that quality enhancement has significantly and partially mediated between value and ethics and student satisfaction, and the hypothesis is accepted. The results indicated that quality enhancement is positively related to both variables, i.e. value and ethics and student satisfaction. This means that value and ethics among stakeholders positively improves the quality in various functions of the institution and the enhanced quality creates satisfaction among students enrolled in open and distance education.

The result of the fifth hypothesis concluded that quality enhancement did not play a mediating role between quality of support services and student satisfaction, and the hypothesis is rejected, since there is no significant connection found between quality enhancement and student satisfaction and also no significant relation evidenced between quality of support services and student satisfaction. Thus, open and distance institutions are needed to improve their quality of support services in order to achieve quality enhancement which will further lead to students satisfaction.

The result of the sixth hypothesis concluded that quality enhancement did not create any significant mediation between ICT-empowered teaching-learning process and student satisfaction, and the hypothesis is rejected. This explains that open and distance institutions are still required to work on ICT-based teaching-learning

process which further leads to student satisfaction. However, in this study, quality enhancement does not play any significant mediation between ICT-empowered teaching-learning process and student satisfaction.

8 Conclusion

Information and communication technology (ICT) has become inevitable in the current world where the learners need to cope up with new innovations and knowledge. Open and distance education offers demand-based educational programmes to nation builders, i.e. students in which ICT plays a dominant role by improving the quality and effectiveness of learners. The current study is focused on examining the mediating role of quality enhancement between ICT-related factors and satisfaction of students enrolled in open and distance educational programmes in government and private universities in Chhattisgarh. This study highlighted the importance of ICT in the current education and also explains its relevance for the future challenges. Quality enhancement, in the regular basis, is utmost important in the current education system to increase the satisfaction and effectiveness among learners.

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Synthesis and Characterization of Nanoparticles

C. Chandralekha

Abstract In the existing technology world, nano is a hot area for the researchers. Nanoparticles of very lesser size like 1 to 100 nm in dimension are used in various chemistry fields, physics related to atoms and several other fields. They were used to analyse and prove the performance of several materials which come in closer to it. Several approaches based on physics, chemistry and biology are used in preparation of these particles. But the most cost-effective, less time consumption and easier approach is the approach based on biology. In this paper, we analyse and synthesize silver nanoparticles (AgNPs) by using methods based on biology with *Ocimum sanctum*. Synthesis of silver nanoparticles was completed using tulsi by applying green synthesis method at different pH ranges. Using UV-visible spectroscopy, characterization of AgNPs was completed. Applying various ph ranges, the adsorption of dyes was conducted and resulted in adsorption of cationic and neutral dyes and pesticide reductions.

Keywords Nanoparticles · Osmium sanctum · Nanotechnology · Computing · Networks

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1 Elementary Units of Nanotechnology: Nanoparticles

1.1 Intoduction

The basic building blocks of various applications in nanotechnology are the nanoparticles. Nanotechnology is playing a significant role in the day-to-day life of research fields. Various properties of nanoparticles vary based on their properties of physics, chemistry and biology. These properties differ based on the composition of both atoms or molecules present in them and also the entire materials. Carbon, ceramics, biomolecules, metal oxides, non-oxide ceramics and metals are some of the chemical nature of nanoparticles. Nanoparticles have several structures like cylinders, tubes, spheres, platelets and so on. The design of nanoparticles is done by modifying the surfaces to cater the requirements of application for which it will be applied for.

Various features contribute to the diversity of engineered nanoparticles. The same chemical can generate a wide variety of nanoparticles.

1.2 Categorization of Nanoparticles

There are two groups in nanoparticles. They are inorganic and organic nanoparticles. Carbon nanoparticles are present in organic nanoparticles and magnetic nanoparticles, and nanoparticles of metals like silver and gold and nanoparticles of semiconductor like zinc oxide and titanium oxide are present in inorganic nanoparticles. Inorganic nanoparticles are used frequently and effectively since they possess several material characteristics with its flexibility in the functions, and this has been identified as the best device for imaging in medicines and in the treatment of various diseases because of their attributes in dimensions and its advantages over the drugs of chemical composition. Gold nanoparticles is mostly used in carriers of drugs and in therapy related to thermo- and biology [1]. Several inorganic nanoparticles such as metallic nanoparticles and semiconductor nanoparticles portray the optical characteristics which increase the transparent nature of composites of polymer particles. Hence these inorganic nanoparticles are playing a major role in providing the optical characteristics in composites. Several gold nanoparticles depending on size are widely utilized in colouring glass for several centuries [2]. Various adaptable characteristics of inorganic nanoparticles made its usage in cellular delivery like availability, abundant functionality, rich compatibility and efficiency of drug delivery [3].

1.3 Features of Nanoparticles

The surface of the nanoparticle consists of many atoms or molecules, and the amount of surface area present in a unit volume of the nanomaterial is the important outgrowth for the nanoparticles. All these properties grow in magnitude with reducing the size of the particles. Due to the presence of physical, chemical and biological characteristics, the nanoparticles come up from two features. The major boundaries of nanoparticles are the shape which includes aspect ratios. Complex structure of nanoparticles is possible with the difficult compositions of adsorbate which depends on the growth features and the lifespan of a nanoparticle. In the liquid interface of nanoparticle, polyelectrolytes are used to change the features of surface and communication among the particles and their environment. They are used in a vast range of colloidal dispersions [4].

2 Silver Nanoparticles

The distinctive properties like shape and size based on the magnetic, electrical and optical properties that can be included in various applications such as biosensor materials, antimicrobial, electronic and cosmetic products. In the synthesization and stabilization of nanoparticles, various methods based on physical and chemical aspects have been devised.

2.1 Nanosilver

Nanosilver is a material used in nanoformulation. Nanosilver has many features which act against bacteria, and hence it is used widely in water filters to purify drinking water and in cleansing of water in swimming pools. Various methods like reduction in electrochemical, discharging of spark and synthesis of cryochemical use metallic silver confined into ultrafine particles [5]. The size of particles of nanosilver is very much lesser than 100 nm and comprises of about 15,000 to 20,000 of atoms of silver. Application of nanostructures in films, wires, tubes, etc. is possible. When measured with nano scale, the particles of silver portray the contrast features related to physical and chemical depending on pH and dissolving particulars, and the metal is compared with the biological activities [6]. The reason behind this is that the very huge amount of atoms interact with their environments because of the large surface area per mass. In recent days, nanosilver is widely utilized in products related to consumers and medicines because of the properties of silver at the nanoscale.

2.2 Requirement for Silver

The basic element present in our planet is the silver. The silver is not costly and rare like gold but is available naturally with the features of ductile and malleability. The more pure the silver is, the more conduction of electricity occurs with very less resistance in contact. The first two are most widely used, and the second one are not stable in the aquatic environment [7]. Metallic silver does not dissolve in water, but metallic salts and silver chloride are dissolvable in water. Fungicides, coinage and splints are some of the fields where metallic silver is extensively used. In the treatment of addiction of nicotine, mentally ill and diseases which are infectious such as syphilis, various compounds of silver like silver slats are extensively used [8].

3 Synthesization of AG Nanoparticles

Many researchers and scientists are developing materials having very good properties, working with high functions and at very less cost than the already existing materials. Various methods based on physical, chemical and biological methods of synthesis have been formulated and developed to promote the performance of nanoparticles which portray the improved features with the aim to have a good hold on the size of the particle, distribution and morphology [9, 10]. The challenges faced by the researchers in the synthesization of nanoparticles are on applying purity, size distribution, quality and quantity as economical processes which are environment -friendly in nature.

3.1 Silver Nanoparticles' Synthesis Techniques

Approaching Physically Most evaporation and condensation and laser ablation are very significant physical procedures used in the synthesis of silver nanoparticles. This evaporation and condensation method has been applied in the synthesis of several metal nanoparticles like gold, cadmium sulphide, silver and lead sulphide. The major advantages of physical approaches when compared with chemical approaches are that the absence of contamination of solvent in the thin films prepared and the uniformity present in the distribution of nanoparticles. It was already proved that using a small ceramic heater comprising a local heating source, the silver nanoparticles can be synthesized [11].

Approaching Chemically Reducing the organic and inorganic agents chemically is one of the common approaches used in synthesization of nanoparticles. In common reduction of silver ions (Ag^+) in aqueous or non-aqueous solutions, several and various reducing agents like elemental hydrogen, sodium borohydride ($NaBH_4$) and

sodium citrate are commonly used. These reducing agents reduce silver ions (Ag^{+}) and create metallic silver (Ag^{0}). This is followed by agglomeration into oligomeric clusters which in turn lead to the formation of metallic colloidal silver particles [12].

4 Tulsi Silver Nanoparticles

The better platform that can be used for the synthesis of nanoparticles are the plants since they are free from chemicals which are toxic. In addition, the usage of extracts from plants is cost-effective regarding the isolation of microorganisms when compared with the synthesis of nanoparticles by microorganisms. In this work we have explained the biosynthesis of silver nanoparticles utilizing the leaf extract of *Ocimum sanctum.*

The usage of seeds of plants, roots, bark and berries for the purpose of medications is referred to as botanical medicine or phytomedicine.

4.1 Several Species of Tulsi

Ocimum americanum This species has arisen from tropical Africa. It is also called as hoary, lime or hairy basil, and it is called as an annual herb having flowers that are white or lavender in colour in nature. Mainly it is used in medicinal fields for curing various diseases. These plants portray antioxidant and antibacterial activities.

Ocimum sanctum This is also called as tulsi in Hindi and is called as holy basil in English. This an erect, soft haired plant with a very good aroma of its herb or undershrub which is found throughout India. This tulsi is commonly cultivated in gardens. There are two categories of *Ocimum sanctum* found. They are tulsi plant with green leaves called as shri tulsi and tulsi plant with purple leaves called as krishna tulsi. *Ocimum sanctum* is held by Hindus as a sacred one, and also it is used as a medicine in daily life in homes of India for various treatments. This has various medicinal behaviours. The commonly used area are antidiabetic, anticancer, antifertility and several other diseases.

Tulsi (*Ocimum sanctum*) – Chemical Composition The family of *Ocimum sanctum* is Lamiaceae. The biogenic inert nanomaterials have applications in the detection, diagnosis and monitoring of cancer and tumour growth.

5 Materials and Methods

Collection of Plant Material First we should collect the leaves of *Ocimum* from the local garden. The collected leaves are washed thoroughly with pure distilled water in order to remove the dust particles. Then the washed leaves are then dried for an hour. Then these dried leaves are cut into small pieces.

Leaf Extract Preparation In a 250 ml beaker with 100 ml distilled water, we should add 3 g of finely sized leaves and allow them to boil for 2 h. Then we should filter the extract to remove the dust which is then stored in the refrigerator for the next characterization and other works to be carried out.

Silver Nitrate Solution Preparation We should prepare a fresh solution of silver nitrate by adding 17 mg of silver nitrate in 10 ml of pure water. In order to avoid reduction, we should cover this solution with aluminium foil in the dark.

6 Characterization Method

In order to confirm the production of silver nanoparticles, we use several methods for characterization of the green silver nanoparticles. In addition to the determination of size distribution profile and surface morphology, it is possible to find out the actual size of the particle. We use the following instrument to characterize the green silver nanoparticles.

UV-Vis Spectroscopy When we add *O. sanctum* leaf extract with solution of silver nitrate, we get a change of colour of the solution from transparent to dark yellow since there are silver nanoparticles produced. In order to find out the optical property of biosynthesized silver nanoparticles, we analyse the samples using UV-Vis spectroscopic at room temperature which is operated at a resolution of 1 nm to 250 nm and 700 nm ranges. The peak of the silver nanoparticles prepared at all pH by green synthesis lies between the range 420 and 480 nm.

7 Application of Tulsi AgNPs

Adsorption of Dyes We dissolve less quantities of solid dye (methylene blue and neutral red each 5 mg in 50 ml in double the distilled water in order to prepare the stock solutions of reactive dye). Several concentrations of dye were obtained by diluting this solution so as to form it as the working solution. We carried out this experiment using all the 5 ph (pH 4, 5, 7, 9, 11). In the 5 ml of tulsi solution of each ph, 100 μl of working solution of each dye at all ph was kept in the darkest place by adding all ph and then stirring at 30 °C. We use UV-Vis spectrophotometer to take

reading every 5 min and 25 min. The methylene blue showed peak at 660 nm and neutral red at 550 nm.

8 Conclusion

The efficient route for the synthesis of nanoparticles was performed at different ph mediums using the silver nanoparticles with *Ocimum sanctum* leaf extract which provided environmental-friendly, simple and efficient route for the synthesis. The size of the synthesized nanoparticles was 10 to 100 nm at different ph ranges, and their shape is sheet and sphere. A thin layer of tulsi is surrounded around the nanoparticles which contains carbohydrates and camphor taken from the characterization using a UV-Vis spectrophotometer technique. From these techniques we come to know that in the shape determination of the nanoparticles, the concentration of plant extract to metal ion plays a significant role. The highly concentrated nanoparticles appear in sheet -shaped size, whereas the lower concentrated nanoparticles appeared in spherical shape. Thus based on the reduction of metal ions, the sizes of the nanoparticles in different ph ranges are different.

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Unisum Labeling of Hydra Hexagons

Lalitha Pattabiraman

Abstract Hexagons are used to a high satisfaction in our daily life as it not only guarantees efficiency but also pleases aesthetics. Even nature has considered hexagons as fundamental units of a great number of its structures. These polygons are highly compact together when as a unit and possess a number of unique features. They have excellent geometrics, being the most convenient symmetrical figures which lie between circles and polygons. These six-sided polygons can form a strongly bound design and are more adept in allowing close packing leading to zero wastage of the space and resulting in maximum utility. This paper focuses on rows of hexagons connected to one another through nodes. The upper end of one hexagonal row is developed further by connecting it to edges which bridges with various other hexagonal rows forming a Hydra Hexagon (HH_n) with odd number of Tentacles. We introduce a new labelling known as 'Unisum labelling' to the vertices and edges of these Hydra Hexagons. Let us assume a graph with the set $G = (V,E)$, where V symbolizes the elements of vertices X(G) = {1, 2, 3, …, n + 1} and E denotes the components of edges $Y(G)$ = {1, 2, 3,..., n + 1}, and then the Unisum labelling of the edges of G takes the value '$|s–t| + 1$' where $s, t \in X(G)$.

Keywords Hexagons · Unisum labelling · Hydra Hexagons · Vertices · Edges · Nodes · Tentacles

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1 Introduction

The field of graph theory has an essential place in various fields. One of the significant regions in graph theory is graph labelling which plays a key role in many computer field applications like artificial intelligence, machine learning, data science, neural networks, augmented reality and virtual reality, quantum computing, blockchain technology and so on [1]. The objective of this paper is to implement a new method of labelling in C_6 chain grouped together in such a way that they form a Hydra Hexagon.

This paper also shows the role of labelling in the assignment process in mobile networks. This paper addresses on how this new concept of graph labelling can find its implementation in mobile networks and its security and how the nodes and edges are uniquely arranged, thus ensuring channel assignment for networks [2]. An overview of a new idea for labelling these networks has been proposed here.

The geographical region of cellular network service area can be segregated into various hexagonal regions named as C_6 cells which form the basic compartment of a C_6 cellular system [3]. These C_6 cells are arranged in such a way that they are in the shape of C_6 rows collectively which can provide coverage over huge dimensional areas. The reason for using C_6 chains instead of square cell shapes or triangular cell shapes in the architecture of cellular network is because it can cover the given area with no overlapping and there would be absolutely no gaps [4, 5].

First of all, divide the entire geographical network area into small hexagonal (C_6) cells which can be described as cell splitting [6]. Here each C_6 cell possesses its individual Base Post and antenna elevation. Nodes of these C_6 cells are positioned, thus ensuring that every node has one or more adjacent nodes [7]. The nodes serve as processors in the network. Accordingly, we propose an appropriate addressing scheme for vertices and their connecting edges, deriving a unique labelling formula for these vertices and edges to present a very easy and elegant routing algorithm [8, 9].

2 Formation of Hydra Hexagons

To construct a Hydra Hexagon (HH_n), the initial step is to form a C_6 cell by joining six vertices through six edges forming a hexagonal shape. These C_6 cells are connected to each other by attaching the last vertex of each C_6 cell to the foremost vertex of another C_6 cell. The opposite vertex of this connected node is again attached to another C_6 cell, and this process is continued to obtain '$2n$', ($n \geq 1$) number of C_6 cells as a chained column. This column forms the Base Post of the Hydra Hexagon (HH_n).

The next step is to construct the Tentacles (T_n) of the Hydra Hexagon (HH_n). For building the Tentacles (T_n), first extend the uppermost vertex of Base Post by

connecting it to multiple bridges. These bridges are nothing but edges which connects a single vertex of the topmost C_6 cell to various columns of identical hexagonal chains. Each hexagonal chain has even and equal number of C_6 cells contained in it. Thus, we build an odd number of Tentacles (T_n), to form the complete Hydra Hexagon (HH_n).

3 Unisum Labeling

To locate and analyse the vertices and edges in the Hydra Hexagon (HH_n), there is a need to name every node and each connecting line by unique labels through a proper algorithm. Here, we introduce a new labelling known as 'Unisum labelling' to the vertices and edges of these Hydra Hexagons.

Assume a graph $G = (V, E)$, where

V indicates the elements of vertices as $X(G) = \{1, 2, 3, \ldots, n + 1\}$ and
E shows the components of edges as $Y(G) = \{1, 2, 3,..., n + 1\}$, where n is the number of edges of the graph G.

Then, the Unisum labelling of the edges of G takes the value '$|s–t| + 1$' where s, $t \in X(G)$.

Theorem

Case: 1

Initially, let us start with the formation of 3-Tentacle 4-Row Hydra Hexagon ($3T4HH_n$). In this $3T4HH_n$, the base unit consists of four C_6 chains which are merged with three bridges leading to three Tentacles, respectively. The Tentacles have four C_6 chains each. This whole arrangement of C_6 chains with a Base Post and three Tentacles forms the 3-Tentacle 4-Row Hydra Hexagon ($3THH_n$).

After designing this $3T4HH_n$, we introduce a new labelling to the entire system known as Unisum labelling of graph.

In this graph,

$X(G) = \{1, 2, 3, \ldots, 100\}$ and
$Y(G) = \{1, 2, 3,..., 100\}$, and then

the Unisum labelling of the edges of G takes the value $|s–t| + 1$ where $s, t \in X(G)$. Here each edge assumes the value obtained by subtracting the values of corresponding vertices joined by this edge and then adding one to the subtracted value. Thus the labels given to every vertex and edge of this 3-Tentacle 4-Row Hydra Hexagon ($3T4HH_n$) take exclusive values with no duplication leading to clear and distinctive vertex and edge Unisum labelling of $3T4HH_n$ as shown in Fig. 1.

The following diagram illustrates the formation and Unisum labelling of 3-Tentacle 4-Row Hydra Hexagon ($3T4HH_n$).

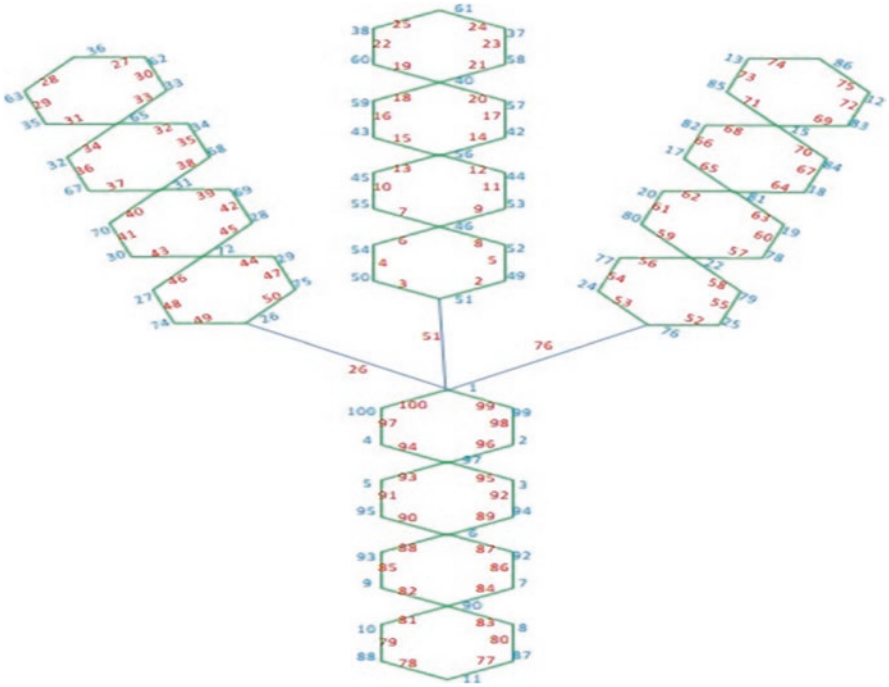

Fig. 1 Example of Unisum labelling of 3-Tentacle 4-Row Hydra Hexagon ($3T4HH_n$)

Case: 2

Furthermore, let us proceed with the formation of 3-Tentacle 8-Row Hydra Hexagon ($3T8HH_n$). Here in this $3T8HH_n$, the base unit consists of eight C_6 chains which are merged with three bridges leading to three Tentacles, respectively. The Tentacles are designed to have eight C_6 chains each. This whole arrangement of C_6 chains with a Base Post and three Tentacles forms the 3-Tentacle 8-Row Hydra Hexagon ($3T8HH_n$).

After constructing this $3T8HH_n$, we again introduce our new labelling to the entire system, the Unisum labelling of graph.

In this graph,

$X(G) = \{1, 2, 3, \ldots, 196\}$ and
$Y(G) = \{1, 2, 3,..., 196\}$, and then

the Unisum labelling of the edges of G takes the value '$|s–t| + 1$' where $s, t \in X(G)$. Here each edge assumes the value obtained by subtracting the values of vertices joined by this edge and then adding one to the subtracted value.

Thus the labels given to every vertex and edge of this 3-Tentacle 8-Row Hydra Hexagon ($3T8HH_n$) take exclusive values with no duplication leading to clear and distinctive vertex and edge Unisum labelling of $3T8HH_n$ as shown in Fig. 2.

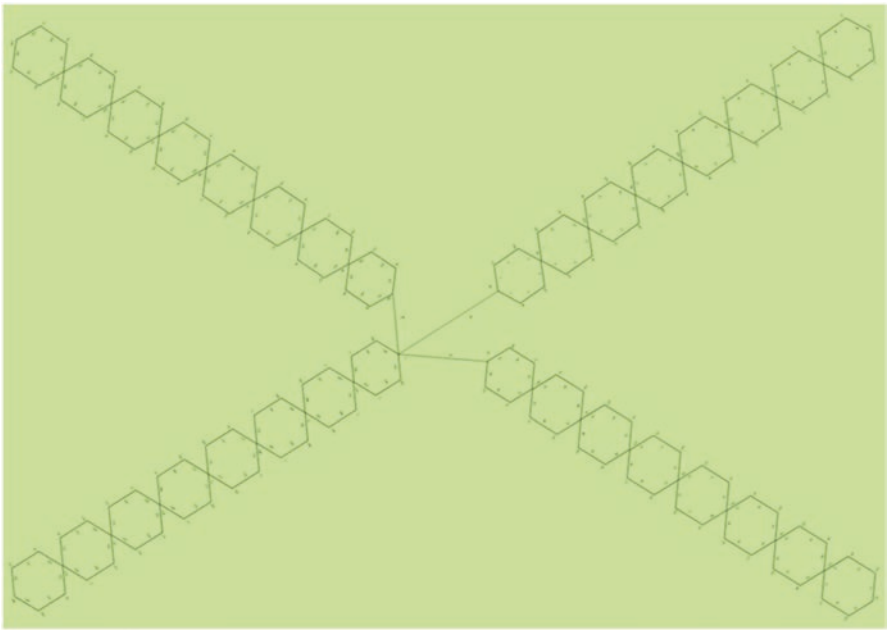

Fig. 2 Example of Unisum labelling of 3-Tentacle 8-Row Hydra Hexagon ($3T8HH_n$)

The following diagram illustrates the formation and Unisum labelling of 3-Tentacle 8-Row Hydra Hexagon ($3T8HH_n$).

4 Application of Hydra Hexagon in Cellular Networks

In this paper, we evaluate the new hexagonal C_6 cell shape modelling and labelling them which could be utilized in developing communication networks in an exclusive manner. This analysis emphasizes on the impact of C_6 structure of the cells on cellular communication system.

In a cellular network, cell shape plays a vital role reliant on topographical, ecological and synthetic structure properties and terrain, Base Post site, broadcast power and so on [10, 11, 12]. Cells are estimated as ordered hexagons for depiction and systematic simplicity. A hexagon is a perfect cell shape positioned compactly without gaps or overlaps [13]. This C_6 graph is mostly engaged in arranging and analysing various networks of communication.

Here, Base Posts installs itself at the focal point of C_6 chain. Within each C_6, all the cell phone handlers are uniformly scattered [14, 15]. These C_6 designs adopt a distinct line-of-sight indicator C_6 row that links the users with the Base Posts, and they contemplate the initial loop of co-network users.

5 Future Scope

The convolution of cellular network figure approaches the embracing of imprecise but graph models for its explanation. Hexagons are compatible structures for approximating C_6 cell shape [16–19]. The demonstration of more complex shapes for the portrayal of cells in developing cellular technologies is of noteworthy significance [20, 21]. We can extend this model by trying it in various shapes of the C_n family and thus can be experimented in C_4, C_8, C_{10} and so on generalizing to C_n. For further extension of the designs in graph theory, with diverse C_n figures, research can be made in multipath uplink interfering signal models and non-uniform nodal distribution.

6 Conclusion

In this chapter we have constructed, modelled and labelled the Hydra Hexagons having C_6 cells. The result indicates the implication of the appropriate selection of cell shape, a choice that is chiefly based on system characteristics. In practice, the use of the Hydra Hexagonal shapes may help in fetching and designing wireless networks. The influence of cell shape on system performance is determined using this derived Unisum labelling. In addition to drop the complexity arising in computation, this model offers optimum network planning as well as parameters [22–25].

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An Implementation of Mobile Shareable Content Object Reference Model for Online Assessment Using Virtual Learning Environment

C. S. Nithya and K. Nirmala

Abstract At present, mobile applications play a vital role in the learning environment. Kids play, learn, and develop their knowledge through the mobile applications. This paper proposed the implementation of a mobile application that would be used to access the online assessment for students. The students can access the assessment and develop their technical skills. This paper is mainly focused on two sections. In the first section, the steps involved in designing a mobile application for online assessment of students mainly focused on MSCORM using a virtual learning environment. The second section is used to evaluate the mobile application based on the mobile shareable object reference model for online assessment to improve the technical skills of the student. This paper implements M-SCORM for online assessment using virtual learning environments.

Keywords M-SCORM · Virtual learning environments · Analyze · Design · Development · Evaluation

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1 Introduction

SCORM defines a selected means of constructing Learning Management Systems (LMSs) and coaching content [1] in order that they work well with different SCORM conformant systems. SCORM stands for "Shareable Content Object Reference Model." The sharable content object model represents the online content which is in the form of audio, video, and multimedia. SCORM defines a way to produce "shareable content objects" or "SCOs" that may be reused in numerous systems and contexts. It will contain its own marker, score, and completion standing [2]. As there may be no physical storage of data, every bit of data is accessed online in the cloud environment. It reduces the access time. The online material content will be fast in accessing the data in the virtual learning environment.

2 Literature Survey

Wibowo and Astriawati [3] used e-learning to investigate the following: (1) the difference in learning outcomes between cadets who were taught by using Edmodo-based e-learning and those who were taught by using face-to-face conventional instruction; and (2) the viability of using Edmodo-based e-learning in terms of cadet learning outcomes [4]. The appraisal was picked up from the instructive results of the cadets before the treatment (pre-test) and after the treatment (post-test). The data was then broken down utilizing a t-test to determine differences in the cadets' learning results and an n-gain investigation to determine the effectiveness of e-learning in general. The results were contrasted with the use of conventional face-to-face instruction [5].

El Borji and Khaldi [6] proposed devices to watch and help the advancement of students/players. The biggest arrangement is to deal with the blending perspectives and, furthermore, the readiness of extraordinary games to accommodate e-learning frameworks upheld by the mechanized bundle and, furthermore, the fate of incredible games as reusable learning objects (LO). The methodology intends to fulfill the exact wants of SGs as far as data all together that they will be spoken to, listed, and promoted. This can be a new application profile of the IEEE LOM standard entitled "SGLOM" integrating fields to clarify SGs not exclusively in an extremely specialized sense anyway conjointly by looking at the training and rules. The creators spend significant time in the blending partner extraction parts of SGs in an LMS, by using the ADL SCORM 2004 data model that characterizes how content is regularly prepacked as a SCORM PIF.

3 Proposed Architecture

This proposed work consists of five stages, as shown in Fig. 1. People have started using mobile phones in their day-to-day lives. Mobile phones play an important role in their lives. Mobile phones act as inevitable devices in the current scenario. Most of the students were practicing based on assessments and developing their careers online [7]. This paper mainly focused on shareable content based on mobile devices. This mobile shareable content object reference model consists of five stages [8].

Analyze: The first stage of the M-SCORM is termed the analysis stage. During this stage, the developer needs to think and analyze the student mentality, age, social factors of the particular place, and also the economic status of the students in terms of customers. The analysis mainly focused on the customer side, such as the presentation layer, back-end layer, navigation process of the student's mentality, and the objective of the assessment to improve the student's technical skills.

Design: The designing stage includes the mentality of student behavior, objectives of technical knowledge, and strategic planning that follows to improve student performance.

Development: In the development stage, a blue print technology must be developed into a mobile application to improve the technical knowledge of the student in terms of assessment. Assessment must be designed and developed in the mobile application using the mobile shareable content object reference model.

Implementation: A mobile Application for online assessment is developed by the shareable content object through the mobile devices. This mobile application is designed and developed for the online assessments that are being implemented [9].

Evaluation: The final stage of the methodologies is the evaluation process, which is used to evaluate the students' technical skills via the assessment.

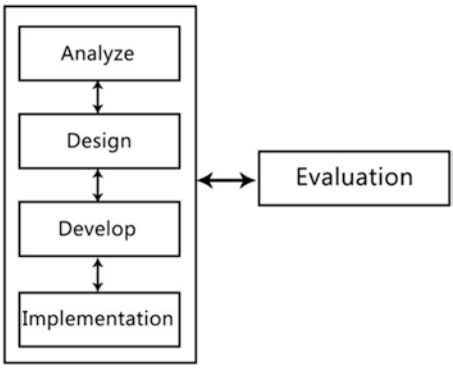

Fig. 1 Proposed architecture

4 Methodology

This paper includes various methodologies involving six stages of a process, as shown in Fig. 2.

First Stage – Analyze: This stage involves two processes such as need assessment and task analysis. Assessment will be planned in a way that should improve the students' technical skills. Assessment mainly focused on a shareable content object through mobile devices can be optimized. The next process is termed as task analysis. It is still unclear how the content should be shared with the specific student via mobile devices.

Second Stage – Design: This stage involves the design stage, which mainly focuses on the strategy for displaying the shareable content of the assessment to train the students' technical skills through mobile apps. A mobile application should be designed in order to make the student comfortable in using the student assessment through mobile applications.

Third Stage – Development: This stage involves two processes. One is a prototype. The prototype of online assessment is a development with effective strategies. The second process involves creation of instruction to access the assessment focused on the shareable content object reference model through mobile concepts.

Fig. 2 Methodology

Fourth Stage – Implementation: This stage involves the combination of the first three stages. Initially, the analyzing phase should be done for the shareable content for the reference model, design, and development at this stage.

Final Stage – Evaluation: This is the final stage of evaluation for an online assessment using a virtual learning environment. This virtual learning environment helps students improve their technical skills, and the content is also shared with a particular group of people through SCORM.

5 Implementation

The online assessment mobile application has been designed and developed in order to improve the technical skills of these mobile applications; and are designed with the following criteria: (a) The Flutter packages were used to create the online assessment applications. These Flutter packages function as one of the Open Source services in Microsoft Visual Studio. These Flutters are used to design a mobile application either for Android or iOS. Figure 3 shows the online assessment based on M-SCORM. (b) The student is logging through their private authentication in order to access the online assessment for the particular courses. (c) This online assessment improves the technical skills of the student through the mobile shareable content object.

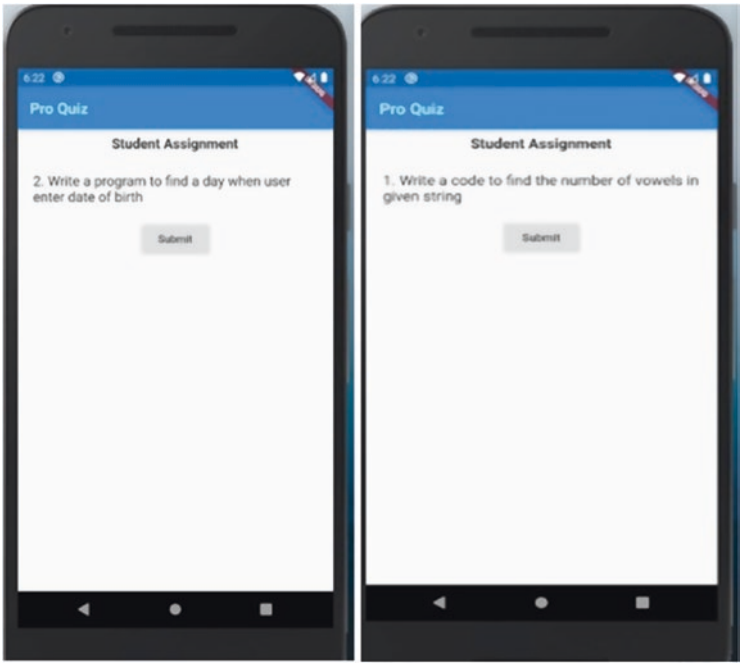

Fig. 3 Implementation of M-SCORM – assessment

6 Experimental Result

The experimental result is categorized into three cases, such as (a) by subject experts, (b) by the students, and (c) a test case based on the user.

Case 1: By the Subject Experts: Validating tests by the subject experts are done with a sample of 100 members. These mobile applications were tested with subject experts regarding the application, shareable content, and flexibility of the mobile application. The percentage of each category is displayed in Table 1 and in Fig. 4.

From Table 1, the graphs are generated based on subject experts using shareable content object using mobile.

Case 2: By the Student: Validating tests by the student were done with a sample of 1000 members. These mobile applications were tested with students on the application, shareable content, and flexibility of the mobile application. The percentage of each category is displayed in Table 2 and in Fig. 5.

From Table 2, the graphs are generated based on student using shareable content object using mobile.

Case 3: Test Case by the User: Test case of an assessment is conducted by a student who is performing their assessment through M-SCORM. The test case was done with satisfaction, ease of use, and ease of learning with a sample of 1000 students. Table 3 and Fig. 6 display the reports of the test cases.

From Table 3, the graphs are generated which are tested by the user for the online assessment based on M-SCORM.

Table 1 Case 1: By the subject experts

Aspect	Percentage
Application	3.7
Shareable content	3.2
Flexibility	3.1

Table 2 Case 2: By the student

Aspect	Percentage
Application	3.4
Shareable content	3.6
Flexibility	3

Table 3 Case 3: Test case by the user

Aspect	Percentage
Satisfaction	5
Ease of use	2.7
Ease of learning	2.3

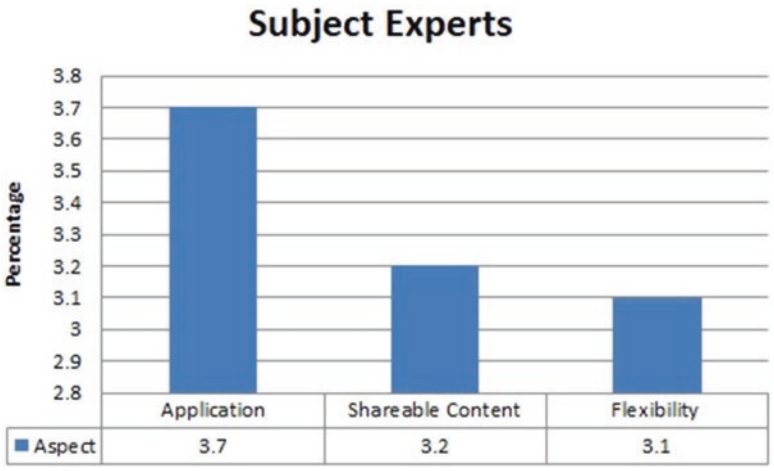

Fig. 4 Case 1: By the subject experts

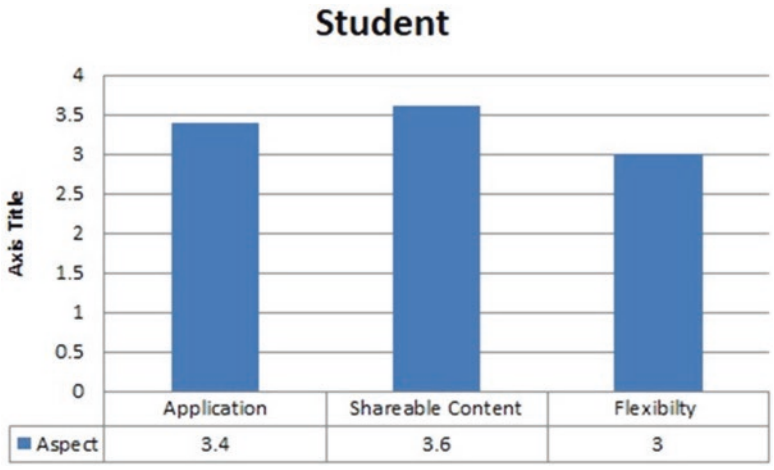

Fig. 5 Case 2: By the student

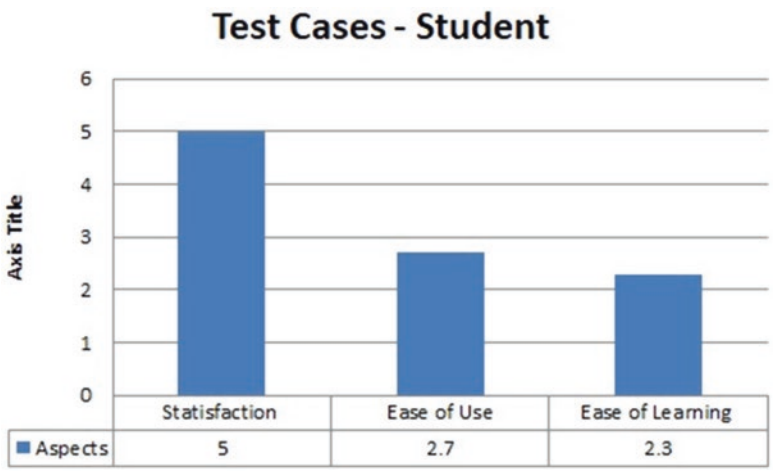

Fig. 6 Case 3: Test cases by the student

7 Conclusion

In conclusion, the mobile-based shareable content object for online assessment was analyzed with appropriate strategies and task analysis. This mobile-based shareable content object was designed with online assessments and developed using Flutter with Microsoft Visual Studio, which is open source. The mobile application was developed to improve the technical skills of students through a shareable content object reference model. This paper concludes that M-SCORM-based online assessment through a visual learning environment leads to being effective and efficient.

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The Finest Secured Routing Techniques with Transmission of Data in Mobile Ad Hoc Networks

R. Nandakumar and K. Nirmala

Abstract In this paper, we proposed the finest secured routing technique in mobile ad hoc network. While sending messages in the MANET, there may be possible various attacks. Signature-based secured routing techniques are proposed in this paper. This routing technique is mainly focused on a dynamic process in the MANET which is classified into two levels of security. These Secured Routing techniques used to determine the generated keys of each and every messages and also authenticated by the source, destination and intermediate node at perfect level. The secured routing techniques in the low level are determined as the normal level; the source node and destination node will authenticate the entire routing process. Hence this paper proposed the finest secured routing techniques in MANET.

Keywords MANET · Secured routing techniques · AODV · Routing protocol

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1 Introduction

MANET might be an arrangement of two or a great deal of nodes outfitted with remote interchanges and system administration capacity. The nodes inside the radio fluctuate and will immediately speak with each other. The Hidden Node which act as an intermediate node to transferred the information to attain objective. Each node composed to a particular information with help of Mobile Adhoc Network.

A Routing protocol mainly classifed into three categories [1]: (a) on demand, (b) table driven, and (c) hybrid routing protocol [2] or a combination of on-demand routing protocol and table-driven protocol. In on-demand routing protocol, each node will find the appropriate route to send the data to the destination node [3]. In on-demand routing protocol, the route to the destination node remains unknown for every intermediate node in MANET. Ad hoc on-demand distance vector and dynamic source routing protocol will be under on-demand routing protocol. The destination-sequenced distance vector (DSDV) [4] is mainly under on table-driven routing protocol.

Zone routing protocol acts as a hybrid of on-demand routing protocol and table-driven routing protocol.

AODV is an on-demand routing protocol [5] mainly considered in this paper [6]. This on demand routing protocol will make the route to the destination nodes very effective. If a flood occurs while sending a data in the appropriate route, the route request message will be passed through the entire network and at the time through the route discovery process. The route reply message will be sent to paths towards the source node. The three types of security threats with AODV are:

(a) Modification attacks which include redirection by the route sequence number, the node count, services denial, and the pipeline process [6]
(b) Identity attack which includes the node that is malicious based on their identity
(c) Fabrication attacks mainly focused on the false route which leads to error messages

2 Literature Survey

An Adhoc System arranged with a mixed portable hubs to determine the unified process in MANET [7]. Every versatile hub goes about as host and switches. Besides, Some of the elective hubs were not used for transmission, in other words all the hubs used in the Adhoc network were not used for transmission [8]. On this paper, a propelled component is given against these empty assaults during a MANET. The existing procedures utilize quality of service (QoS) for the whole system to find assaults. Our philosophy utilizes the bundle conveyance quantitative connection and excursion time for each hub, and it moreover identifies dynamic and aloof assaults. Along these lines, the entire ID of empty assault is a practical exploitation of the arranged procedure.

The possibility Delivery quantitative connection (PDR) boundary worth is misrepresented as demonstrated by the variable alteration of the amount of hubs to be zero.431%, decreasing the regular postponement by sixty three.525%, and assembling the vitality utilization overstated by zero.170% [9]. Recreation [4] with the variable alteration of speed got zero.482% PDR results, decreasing the normal postponement by seventy eight.710% and vitality utilization overstated by zero.167%. Alteration of cushion size factors got zero.729% PDR results, decreasing the regular deferral of seventy one.603% and vitality utilization misrepresented by zero.161%. From these data, MANET AODV-DTN is better than MANET AODV.

[10] expound on the center of the convention and examine the advancement, its variations, expansions, and accordingly the applied thought. We have studied the expansive space of AODV [11] augmentations and have ordered them to bolster the varying standards, e.g., quality, reliability, vitality, security, steering strategies, and so forth. This paper draws out the origination, style objective, examination patterns, and consequently the current progressions inside the investigation controlled for AODV improvement [11]. The paper also sums up various parts of the investigation slants and depicts execution measurements, input boundaries, pertinent spaces, and along these lines the received strategies for up the convention [12].

3 Proposed Architecture

The proposed work is mainly focused on the transport layer of the OSI architecture. This layer is mainly focused on transmission of data from one node to another node. While transferring a data from one node to another node, there may be certain flaws such as data may be lost due to environmental change in the ad hoc networks. This paper is focused on the proposed secured routing techniques while transferring data from one node to another node in the MANET as given in Fig. 1.

From the above diagram, the source node (S) will send a message to the destination node (D). This proposed routing technique is used to determine three types of security level: the source node, intermediate node and destination node.

We had proposed two cases related to the level of securities as described below.

Case 1 This is the perfect level of security of data transmission, during the process of routing. This level of security assumed to be one (level of security = 1). During the process of routing, the source node and destination node separately verify the authentication of all the intermediate nodes in the given routing path. Each intermediate node will authenticate with a neighboring node which includes both previous and next nodes in the given routing path.

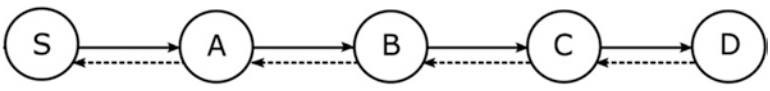

Fig. 1 Process of routing protocol

Case 2 This is the normal level of the security of data transmission, during the process of routing. This level of security assumed to be zero (level of security = 0). During the process of routing, the source node and destination node alone verify and authenticate with each other. Each intermediate node authenticates with the neighboring node which includes both previous and next nodes.

This proposed routing protocol technique is the combination of sequential aggregate signature based on RSA algorithms. It's mainly categorized into two levels: (a) session key generation along with route discovery and (b) maintenance route information.

(a) **Session Key Generation Along with Route Discovery:** This process is done at three levels of nodes such as source node, intermediate node, and destination node at both cases as shown in Fig. 2.

Source node : A prime number, two random numbers generated, encrypts the random number based on the proposed techniques, broadcasts the random number from the source node, and requests the message which consists of source IP address, sequential number of the source, destination IP address, and broadcast ID.

Intermediate node : The intermediate node will check the broadcast and request message from the previous node. Initially, it will check the previous node to be authenticagted and will perform the next process to send the request message, broadcast ID to the next level of intermediate node.

Destination node : The destination node (D) will authenticate all the intermediate nodes and request the source ID, source IP address, and broadcast ID. If all the AODV protocols are true, then it will decrypt the random number and prime number at the destination level. If it fails, the messages will not be authenticated to view at the destination level.

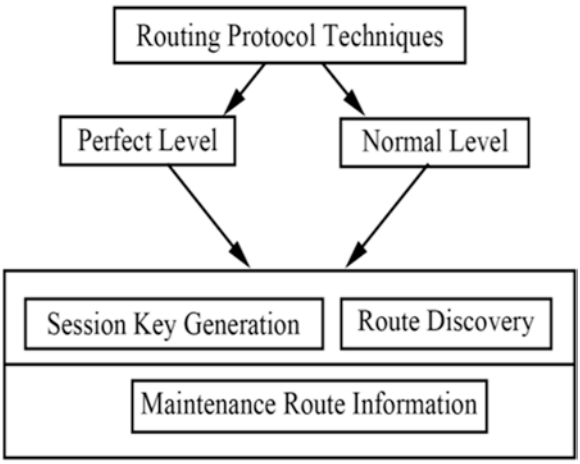

Fig. 2 Proposed routing protocol

(b) **Maintenance Route Information:** This process is used to determine the route information in both cases.

Source node : Broadcast ID, the request message generated at the source node, sends the request message based on AODV to the next node.

Intermediate node : The intermediate node receives the request message from the previous node, it authenticates the request message, it removes the signature message, and it regenerates the broadcast ID to the next level of intermediate node.

Destination node : The destination node checks the information received from the previous intermediate node of the request messages and also checks the entire path of the intermediate node along with the source node.

4 Algorithm and Experimental Result

A Proposed Routhing Adhoc on-demand distance vector (AODV) algorithm described with two cases.

// Algorithm
Step 1 Let p_i be the Prime number
Step 2 Let r_1 and f be the generate random number of the source node
Step 3 Let R_1 be the Generate number based on the mod value of pi to the power of g
Step 4 Let R_2 be the encrypted key of r1
Step 5 Sig(S) = R_2 key are broadcast with the appropriate id of the source node
Step 6 Req(S) includes ip address,the sequence number of the source, broadcast id, destination address, source address based on the AODV protocol
Step 7 If level is equal to 1
Step 8 {
Step 9 If(k equal to intermediate node)
Step 10 {
Step 11 Each intermediate node will authenticate the request message Req(Previous node) received.
Step 12 Req(Previous node) consist of ip address,source address, sequence number of the source, broadcast id, destination.
Step 13 If(authentication failed) messages will not receive by the destination node
Step 14 else If (k be the destination node)
Step 15 {Destination node will receive the Req(previous node), it will check the appropriate parameters of the source and intermediate node.
Step 16 If(Req (previous node))
Step 17 The Message received by the destination node
Step 18 else
Step 19 Message failed. }}}
Step 20 If(level ==0)
Step 21 {Source node will generate generate broadcast id, and Req(S) which include ip address, source address, destination address.

Step 22 Each intermediate node receives the Req(Previous node) and remove the signature key of the previous node, regenerate the broadcast id and send to the next level of node.
Step 23 If the previous node are not authenticate, message will be failed at the existing intermediate node
Step 24 Else the message passed to the next level
Step 25 Destination node will authenticate the previous request message, and also the source ip address. If both parameter are authenticate, message will be decrypt and leads success routing process.
Step 26 Else message are failed in the normal level.
}

Security and Performance Analysis Figure 3 presents the process of the proposed routing techniques for both perfect level and normal level.

Security Level The performance analysis is mainly focused on the security level based on the two cases: (a) perfect level and (b) normal Level. The following table is generated with the sample node for both of the cases.

From the Table 1, the following graph generated which result the security level of proposed techniques. The graph presents the perfect level which will lead to be more effective compared to the normal level in Fig. 4.

Message Delivery Ratio The message delivery ratio is determined by the total number of messages received divided by the total number of messages transmitted at a particular node in the routing path. The proposed routing techniques are compared with the existing routing techniques using MANET. The following table is generated with the sample data compared with the existing one with proposed routing techniques as shown in Fig. 5.

The following graph is generated from Table 2 which provide the performance analysis of the existing algorithm with proposed AODV in MANET.

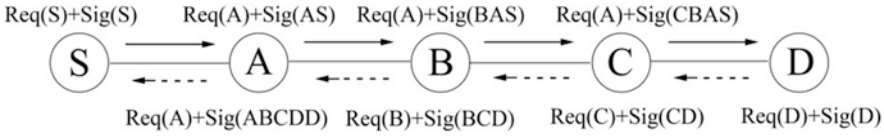

Fig. 3 Process of proposed routing techniques in MANET

Table 1 Security level

Level/node	75	50	25
Perfect	92.00	93.33	93.85
Normal	89.33	90.67	92.31

Table 2 Security level

	Received	Transmitted
AODV	88.67	87.33
PAODV	92.67	90.67

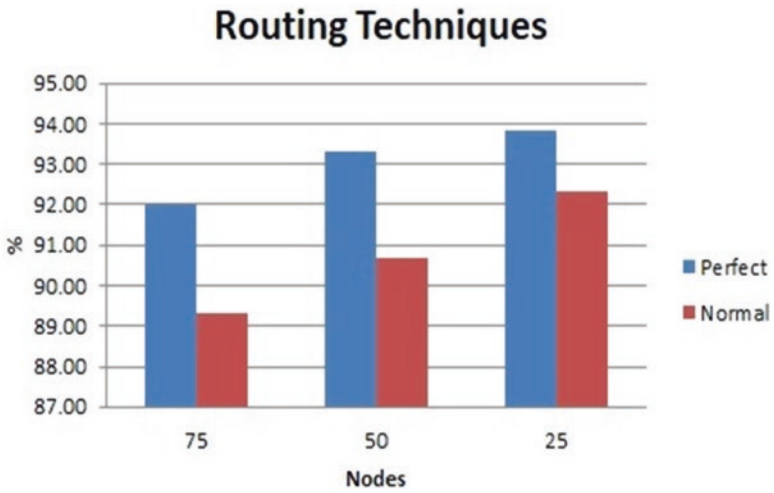

Fig. 4 Security level

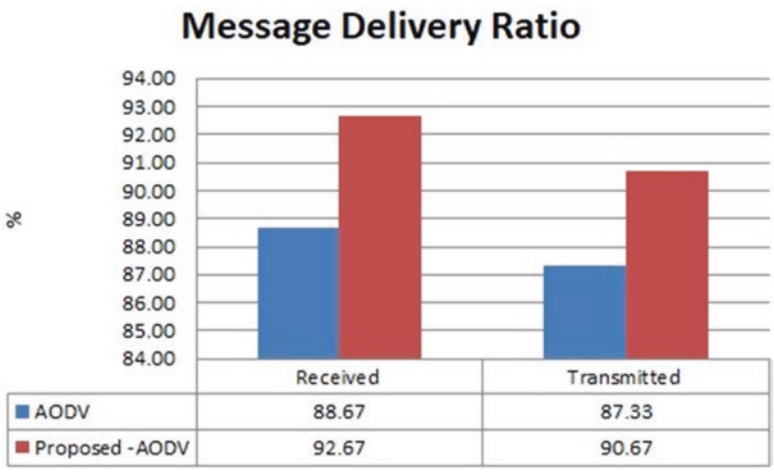

Fig. 5 Message delivery ratio

5 Conclusion

It is concluded that this paper focused on the MANET using ad hoc on-demand distance vector (AODV) protocol is used to improve the routing techniques based on the security level of the messages sent and received by the source node, intermediate node, and destination node. This paper also proposed two levels of security, such as perfect level and normal level, with automated key generation based on the public and private key. This proposed security and routing techniques with transmission of data in MANET are determined to be effective and efficient.

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Evaluation of Various Cryptographic Techniques Based on File Size on Cloud Storage Security

K. Mahalakshmi and K. Kuppusamy

Abstract Cloud storage and Internet applications are growing rapidly in the recent years. These applications are used by millions of users and controlled by authorized administrators. With the rapid growth of the Internet, there should be a need for protecting confidential data. The Internet provides the services to make use of the application with minimum security. Along these issues, providing the information security, it utilizes the various encryption strategies to protect the information. Though many cryptographic algorithms are developed by researchers to provide better security, the encryption and decryption techniques have some limitation based on performance metrics. This paper presents the comparison of various cryptographic algorithms based on performance metrics such as block size, key, storage, computational cost and execution time. This work will be useful for further research to implement a new encryption algorithm which provides a higher security with less computational time.

Keywords Cloud storage threats · Encryption techniques

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1 Introduction

Communication through network plays a vital role in the digital era. Most of the government organizations, corporate sectors and military share their information by the Internet. Data is the asset of every organization to develop their future growth. Data storage requires vast investment for storage devices. Industries decide to cut down the storage devices expenses with high security to avoid data loss or misuse from hackers [1]. Also companies that handle sensitive information like sales or stock details must ensure it is stored properly. Data securities are achieved by authentication and change the data into human unreadable format. Cryptography is the science of using mathematics to encrypt and decrypt the given input to provide efficient security [2]. Encrypted data are stored in the free storage area provided by cloud service providers in the form of storage as a service in the technology world. Most of the organizations avail the cloud platforms such as Google Drive, Amazon Web Services or Microsoft OneDrive to store data as they are easily accessible and simple to follow. The majority of cloud service providers has no well-established process to ensure security of data from threats [3]. Hackers target the end-user data whose primary goal is to destroy the data. Encryption and decryption are the best ways to implement the security.

2 Cloud Storage Security Issues

Cloud service adoption has quickly increased in the last decades. With respect to cloud computing, the security threats will be information security, network traffic and node security which is in the network. There are various security threats in the cloud. Cloud security threats are shown in Fig. 1.

Unauthorized Access When data is stored in an organization premise, they need to be physically present in the venue to access the data that creates a strong boundary for security. In cloud storage data can be accessed anywhere from the world which makes the unauthorized access in a very easy manner [4].

Data Breaches Data breach is a confirmed incident in which sensitive and confidential data would be accessed by an unauthorized person. Definitely it should distribute one's personal details, health histories, credit or debit card details, manufacturing formulas and software source code. It's a kind of theft or a violation of organization compliance mandates. While hackers and cybercriminals often made data breaches, in cloud they usually involve organizations misconfiguring cloud services or failing to implement the proper access controls.

Data Integrity Data integrity gives the guarantee that data is of high quality and valid, and unchanged data remains in the storage. The system may collapse when high amount of data shared in the network and bottleneck occurs in the network [5–9]. Data integrity refers to the process of ensuring that the data is accurate.

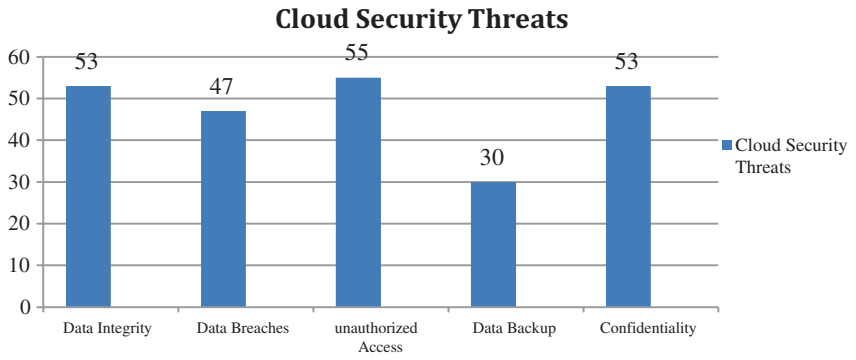

Fig. 1 Cloud security threats

Sometimes, the cloud service providers may discard the data that has not been used. Finally data integrity is entrusted in cloud services.

Data Backup Cloud backup or online backup is a strategy for storing a file in a secondary storage area [10]. Typically backup software is used to take a backup in a reliable manner. The important backup process is to check that the backup process has been completed successfully [10–12].

Confidentiality Confidentiality is a set of rules that limits access to information [13]. Confidentially enhances our privacy. Every user in the cloud expects their privacy in the service provided by cloud. It refers to the data that will be concealed from unauthorized access [14].

3 Encryption Algorithms

A strong security strategy is necessary to secure data which is in cloud, but it never affects the performance. Encryption of data is being sent to the cloud, and decryption of files is called back from the cloud. Security algorithms are classified into symmetric and asymmetric.

Symmetric algorithms use a single secret key for both encryption and decryption process and are very fast in execution. Both the sender and receiver should know the secret key. Asymmetric algorithms use a pair of key for security in which public key is used for the encryption process and private key is used for the decryption process. Relatively, the process is compared to symmetric,it also requires high computational cost [15, 16].

Advanced Encryption Standard AES is a symmetric key block cipher. It encrypts data with block size of 128 bits. It uses 10, 12 or 14 rounds. Based on the number of rounds, the key size may be 128,196 or 256 bits. AES requires less space among all algorithms.

Blowfish Blowfish is a symmetric key block cipher used for encryption products. This algorithm is a 64-bit block cipher technique where a message is divided into multiple blocks of data which has a fixed length. This algorithm consists of two parts: a key expansion part and a data encryption part. There are three parts in Blowfish: encryption algorithm, key expansion, and decryption algorithm [17]. Blowfish [18] utilizes a maximum memory space compared to AES.

Twofish Twofish is a symmetric block cipher encryption technique. A public key is used for encryption and decryption. It has 128 bits of block size and accepts a key of any length up to 256 bits. Twofish is very flexible compared to other encryption standards, and it can be used in network application where keys are changed frequently and where there is little or no RAM and ROM available. Twofish requires same level of memory space like Blowfish.

IDEA The IDEA is a 64-bit symmetric block cipher algorithm. It's a replacement for data encryption standard. The key is of 128 bits, and it is divided in 52 sub-keys. The design philosophy behind the algorithm is one of the "integration operations from diverse algebraic groups". IDEA is used to defend data during transmission and storage.

4 Performance Metrics

Encryption and Decryption Time Encryption time is considered as the time required for encryption which we have to convert the plaintext into cipher text. The decryption time is considered as the time required for converting the cipher text into plaintext.

CPU Process Time The CPU process time is the time that a CPU is assigned to a process.

Throughput Throughput for encryption and decryption defines the speed for encryption and decryption. It is calculated from the file size and the time taken it takes to process the encryption and decryption. This is applied for all files.

5 Comparative Study of Performance Evaluation

The following action is performed as the throughput using different symmetric algorithms to encrypt the data to determine the time required for reading the file, create the encrypted file and send it to cloud storage.

Table 1 shows the comparison of various encryption algorithms based on performance metrics like key length, block size and cipher type. Efficiency of the

Table 1 Comparison of encryption algorithms

Algorithms	Block size	Key length	Security level
Blowfish	64	32–448	Very high
Twofish	128	128,192 or 256	Medium
AES	128,192 or 256	128,192 or 256	High
IDEA	64	128	Low

Table 2 Comparison of encryption time

Data in KB	AES	Twofish	IDEA	Blowfish
705	226	248	270	190
962	267	213	457	300
1027	283	223	532	178
5200	1200	1324	1520	982
Average	1976	2008	2779	1650
Throughput	3.99	3.93	2.84	4.78

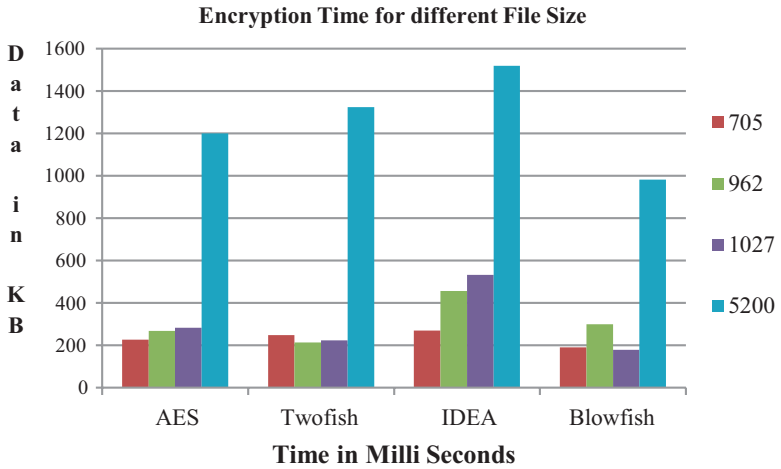

Fig. 2 Time consumption for encryption process (in milliseconds)

algorithm is determined by how strong the security will be for the stored information. Blowfish and AES provide better security compared to other encryption algorithms. IDEA provides security for data. But it should be suitable for specific applications.

The performance evaluation based on encryption time is compared in Table 2. Blowfish takes lesser time compared to other encryption algorithm and also provides enough security in cloud storage. AES provides high security, but it fails to protect from brute force attack. Time consumption for encryption process is shown in Fig. 2. Comparison of decryption time is shown in Table 3.

Table 3 Comparison of decryption time

Data in KB	AES	Twofish	IDEA	Blowfish
705	205	244	302	157
962	298	336	378	168
1027	322	380	423	176
5200	1028	1223	1650	769
Average	1853	2183	2753	1270
Throughput	4.26	3.61	2.86	6.21

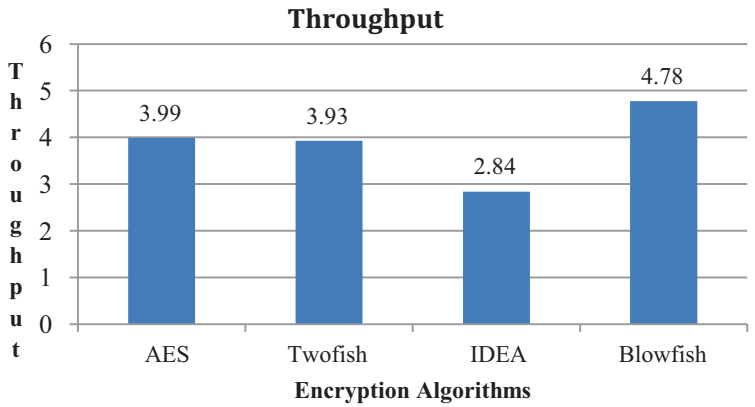

Fig. 3 Throughput of different algorithms (encryption)

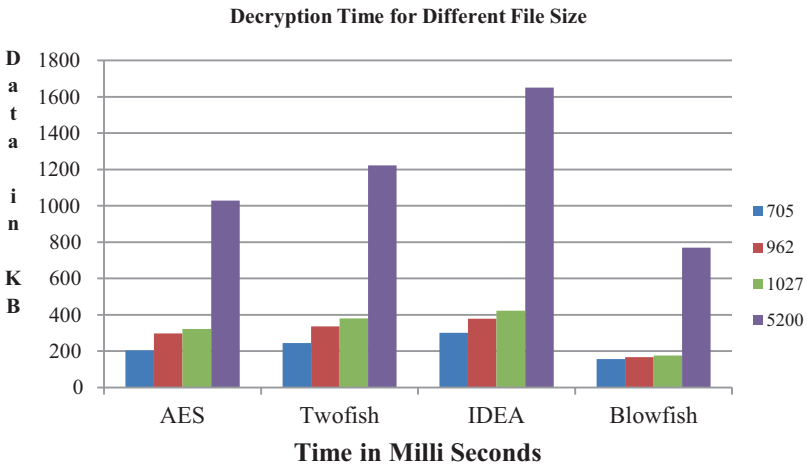

Fig. 4 Time consumption for decryption process (in milliseconds)

Throughput of different algorithms (encryption) is shown Fig. 3. Time consumption for decryption process (in milliseconds) is shown in Fig. 4.

6 Conclusion

Data security is the heart and soul of any organization. Data in the cloud may have more than one legal storage space. Data should not be hacked by the hackers. So we need an efficient security mechanism. This paper encompasses the encryption and decryption process in comparison to the basis of time consumption to check which algorithms are more efficient during the cryptographic implementation. We compared various encryption algorithms with data in different sizes and results. It illustrates the execution time in milliseconds taken by each algorithm during encryption and decryption process. The Blowfish algorithm performs better compared to other encryption algorithms. The future work can also be focused to provide new efficient encryption algorithm for cloud security. Storage as a service is generally a good alternative to small- and medium-sized business that they are not affording the storage cost. With the minimum cost, high security will be provided to the data in cloud. Also it maintains the confidentiality, integrity and authentication.

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Cloud-Based Biometric-Enhanced ATM Powered by Deep Learning

R. Vidhya and S. Gokila

Abstract Automatic teller machines (ATMs) are the most common way to withdraw cash from a user's account. It offers a quick and convenient way to access one's funds. However, the technology used to authenticate the user and authorize the transaction has somewhat remained unchanged. The advances in computer vision technologies have made it reliable than ever before. Utilizing these computer vision-based technologies combined with fingerprint-based authentication-based technologies in ATMs makes the system fool-proof and robust. With an additional eye watching over, the user can carry out the transaction in complete confidence.

Keywords Authentication · Biometrics · Face detection · Face recognition · Neural networks

1 Introduction

Automatic teller machines (ATMs) as we know commonly were introduced in the early 1950s in the UK. A unique code was issued to the users with which a maximum of $10 could be withdrawn. The concept of a PIN (personal identification number) was introduced in 1970 to have a reliable way of authorizing the users. Methods to authenticate and authorize a user are something you are, something you know and some- thing you have, and ATM card comes under the category of 'something you have'. A PIN is generally four numbers long in most banks and is asked

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every time a user tries to carry out a transaction combining that with an ATM card; it covers both 'something you have' (the card itself) and 'something you know'. Even though it is considered secure, it does not take into account the fact that most ATM centres are in a public setting. In public setting a shoulder surfing attack is very simple. And the fact that PIN is only four numbers long makes it easier for the attacker to remember it. A skimming device may be attached to the machine which strips the card details with which the prospective attacker can recreate the card and since the PIN is known to them, making a fraudulent transaction becomes easier [1–3].

2 Technological Survey

There are two main artefacts required to carry out a transaction: the ATM card and the PIN that the user knows.

2.1 Artefacts

EMV Card EMV can be abbreviated as Europay, MasterCard and Visa which refer to the companies that came up with the early standards in 1995. Recently the standard was acquired by EMVCo, LLC who defines and manages the standards since. It is most commonly known to us as ATM card. According to Wikipedia an ATM card is as the name suggests, usually a plastic card issued by a bank to its customer which allows them to access the ATMs. The cards have a magnetic stripe that stores data related to the card (unique card number) and so on and have an additional security mechanism in the form of a CVV number. Card verification value or CVV in short is usually a three-digit number used to validate the card during online transactions. Also printed on the card are the card holder's name and the expiry date. Nowadays chip-based card has been replacing the magnetic strip cards. While they are secure, it takes a lot of time to read and process.

PIN It is a four-digit number that a user chooses while activating the card. It is kept at four digits so that it is easier to remember. It acts as the second layer of protection in the existing implementation.

Operation of ATM Machines The basic functionality of an ATM machine can be illustrated in Fig. 1. The existing implementation relies on two factors: possession of both the card and remembering the access code. The functionality can be briefly elucidated as below. The user walks into an ATM centre and inserts the card when prompted, then the user is asked for the amount and then finally the amount is dispatched after the PIN is entered by the user.

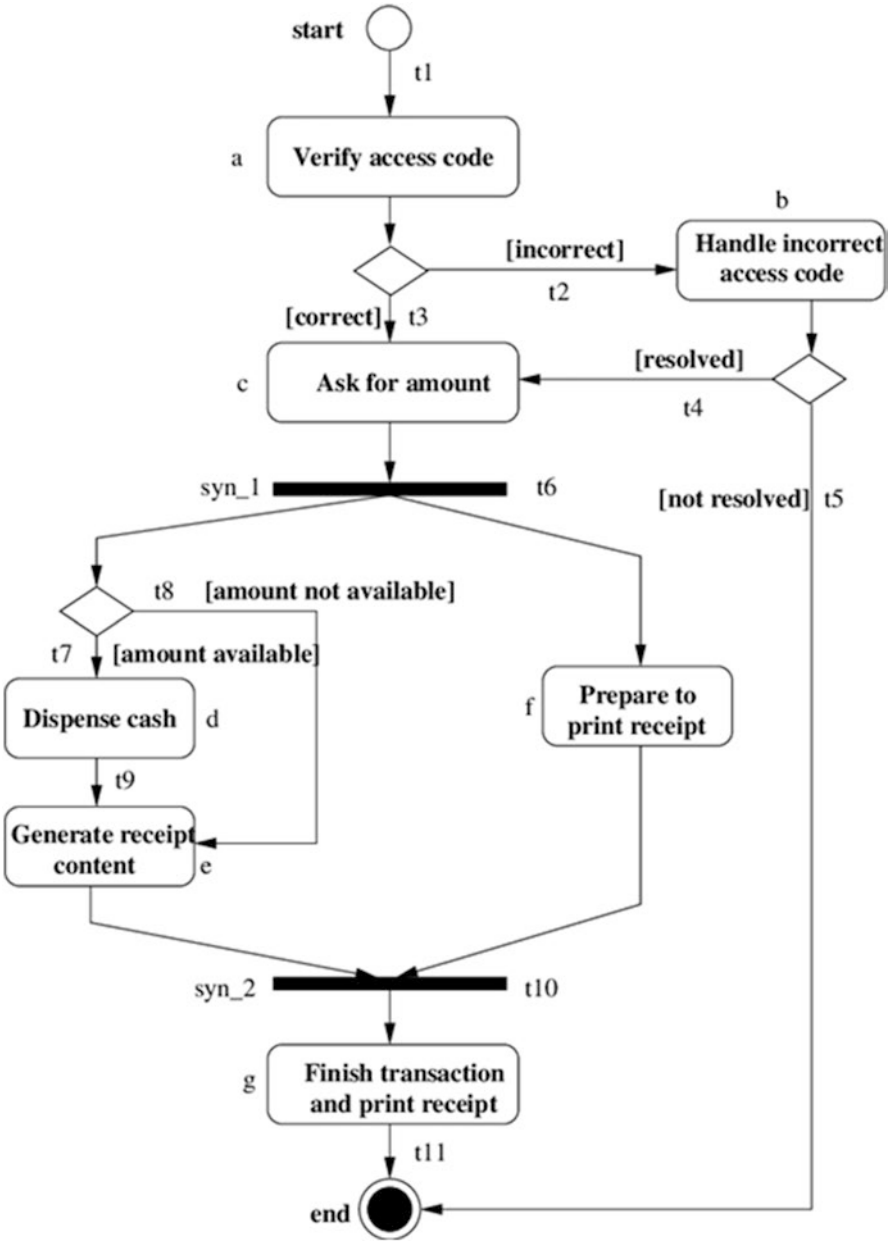

Fig. 1 UML diagram of ATM working [4]

3 Shortcomings with the Existing Implementation

The mere possession of both the card and the pin by an individual allows them to access the funds. ATM does not ensure that the person carrying the card is the one who is authorized to do so. If by any chance a person gets access to another person's card, there are many ways to know the PIN. The one situation when the current implementation holds its ground is when it comes to brute force attacks. An attack can be classified as brute force if it involves repeatedly trying to submit a value usually the password by putting together all the possible combinations. An evolved variant of brute force attacks uses a predefined dictionary which contains the most commonly used passwords which are tried first. While four-digit number is easier to brute force with today's computing power, there is restriction on how many attempts can be made before the card gets blocked. Because of this restriction, attackers generally try a more focused brute force attack utilizing social engineering. To accomplish this the attacker first identifies the victim and gathers as much information about them as possible. Then the attacker tries to come up with the combination the victim is most likely to use, for example, their birthdays or anniversaries or their ZIP code (0101, 0205 and so on). Ultimately all variants of brute force attacks have a little chance of success; hence the PIN is collected targeting and luring the victims with offers of a huge reward only to collect sensitive information like PIN in the end.

In the age of rapid information exchange, where everyone has access to the Internet, attacks are very easy. Phishing is one common practice. It is a targeted attack carried out on a particular set of people with the aim to extract sensitive information which can be their banking information, Social Security Number or any data that can be used to personally identify the person from them by reaching out to them by some medium like telephone, email and social media to mention a few while posing as genuine people from reputable institutions [5]. Old people are especially vulnerable due to a lack of awareness. Because of this they are targeted the most. Even if the attacker is unable to get the PIN, many cards nowadays use NFC to carryout pin-less transactions with which the attacker could withdraw the amount.

4 System Development

4.1 Overview of the Proposed Implementation

Our implementation creates a secure transaction layer between the existing ATM system and the user. At a higher level, the functionality can be divided across multiple modules as illustrated in Fig. 2.

To improve security and efficiency, the ATM starts to read facial data as soon as a user enters the ATM centre. By doing this, the ATM can detect a person's presence and get the user interface (UI) ready so that the user can interact with it immediately. From the security aspect, gathering facial data helps with the following:

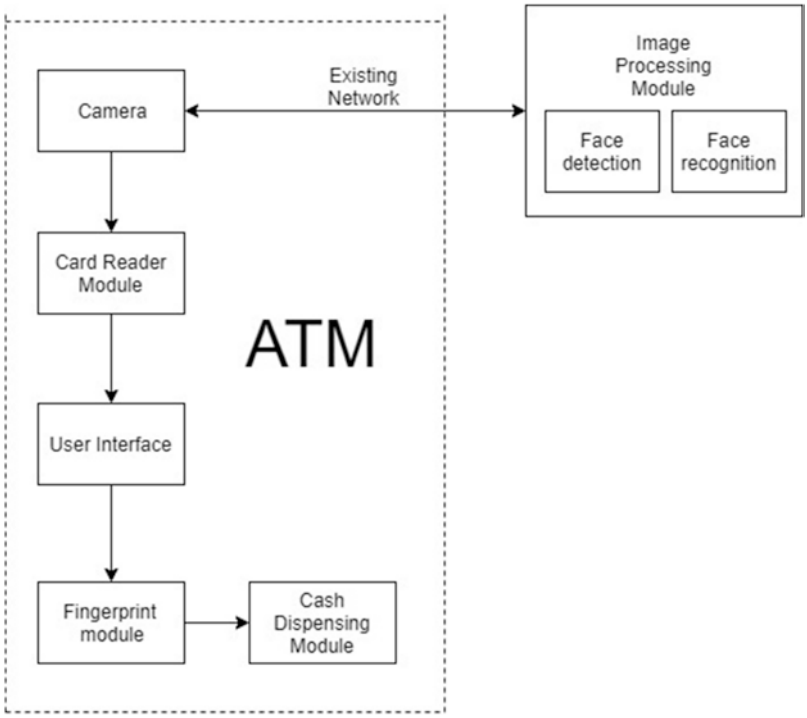

Fig. 2 Module-level functionality diagram

- Detect and identify malicious activity, and thwart maple is miscreants fixing a skimming device into the card reader that retrieves the card data once it is swiped.
- Identify if there are more people inside the ATM centre than allowed.
- Raise alarm if someone attempts to cover the face which could indicate some kind of unusual activity.
- Act as the first layer of security by identifying the user.

The actual processing of the gathered facial data happens remotely using the existing infrastructure set up by the bank which ensures that compatibility with the existing implementation is maintained. Image processing happens independently while the user interacts with the UI. Thus the UI always remains responsive. The user proceeds with the transaction inputting the amount required and so on; finally the user ID prompted to provide their fingerprint. Only if all the conditions are met, the transaction will get completed.

4.2 Web Camera

A webcam is a video camera retrofitted with circuitry that allows it to be exclusively used with a personal computer or a laptop. They use the USB (Universal Serial Bus) interface to communicate with the host. At the heart of a webcam is an image sensor

that is either made of CMOS (complementary metal oxide semiconductor) or CCD (charged coupling devices). Above the image sensor lies the lens which is either plastic or glass. Webcam produces a continuous stream of video and should always be connected with the internet [6].

4.3 Convolutional Neural Network-Based Image Classification

A convolutional neural network (CNN) is a class of deep learning neural networks [7]. Figure 3 shows layers in a convolutional neural network.

A neuron is the smallest unit of a neural network, and a collection of such neurons make up a neural network. In neural network these neurons are grouped together as layers, and the layers are connected to the subsequent layer. CNN or convolutional neural networks were proposed by Yann LeCun in 1988. It is a special architecture of artificial neural networks. In mathematical terms a convolution is when we take two functions f and g and perform a mathematical operation which produces another function h that describes how each function is modified by one another. Here we convolve the learnt data and the input data using 2D convolutional layers; this characteristic makes it ideal for 2D image processing.

Figure 4 shows what we perceive versus what a computer sees. To a computer an image is just an array of pixels which is of the same dimension as the image. Each element in the array contains a number from 0 to 255 indicating the pixel intensity at each point. The image is then passed through a series of connected layers where a small calculation is carried out at each layer. The convolution layer is always the first. The image (matrix of pixels) is given as the input to the first layer. Let us say this is the original pixel value function f, and then a smaller matrix is selected from

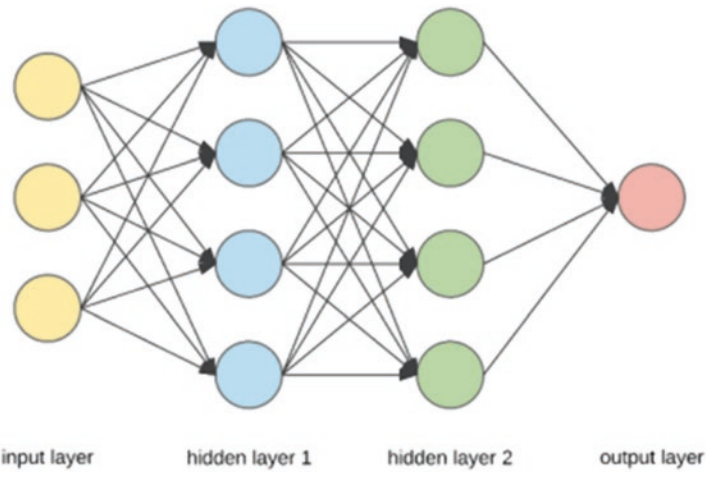

Fig. 3 Layers in a convolutional neural network

Fig. 4 What we perceive versus what a computer sees

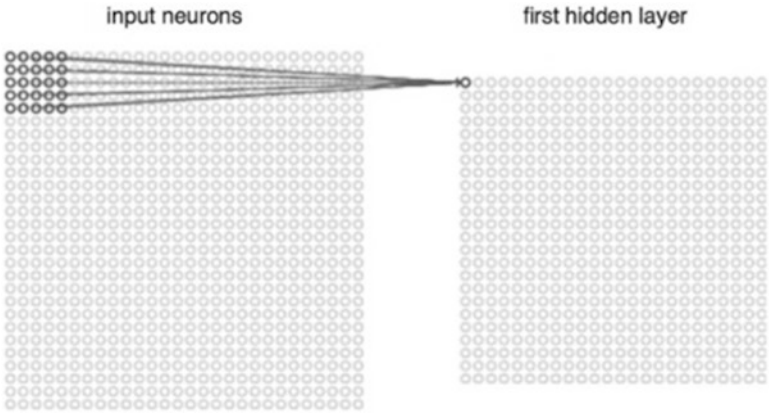

Fig. 5 Filter calculation to obtain a single value

the array which is called the filter which produces the convolution. Let us call it function g. Now function f is multiplied with function g and summed to produce a single value. This operation is analogous to us humans identifying the different features in an image like the face, hands, etc. This process is illustrated in Fig. 5.

4.4 Facial Detection

Face detection is a subset of machine learning that utilizes image processing technologies to carry out object class detection to identify human faces in digital images. An object class detection system aims to identify the different classes of features present in an image. Our implementation aims to utilize the existing infrastructure set up in the banks. To demonstrate this project utilizes third-party services provided by Amazon Web Services [8].

4.5 Face Recognition

Similar to face detection, face recognition uses image processing to identify a person's face, where its difference is that while face detection only aims to find faces in an image, a face recognition system attempts to establish the identity of the person(s) in the image. To achieve this each person's face is classified based on the facial feature points [9].

Figure 6 shows feature-based face detection. The face possesses. The most commonly used feature is the pupillary distance that calculates the distance between two pupils in a face. When combined with other modes of authentication, it becomes very reliable and hassle-free; the two most commonly used methods are bilinear interpolation and improved linear discriminant analysis [10]. Figure 7 shows working of a face recognition system.

4.6 Fingerprint Identification

The fingers of every human being have a unique pattern formed due to the ridge like structure of the skin. Evolutionally these ridges help us grip onto things. The ridge patterns are unique even between identical twins. This uniqueness makes it an ideal method to identify individuals. The process of conducting a fingerprint identification on a person is called dactyloscopy. In earlier days thumb impressions were checked by persons with nothing more than a magnifying glass. Nowadays with advances in computing technologies, it is automated. There are two ways to carry

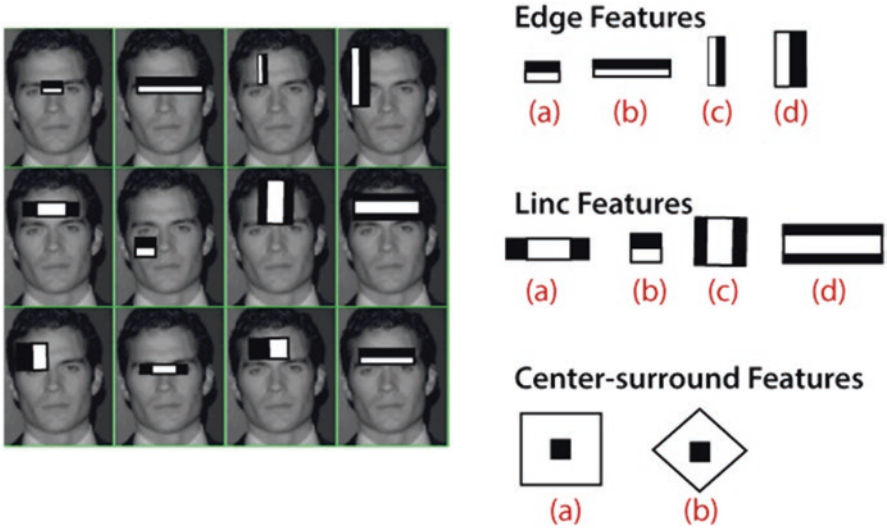

Fig. 6 Feature-based face detection

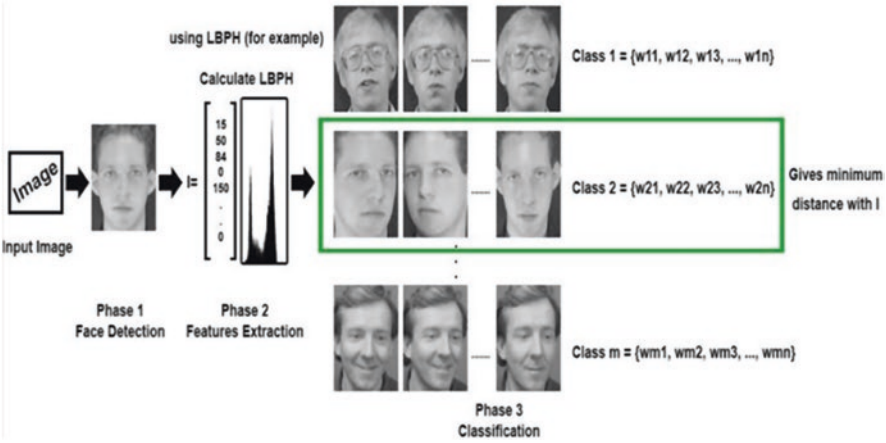

Fig. 7 Working of a face recognition system

out dactyloscopy: pattern matching and minutiae-based matching. A pattern matching simply tests if two images have a similar pattern, whereas minutiae-based matching tries to identify the minutiae points [11]. Figure 8 shows fingerprint identity.

4.7 Minutiae-Based Fingerprint Sensor

A minutiae-based fingerprint scanner works by comparing the minutiae points specifically the location and direction of each point. There are two methods to achieve this: using optical sensors and using capacitive sensors. In optical sensors, the CMOS sensor clicks a picture of the ridge patterns in the computer that analyses it. In capacitive scanners the distance between two ridges is measured as there exists a difference in capacitance since one part is raised and conductive, while the other part is not [12–15]. Fingerprint identity working is shown in Fig. 9.

5 Conclusion

This paper has demonstrated how the existing ATM setup can be enhanced in both the security aspect and in the usability aspect. The exponential growth in computing power has allowed running such complex deep learning tasks simpler and more efficient. Compared to the models of the yesteryears, today's models are smarter and more faster which allow for very low false-positive detections required when dealing with bank transactions.

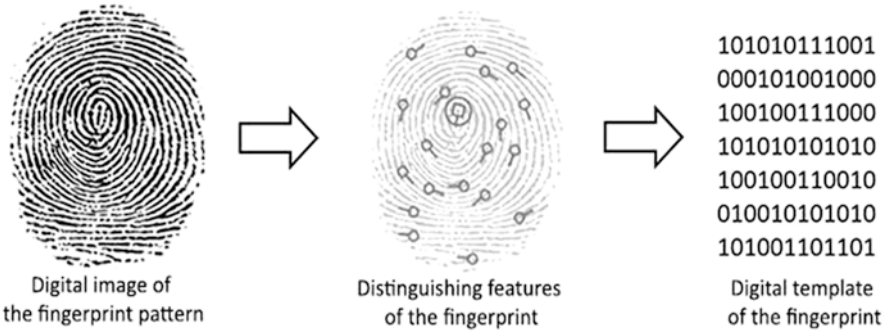

Fig. 8 Fingerprint identity

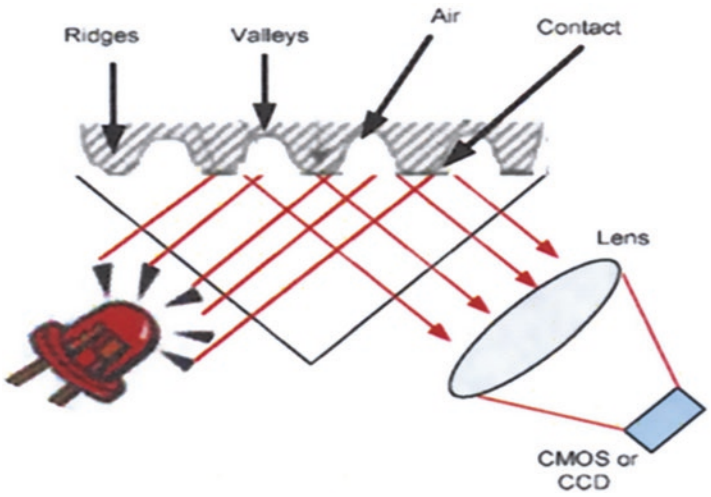

Fig. 9 Fingerprint identity working

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Data Mining in Health Care: Application Perspective

A. S. Shanthakumari and R. Jayakarthik

Abstract In order to attract the attention of doctors, nurse practitioners, clinical pharmacist, physician assistants and scientists alike, the rising health sector is producing a massive quantity of patient personal details and imbursements. The aims of this paper are to compare the different techniques, approaches and tools and also to measure their effectiveness in the healthcare sector. The main objective of the data mining application is to convert data into facts, text or number of applications that have been refined into knowledge by a computer. The purpose of applying data mining is to devise a programmed tool to identify and inaugurate relevant healthcare information in the healthcare industry. The researcher aims to study different types and challenges of data mining applications in the healthcare industries. Lastly, it also shows the past data mining techniques and its implementation methods.

Keywords Data mining · Application · Health care · Algorithms · Diseases

1 Introduction

Some of the papers have recently discussed various aspects of data mining's use in health care. In this paper the researcher used data mining algorithms to present a summary on healthcare analytics. In the current scenario of application of data mining in health care, create and gather high volumes of information that assist to give some interesting patterns from electronic systems that will protect medical records and enable quick detection of infectious diseases. Data mining facilitates healthcare

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sectors to forecast trends in the patient's health state by building links between apparently disparate information. The raw data from healthcare sectors needs to be stored, and their combination allows the formation of a connected medical information system [1].

2 Literature Survey

Durairaj and Ranjani [2] in his article found that the raw data from healthcare sectors are huge and assorted. The data needs to be collected, and the extracted patterns can be utilized by healthcare practitioners to construct forecasts and locate treatments for patients in healthcare sectors.

Ţăranu [3] suggested an innovative perspective on decision-making strategies for the health data to give examples in the healthcare industry through data mining techniques. The theoretical framework of data discovery in databases concluded that the problems in the healthcare sector are identified by data mining applications.

Karegar et al. [4] constructed an automated tool for relevant healthcare information of various types of data mining applications and to minimise the complexity of the healthcare data transactions. The past data mining techniques and its function tools for healthcare organisations are also discussed.

Islam et al. [5] reviewed the numerous papers in this area concerned in terms of algorithms, methods and performance. Their analysis paper summarised the papers that the disciplines, pattern, errands and methods attempted inline.

Cifci and Hussain [6] were motivated by a lack of a coherent and structured narrative to frame a summary of the literature on this specific issue. From 2005 to 2016, they performed a sample search. They examined that the current literature explores analytics in decision-making in clinical and directorial. They were extracted through sub-areas of health care, DM techniques and forms of analytics to provide potential future directions.

Mercy Beulah et al. [7] revealed in their paper that data mining is one of the important motivating spaces for investigation that is mounting gradually standard in the healthcare sector. DM plays a vital role in revealing the innovative emerging trends related to these circumstances. Their survey highlighted some of the applications and the opportunity issues of DM in medical sectors. They also provided a picture of a database of the present situation held in the healthcare sector.

3 Data Mining

Data mining is a method by which patterns are extracted from data. With prevalent usage and unpredictable growth in database sizes, the sectors are confronted with the question of using such huge quantities of data in companies. Knowledge

discovery in databases is an important extraction of embedded data that gives potentially useful information from the data [8, 9].

4 Methodology

The degree of precision is claimed by the applications. Sterility requires complex methodologies to conclude the outcomes at the end of IVF (in vitro fertilization) treatment specific procedures. In this paper the researcher compares the different data mining techniques to the same standard to estimate IVF treatment success rate. This comparative study may be useful in which data mining method offers a reliable level of knowledge from data from health care.

5 IVF Success Rate Prediction Comparison

The data mining derives the conclusions from the data and presumes the level of precision in different healthcare issues. Figure 1 shows data mining applications in health care. Table 1 shows data mining applications in health care. The list for assessment of medical conditions is:

- Heart disease.
- Cancer.
- Tuberculosis.
- Diabetes.
- Kidney dialysis.
- Dengue.

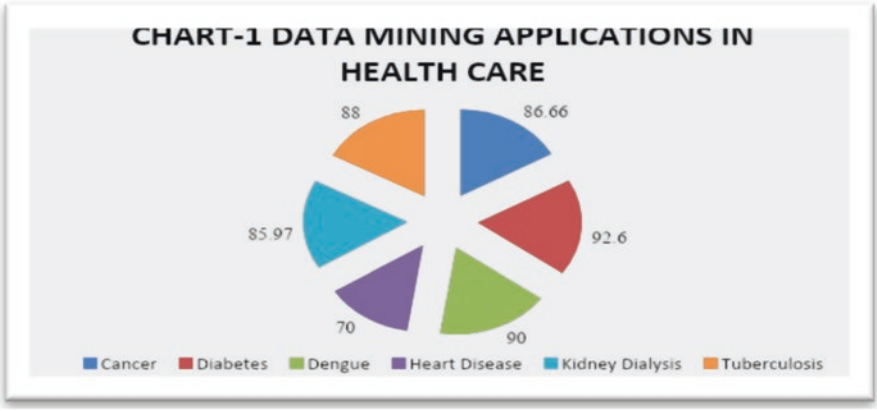


Fig. 1 Data mining applications in health care

Table 1 Data mining applications in health care

S. no.	Diseases	Tool of data mining	Technique	Algorithm	Traditional method	Accuracy level (%) from DM application
1.	Cancer	WEKA	Classification	Decision table	–	86.66
2.	Diabetes	ANN	Classification	C4.5	Neural network	92.6
3.	Dengue	SPSS Modeller	–	C5.0	Statistics	90
4.	Heart disease	NCC2	Classification	Naive	Probability	70
5.	Kidney dialysis	RST	Classification	Decision-making	Statistics	85.97
6.	Tuberculosis	WEKA	Naive	KNN	Probability, statistics	88

Table 2 Estimates of the rate of success of the operation and presents the outcome

	Predicted			
Actual		**Success**	**Unsuccess**	
	Success	17	4	0.80
	Unsuccess	26	10	0.277
		0.3953	0.7142	0.4736

6 Application of Rough Set Theory for Medical Informatics Data Analysis

Development of the rough set theory is used in medicinal data evaluations. Raw collection is used to lower the attributes, without losing the relationship of the initial. The fertilization data to construct the optimal editing is set without having any effect on the original relationship. Table 2 shows the estimates of the rate of success of the operation and presents the outcome.

Comparison is made between expected and real outputs. It also indicates that the performance rate after attribute reduction is 47%.

7 Artificial Neural Network in Classification and Prediction

The network being modelled is evaluated, trained and confirmed using patient sample IVF data. Finally, it measures the rate of performance between expected outcome and actual production. Table 3 accounts for a success rate foreseen by ANN.

Table 3 IVF success rate predicted by ANN

Performance	Desired output	Actual network output
MSE	0.209	0.2128
NMSE	1.164	1.1830
MAE	0.231	0.2578
Min. Abs error	9.908	6.6604
Max. Abs error	1.015	0.9988
R	0.0498	0.4980
Percent correct	73.07	75

Table 4 Performance of IVF success rate prediction using hybrid technique

Performance	Unsuccess of treatment	Success of treatment
MSE	0.093	0.110
NMSE	0.379	0.451
MAE	0.143	0.192
Min. Abs error	0.003	0.006
Max. Abs error	1.056	1.056
R	0.789	0.789
Percent correct	89.230	91.837

8 Modelling Neural Networks and Rough Sets for Analysing Medical Data

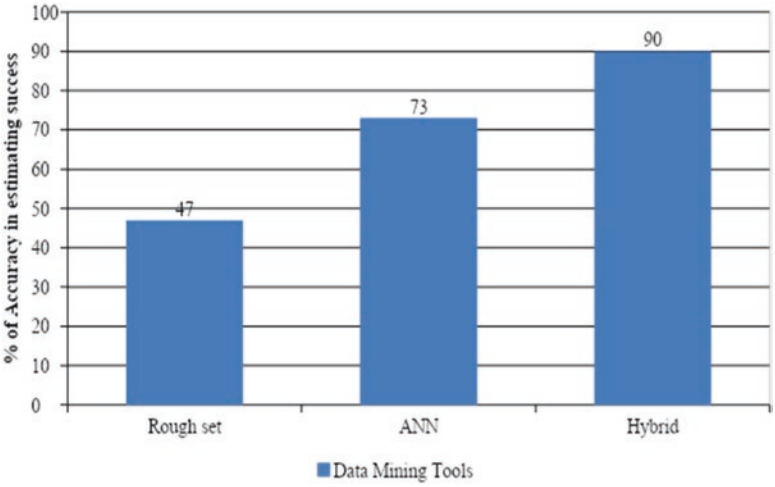
In the application of rough set method, the two forms of rules destinism and non-destinism are affected. The presentation of artificial neural network's collective technique and rough set theory is explained in Table 4.

In Table 4, this hybrid method predicts the accuracy of ANN and RST collectively. Collective rough collection and artificial neural network implementation yields better outcomes when opposed to other techniques. Table 5 shows comparison between two different data mining applications.

9 Conclusion

It is a difficult task to hypothesize disorders using data mining tools, but it significantly minimizes manual workers and maximizes prediction value. Improving efficient data mining software minimizes the expense of HR and experience and time constraints. Exploring medicinal data knowledge is such a dangerous activity as the collected data is always chaotic, immaterial and enormous, such as 86.66% for cancer prediction and about 70% for estimating the rate of success of IVF treatment.

Table 5 Comparison between two different data mining applications



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A Hybrid Filter Wrapper Embedded-Based Feature Selection for Selecting Important Attributes and Prediction of Chronic Kidney Disease

K. Kalaiselvi and S. Belina V. J. Sara

Abstract Today's most significant healthcare problem that is prevailing is the chronic kidney disease (CKD). The disease integrates well-defined pathophysiological process that will be experimental for determining irregular kidney functions and the glomerular filtration rates. To forecast the disease, different data mining techniques are used to discover the connections between various elements, which can be utilized to determine the progress and status of CKD. Data is obtained from the patient's healthcare records. The main purpose of this research is to avail the Hybrid Filter Wrapper Embedded-Based Feature Selection (HFWE-FS), which will be utilized to select CKD datasets from potential feature subsets. HFWE-FS algorithm integrates the process of filtering, wrapping and embedding algorithms. The filter algorithms are integrated with reference on certain metrics: Gini index, gain ratio, One R and Relief. The wrapper algorithms via enhanced bat algorithms are purposed to select the analytical features from wide-range CKD sets of data. The embedded algorithms are underpinned, and this depends on the support vector machine (SVM)-t statistic, which selects the analytical features out of the wide-range CKD dataset. The results of the feature selection algorithms are integrated and identified as the HFWE-FS algorithm. The SVM algorithm for the CKD prediction is proposed as a final stage. The database used is taken from 'CKD' implemented on the MATLAB. The results perceived that the SVM classifier along with HFWE algorithm gets high classification rate when contrasted with other categorization algorithms: Naïve Bayes (NB), artificial neural networks (ANNs) and support vector machine (SVM) in CKD completion.

Keywords Chronic kidney disease (CKD) · Improved bat algorithm (IBA) · Feature selection (FS) · Hybrid Filter Wrapper Embedded (HFWE) · Classification · Support vector machine (SVM)

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1 Introduction

Chronic Kidney Disease (CKD) is progressively development in generally following months. In common it shouldn't be identified previously to it dropped to 25% of its functionality. The persons who get treatment for this shouldn't be affected and identified by renal failure because kidney failure couldn't provide some symptoms originally.

In accordance with the National Health Service, kidney disease is found to be predominant in Africa and South Asia compared to other countries. There is a need for early detection of kidney failure, through which both kidneys be capable under control and consequently mitigate the threat of irreversible issues [1]. CKD can be able to be identified through a blood test which distinguishes measuring factors, and thereby doctors can decide the treatment process that reduces the progression rate (Kathuria and Wedro [2]).

Filter, wrapper and embedded methods are the taxonomy of feature selection methods. The reavailability of the embedded algorithm and the filter wrappers for FS and the algorithm used for classification called SVM to characterize the subset which is chosen is illustrated in Fig. 1.

The wrapper method measures the feature sets that depend on the predictable influence by means of a classifier like a black box (Ladha and Deepa [3]). Classification system makes use of varied classifiers to reduce the features and classifiers to identify quite a few types of diseases [4].

The accuracy rate of these methodologies using feature selection is investigated in this study. For the diagnosis of CKD, Hybrid Filter Wrapper Embedded-Based FS algorithm is used to reduce the element of features, and consequently the features are classified using SVM. The collection of data was done from the University of California Irvine (UCI) repository. The element is diagnosed as given: earlier, in Sect. 2, a background analysis of the techniques utilized in feature selection

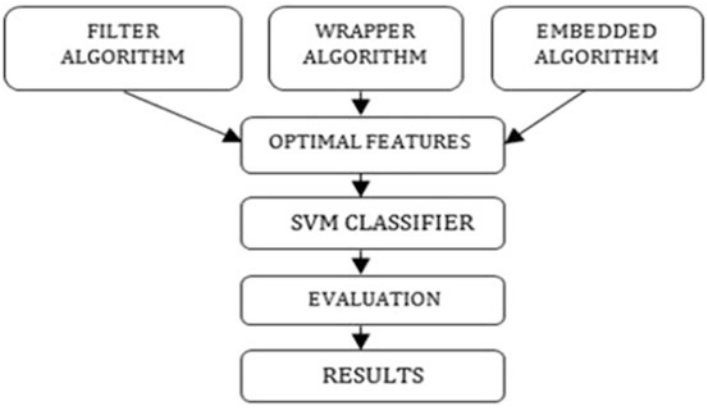

Fig. 1 SVM classification with Hybrid Filter Wrapper Embedded (HFWE) algorithm

purposed for further evaluation of the illness is conducted, and Sect. 3 details the methodology which is proposed. Section 4 shows the simulation results for the used methods and its comparison. In conclusion, Section 5 wraps up the paper.

2 Literature Review

[5] projected a system for forecasting the renal failure timeframe and named as adaptive neuro-fuzzy inference system (ANFIS) which used CKD which depends on live time clinical data. On comparing real data with predicted values, the study exposed to smooth the progress of the ANFIS model is capable of precisely estimating GFR variations in each and every sequential epoch and at long future periods in spite of elevated qualms of the human body and the energetic environment of CKD sequence.

[6] developed a method, which is too risky to estimate an individual's absolute risk of incident CKD. The participants were observed for a decade to assess the development of CKD. Performance measure evaluation was carried out using calibration and discrimination measures. Further investigation was proposed for the efficacy of this score in recognizing individuals in the community at risky chronic kidney illness.

[7] introduced a machine learning wrapper method for the identification of a set of 12 attributes which exhibits CKD detection with high accuracy. The experiment was conducted on a 400 individual's dataset, out of which 250 were detected for CKD. The results revealed that according to F1 measure the precision of 0.993 with 0.1084 root-mean-square error was attained.

[8] designed a technique that incorporates case-based reasoning (CBR) and data mining (DM) for forecasting and identifying chronic disease. These conclusions elucidate the references for the doctors as well as the patients who are into the CKD.

[9] IgA nephropathy (IgAN) is a wide-reaching disease that has an effect on human kidneys and shows the way to the end-stage kidney disease (ESKD), which typically necessitates renal spare therapy with kidney transplant or dialysis. Introducing an artificial neural network is to categorize patients' health prominence impending to ESKD. The developed tool is accessible together as a live web application and as an Android mobile application.

[10] conducted a study on the warning signs that are connected with the progressive development of CKD, with different frameworks, i.e. support vector machine (SVM), soft independent modelling of class analogy (SIMCA) and the k-nearest neighbour (KNN). The techniques are applicable in assessing the clinical data used from UCI machine learning repository.

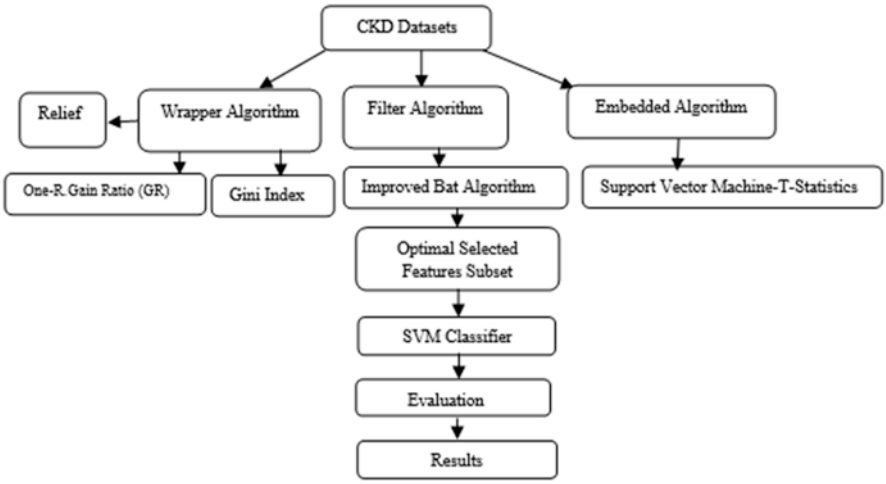

Fig. 2 Block diagram reavailable HFWE-FS

3 Proposed Methodology

For chronic kidney disease (CKD) development, early recognition and successful dealing are the simple treatment to decrease the death rate. The machine learning algorithm with respect to SVM was utilized in the direction of CKD forecasts in this work. In the prediction process of CKD, filter wrapper embedded techniques are utilized to potentially minimize the feature number in CKD set of data. In the technique, Gini index (GI), gain ratio (GR), One R, Relief and filter were utilized. In the wrapper technique, improved bat algorithm (IBA) was utilized. The embedded algorithm is typically executed based on the SVM-t statistics to select the probably analytical feature from wide-range CKD dataset from UCI repository for machine learning. Figure 2 shows the structure of the Hybrid Filter Wrapper Embedded (HFWE) for predictive attributes and SVM algorithm for the identification of the CKD.

3.1 Dataset Information

The rate of glomerular filtration (GFR) includes mathematical functions utilizing serum, origin, body size and age, among others. If a kidney's work is regular and polluted to scope, to make the blood unwell, unnecessary items are put together up to higher levels. A set of UCI CKD data contain 24 attributes and one additional (binary) [11] class attribute with 400 samples ("CKD"-.250 cases; "NOTCKD"-.150 cases).

3.2 Wrapper Algorithm

The achievement of feature sets is evaluated using a classifier.

3.2.1 Relief-F

An attribute selection technique called Relief-F determines features by how fine its value differentiates examples with the purpose are from several groups, however, are comparable to each other. For each feature Fr, Relief-F chooses a random sample and k of its nearest neighbours from the similar class and every class. Then f is scored as the sum of weighted variation in several classes and the similar class. If Fr is expressed in a differential form, its determination shows higher variation, for instance, from several classes, consequently, it will obtain a higher score [12]:

$$\mathrm{SC_R}\left(\mathrm{fr}_i\right)=\frac{1}{p}\sum_{t=1}^{p}\left\{-\frac{1}{m_{\mathrm{fr_t}}}\sum_{\mathrm{fr}_j\in \mathrm{NH}_{\mathrm{fr_t}}} d\left(f_{t,i}-f_{j,i}\right)+\sum_{y\neq \mathrm{y}_{\mathrm{fr_t}}}\frac{1}{m_{\mathrm{fr_t}}}\frac{P\left(y\right)}{1-P\left(y_{\mathrm{x_t}}\right)}\sum_{\mathrm{fr}_j\in NM\left(\mathrm{fr_t},y\right)} d\left(f_{t,i}-f_{j,i}\right)\right\} \tag{1}$$

where $\mathrm{yfr_t}$ is the sample class label, frt, and $P(y)$ is the likelihood of a classy sample. NH(Fr) or NM(Fr,y) are the few points closest to the sample of Fr with a related class of Fr or a separate class (class y), respectively. The sizes of the $\mathrm{NH(fr_t)}$ and $\mathrm{NM(fr_t}, y)$ sets are correspondingly $\mathrm{mfr_t}$ and mfrt, respectively. The magnitude of both NH(Fr) and NM(Fr, y); ¥y x $\mathrm{yfr_t}$ is typically set to an unvarying value k, which is a user-defined identifier.

3.2.2 One-R

One-R is an easy algorithm, and it considers each and every numerical feature as unbroken and makes use of a simple algorithm to separate the range of values addicted to a number of disjoint intervals. The gain ratio is a ratio of the information obtained to the intrinsic drilled down data and also unique to the equation of y means (2):

$$GR=\frac{IG}{\mathrm{H}\left(fr\right)} \tag{2}$$

As shown in Eq. (2), as soon as feature Y needs to be forecasted, the information gain (IG) has to be normalized by separating entropy of feature fr and likewise to the reverse also. Suitable in the direction of the normalization, the gain ratio ideals constantly decrease in the series [0,1]. The importance of gain ratio = 1 denotes with the reason of the information of feature entirely to predict Y, and gain ratio (GR) = 0 means with the purpose around nil relation among Y along with fr|Y. The GR works well features by smaller amount values whereas the Information Gain (IG)

$$IG(fr,y) = H(fr) - H(fr|Y) \tag{3}$$

The measure of uncertainty related to an indiscriminate variable is entropy (H). H (Fr) and H (fr/Y) are the entropy of Fr and, correspondingly, the entropy of successive observation, Y:

$$H(fr) = -\sum_i P(\mathrm{fr_i}) \log_2 \left(P(\mathrm{fr_i}) \right) \tag{4}$$

The highest data benefit value is 1. A function with a high data gain is important. For each trait, IG is independently calculated, and the top k values of characteristics choose the required characteristics. This FS algorithm, based on a philtre, does not delete redundant features:

$$H(fr|Y) = -\sum_j P(y_j) \sum_i P(fr_i|y_j) \log_2 \left(P(fr_i|y_j) \right) \tag{5}$$

3.2.3 Gini Index (GI)

[13] is a multivariate FS filter measurement algorithm aimed at determining the ability of a function to distinguish between groups. GI of each function can be calculated by defined C groups, as GI can take the utmost value of 0.5 for a twofold classification. There are smaller GI values for the other related characteristics. Each function of GI is independently calculated, and the top k features with the smallest GI are selected. It also does not delete unwanted functions, including IG:

$$GI(fr) = 1 - \sum_{i=1}^{C} \left[P(i|fr) \right]^2 \tag{6}$$

3.3 Filter Algorithm

The filter algorithm selects the rank features that are most elevated, and then the subset features selected can be used for some other classification.

3.3.1 Bat Algorithm (IBA)

Bat algorithm is known as the sound of echolocation produced by bats. Echolocation is characteristic sonar used by bats to locate predators and eliminate potential obstacles. Bats can produce louder sounds and produce echo with the intention of jumping back from the obstacles nearby. Therefore, a bat will measure how far from a

function they are. Bats can find variation between an obstacle and a victim among the variety, even in total darkness. In order to the collection of features from the dataset, the bat's algorithm follows some basic rules [14–16]:

Bats flutter haphazardly by means of velocity denoted by vi at locations 'xi' by '$f_{\min}$' frequency, which is changeable loudness and wavelength AO to evaluate the optimal characteristics, which also facilitates an update of the pulse emission rates rϵ [0, 1], with respect to the nearness to the categorization accuracy, although its soundness is capable of diverging different ways. Let us focus on the varied usage of soundness from AO to lesser unchangeable value 'Amin'.

3.3.2 Initialization of Bat Population

The preliminary population features are randomly produced since original CKD dataset samples with information size *d* and *n* no. of bats, by consideration of lower and upper boundaries shown in:

$$x_{ij} = x_{\min,j} + rand(0,1)\left(x_{\max,j} - x_{\min,j}\right) \tag{7}$$

where $i = 1, 2, n$, $j = 1, 2, .d$, $x_{\min}$, j and $x_{\max}$,are lesser and higher limitations for feature j correspondingly.

3.3.3 Update Procedural Frequencies, Velocity and Remedy

The factor of frequencies can control the size of steps of feature selection remedy for BA. The frequencies in the lower and upper boundary are denoted by ($f_{\min}$ and $f_{\max}$). The speed of feature selection feature selection result is comparative towards frequency and novel result depending on its current velocity:

$$f_i = f_{\min} + \left(f_{\max} - f_{\min}\right)\beta \tag{8}$$

$$v_i^t = v_i^{t-1} + \left(x_i^t - x^*\right) f_i \tag{9}$$

$$x_i^t = x_i^{t-1} + v_i^t \tag{10}$$

where $\beta\epsilon$ [0, 1] specifies arbitrarily creating a value, x^* denotes the existing overall best feature selection solution. For neighbourhood search part of utilization, one feature selection result is chosen between the certain best solutions and the unsystematic walk is useful:

$$x_{\text{new}} = x_{\text{old}} + \varepsilon \overline{A^t} \tag{11}$$

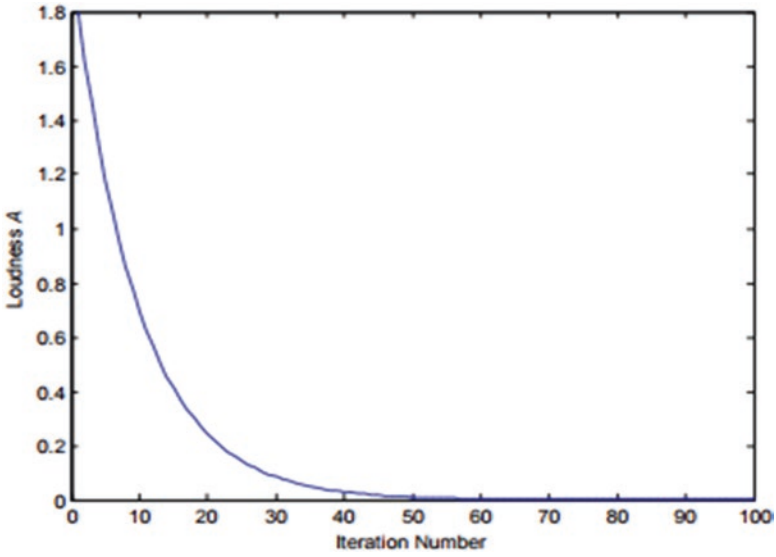

Fig. 3 Loudness *A*

where *t* [0, 1] is∈*εA* is average loudness of each and every bat, arbitrary number and denotes way and strength of unsystematic walk.

3.3.4 Changing Rate of Pulse Emission and Loudness

Loudness *A* with pulse emission rate *r* is reorganized as (Fig. 3)

$$A_i^{t+1} = \alpha A_i^t \tag{12}$$

$$r_i^{t+1} = r_i^0 \left[1 - e^{-\gamma t}\right] \tag{13}$$

Where α and γ are constants. r_i^0 & Ai are features those includes of random values and A_i^0 be able to characteristically be [1, 2], while r_i^0 be able to characteristically be [0, 1].

Algorithm 1. Pseudo Code of BA

1. Intention of function: $f(x)$, $x = (x1,\ldots.xd)t$
2. Initiate bat population xi and velocity $v_{ii} = 1, 2,n$
3. Describe frequency of pulse f_i at x_i
4. Initiate pulse rate ri with loudness A_i
5. when ($t <$ greatest iterations of frequency)
6. Produce latest solutions by fiddling with frequency, and by bringing up to date velocities and location/solutions.
7. F (rand $> r_i$)

8. Choose a feature selection solution between the best-selected features solution
9. Create a local feature selection solution with the best-picked features
10. end if
11. if (rand< A_i and $f(xi) < f(x^*)$)
12. Recognize recent feature selection solutions
13. Raise ri,reduce A_i
14. end if
15. Find the position of ranking the bats and uncover updated recent best-selected features x^*
16. end while
17. Exhibit final feature selection outcomes.

3.3.5 Improved Bat Algorithm (IBA)

BA reavailable a critical algorithm that is capable of straightforwardly getting falls in local smallest on the majority of the functions. To solve this two major changes are applied to increase investigation and development ability of BA.

3.3.6 Inertia Weigh Factor Modification

In general, pulse emission rate r is used to control research and development of BA, and this element improves as it does until it reaches iteration (Fig. 4). At BA, steps 8 and 9 bear the localized BA hunt. The algorithm slowly decreases the production potential as iteration continues when step 7 is analysed. BA's research and development was affected by the weight of inertia factor. Then when the weight of inertia is higher, it is more like the quest overall. The effect of earlier velocity decreases gradually with the linear decreasing inertia weight factor. Consequently, BA's rate of growth is rising slowly as iterations continue:

$$w_{\text{iter}} = \frac{\text{iter}_{\max} - \text{iter}}{\text{iter}_{\max}} \left(w_{\max} - w_{\min} \right) + w_{\min} \tag{14}$$

where iter is the available iteration count, $\text{iter}_{\max}$ is maximum noumber of iterations and $w_{\max}$ and $w_{\min}$ are maximum and minimum inertia weight factors, respectively.

3.3.7 Adaptive Frequency Modification

In IBA, each feature of a solution is allocated a frequency from $f_{\min}$ to $f_{\max}$ individually:

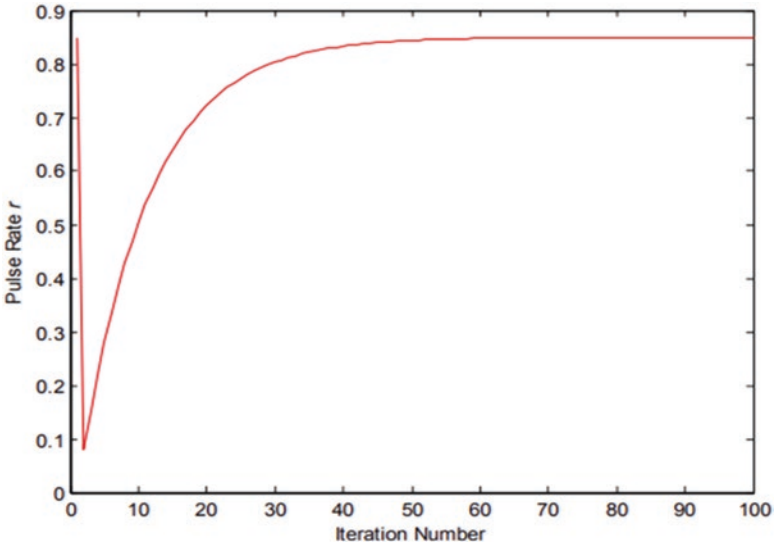

Fig. 4 Pulse emission rate *r*

$$diff_j = \sqrt{\left(x_{ij} - x_j^*\right)^2} \tag{15}$$

$$\text{Range} = \max\left(\text{diff}\right) - \min\left(\text{diff}\right) \tag{16}$$

$$f_j = f_{\min} + \frac{\sqrt{\left(\max\left(\text{diff}\right) - \text{diff}\left(j\right)\right)^2}}{\text{range}} * \left(f_{\max} - f_{\min}\right) \tag{17}$$

First, distances between solution *i* and the most excellent global feature selection solution are measured for each and every dimension, then neighbouring and furthest distance dimensions of selected features are allocated correspondingly to $f_{\min}$ and $f_{\max}$, and finally the frequencies of other feature dimensions differ in the $f_{\min}$ and $f_{\max}$ series with respect to their distances (Eq. (15)–approx. (17)). When we are analysing the figure (Fig. 5), the object of the solution's closest dimension to the largest is 1, and the farthest away is 3. First feature component of result increases gradually, at the same time as the third dimension of selected feature solution moves quickly. Else it moves from $f_{\min}$ to $f_{\max}$. Consequently, the dimensions are closer to the global feature selection solution. Velocity formulation (Eq. (9)) should be changed as follows:

$$v_{ij}^t = v_{ij}^{t-1} + \left(x_{ij}^t - x_j^*\right) f_j \tag{18}$$

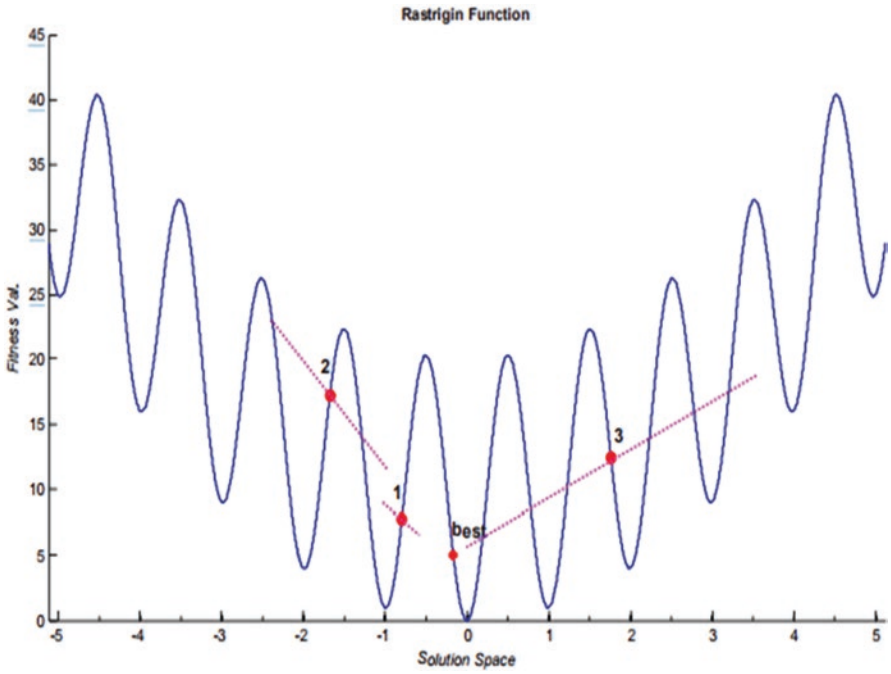

Fig. 5 Distribution of frequency

3.4 Embedded Algorithm

The embedded algorithm is underpinned with respect to SVM-t statistics to select the most preferred analytical feature in the CKD dataset. So, with the difference of trials, we are able to classify the main dissimilarity for specific genes between the nearest information points:

$$\left|t_j\right| = \left| \frac{\left(u_j^+ - u_j^-\right)}{\sqrt{\left(\left(s_j^+\right)^2 / n^+\right) + \left(\left(s_j^-\right)^2 / n^-\right)}} \right| \tag{19}$$

whereby $n+$ resp, $n-$) reavailables the number of supportive vectors that are formulated for class +1 (resp, −1). Compute mean u_j^+ (resp., u_j^-) and standard deviation s_j^+ (resp., s_j^-) based on typically supportive vectors of characteristic j-denoted category +1 (resp, −1) to evaluate the overall score of each feature.

4 Experimental Results

The classifier results were experimented via the use of the MATLAB tool with Intel Core 2 Duo Processor E7400 CPU (2.8 GHz Dual-Core, 1066 MHz FSB, 3 MB L2 cache) and 2 GB RAM.

4.1 Dataset Information

Glomerular filtration rate (GFR) can be calculated using creatinine serum, age, sex, size of the body, ethnic origin, etc. When a kidney's work is regular and polluted to a limit, unnecessary stuff will bring the blood elements up to elevated levels. Table 1 shows the stages of CKDs.

Table 2 symbolizes the CKD collection of information collected by UCI carrying 24 attributes along with another additional attribute for class (binary).

The confusion matrix is applied for narrating the classification performance algorithms through evaluating the performance metrics (Table 3).

The following metrics, such as classification accuracy (CA), accuracy, rate of errors, F-measure, accuracy and sensitivity, were utilized for the evaluation of the following: computed true positive (TP), false positive (FP), false negative (FN) and true negative (TN) and decision factor for the additional results:

True positive (TP) accurately refers to true information listed as true outcomes. True negative (TN) refers accurately to false information identified as false outputs. False positive (FP) refers to false information identified as real outputs, refers to real information, and is known as false outputs. False negative (FN) (accuracy of classification) refers to the algorithm used in the classification process in the CKD groups for diagnosis:

$$\text{Accuracy} = \frac{TP + TN}{TP + FP + TN + FN} \times 100 \tag{20}$$

Sensitivity specifies the correctness of evaluation of the target class's rate (Eq. 16):

Table 1 The stages of CKDs

Stages	Clinical features	GFR(mL/min/1.7 m^2)
I	Damage with normal or increased GFR	≥90
II	Damage with a mild decrease in GFR4	60–89
III	Moderate decrease in GFR	30–59
IV	Severe decrease in GFR	15–29
V	Kidney failure	<15 or dialysis

Table 2 The attributes of CKD of UCI

Attribute number	Attributes (type)	Attribute values	Attribute codes
1	Age (numerical)	Years	Age
2	Blood pressure (numerical)	mm/Hg	bp
3	Specific gravity (nominal)	1.005, 1.010, 1.015, 1.020, 1.025	sg
4	Albumin (nominal)	0, 1, 2, 3, 4, 5	al
5	Sugar (nominal)	0, 1, 2, 3, 4, 5	su
6	Red blood cells (nominal)	Regular, irregular	rbc
7	Pus cell (nominal)	Regular, irregular	pc
8	Pus cell clumps (nominal)	Available, not available	pcc
9	Bacteria (nominal)	Available, not available	ba
10	Blood glucose random (numerical)	mg per dl	bgr
11	Blood urea (numerical)	mg per dl	bu
12	Serum creatinine (numerical)	mg per dl	sc
13	Sodium (numerical)	mEq/L	sod
14	Potassium (numerical)	mEq/L	pot
15	Haemoglobin (numerical)	g	hemo
16	Packed cell volume (numerical)	–	pcv
17	White blood cell count (numerical)	Cells/cumm	wbcc
18	Red blood cell count (numerical)	Millions/cmm	rbcc
19	Hypertension (nominal)	No, yes	htn
20	Diabetes mellitus (nominal)	No, yes	dm
21	Coronary artery disease (nominal)	No, yes	cad
22	Appetite (nominal)	Good, poor	appet
23	Pedal oedema (nominal)	Yes, no	pe
24	Anaemia (nominal)	Yes, no	ane
25	Class (nominal)	CKD, NOTCKD	–

Table 3 Confusion matrix

Confusion Matrix		Prediction	
		Positive	Negative
Actual	Positive	TP	FN
	Negative	FP	TN

$$\text{Recall} = \text{Sensitivity} = \frac{TP}{TP + FN} \times 100 \tag{21}$$

Specificity relays in the direction of the test's ability in the approved manner detecting patients without a stipulated condition:

$$\text{Specificity} = \frac{TN}{TN + FP} \times 100 \tag{22}$$

Precision also, namely, positive predictive value, is the fraction of same information between the recover information:

$$\text{Precision} = \frac{TP}{TP + FP} \times 100 \tag{23}$$

F-measure is the average of precision and recall which is described as

$$\text{F} - \text{measure} = 2 \times \frac{\text{Recall} \times \text{Precision}}{\text{Recall} + \text{Precision}} \times 100 \tag{24}$$

Figure 6 depicts the sensitivity and specificity results to classifiers like the NB, ANN and SVM. These results are measured in terms of the feature selected from the HFWE-FS algorithm; it concludes that these three classifiers perform better under HFWE-FS algorithm in Table 4. Nevertheless, the proposed SVM-HFWE-FS algorithm gives improved sensitivity results of 95.45% which is 13.08% and 14.77% high compared to ANN-HFWE-FS algorithm with SVM-HFWE-FS algorithm. Proposed SVM-HFWE-FS algorithm gives improved specificity results of 87.5% which is more efficient than the previous classifiers.

Figure 7 shows the precision and recall metrics evaluation to classifiers like the NB, ANN and SVM. The results are measured using the features selected from HFWE-FS algorithm; it proposed HFWE-FS algorithm with three classifiers that produce higher results than traditional classifiers. Proposed SVM-HFWE-FS algorithm gives improved precision results of 95.45% which is 5.54% and 6.66% more compared to ANN-HFWE-FS with SVM-HFWE-FS algorithm. Similarly proposed SVM- HFWE-FS algorithm gives improved F-measure outcomes of 95.45% which is 4.71% and 5.83% higher compared to ANN-HFWE-FS and NB-HFWE-FS methods correspondingly.

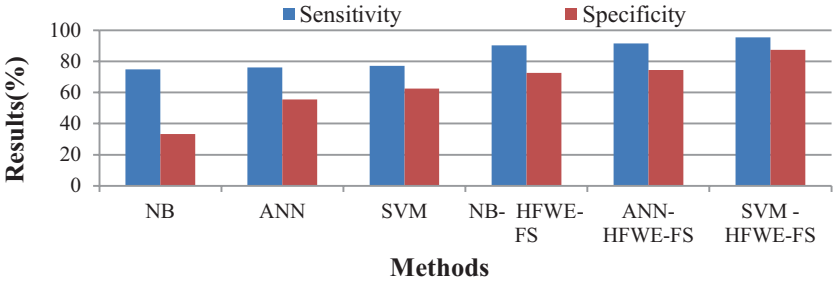

Fig. 6 Classifiers vs. sensitivity and specificity metrics

Table 4 Performance metrics vs. classifiers

Methods	Results (%)					
	Sensitivity	Specificity	Precision	F-measure	Accuracy	Error rate
NB-HFWE-FS	90.48	72.73	88.79	89.62	85.23	14.77
ANN-HFWE-FS	91.59	74.42	89.91	90.74	86.67	13.33
SVM-HFWE-FS	95.45	87.50	95.45	95.45	93.33	6.67
NB	75.00	33.33	81.82	78.26	66.67	33.33
ANN	76.19	55.56	80.00	78.05	70.00	30.00
SVM	77.27	62.50	85.00	80.95	73.33	26.67

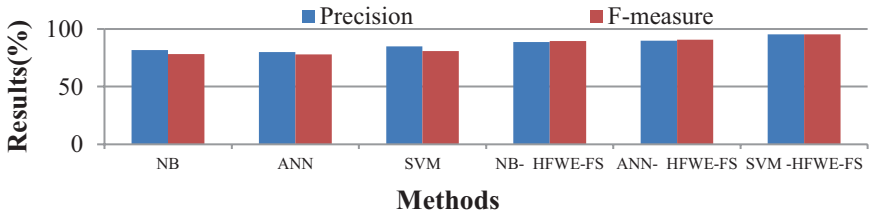

Fig. 7 Classifiers vs. precision and F-measure metrics

Figure 8 shows the accurateness and error rate metrics evaluation along with classifiers like the NB, ANN and SVM. The results are measured using the features selected from HFWE-FS algorithm; it proposed HFWE-FS algorithm with three classifiers that produce higher results than traditional classifiers. On the other hand, the anticipated SVM-HFWE-FS algorithm gives improved accuracy results of 93.33% which is 6.66% and 8.1% more compared to ANN-HFWE-FS and SVM-HFWE-FS algorithm. Similarly, proposed SVM-HFWE-FS algorithm gives reduced error rate results of 6.67% which is 6.66% and 8.1% less significant compared to ANN-HFWE-FS and NB-HFWE-FS classifiers correspondingly.

5 Conclusion and Future Work

A novel Hybrid Filter Wrapper Embedded (HFWE) is embedded in our paper along with Feature Selection (FS) algorithm to pick from the datasets the most favoured subset of features to predict CKD datasets.

Embedded, filter, and wrapper alongside the FS algorithm are utilized to minimize the feature attribute, and therefore SVM is also utilized in the classification of the attributes. The filter algorithm with four functions: Gini index (GI), gain ratio (GR), One R and Relief. The wrapper algorithm is implemented, and that is based on improved bat algorithms (IBA) to select the analytical feature from the wide-range CKD set of information. Embedded algorithm is executed with respect to the SVM-t statistics to choose the analytical attribute out of CKD dataset. SVM

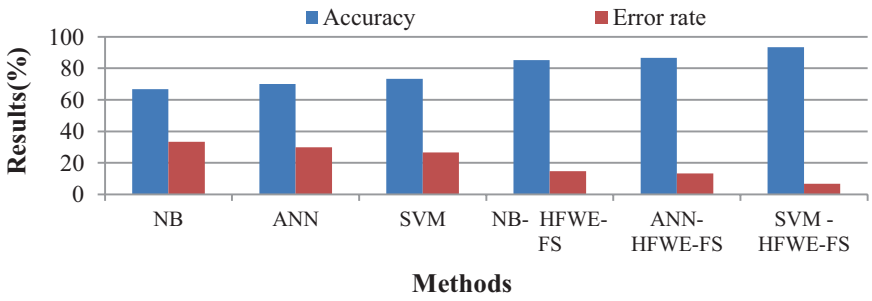

Fig. 8 Classifiers vs. accuracy and error rate metrics

classifier has been chased for the validity with reduced feature set. On a CKD dataset with 400 patients collected, an evaluation was carried out through the UCI machine learning repository. The main aim of this research is to evaluate whether CKD or non-CKD can be projected with even-handed precisions based on the chosen attributes from the HWF-FS algorithms. Performance was calculated in terms of six essential evaluation factors for categorization. On the other hand, the projected SVM-HFWE-FS algorithm gives improved accuracy results of 93.33% which is 6.66% and 8.1% more compared to ANN-HFWE-FS and SVM-HFWE-FS algorithm. Similarly, proposed SVM-HFWE-FS algorithm gives reduced inaccurate results of 6.67% that is 6.66% and 8.1% less significant in contrast to ANN-HFWE-FS and NB-HFWE-FS classifiers correspondingly. The same as explained from the outcomes, focus is more on the decreased features that are meant for recognizing CKD and thereby decreasing uncertainty, time saver with cost-effectivity. These set of information contain some unwanted and omitted values, so innovative classifier is needed to handle this issue efficiently. So it is left as future work.

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A Survey on Algorithms in Game Theory in Big Data

D. Rasi and R. Mahaveerakannan

Abstract Conventional data processing application software for handling huge data or intricate data is eased nowadays due to the evolving technology specifically termed as big data. Three Vs, namely, volume, velocity and variety, play a significant role in big data which is a necessity for a particular technology as well as analytical approaches involved in its transformation into value. The major issue involved is that the steady growth of it and opportunities are not caught by the organization frequently as well as extraction of actionable data.

Keywords Big data · High-order PCM algorithm · Cloud

1 Introduction

Big data is the one that is greatly exploited for description of structured as well as unstructured data encompassed in an enormous manner. There are various benefits of big data such as management ease and procession or examination through traditional technologies in addition to tools like relational database, visualization, statistics of data, etc. The petabyte is the one mainly meant because of increasing big data size [1]:

$$1\text{Petabyte} = 1000\text{Terabytes}$$

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Big Data Characteristics

- *Volume:* The amount of data which is generated by particular online applications in the form of megabytes and gigabytes into petabytes is referred to as volume.
- *Variety:* The nature and the type of data. It has the capability to classify all the incoming data into various categories like structured, unstructured and semi-structured.
- *Velocity:* The speed of data involved in generating term velocity. It accepts the incoming flow of data and at the same time processes it fast to avoid creating bottlenecks.

Big Data Trustworthy

The structured big data is examined through a core platform, namely, Hadoop, which is regarded as a problem solver through utilizing certain convenient data analytical techniques. Hadoop is greatly utilized for scaling a particular server to a thousand of machines [2].

2 Related Work

Privacy-Preserving High-Order Possibilistic C-Means Algorithm for Big Data Clustering with Cloud Computing (PPHOPCM)

[3] utilized the possibilistic c-means (PCM) algorithm for clustering data mining and pattern recognition. Better outcomes are obtained for heterogeneous data involved in big data which is achieved through PCM and regarded as quite difficult. A high-order PCM algorithm (HOPCM) is presented to alleviate this issue which is considered as the main aim designed in tensor space. Privacy-preserving HOPCM algorithm is another vital technique adopted for data protection in cloud through BGV encryption. The PPHOPCM can effectively cluster a large data set by utilizing cloud computing deprived of private data disclosure.

This paper proposed PPHOPCM for big data clustering. It cannot be applied directly because merely small structured data sets might be designed:

1. It is also because HPCM algorithm is nothing but the extension version of PCM algorithm designed in tensor space, where tensor corresponds to a multidimensional array in mathematics utilized for heterogeneous data representation.
2. It also proposes PPHOPCM algorithm for private data protection in cloud through BGV encryption due to its greater efficiency.

Possibilistic C-Means Algorithm

It is regarded as a fuzzy clustering scheme which varies from classical approach in which data set is given by

Data set:

$$X = \{x_1, x_2, \ldots..x_n\}$$

Where:

PCM = c X n membership matrix:

$$U = \left\{u_{ij}\right\}$$

$$J_m\left(u,v\right) = \sum_{i=1}^{c}\sum_{j=1}^{n} {U_{ij}}^m \left\| x_j - V_i \right\|^2 + \sum_{i=1}^{c} n_i \sum_{j=1}^{c} n_i \sum_{j=1}^{n} \left(1 - u_{ij}\right)^m \tag{1}$$

Where:

$V = \{v_1, v_2, \ldots\ldots v_n\}$ set of clusters.
V_{ij} = Membership of x_i € v_i

By eliminating Eq. 1, we get

$$U_{ij} = 1 / \left(1 + \left(d^2{}_{ij} / n_i\right)^{1/(m-1)}\right) \tag{2}$$

$$V_i = \frac{\sum_{j=1}^{n} Ux}{\sum_{j=1}^{n} U} \tag{3}$$

Where:

d = Distance between jth object of x_j and ith cluster.
V_i, η_i = scale parameters

$$\eta_i = \sum_{j=1}^{n} u_{ij}^m \times d_{ij}^2 / \sum_{j=1}^{n} u_{ij}^m \tag{4}$$

Distributed High-Order Possibilistic C-Means Algorithm Based on MapReduce

The distributed high-order possibilistic c-means (DHOPCM) algorithm is a notion on the basis of MapReduction and has been considered as an improved version of HOPCM pertaining to efficiency enhancement yielding proficient cloud computing programme model for massive data computing [4]. HOPCM exploits membership matrix as well as clustering centres for calculation purpose. Now, Map function is utilized for membership matrix computation along with Reduce function for clustering computations:

So:

Clustering centres V_i with X_i object:

$$V = \{v_1, v_2, \ldots\ldots v_i\}$$

The sub-matrix is

$$U = \{u_1, u_2, \ldots\ldots u_p\}$$

Data set X:

$$X = \{x_1, x_2, \ldots\ldots x_p\}$$

In MapReduce, we can establish each sub-matrix with their corresponding subsets to one computing node with the parameters (α_i, β_i) that are defined to calculate t computing node as follows:

$$\alpha^{(t)} = \sum_{k=(t-1)}^{tm/p} u$$

In Reduce phrase, the $\alpha_i^{(t)}$ $\beta_i^{(t)}$ where $t = 1,2,\ldots\ldots,P$

Then:

$$V_i = \qquad\qquad ( )$$

Reduce function is mainly deployed for clustering centre computation and dispatched to other computing nodes with another MapReduce function unit of convergence:

$$\text{The time complexity of DHOPCM is specified as O}\left(\text{tnc} / p\right) + \text{O}\left(\text{commu}\right)$$

Where:

P = number of computers engaged for accomplishing HOPCM.
O(commu) = communication overhead.

Hence communication quickly decreases time involved in clustering process estimation explicitly in centralized cloud computing platforms since ignoring can be done easily. Finally, computational complexity of DHOPCM is O(tnc/p).

Privacy-preserving high-order possibilistic c-means algorithm based on BGV

DHOPCM scheme is based on the MapReduce concept which rapidly increases clustering big data efficiency associated with cloud services. Generally, the private data gets affected due to disclosure as soon as it is processed in DHOPCM on cloud. Privacy-preserving HOPCM (PPHOPCM) scheme is introduced for private data production depending on BGV operations. This concept cannot be processed by cloud services, but it avoids private data disclosure. The PPHOPCM requires BGV operations for private data set security [5].

BGV Secure Operations
BGV is regarded as a completely homographic encryption technique. This procedure is used for the selection of a μ-bit modulus q bit and parameters as follows:

Dimensions(n) = $n(\lambda,\mu)$
Degree(d) = $d(\lambda,\mu)$
Distribution(X) = $X(\lambda,\mu)$

$$N = \left[(2n+1)\log 9 \right]$$

This format is mainly exploited for cipher text dimension reduction along with noise [6].

BGV technique comprises four secure operations, i.e. encryption, decryption, secure addition and secure multiplication, which are used for proposed PPHOPCM scheme implementation as follows:

Encryption
It encrypts a plaintext m R as a cipher text:

$$c \leftarrow m + A^{T}{}_{r} \in R_{q}^{\,n+1}.$$

Decryption
It decrypts a cipher text C to its plaintext:

$m \leftarrow (C, \mathrm{Sj} > \mathrm{mod}\ q) \mathrm{mod}\ 2)$ which uses its corresponding secret key Sj

Secure Addition
It adds two cipher texts like C1 and C2 to their sum as C4 on cloud C3 C1 + C2 mod qj and $C_4 \leftarrow (C_3, T(S_j\, S_j - 1) q_j, q_{j\text{-}1})$.

This Technique Has Two Advantages as Follows
It is a fully homographic encryption scheme supported by an arbitrary number of addition and multiplication operations simultaneously [7]. BGV technique yields a greater efficient output compared to other encryption schemes utilized for private data encryption of the large data sets.

Privacy-Preserving High-Order Possibilistic C-Means Algorithm on Cloud
[8] The grouping of X into c clusters is achieved with the help of secure HOPCM algorithm on cloud deprived of disclosure of the private data that is obtained through heterogeneous data set $X = \{\}$ with PHOPCM. The initialization of membership matrix $U = \{Uij\}$ with clustering centres $V = \{V\}$ is attained by PPHOPCM for encryption of membership matrix (μ) object in clustering client [9–11]. Also, updating of matrix and clustering centres is also performed by operating clustering (V) with other parameters on the cloud server by means of PPHOPCM algorithm. It is decrypted, while re-encryption gets updated based on the cloud for iteration. This process repetition is done till the convergence is met. The PPHOPCM can

effectively private data preservation. But data protection is not feasible due to clustering of heterogeneous data sets which are encrypted simultaneously in addition the complete clustering process that is executed on the cipher texts.

Game Theory-Based Correlated Privacy-Preserving Analysis in Big Data [GTCPA]

The greatest challenge involved in big data is privacy preservation. Privacy-preserving data publication (PPDP) is regarded as an extensive application of big data and an significant research field [12]. The trade-off amid privacy as well as utility of the single and independent data set is yet another challenge to be concentrated. This research work concentrates on the investigation of differential privacy parameter selections in correlated network data sets and maximizing each data set utility. There are several other challenges necessitated to be addressed which are as follows:

- Description of correlated relationship amid different data sets pertaining to privacy
- Design of reasonable extent about the utility of a sanitized data set
- Evaluation of data owners' value of privacy

Contributions

- Game model construction of multiple players for releasing their own data sets which is sanitized through anonymization mechanisms as well as measuring the differential privacy relationship of correlated data sets, the utility of sanitized data and the value of privacy.
- On the basis of game model, game analysis is performed.
- Anarchy price is utilized for efficiency assessment of the pure Nash equilibrium.

Game Theory

Game theory is being greatly utilized in data privacy game to analyse users' behaviour [13]. It can analyse competitive situations in a structured way. This theory understands the strategic situations. The basic principle for game theory is to find out an optimal solution.

Differential Privacy

Differential privacy generally refers to a standard meant for privacy definition in addition to rigorous mathematic definition which pertains to sensitivity of a query function. Two standard mechanisms, namely, Laplace mechanism and exponential mechanism, are generally used for attaining differential privacy. Multiple queries are considered together for privacy guarantee degradation for mitigating the privacy composition issues in differential privacy. Sequential composition is how the group of the privacy mechanisms gives differential privacy in isolation. While handling the multiple correlated data sets, privacy mechanism affording differential privacy over a data set might not hold same privacy guarantee. It is necessitated for assessment of relationship amid correlated data sets pertaining to privacy for computation of the real privacy level of a data set. Generally splitting is done for relationship of records about some user in different data sets as follows [14, 15]:

- *Direct Relationship*: This is merely meant for strict definition of relationship of two fully same records. For instance, a user concurrently defers to his tourist information to Facebook and Twitter. As a consequence, two different data sets have one same record about some user.
- *Indirect Relationship*: The direct relationship is more intricate and divided into two different records about some user or his correlated users, for instance, information streams of some user's activity, e.g., GPS record differential privacy and social networks records.

Efficient Trustworthiness Management for Malicious User Detection in Big Data Collection (ETMMUC)

Data collection refers to aggregation of information which plays a vital role in big data, and there exists no guarantee for the data that the users offer. There is no option for the collector to validate the authenticity of every piece of information and the trustworthiness of users participated in the collection which is also considered the most significant. Besides user actions influences on trustworthiness have to be also investigated. Malicious users are also thereby prevented from raising their trustworthiness also given that false information might mislead the final outcomes, a security queue to record users' historical trust information, so that malicious users can be detected with high accuracy. Trustworthiness encompasses two main parts: familiarity and similarity. The computational complexity is alleviated through division of all the participated users into small groups on the basis of similarity, also assessing the trustworthiness of each group separately. The grouping strategy makes the trustworthiness aiding in representation of the trust level of the whole group.

System Model

System model is presented encompassing the theoretical basis for computation of trustworthiness of users and threat model.

Social relationship factor is regarded as a vital part for feature study which encompasses user's social activities pertaining to trustworthiness computation. Their amicability level is determined through the number of interactions amid users; hence it is beneficial for extemporizing this sort of relationship as well as the trustworthiness value delivered through a friend.

Threat Model It is presumed that few users are malicious as well as attacks are launched for compromising data collection. In a sort of attack, malicious users raise their trustworthiness through collaborating with others for sending and receiving an enormous amount of messages. Malicious users affording false information in the collection are considered as another sort of attack. If the data is considered as authentic by the collector, the final outcome will be misinformed and also distant from the real one. The collector has to concentrate on both sorts of attacks for data collection obstruction.

System Design

User Grouping

In data collection, the trustworthiness of users has evaluated through dividing the initial trustworthiness into two segments, i.e. (i) on the basis of familiarity and similarity, trustworthiness will be increased, and (ii) in accordance with the user activities over the data transference, initial trustworthiness will be adjusted.

Trustworthiness Calculation

1. *Initialization phase:* In this phase, users' initial trustworthiness has been attained, and the social relationship between the groups and others has been taken into account, in particular the groups known to be trusted by the collector. Let group G*i* be the friend of a trusted group *Gt* and trustworthiness of group G*i*, which has represented as *Tr*. Then, the estimation has performed through associated transaction amount and similarity. In addition, the trustworthiness of the group, those who are not directly associated with the trusted group, has estimated.
2. *Adjustment phase:* Here, users' trustworthiness has been adjusted, if activities seem to be compromised and malicious. In data transmission, trustworthiness has been considered for adjustment according to the performance of the groups. Consequently, it might be reduced by the abnormal performance of the groups (such as long delay in the data transmission process, massive packet repetition, etc.), during which the trustworthiness of the groups has been adjusted using the adjustment strategy. In the data collection, the trustworthiness of the contributed groups may gradually get revised, since the adversaries have the chance to convince the groups with authentic users.

Initial Trustworthiness

The estimation of users' initial trustworthiness has been carried out, and the trustworthiness of familiarity and similarity has been evaluated.

Familiarity Trustworthiness

Familiarity has been considered as the conveying factor of trustworthiness. For the attainment of familiarity amid G*l*, *a* and G*T*, the groups have included those who possess direct transaction with G*T* and the ones with indirect transactions. The familiarity between group G*I* and G*T* has indicated by the lower level of G*I* than the remaining groups, and it signifies its superior trustworthiness. The estimation of trustworthiness is increased by familiarity.

Malicious User Resistance

In order to conclude the reliability of the user-provided data, the data collector has facilitated by the trustworthiness estimation. Throughout the process, all the users are not malicious, if they are marked by lesser trustworthiness. In that case, the collector takes place to figure out.

Security Queue

In order to identify the abnormal trustworthiness, constructing the security queue has considered to be an efficient way. During the process, on the basis of familiarity and similarity of the users, the groups' initial trustworthiness has evaluated in

data collection. A security queue has been developed to register the historical data of the groups, and the abnormal trustworthiness has been identified, concerning the identification of malicious users. Alongside the constant size, the construction of the security queue has been processed, intending to register the trustworthiness information of group G*I*. The statement has registered the general information regarding G*I*s.

Abnormal Transaction Resistance

In the groups, post-identification of abnormal trustworthiness, the undesirable impacts created by the malicious users should be controlled, for which two scenarios have been conferred: (i) The malicious users are collectively started transmitting enormous messages within them, concerning the increment of their trustworthiness, during which the augmentation of trustworthiness needs to be controlled, which have driven by abnormal activities. (ii) The false data has intentionally been transmitted by malicious users for creating the outcome of the inauthentic collection in which the malicious users have been cumulated, during which the removal of inauthentic data needs to be identified. The sudden augmentation of trustworthiness has been effectively restricted by making the modifications on the abnormal transaction, through which the authentic trustworthiness estimation has safeguarded. In such scenarios, the performance of some users might have been wrongly marked as abnormal that leads them to reduced trustworthiness, which solely occurs during the estimation of trustworthiness while modifying it as per the user performance. In that case, the users can approach the collector by sending the request, since then the respective user's data that has been considered as abnormal will not impact their trustworthiness for the time being. Concurrently, the scenario of the concerned users will be individually considered and elaborately scrutinized by the collector to ensure their reliability. In accordance with the conclusion made by the collector, the respective users' trustworthiness will be increased or may be diminished. Besides, when the reliability of the users was unable to be identified by the collector, and the data has been claimed by the user as normal, the trustworthiness has mutually been marked by an average value, subsequently designated for additional observation.

3 Performance Evaluation

The assessment on the proposed trustworthiness management has been carried out and approached by contrasting it with the inclusion of data transmission trustworthiness, transmission delay impact on trustworthiness and handling of the malicious activities of users.

Advantages

- The high-order possibilistic c-means algorithm outcomes are clustering accuracy for big data, particularly a heterogeneous data.
- The clusters of big data from cloud services can be capably utilized by PPHOPCM, in which the disclosure of private data has been omitted.

Table 1 Comparison chart

Parameter	PPHOPCM (1)	GTCPA (2)	ETMMUC (3)
Objective	The comprehensive trustworthy data collection approach sensor cloud system to extend the data processing ability of WSNs	For defining the association within various data sets concerning privacy	For improving the recognition of malicious users and their unusual behaviour through security queue
Proposed model	PPHOPCM uses multiple mobile sinks to upload the data from wireless sensor networks to cloud	For multi-players' game model for releasing their data sets, where each has been sanitized through anonymization mechanism, we measure the differential privacy correlation of data sets	Malicious users enhance their trustworthiness by colliding with others through transmitting and receiving a huge quantity of messages
Merits	It evaluates the trustworthiness of sensors and mobile networks to conduct extensive simulations to evaluate the performance	Pure Nash equilibrium efficiency has been assessed through the price of anarchy	It is used to prevent group trustworthiness from abnormally growing by malicious users from various groups colliding collectively
Demerits	In cloud-based system, the quality of sensor cloud system is increased, and it causes physical layer attacks like node capture, DoS, integrity, etc.	Identifying the highly critical data publisher who greatly influences his/her neighbours' privacy level	It is a psychology-aware method that could be integrated to the estimation of trustworthiness in order to elevate its level

- This paper proposed the algorithm of HOPCM, during which the objective function of higher-order tensor space has been optimized for the clustering of heterogeneous data.
- The clustering efficiency has been enhanced by designing HOPCM algorithm based on MapReduce to utilize the cloud server.

Disadvantages

Due to the proficiency of psychology, it could be integrated to the estimation of trustworthiness in order to enhance it. There is a possible lack of efficient identification of malicious detection when receiving false information from users. To surpass this issue, designing a few approaches has been necessitated in Table 1. The clustering of big data with heterogeneous data becomes a little difficult to make it efficient which is caused by the following reason:

- To procure the optimal outcomes, the features from various modulate have linearly been concatenated, and the multifaceted association within heterogeneous data sets has been disregarded.

These are eligible to be applied with small data sets. However, in heterogeneous data, it shows its inability to efficiently process the clustering of large data sets due to its extensive time complexity.

4 Conclusion

In this paper, a higher-order privacy level from a few data set that relies on the privacy parameters of its own and the neighbours has been proposed. At the time when the privacy parameters have been considered by their respective data publisher to make the best use of the utility, the trade-off problem is getting transformed into a game problem. In order to assess the impact of the remaining data sets over the real privacy level of a single data set, the correlated differential privacy has been referred. Subsequently, the game model has been developed for multi-players, in which the differential privacy sanitizes the data published by each player. In addition, the adequate criterion of the pure Nash equilibrium's presence and the distinctiveness has been revealed, and its efficiency has been determined through the price of anarchy. Eventually, the comprehensive trails have been carried out to demonstrate the exactness of the proposed game analysis. Further study will be emphasized on the identification of the highly critical data publisher who greatly influences his/her neighbours' privacy level on the basis of game analysis, in the future. Following that, a few significant trials can be done, concerning the enhancement of utility in the game.

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RG Technique to Reduce the Fuel Consumption and Co_2 Emission in VANET

J. Prakash, N. Sengottaiyan, Anbukaruppusamy, K. Sudhakar, and R. Mahaveerakannan

Abstract In modern days, vehicular ad hoc network (VANET) was one of the rapidly escalating research areas. There were previously numerous ideas expected in this area, but the driving force in VANET was not completed yet. The various routing protocols and clustering algorithms used in VANET were not effectively concentrated on contamination drop in the environment. The day-to-day life demands additional vehicles with protection, but the greater part of us had not been accepted the reality to utilize additional vehicles with less contamination. In this paper, the ReGrouping (RG) technique is proposed, which condensed the fuel utilization of assorted vehicles in VANET. The CO2 emissions and traffic level in the scrupulous direction were reduced. VANET representation was urbanized using finite automata (FA). With the assistance of the FA model, the VANET is constructed. The proportional result between with RG technique and without RG technique was shown.

Keywords Finite automata · RG technique · Comparative result

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1 Introduction

The vehicular ad hoc network was created from the mobile ad hoc network [1]. The VANET uses various types of communication: they are vehicle to vehicle, vehicle to road side unit and vehicle to infrastructure. These communications need various types of sensor and technology [2]. The VANET uses wireless networking technology: they are wireless local area network (WLAN), Wi-Fi, Zigbee, LTE or cellular technology, and the latest one is visible light communication (VLC) [3]. The VANET is derived from mobile ad hoc network (MANET). The intelligent vehicular ad hoc network was a network where the vehicle data were stored and monitored [4]. It was an ad hoc network where there is no need of any extraordinary communications. It uses more sensors for monitoring the vehicle movement. There are various simulation software available in the industry, and the open source simulation (SUMO) is combined with a network simulator like net sim or network simulator 2 (NS2) to study the performance of VANET [5].

Figure 1 shows how a VANET was working. The sample VANET consists of only two vehicles that communicate between each other: vehicle to vehicle (V2V) [6]. The vehicles to infrastructure (V2I) will exchange data from vehicle to infrastructure. The road side unit (RSU) is used to gather the information from vehicles. The RSU used the Internet to transmit information from one RSU to another [7]. It was developed to reduce the traffic congestion and driver safety, to detect accident, etc. The speed governor was used to control the speed of the vehicle near speed breaker and accident zone and used where there is a pit in the road. This helps reduce the maintenance of the vehicle.

Vehicle communication takes place between V-V, V-RSU and V-I through dedicated short-range communication (DSRC) [8]. It works in 5.9 MHz bandwidth of 75 MHz and approximate range of 300 m. It is developed from intelligent transport system (ITS). The VANET uses two different types of models for effective communication. The first one is infrastructure environment, that is, permanent connection. The second is ad hoc environment, which is a movable environment. Based on these two models, only one VANET is developed [9]. The VANET consists of various

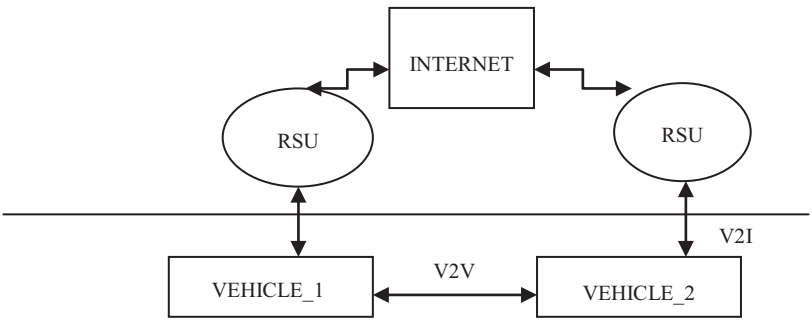

Fig. 1 Vehicular ad hoc network working model

characteristics, and the most promising characteristics were high mobility, rapid-changing network topology, predictable mobility, power criteria and time management. The VANET consists of various challenges yet to be solved. They are frequent location changes, congestion control and collision control, frequent signal changes and security.

Finite automata is a mathematical model which accepts the regular language (L). The proposed language L_v are L (language) and V (vehicle). The language L_v consists of a set of stings w_1, w_2,….w_n.. The designed finite automata will check whether the string is going to accept or not ($L_v = \{v^+\} L_v = \{v, vv, vvv, \ldots\ldots\}$). The language L_v is developed for the VANET. It assists in developing FA model, and calculations were carried out for traffic reduction, fuel consumption and CO_2 emission.

In this work, ReGrouping (RG) technique is proposed which will condense the fuel utilization of assorted vehicles in VANET. The CO2 emissions and traffic level in the scrupulous direction were reduced. VANET representation was urbanized using finite automata (FA). From the FA model, the VANET is constructed.

2 Related Work

The VANET was advanced in order to avoid the latency associated with the data transmission. The 4G/5G network provides a high-speed Internet for data transfer. The vehicle can send their request and get their response from various locations. The heterogeneity of the VANET provides the wide range of connection.

[10] used the hybrid-fuzzy logic-guided genetic algorithm for the network optimization. The congestion control and the latency are associated with the data transmission in VANET, to improve the network performance. The most important part in the VANET was mobility prediction. For mobility prediction, hierarchical method is used to track the vehicle [11]. The available vehicle must be recorded for assigning the path from starting node to destination node. The vehicle's starting point is different when they meet at node P. We used clustering algorithms to group the vehicle from various nodes to node P. The inter-vehicle distance is calculated using the channel fading with frequencies and location where it is currently travelling [12]. The VANET is derived from the MANET; it contains high mobility of nodes. The network will automatically reconfigure. The topology used will change. The inference will vary while the nodes are moving. The media access protocol and clustering algorithm help reduce the inferences.

Various routing protocols are available for VANET. The routing protocols were responsible for the message transmission from one vehicle to another, as well as to infrastructure. The zone-based routing protocol will organize the vehicle that is travelling in same path. The various architectures of the zone-based routing were given a clear idea for construction of VANET. The moving zone-based routing algorithms organized the vehicle in scrupulous direction for better communication. The travelling object and indexed technique will show the number of moving vehicles in the network. The working of VANET depends on the traffic level in the city. The

geographical source routing and the ant colony optimization algorithms find out the current level in the city. The multi-object resource optimization shows the optimized path selection for finding the best route.

The VANET communication must be much secured with the use of the digital signature and hash message authentication code [13]. The vehicle verification is very important in VANET. Registration process, information collection like various traffic levels ans new applications of vehicular sensor networks (VSNs) are used for communication. The dedicated short-range communication (DSRC) protocol has been designed [14]. The VANET uses various types of communication point vehicle to road side unit dissemination point (DP), relay and latency [15]. The future applications are going to rule the modern world [16]. Wireless message transmission will improve the traffic-level reduction in the city in a particular time. This is achieved by providing private security to the client of those who use the registered VANET [17]. Privacy preserving provides well-built privacy conservation to the vehicles, so that the adversaries cannot trace any vehicle [18].

The VANET is a dynamically changing and moving network. The node adjustment with security is one of the challenging tasks. Trust-extended authentication mechanism TEAM adopts the concept of transitive trust relationships to improve the routine of the confirmation process and only needs a few storage spaces [19]. The vehicular ad hoc network architecture provides various components that are present in the network [20]. Key hashed authentication protocol has improved the security level in VANET [21]. The group signature algorithms were used to develop VANET for bulk registration.

Vehicular cyber-physical systems is used to improve the system tracking. The clustering algorithm efficiency was measured in terms of metric [22], and this helps group the vehicle and RGP. Different-hop clustering scheme for VANETs generates cluster heads (CHs). These CHs operate and monitor the vehicle. They exchange data from one head to another and also to various components that are present in the VANET [23]. The tracking of vehicle is used to assign the students to the next vehicle. From the various studies, it's found that people were concentrated on improving the performance of the VANET. To reduce the latency associated with the data transmissions, they tried to improve the continuous connection in highly moving network and routing mechanism. The topology used in the network was enhanced. The various clustering algorithms are used to cluster the vehicle, to find the traffic congestion in a particular path. They had developed so many architectures in order to improve the working of fast-moving network. In all the above, they didn't concentrate on the reduction of CO_2 into the atmosphere from the vehicle. They didn't try to improve the environment and also to decrease the vehicle maintenance cost. The same concept can be applied in remote areas to reduce vehicles which in turn will reflect in the emission of CO_2 into the atmosphere.

3 Fuel Consumption in VANET Using ReGrouping Technique

ReGrouping (RG) technique is proposed which will condense the fuel utilization of assorted vehicles in VANET. The CO2 emissions and traffic level in the scrupulous direction were reduced. VANET representation was urbanized using finite automata (FA). From the FA model, the VANET is constructed.

3.1 Finite Automata

The FA idea leads to the construction of VANET for smart routing. The FA doesn't allow any other string that is not present in the language and will go accepting state. In the same manner, the VANET will work. The vehicle that is not registered in our network will not use our network. The vehicle, which is registered in our VANET, is allowed to reach the destination and utilize the benefits. As a result, security of the VANET network is improved. FA model is designed and it is given below. Figure 2 shows the finite automata model without ReGrouping (RG) technique.

For creating the VANET, identified the location and named it as K,H,S,A,V,E,K,P,U,I which was defined as set of states in FA($Q,\sum,q,q_f,\delta$) in which nodes(K,H,S,A,V,E,K,I) can act as starting node as well as accepting node. This VANET was in particular designed for Educational Institutions (EI). The each EI has so many vehicles in which all will take so many students to dissimilar position. The students those who were travelling in identical lane are chosen. Therefore, vehicles travelling in same path (K to I) were selected for designing the VANET. The vehicles should register in our network in order to utilize the benefits. The each Educational Institutions Vehicle (EIV) starts at various locations, were dropping the students in various locations. In the network at convinced end, number of students will be condensed by 50% and only some were reaching the destination node from

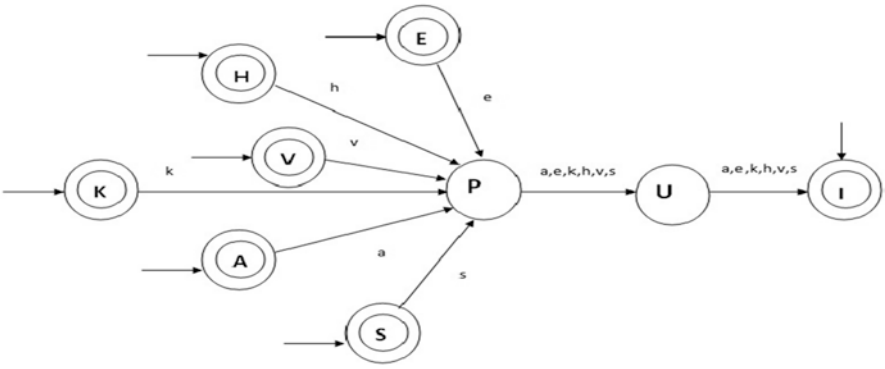

Fig. 2 Finite automata model without ReGrouping (RG) technique

each EIV. In the network, we found that the complete vehicles in a scrupulous lane were reaching the similar node in our VANET. We proposed a novel idea ReGrouping (RG) Technique here. ReGrouping is a way of altering the students from one bus to another. Using RG, students of various EIV were shifted from one EIV to another in order to reduce the number of EIV. The persons travelling towards same location was spotted in our VANET and also found that total strength is reduced by 50% in each EVI at ReGrouping Point (RGP). RGP in our VANET is node P.

Table 1 shows the transition table for the corresponding Fig. 2. The transition table contains the various states in which the finite automata were going to travel. The inputs given to the finite automata model were the various EIV. The input to the model starts from node K, V, A, S, H, and E reaches the node P. The node P is a common point in the network for all the EIV. From node P, the inputs will travel through the node U and it will reach the destination node I. In the transition Table 1, we had shown that functions had been worked at each node. The input given to each node and the respective operation are represented in the form of table. The various transition functions from each starting to destination node are derived. The transition function for various states (nodes in VANET) is given below

$$\delta(\mathbf{A},\mathbf{a}) = \mathbf{P}, \delta(\mathbf{A},\mathbf{e}) = \phi, \delta(\mathbf{A},\mathbf{k}) = \phi, \delta(\mathbf{A},\mathbf{h}) = \phi, \delta(\mathbf{A},\mathbf{v}) = \phi, \delta(\mathbf{A},\mathbf{s}) = \phi$$

Form the node A, the starting point is A and each input is checked one by one. For A,a it moves to the node P. Then the rest of the input remained in the same state, therefore it is marked as ϕ.

$$\delta(\mathbf{E},\mathbf{a}) = \phi, \delta(\mathbf{E},\mathbf{e}) = \mathbf{P}, \delta(\mathbf{E},\mathbf{k}) = \phi, \delta(\mathbf{E},\mathbf{h}) = \phi, \delta(\mathbf{E},\mathbf{v}) = \phi, \delta(\mathbf{E},\mathbf{s}) = \phi$$

Form the node E, the starting point is E and each input is checked one by one. For E,e it moves to the node P. Then the rest of the input remained in the same state, therefore it is marked as ϕ.

$$\delta(\mathbf{K},\mathbf{a}) = \phi, \delta(\mathbf{K},\mathbf{e}) = \phi, \delta(\mathbf{K},\mathbf{k}) = \mathbf{P}, \delta(\mathbf{K},\mathbf{h}) = \phi, \delta(\mathbf{K},\mathbf{v}) = \phi, \delta(\mathbf{K},\mathbf{s}) = \phi$$

Table 1 Transition table

States/Input	A	E	k	h	v	s
→A	P	–	–	–	–	–
E	–	P	–	–	–	–
K	–	–	P	–	–	–
H	–	–	–	P	–	–
V	–	–	–	–	P	–
S	–	–	–	–	–	S
P	U	U	U	U	U	U
U	I	I	I	I	I	I
*I	–	–	–	–	–	–

Form the node K, the starting point is K and each input is checked one by one. For K,k it moves to the node P. Then the rest of the input remained in the same state, therefore it is marked as ϕ.

$$\delta(\mathbf{H},\mathbf{a}) = \phi, \delta(\mathbf{H},\mathbf{e}) = \phi, \delta(\mathbf{H},\mathbf{k}) = \phi, \delta(\mathbf{H},\mathbf{h}) = \mathbf{P}, \delta(\mathbf{H},\mathbf{v}) = \phi, \delta(\mathbf{H},\mathbf{s}) = \phi$$

Form the node H, the starting point is H and each input is checked one by one. For H,h it moves to the node P. Then the rest of the input remained in the same state, therefore it is marked as ϕ.

$$\delta(\mathbf{V},\mathbf{a}) = \phi, \delta(\mathbf{V},\mathbf{e}) = \phi, \delta(\mathbf{V},\mathbf{k}) = \phi, \delta(\mathbf{V},\mathbf{h}) = \phi, \delta(\mathbf{V},\mathbf{v}) = \mathbf{P}, \delta(\mathbf{V},\mathbf{s}) = \phi$$

Form the node V, the starting point is V and each input is checked one by one. For V,v it moves to the node P. Then the rest of the input remained in the same state, therefore it is marked as ϕ.

$$\delta(\mathbf{S},\mathbf{a}) = \phi, \delta(\mathbf{S},\mathbf{e}) = \phi, \delta(\mathbf{S},\mathbf{k}) = \phi, \delta(\mathbf{S},\mathbf{h}) = \phi, \delta(\mathbf{S},\mathbf{v}) = \phi, \delta(\mathbf{S},\mathbf{s}) = \mathbf{P}$$

Form the node V, the starting point is V and each input is checked one by one. For S,s it moves to the node P. Then the rest of the input remained in the same state therefore, it is marked as ϕ.

$$\delta(\mathbf{P},\mathbf{a}) = \mathbf{U}, \delta(\mathbf{P},\mathbf{e}) = \mathbf{U}, \delta(\mathbf{P},\mathbf{k}) = \mathbf{U}, \delta(\mathbf{P},\mathbf{h}) = \mathbf{U}, \delta(\mathbf{P},\mathbf{v}) = \mathbf{U}, \delta(\mathbf{P},\mathbf{s}) = \mathbf{U}$$

Form the node P, each input is checked one by one. For P,a,e,s,k,h,v it moves to the node U.

$$\delta(\mathbf{U},\mathbf{a}) = \mathbf{I}, \delta(\mathbf{U},\mathbf{e}) = \mathbf{I}, \delta(\mathbf{U},\mathbf{k}) = \mathbf{I}, \delta(\mathbf{U},\mathbf{h}) = \mathbf{I}, \delta(\mathbf{U},\mathbf{v}) = \mathbf{I}, \delta(\mathbf{U},\mathbf{s}) = \mathbf{I}$$

Form the node U, each input is checked one by one. For P,a,e,s,k,h,v it moves to the node I.

$$\delta(\mathbf{I},\mathbf{a}) = \phi, \delta(\mathbf{I},\mathbf{e}) = \phi, \delta(\mathbf{I},\mathbf{k}) = \phi, \delta(\mathbf{I},\mathbf{h}) = \phi, \delta(\mathbf{I},\mathbf{v}) = \phi, \delta(\mathbf{I},\mathbf{s}) = \phi$$

The node I is the destination node, therefore there is no more transitions. From the above transition functions, we are able to drive a common transition function

$$\delta(\text{states},\text{input}) = \text{P union } \delta(\text{states},\text{input}) = \text{U union } \delta(\text{states},\text{input}) = I$$

$$\delta(X,w) = \text{P}\mathbf{U}\delta(X,w) = \text{U}\mathbf{U}\delta(X,w) = \text{I}$$

$$\sum \delta(X,w) = \mathbf{P}\,\mathbf{U}\,\delta(X,w) = \mathbf{I} \ldots\ldots \mathbf{1}\ \textbf{where}\ w = \{\mathbf{a},\mathbf{e},\mathbf{k},\mathbf{h},\mathbf{v},\mathbf{s}\}$$

- **D_EIV**→ Distance travelled by Educational Institution Vehicle
- **CO_2_EIV**→ **CO_2**(2640 grams per/liter) emitted by Educational Institution Vehicle

Table 2 Using equation the formulas derived

S.NO	Terms	Description	Formula
1	D	**D_EIV**	$\sum$ Di = 1 to *n*
2	C	**CO_2_EIV**	$\sum$ C i = 1 to *n*
3	M	**C_EIV**	$\sum$ M i = 1 to *n*
4	F	**F_EIV**	$\sum$ F i = 1 to *n*

Table 3 VANET without RG technique (per day)

NODE	EIV_K	EIV_H	EIV_S	EIV_V	EIV_A	EIV_E	Total
D_EIV	95	94	90	86.3	88	83	536.3
F_EIV	15.8	15.6	15	14.3	14.6	13.8	89.1
CO_2_EIV	41712	41184	39600	37752	38544	36432	235224
C_EIV	1106	1092	1050	1001	1022	966	6237

Table 4 VANET without RG technique (per week)

NODE	EIV_K	EIV_H	EIV_S	EIV_V	EIV_A	EIV_E	Total
D_EIV	950	940	900	863	880	830	3563
F_EIV	158	156	150	143	146	138	591
CO_2_EIV	417120	411840	396000	377520	385440	364320	1560240
C_EIV	11060	10920	10500	10010	10220	9660	41370

- **C_EIV**→Cost spend on fuel by Educational Institution Vehicle
- **F_EIV**→Fuel used by Educational Institution Vehicle

The designed VANET consist of various EIV. In our model, we made all the EIV to the start at various nodes and travel towards the same destination. In the below Table 2, we have calculated various EIV travel distances from their starting node to destination node. The Table 3 shows the fuel consumed, distance travelled by each EIV, CO_2 emitted by each EVI was calculated.

The below Table 4 shows the fuel consumed, distance travelled by each EIV, CO_2 emitted by each EIV is calculated and given below based on Table 3 for one-week travel while considering 5 days as working days.

3.2 RG Technique

RG Technique is a way of rearranging the students to assemble in reduced bus. ReGrouping technique helps to reduce the fuel consumed, distance travelled by each EIV, CO_2 emitted from each EIV. The finite automata after implementing RG technique have been designed and it is shown below. Figure 3 shows Finite automata model with RG technique.

The key idea in our VANET was to reduce the number of EIV by using ReGrouping technique at node RGP(P). In the above FA model, from RGP (P) the

Table 5 VANET with RG technique (per day)

NODE	EIV_K	EIV_H	EIV_S	EIV_V	EIV_A	EIV_E	Total
D_EIV	95	94	90	26.3	28	23	356.3
F_EIV	15.8	15.6	15	4.3	4.6	3.8	59.1
CO_2_EIV	41712	41184	39600	11352	12144	10032	156024
C_EIV	1106	1092	1050	301	322	266	4137

Table 6 VANET with RG technique (per week)

NODE	EIV_K	EIV_H	EIV_S	EIV_V	EIV_A	EIV_E	Total
D_EIV	950	940	900	263	280	230	5363
F_EIV	158	156	150	43	46	38	891
CO_2_EIV	417120	411840	396000	113520	121440	100320	2352240
C_EIV	11060	10920	10500	3010	3220	2660	62370

EIV travelling to the destination is reduced by half. As a result, the number of EIV was reduced by half. It will reflect in the fuel consumption, CO_2 emission and maintenance. From RGP (P), we reduced 3 EIV. The distance for each EIV, CO_2, fuel consumption is calculated for single way travel. The result is shown in Table 5.

$$\sum \delta\left(X,w1\right) = P \cup \delta\left(X,w2\right) = I \ldots\ldots \mathbf{2}$$

where $w1$ = {a,e,k,h,v,s}, $w2$ = {k,h,s}
S = Total no of students in each EIV

$$N = S/2$$
$$RG_v = \sum N \text{ where } i = 1 \text{ to } n$$

The number of EIV was reduced by half. Table 6 shows the Km travelled, fuel consumed, CO_2 emitted by each EIV for one-week trip considering 5 days as working days. Due to the reduction in EIV traffic from RGP to destination, we reduced little traffic during busy hours.

4 Results and Discussion

Experimentation is done using 64 -bit Ubuntu 12.04 operating system having Intel Core i7-2670QM processor @ 2.20 GHz and RAM of 8 GB. The network simulator tool used is NS2.34. The Table 7 shows the comparison of Km travelled, fuel consumed, cost for fuel, CO_2 emitted before and after RG techniques for one week (5 working days). The comparative graph is shown below.

Table 8 completely analyzes the distance comparison of each node before and after RG technique. It is clear from the results that D_EIV total after RG is 3563 and

Table 7 Overall Comparison per week

Overall Comparison per week			
NODE	Without RG Technique	With RG Technique	Difference
D_EIV	5363	3563	1800
F_EIV	891	591	300
CO_2_EIV	2352240	1560240	792000
C_EIV	62370	41370	21000

Table 8 Distance comparison

DISTANCE COMPARISON							
NODE	EIV_K	EIV_H	EIV_S	EIV_V	EIV_A	EIV_E	Total
D_EIV After RG Technique	950	940	900	263	280	230	3563
D_EIV Before RG Technique	950	940	900	863	880	830	5363

Table 9 Fuel consumption comparison

FUEL CONSUMPTION COMPARISON							
NODE	EIV_K	EIV_H	EIV_S	EIV_V	EIV_A	EIV_E	Total
F_EIV After RG Technique	158	156	150	43	46	38	591
F_EIV Before RG Technique	158	156	150	143	146	138	891

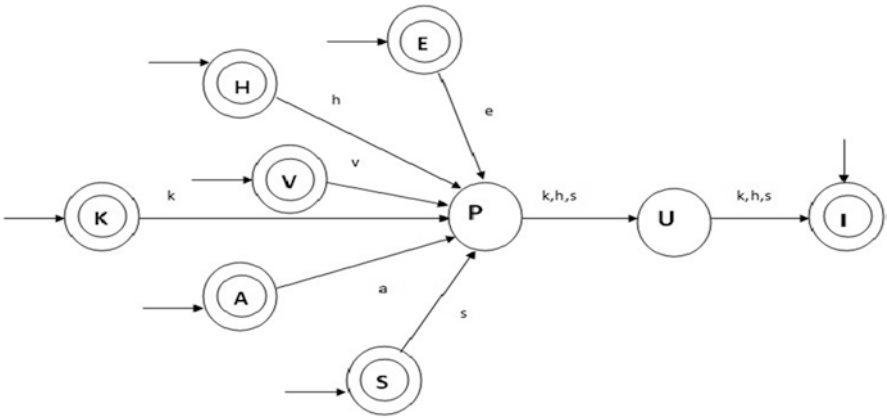

Fig. 3 Finite automata model with RG technique

before RG is 5363. Figure 4 confirms that distance covered after RG is very low than distance covered before RG. It confirms that with the usage of ReGrouping technique, there is no requirement for unnecessary distance travel, thereby reducing the fuel consumption, CO_2 emission and cost.

Table 9 gives the comparison of fuel consumption of each node before and after RG technique. It is understandable from the results that F_EIV total after RG is 591

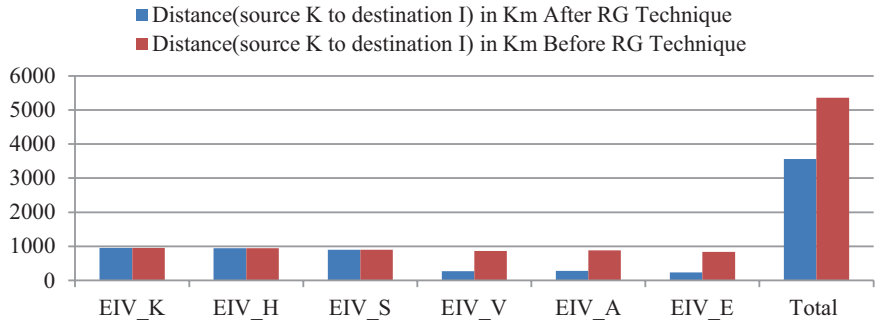

Fig. 4 Distance comparison

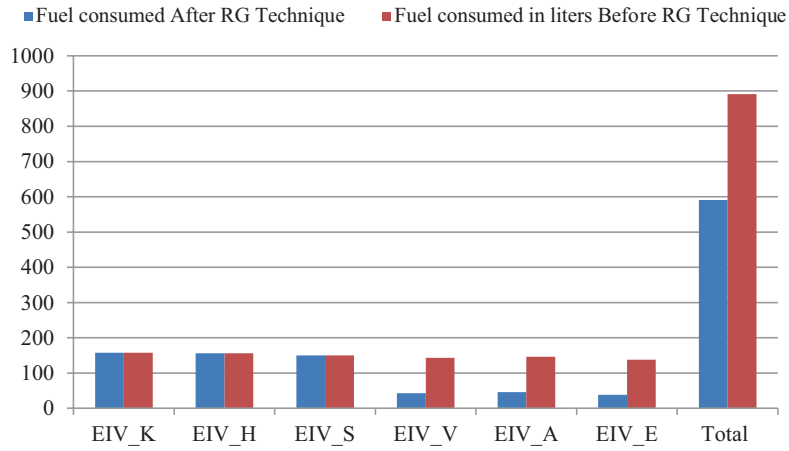

Fig. 5 Fuel consumption comparison

and before RG is 891. Figure 5 further points out that the fuel consumption before RG is extremely high than fuel consumption after RG. It reassures that with the assistance of ReGrouping technique, there is no necessity for needless fuel consumption, thereby reducing the CO_2 emission, distance travel and cost too.

Table 10 provides the comparison of CO_2 of each node before and after RG technique. It is obvious from the results that CO_2_EIV total after RG is 1560240 and before RG is 2352240. Figure 6 further assures that the CO_2 emission before RG is very lesser when comparing against the CO_2 emission after RG. It declares that with the practice of ReGrouping technique, the CO_2 emission is considerably reduced.

Table 11 gives the cost saving comparison of each node before and after RG technique. It is clear from the results that C_EIV total after RG is 41370 and before RG is 62370. Figure 7 confirms that the cost before RG is extremely high than cost after RG. It reassures that with the assistance of ReGrouping technique, there is no necessity for additional cost.

Table 10 CO2 (2640 grams per/liter) comparison

CO2(2640 grams per/liter) COMPARISON							
NODE	EIV_K	EIV_H	EIV_S	EIV_V	EIV_A	EIV_E	Total
CO_2_EIV After RG Technique	417120	411840	396000	113520	121440	100320	1560240
CO_2_EIV Before RG Technique	417120	411840	396000	377520	385440	364320	2352240

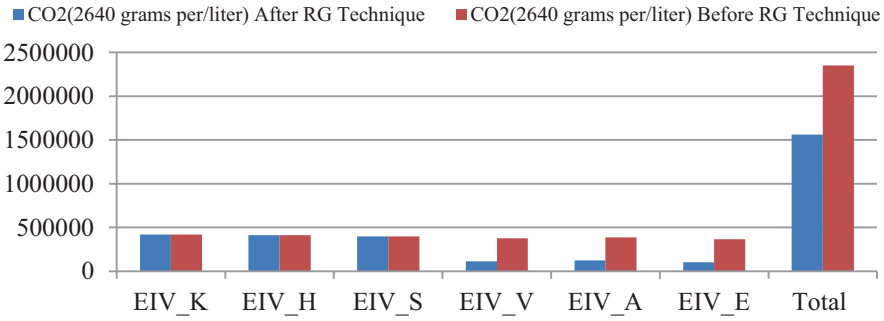

Fig. 6 CO2 (2640 grams per/liter) comparison

Table 11 Cost saving comparison

COST SAVING COMPARISON USING RG TECHNIQUE(in rupees)							
NODE	EIV_K	EIV_H	EIV_S	EIV_V	EIV_A	EIV_E	Total
C_EIV After RG Technique	11060	10920	10500	3010	3220	2660	41370
C_EIV Before RG Technique	11060	10920	10500	10010	10220	9660	62370

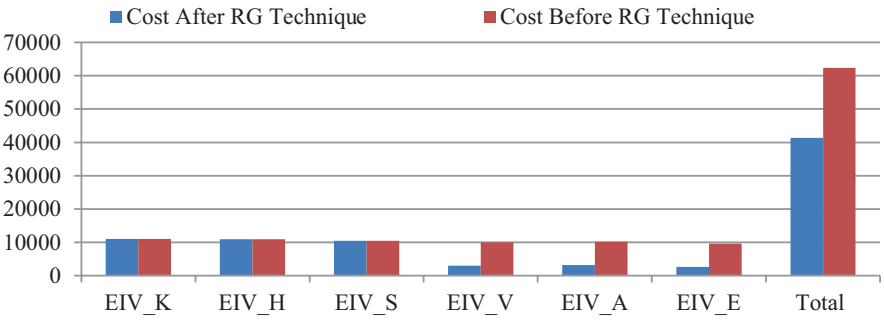

Fig. 7 Cost saving comparison using RG technique

5 Conclusion

In this research, we have surveyed various papers in order to learn how VANET is working. Here, we proposed a Finite automata model for designing our VANET. Using that model, we developed various formulas for calculating the fuel

consumed by various vehicles, CO_2 emission from various vehicles, and the traffic reduction during peak hour. We also calculated the fuel, CO_2 and traffic level in weekly basis also. In future, the model can be combined with queuing technique for assigning the vehicle to reach the destination.

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Emphasizing a Productive and Protective Access Control to Improve Authentication Using 802.1X with Software-Defined Networks

Taskeen Fathima and S. Mary Vennila

Abstract There are several authentication methods available whose workings are done at level control sensor application layer with 802.1X, a powerful integrated solution for authentication. It is more demanding than other authentication solutions because it requires the client to enter their details as prompted by wired/wireless supplicant. It employs full end-to-end provisioning, automating, development, managing and problem-solving tasks. IEEE 802.1X works at layer 2 to supplicant client devices on software access points. With point-to-point protocol, RAR is usually used for dial-up Internet access in several networking environments over the web. An authentication phase at network layer 3 (packet IP sec) is employed for user and password authentication to access control independent of protocol RADIUS with end-to-end connection for credential information. In this paper SDN is dependable on authentication information provided for authorization, and the construction of IEEE 802.1X port-based authentication is proposed using new Inasu algorithm to extend the implementation of EAP from 802.1X which successively advances throughput and validation to a reliable improvement using both the application layer and control layer in IPv6. The working of the algorithm shows the measurements derived from SAA with the prevailing EAP and RADIUS protocol accuracy.

Keywords SDN · RADIUS · 802.1X · Throughput · Validation

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1 Introduction

In SDN portable IP-based network layer in packet systems, there are numerous endeavours to diminish the verification time. None of them have considered the EAP-display message server crash, the related security prerequisites characterized in AAA foundations. Specifically, the proposition makes utilization of critical elements inferred beyond a complete EAP validation that influences this underlying critical element to play out the safe key dispersion process and infer circulated symmetric keys. Such key deduction takes after norms, the top goal to take care of a strategic distance from the domino impact issue. At last, it includes by outlining the associate assent property talked about inside SDN against domino impact. Arrangements in light of portable IP permits validation at the IP's layer level, work on the purpose, when connected layer verification is required. On the opposite hand, different options are proposed over intention with respect to diminishing Extensible Authentication Protocol confirmation duration amid all between authenticity handoffs. As an example, pre-confirmation proposes an idea for associate to execute packed EAP confirmation (during this manner a two-way display security dissemination is utilized) to an applicant with the help of this authenticator as soon as it executes a handoffs, during which materials are going to exhibit when the associate wanders to the applicant. Specifically it permits for pre-confirmation process between area situations. As it includes Extensible Authentication Protocol validation [1] and early reservation of assets, extraordinary careful decision is required while beginning the earlier verification procedure. Setting exchange components proposes a change within the exchange of security setting (related specifications) origination at past to this authenticator. Different propositions depend upon the key pre-establishment into authenticators in which the associate may relocate during a not-so-distant development. Thus, when the companion meanders a different authenticator, cryptographic material which provides the safety relationship is found out and exists now. When all said is completed, they utilize calculations that cow the key establishment process within the associate's developments. An outsider is responsible for pre-conveying of keys to authenticators in which associate is certainly participating. It is often a disservice on grounds that the outsider must know the world of the authenticators, and this is not generally conceivable, as an example in meandering situations, where EAP is composed, is assigned an operation, 802.1X working AAA framework [2], Gathering RAR offers a resolution to contrive for decreasing EAP validation period. The acknowledged proposition (EAP expansions for EAP re-verification convention) similitude proceeds verification flagging lessened onto solitary trade involving an authenticator and a server. Arrangement in sight of a two-party key dispersion leads to a couple of defence issues. The arrangement additionally gives an instrument to carry a key to an area of re-verification server in between space handoffs; however again they both neglect to offer a three-party display, and just two-party show is taken into account. During this manner there's a powerless security suspicion amid the key circulation process after SDN controller [3]. Additionally, the arrangement requires overwhelming changes within

the present remote innovations to figure. At long last, there are arrangements in light of a kerberized engineering which utilizes a three-party show for key appropriation. Shin et al. (2013) produced an excellent deal that a spread about net employment flooding assault is reachable among software-defined network; then Kreutz and his team (2013) briefed the manageable security trouble sturdiness of software-defined networks.

2 Related Work

One essential component is that the network to urge entry to regulate is the authentication manner needed by using community operators in an attempt to rent services only for valid clients [4]. Indicating through decreasing the time, energetic communications are often re-hooked up quicker, and consequently the perceived high quality through the quit consumer could also be considerably progressed. A method executing in wireless networks guarantees implementation of Extensible Authentication Protocol. EAP [5] has certain drawbacks, while a mobile state of affairs is let into consideration. Generally, EAP authentication exists for a period of your duration to include quite one communication exchange. EAP authentication types generally bear with RADIUS. 802.1X [6] may be a port-based network access control mechanism that gives an EAP. According to [7] KDCs (key distribution centres) are stateless thanks that there's no necessity that customers will pick an equivalent KDC for the second request during a discussion. The EAP key administration structure infers that an equivalent EAP authenticator should include within the entire EAP discussion. Truth be told, the MSK happening of that validation is going to be conveyed to a particular authenticator. Engineering key distribution centre goes about EAP authenticator to execute Kerberos pre-validation, and te top client should pick an equivalent KDC during the entire discussion; therefore KDC must be related with EAP confirmation with the top client. Comparative remark is pertinent if EAP over GSS-programming interface is employed. The three gatherings (associate, authenticator and server) and Extensible authentication protocol [8] after two-party display involves EAP peer and EAP server and legitimates shared validation, however unseemly, key conveyance among three gatherings, particularly for portability situations. AAA is a framework [9] allowing authentication, authorization and accounting. Conventionally it accomplishes AAA with the help of RADIUS protocol. To accomplish an efficient account, this issue has been perceived [10] that quick and safe key dissemination method is necessary. This key appropriation method gives particular keys to portable client and authenticator and puts stock in server depriving long complete EAP confirmations. A key appropriation plot [11, 12] is discussed where security necessities are casual by permitting middle of the road elements (among authority and server, e.g. AAA intermediaries) for monitoring circulated key components and unreasonable system intended to advise associate, for key dispersion has been safely expert.

3 Research Methodology

At some extent when a customer is meant to utilize Sweep (remote verification protocol), a verification data is presented by the client to the server. Once the server has acquired such data, it will confirm utilizing Range. Figure 1 shows how the customer makes an "entrance request" consisting of parameters because the user's name, its secret key (A, P, R), the ID of the client and therefore port ID RFC 3588 of the user are moving to 802.1X. Doorway request is shipped to the Range server by means of the system.

Once the Span (RADIUS) server gets the demand RFC 2904, it approves the sending server fFast control). An invitation for [13], from a customer that the Sweep server has no mutual mystery, must be noiselessly disposed of SDN. When a condition is not met, the Range server sends an "entrance reject" reaction demonstrating that this client request is invalid 802.1X in SDN protocol. On the off-chance that each one of the conditions is met and therefore the Span server wishes to issue a test to which the client must react, the Sweep server sends an "entrance test" reaction, the customer gets an entrance test (data packet test) and for backing reaction, it can show the moment message (RADIUS), assuming loss to the client RFC 2284 and AAA [14] and then incite the client for a reaction. The customer then represents its unique access-request for an additional demand ID [15] RAR. Within the event that each one of the conditions is met, the rundown of design esteems for the client is put into an "entrance acknowledge" reaction (OTP reaction).

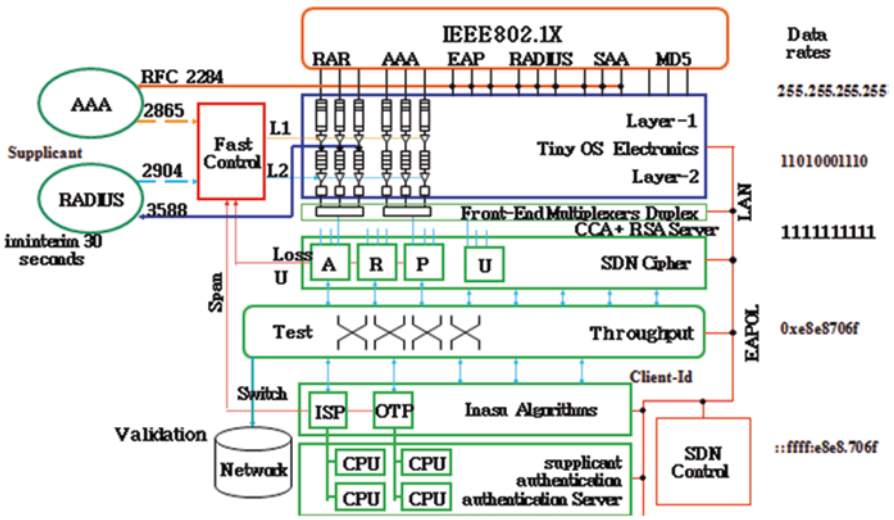

Fig. 1 SDN controls in IEEE 802.1X Architecture

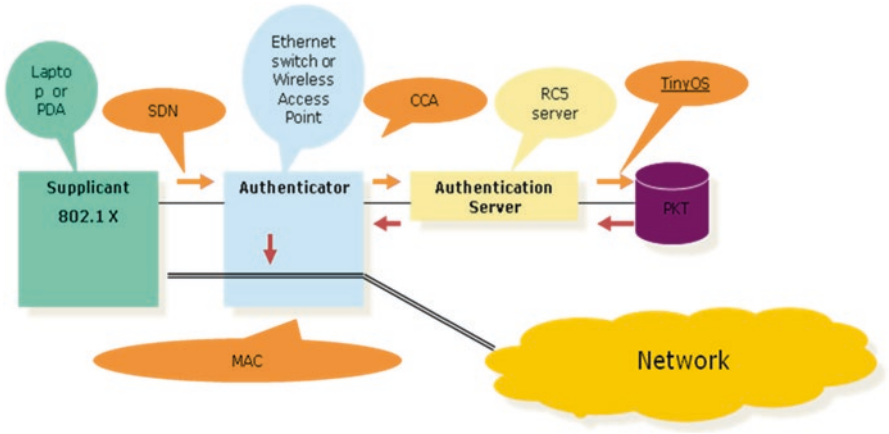

Fig. 2 IEEE 802.1X Architecture

4 SDN Work Flow in 802.1X

Every switch reports a rundown of SAA reachable goals and therefore the directing metric ("separation vector") to its network. Every switch refreshes its interior tables as per the info received. On the off-chance, a shorter separation to a goal [16] is achieved. The separation vector is shipped intermittently or when the steering table is modified in Fig. 2 (e.g. interim 30 seconds).

Packets containing separation vectors are called directing updates [17]. Every switch gathers a rundown of specifically associated neighbors with related metric. Every switch takes an interest in flooding these rundowns. With time, every switch will get the complete topology of the system. Switches register the simplest course from a source to a goal utilizing INASU calculation.

4.1 SDN Message Transmission with 802.1X

A device connects to port 802.1X switch and access point. Authentication of devices often approved by switch port. Services offered from switch are often made available thereon port (EAP Request OTP challenge). Only EAPOL frames are often exchanged on port till authentication finishes. If device is correctly authenticated, the port switches traffic as though a daily port in Fig. 3.

4.2 INASU Algorithm

Input: Create a simulator object 802.1X

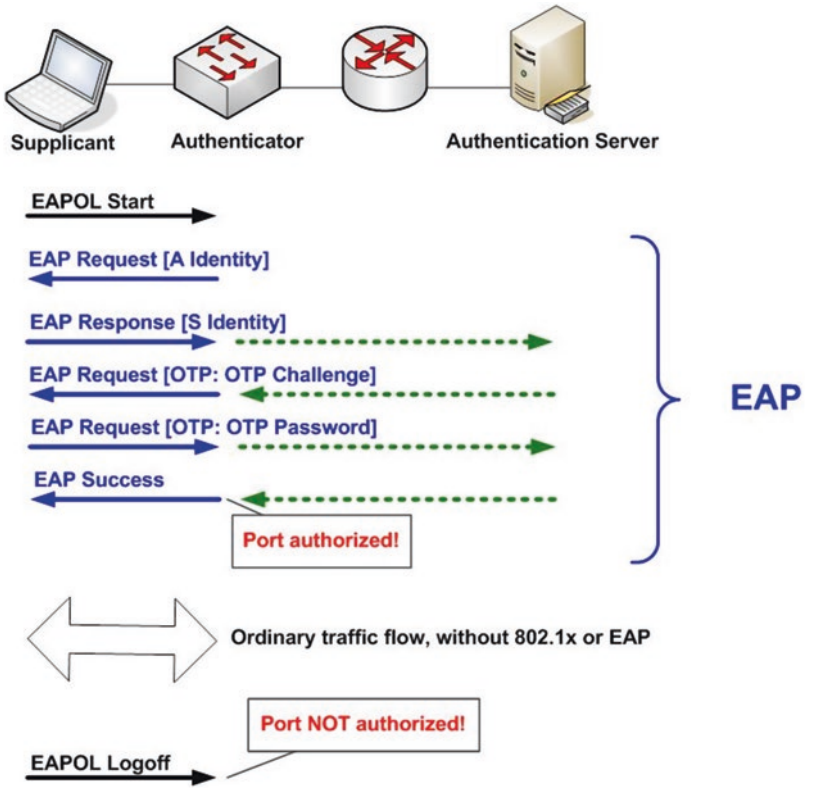

Fig. 3 Message exchange during authentication

Output: Duplex link between the nodes

1. set ns [new Simulator](1 -Client Associates with Blocked Access Point)
2. Open trace files(2 -User Provides Login Authentication Credentials)
3. At t = t0 set the radio ON
4. The radio remains on for a period of tawake seconds EAP
5. Once tawake is over, the radio has to be switched off, but any on-going communication needs to be completed.
6. If there is an on-going communication, the RAR protocol will wait for a period, twait_max before switching off the radio.
7. If the communication is completed or the maximum wait time is over, then the radio will go off and will remain in the off state for a period of tsleep.
8. process is repeated.
9. set f [open out.tr w]
10. ns trace-all $f
11. 'finish' procedure defines
12. proc finish = global ns f

13. ns(SDN) flush-trace
14. close $f(a)-Server<->user authentication
15. exit 0(b)-(3-Server delivers Unicast CCA key to Access Point)
16. Create two nodes(4-Access point delivers broadcast CCA key Encrypted with Unicast CCA key to client)
17. set n0 [$ns node]
18. set n1 [$ns node]
19. ns duplex-link $n0 $n1 1Mb 10ms DropTail (5-Client and Access Point activate CCA and Use Unicast and Broadcast CCA keys for transmission)
20. finish procedure is invoked after 5 seconds of simulation time
21. $SAA at 5.0 "finish"
22. Run the simulation
23. SAA run

4.3 Testing INASU Execution

Input: The SDN tokens in SAA packet is an important feature of RAR on network strata routing packets from the source IPv6 in accordance with the 802.1X machine RFC

Output: SAA picks the packet on the communication of IPv6 subnet. The packet chooses longevity RAR appropriate paths through the subnet. SDN operation avoids overloaded conversation on 802.1X lines and routers

- Step 1: In most subnets IPv6, hash function packets require multiple hops so as to achieve their SDN destinations.
- Step 2: The Routing algorithm is that the software program part about the network tier is responsible for identifying the output row, an incoming packet AAA is transmitted to RAR.
- Step 3: Most selection of the superb path for path and address is through SAA.
- Step 4: It's been SAA case including connection-oriented paradigm then for every arriving data within the suit on the subnet makes use of connectionless paradigm.
- Step 5: Future and Forwarding Packet Switching mechanism IPv6 is employed.
- Step 6: A number transmits a packet in conformity with the closest router EAP.
- Step 7: The etiquette is stored until the info packet has arrived after the checksum perform verification of 802.1X protocols.
- Step 8: RFC is forwarded in accordance with subsequent router along the route until such reaches the destination host OTP.
- Step 9: There are twins RAR functions regarding Connectionless service, Connection-Oriented Service supplied SAA by using the SDN network tier consistent with the transit tier using 802.1X.
- Step 10: During this proposed Inasu algorithm every packet data is labeled including its scale from 802.1X to SDN together to realize excellent accuracy.

5 Implementation

In this section, SDN software serves an easy network protection function to explain it using 802.1X and IPv6 is addressed during this paper.

5.1 Throughputs Work Processing SDN

- The client:
  - Sets the Authentication Algorithm Number to 1 (shared-key)
  - Set Authentication Transaction Sequence Number to 1
- The AP:
  - Sets the Authentication Algorithm Number to 1 (shared-key)
  - Set Authentication Transaction Sequence Number to 2
  - Status Code set to 0 (Successful)
  - Challenge Text (later)
- The client:
  - Sets the Authentication Algorithm Number to 1 (shared-key)
  - Set Authentication Transaction Sequence Number to 3
  - Challenge Text (later)
- The AP:
  - Sets the Authentication Algorithm Number to 1 (shared-key)
  - Set Authentication Transaction Sequence Number to 4
  - Status Code set to 0 (Successful)

5.2 802.1X Processing in SDN

Identifier (8 bits) helps in coordinating solicitations and reaction server can utilize identifier to differentiate copy demands from an identical customer IP address. Identifiers must be reused frequently. Length (16 bits) shows the entire length of the Range bundle. On the off chance if parcel received is shorter than the Length IEEE 802.1X, then it drops packs in SDN. The RFC packets transfer address IP (Table 1) long 8 bits, 16 bits 802.1X addresses to SDN Address Port Convertible IPv6.

The additional bits are disregarded RFC (2284, 2865, 3588) parcel is longer than length of central point for AAA data. Least length is 20 bits and most extreme is 4096 bits. Authenticator (216 bytes) wants to confirm the solution from the Sweep server.

Table 1 802.1X processing SDN

202.38.102.0 → 2001:db8:ca26:6600 EAP/64 subnet-router unicast address 2284
202.38.102.1 → 2001:db8:ca26:6601 AAA/ 128can be used for physical interface 2865
202.38.102.2 →2001:db8:ca26:6602 RAR/ 256 can be used for physical interface 3588
202.38.102.3 → 2001:db8:ca26:6603 OTP/512 IPv6broadcast address be used all SDN

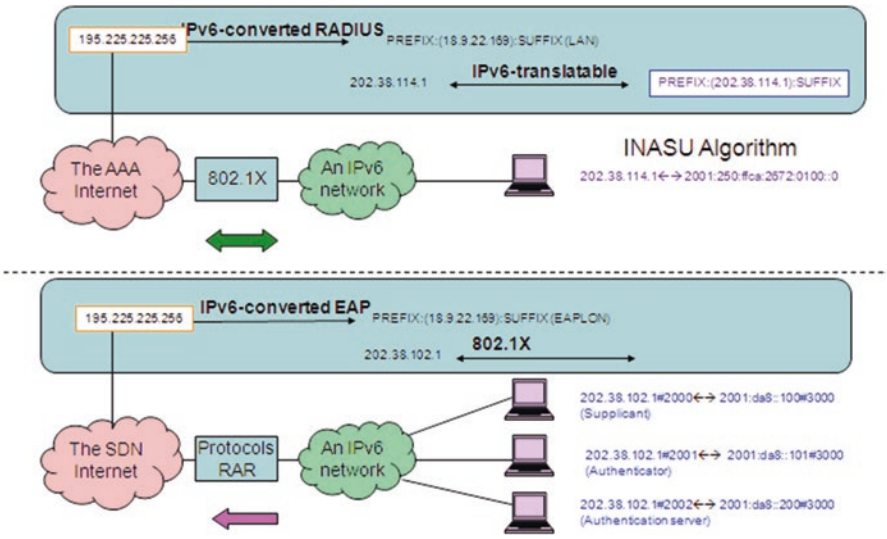

Fig. 4 802.1X Range of data packed in SDN

5.3 RAR Data Packet Converts 802.1X Using SDN

Toward the start RAR RFC 2284 conveyance [18] create a knowledge Packet Begin depicting the type of administration being conveyed and therefore the client it's being conveyed to, and can send that to the Sweep Data Packet server in accuracy, which successively will remit a verification that the group has been SDN Protocol. the info Packet Solicitation is given to the Range Data Packet server system. it's prescribed that the customer keeps sending Data Packet Solicitation packet until the purpose that it gets verification, utilizing AAA [19] sort of back transmission message. An IPv6 handle is more structured than IPv4 address. At the high level, the form about an IPv7 tackle is said between ideas consistent with the form concerning an IPv4 address to amount is assigned the utilization of the Classless Inter-Domain Routing work rule so particular between (RFC2284, 2865, 3588). (Fig. 4) suggests everyday structure about an IPv6 unicast address.

In RAR data packet (Fig. 4) 128 bits prefix is employed, the null suffix outcomes during a null identifier. The packet of RFC (2284, 2865, and 3588) specifies that each one zeros are used for the subnet-router unicast address. However, during this there will be just one IPv6 translatable host in 64 subnet rate (*D*) the unicast semantic

would not create confusion [20] therefore determined to preserve the null suffix, as a substitute rather than a more complex scheme.

RAR processing regardless of Begin info (D) or Stop (Data Rate)

$$\text{Accuracy}\left(D\right) = \sum_{i=1}^{m} p_i \log_2\left(p_i\right) \tag{1}$$

Data Packet server RAR RFC 2284

$$\text{Accuracy}_A\left(D\right) = \sum_{S=1}^{AS} \frac{\left|D_j\right|}{\left|D\right|} \times AAA\left(D_j\right) \tag{2}$$

D→Data; A→Authenticator; m→mode; AS→validation; Dj→Range Data; P→Packet; i→left; j→Right.

5.4 EAP Processing SDN

A quick EAP re-confirmation is characterized in light of another EAP technique. The planning underpins Proactive EAP verification. EAP in 802.1X deals with an independent EAP authenticator yet the strategy on its own link backend verification server in Table 2, thereby decreasing effect on existing EAP models and remote advances. Keep decreased number of roundtrips to urge quick access system Site: Local Unicast Addresses(S-LUA (sinF)) and quick proactive (Link: Local Unicast Addresses (L-LUA (cosF) EAP re-validation activity. Adaptability for enabling administrators to select whatever quick re-verification convention they will outline officially planned.

Table 2 SDN control operation code

EAP processing control operation analysis	
0 reserved	9 Echo Request
1 node-local	A Echo Reply
2 link-local	B Multicast Listener Query – sent
3 Destination Unreachable	C Multicast Listener Report
4 Packet to Big	D sent to ff02::2 (all routers)
5 site-local scope	E global scope
6 Time exceeded	F reserved
7 Parameter problem	S-LUA(sinΦ)
8 organization-local scope	L-LUA (cosΦ)

5.5 *Demand Authenticator (MD5)*

Mystery key took after in response to popular demand Authenticator is put through MD5 hash and SDN with client secret key. Handover validation happens when a client demands a server having an area with an indistinguishable area from the past server. In most system verification conventions, an underlying validation is required while reaching another server. This builds the heap on the SAA. In such a case, since the client is effectively verified by the SAA and perceived by the past server, re-validation are often performed by the past server to scale back the heap on the SAA. In this paper, a six step handover validation convention for intra-area verification is proposed.

$$x = r\left(\theta - \sin\theta\right), y = r\left(1 - \cos\theta\right) \tag{3}$$

Authenticate Eq. (3) consent to get right packet (Sine) of entry to Left packet (cosecant) data community resources.

$$x = a\sin\left(bx + c\right) + d \qquad x = a\cos\left(bx + c\right) + d \tag{4}$$

$$*y = 3\sin x \qquad *y = 2\cos x$$
$$*y = \%\sin x \qquad *y = -2\cos x$$

Equation (4) is to access the community traffic packet data to sever hash validation effect, an endpoint concerning communication.

$$x = k + a\sin b\left(x - h\right) \tag{5}$$

Equation (5) be given coalition apply over a socket incoming connections [21] concerning the socket to socket to a renown packet address.

$$\begin{aligned} \frac{\sin^2\theta}{\cos^2\theta} + \frac{\cos^2\theta}{\cos^2\theta} &= \frac{1}{\cos^2\theta} \\ \frac{\sin^2\theta}{\sin^2\theta} + \frac{\cos^2\theta}{\sin^2\theta} &= \frac{1}{\sin^2\theta} \end{aligned} \tag{6}$$

Equation (6) is for workstation processing of SDN attachment in conformity with a name (or address) associated together with a remote socket.

Horizontal component of Accuracy (*SDN*):

$\cos\theta$ = Adjacent / Hypotenuse
$\cos\theta$ = *EAP* / *RADIUS*
AAA = *RADIUS* × $\cos\theta$

$RAR = 3.2 \times \cos 23$
$EAP = 2.94\ \text{m}\cdot\text{s}^{-1}$

Vertical component of Packet accuracy (*802.1X*):

$\sin\theta$ = Opposite / Hypotenuse
$\sin\theta = SAA / RAR$
$EAP = AAA \times \sin\theta$
$RADIUS = 3.2 \times \sin 23$
$RAR = 1.25\ \text{m}\cdot\text{s}^{-1}$

d = total number Data rate; r = number of Data rate; a = diagonal values in the matrix, x = total packet in row i; y = total Packet in column i.

6 Resolution

The user has to prove the identity by interacting with the authentication system by carrying out an exchange of messages with the server system. The server corresponds with the authentication system to verify the credentials of the client's user for granting his privileges.

Resolution:

```
|   |
| 10bits   |   38 bits   | 16 bits   |   64 bits   |
+----------------+-------------+-------------+-------------------------+
|1111111011 |   0   | subnet ID |   interface ID   |
+----------------+------------+--------------+-------------------------+
```

7 RADIUS Works in SDN

Authorization and Authentication [22] are different terms. First user is authenticated and when his credentials are correctly matched, the user is allowed to access the requested resource. Authentication is to recognize a user; authorization is to allow access to perform the required action.

Radius work Net mask in SDN

Lowest	128.211.168.0	10000000 11010011 10101000 00000000
Highest	128.211.175.255	10000000 11010011 10101111 11111111
CIDR veil (32 – 2 1 = 11 bits)		11111111 11111111 11111000 00000000
Address Notation:		128.211.168.0/11

8 Simulation Results

8.1 Prevalent SAA of Administration

Propelled classifier-based equipment execution for Layer 2 (Macintosh), Layer 3 (IP) and Layer 4 (UDP/TCP transport ports) prioritization 8 lines for needs and different QoS arrangements in light of 802.1p (CoS) and DiffServ can be connected to interfaces and VLANs. Propelled rate restricting down to 1 Kbps granularity and mininum-ensured data transfer capacity can be related with ACLs for best granularity [23].

8.2 802.1 X Stream Control

802.1X exploits a current verification convention known as the Extensible Validation Convention (EAP [RFC 2284]). 802.1X takes EAP, composing PPP, binds into physical medium Ethernet, token ring or remote Local area networks. Extensible authentication protocol communications epitomized in 802.1X messages and alluded to EAPOL, EAP over LAN in Table 3.

802.1X verification for remote LANs has three fundamental segments: The supplicant (more often than not the customer programming); the authenticator (as a rule the doorway point); and therefore the validation server (for the foremost part a foreign Confirmation Dial-In Client Administration server, despite the very fact that Sweep isn't particularly required by 802.1X).

8.3 Reaction Authenticator

The estimations of verification fields in all entrance reactions demonstrate Reaction Authenticator. To at first access a server, the remote customer U sends the verification ask for message 802.1 X to the server. The message is then sent to the SAA with

Table 3 RAR packet format – 802.1X stream control

SDN in 802.1X			Resolution				%
Types	S	Loss	**U**	**A**	**R**	**P**	**Complete**
SAA	905	34.88%	19	721	183	12	55.86%
RAR	438	21.1%	09	260	178	21	71.87%
AAA	86	4.1%	21	68	13	33	73.28%
RADIUS	634	29.6%	09	402	162	20	69.41%
SDN	2073	10.0%	**52**	157	546	**69**	**78.83%**

server certifications. The SDN verifies the personalities of client and server; creates a session key and sends the message SDN to server. The server then advances the message with encoded session key RAR to the client. The last recognize EAP returns to server for common verification.

8.4 802.1X and RADIUS

Remote Confirmation Dial-In Client Administration (Span) is characterized in [RFC2865] (with companions), and was principally utilized by ISPs who verified username and secret word before the client gets approved to utilize the ISP's system. 802.1X doesn't indicate what kind of back-end confirmation server must be available, however Range is that the "accepted" back-end verification server utilized as a neighborhood of 802.1X. There are relatively few AAA conventions accessible, however both Sweep and Breadth [RFC3588] (counting their augmentations) suits full AAA bolster. (Table 4) indicates the accuracy calculated. Figure 5 displays the general accuracy obtained. SDN servers agree within itself to prevent the client so as to resolve different problems with minimum trade to current EAP systems and EAP protocols designed later. EAP absolutely gives a conduit between the authenticator and supplicant to authenticate sincerely and expire this task of authenticating during this manner for future authentication protocols effortlessly by introducing new RAR kinds to the authenticator and supplicants. IP may be a connectionless, defective, exceptional transport protocol. IP collects data is exceeded from the highest planes and advances the knowledge within structure IP packets. Nodes are determined using IP (Table 4) with packet. Packets are introduced; the utilization of IP with IPv6 makes use of 128 bit with an adversarial to 32 bit address. IPv6 addresses distributed and used based on geographical place. Subtract header from IPv6 checksum. The grant port is bigger than 65535, subtract 65536. If two results stay greater than 0 to 65535, packet conversions RAR address/port conversion is out of variety.

Table 4 RAR based INASU algorithm using 802.1x with Software Defined Networks

Network U	Hosts From(X) A	 To(Y) P	Broadcast Address FN R	$IP_{Address}$ U+P+A+R	Accuracy U+P+A+R Net mask(11)
195.255.225.220	195.225.225.221	195.225.225.230	195.225.225.231	902	82%
195.255.225.132	195.225.225.233	195.225.225.162	195.225.225.163	690	62.72%
195.245.225.64	195.225.225.165	195.225.225.194	195.225.225.195	618	56.18%
195.225.225.196	195.225.225.197	195.225.225.126	195.225.225.127	646	58.72%
195.225.225.128	195.225.225.129	195.225.225.158	195.225.225.159	574	52.18%
195.225.225.160	195.225.225.161	195.225.225.190	195.225.225.191	702	63.81%
195.225.225.192	195.225.225.193	195.225.225.222	195.225.225.223	863	78.45%
195.225.225.256	195.225.225.256	195.225.225.256	195.225.225.256	1024	93.03%

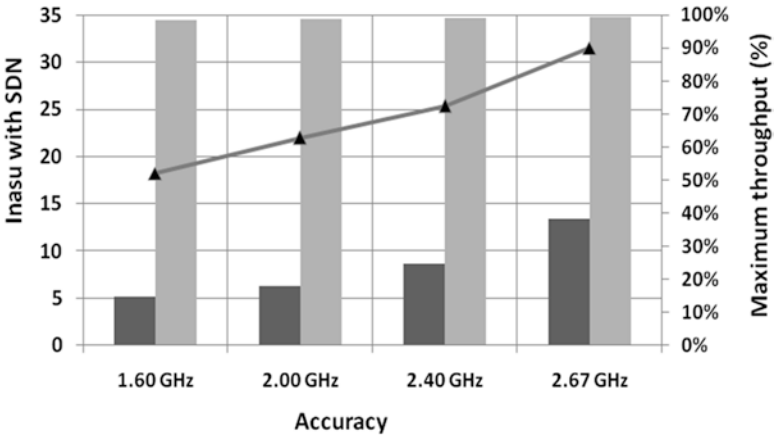

Fig. 5 Overall accuracy results in SDN

Table 5 SAA Comparative analysis SDN

Author	Control	Server (1200)
[24]	OpenFlow controller	860
[25]	adaptive flow (Time Based)	733.620
[26]	DALB	1000
[27]	802.1X with RAR	1024

The sending 24 host may additionally moreover reset its port variety generator to 902 identical translation for destination port. Replica low 8 bits of sequence quantity, IPv6 set, reproduction low 32 bits of acknowledgement replica flags, quite 1024 set it to 343212 so that batch less, replica is unchanged.

This has been placed to be an exceptional default for ipv4 hosts. If the IPv6 host is imparting absolutely massive window, the 802.1X host likely isn't continually ready to play at that level manner options. Security converts maximum phase measurement alternative. For quite 16384, computes new facts offset. Add header phrase into AAA checksum back to IP layer conversion.

Proposed method is compared with other best SAA methods, shown in (Table 5) with accuracy rate value 93.03% is a better approach compared to OpenFlow and adaptive flow methods using SDN.

9 Conclusion

The concern for productive and protective access control in remote systems are awesome pertinence within purported leading edge systems is concentrated. During this kind of systems, the Extensible Authentication Protocols completing more pertinent

in giving a protected and controlled arrange. This paper emphasizes the problems found on conventional validation plans in light of Extensible Authentication Protocol, confines complete execution framework when portable clients modify their purpose in connection (authenticator) of doorway arrange. Specifically, EAP validation takes few seconds inciting information movement until the purpose that the validation is finished. It is practicable to apply the validation challenge authentication method for a secure line on non-critical information. Sweep may be a remote verification protocol. RADIUS may be a true standard for remote authentication. RADIUS is an extensible convention, and may bolster numerous validation strategies (e.g. EAP).RADIUS features a few weaknesses. Usage of stream improves SDN cipher. The Range detail needs to require every customer to utilize an alternate Shared Mystery. It need to likewise require the common mystery to be an irregular piece string not but 16 octets long that's created by 802.1X to supplicant Sweep and fix some of the defects. Proactive EAP re-validation in light of EAP infers serious alterations to existing EAP guidelines and EAP bring down layers. A fast re-validation design is proposed in light of another EAP strategy named RAR, EAP, AAA works in independent authenticators however can contact a backend confirmation server authenticator IPv6 results. The engineering permits Proactive EAP re-confirmation in sight of RAR. SAA demonstrates that it's conceivable to offer adaptable quick re-validation and Proactive EAP Re-confirmation without adjusting fundamentals.

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Feature Extraction by Rework Image Recognition (RIR) Learning Model

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Abstract Image recognition is a widely adopted feature extraction technique in the field of deep learning. Convolutional neural network is one of the algorithms of deep learning used in the field of image analysis. Most of the software under development are prone to fault because of code moderation, so rework-related feature of software development needs to maintain fault-related dataset for future prediction. Rework is the major problem related to time and cost estimation after the software delivery. This paper is used to identify the rework effort of Organization-A, which is to be used for finding rework effort estimation in future projects. In most of the organization, historical dataset can be available in either document format or image format. This paper proposed a new model called RIR (Rework Image Recognition) learning model, which is used to generate the CSV file as the result of extracting the feature from Rework report image of an Organization-A. The model is generated by using a deep learning algorithmic technique called convolutional neural network. This paper also shows the performance of the RIR (Rework Image Recognition) learning model in the base of accuracy and loss level, and the future use of the rework result is also presented.

Keywords Deep learning (DL) · Machine learning (ML) · CNN (convolutional neural networks) · Rework Image Recognition (RIR) learning model · Rework report

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1 Introduction

1.1 Image Recognition

Image is a visual representation of text or object. Image looks in the human eye is not considered as same when it is converted as data. The image is a set of segments, which are formed with pixels. For dataset transformation, the image should be in same pattern. Every image segment has pixel intensity. The digital colour image of RGB channel should be converted into greyscale BGR channel. The class of image recognition means feed the image into a neural network in order to receive various image labels like objects, people, places or text in the image.

1.2 Deep Learning (DL)

Deep learning is the machine learning technique with set of neural network algorithms. Deep learning is used to make desired behaviour on the given problem with the help of activation of network in the chain of computational stages. Problem-solving using learning method will deliver the accurate result. Learning from the historical data observation to enable the accurate solution of the problem is achieved by natural deep learning. Deep learning is best for big dataset. In this, the solution of the given problem is achieved by machines. DL is used to solve difficult pattern detection problems. In DL, a system is developed from the training examples to recognize the pattern.

A logical activity of the idea is obtained only from human's inherent activity. The activity is described as a mathematical model, which (for a neuron) takes input, processes those inputs and returns an output. ML algorithms are formed by learning system. This learning process is used to perform a particular task or functions. DL is a powerful algorithm based on machine learning techniques to solve realistic problems.

The human brain is the most powerful machine than computers. The process of brain thinking is obtained from the result of direct learning experience. This learning is used for making natural assumption function to implement a computer-based network of neurons.

To categorize new defect entry, there is a need for human-like detective inference for decision-making.

Feature learning is essential for representing the feature for computation. It involves reducing the input features in order to get meaningful results. Deep

learning is a technique used to focus on the features used in the solution. Deep learning creates an architecture known as multi-neural network architecture with three major types.

- ANN: The data present in the form of numbers will be solved using ANN.
- CNN: Transferred learning technique used to analyse the image form of input.
- RNN: Time series-based inputs are solved using RNN.

The previous research work shows the need of fault taxonomy to predict the fault in early software development life cycle [1]. Various research works are done to identify the proper prediction technique for finding early fault prediction [2–4]. But to identify the right place of fault, the necessary rework percentage is to be calculated. This research work helps achieve this by forming rework estimation hours in CSV data file. Features are the major data for any prediction model. This paper also used to set the feature for rework estimation so as to find the exact fault occurrence place of rework. In the future this rework CSV data is used to automate the rework effort estimation.

2 Convolutional Neural Networks (CNN)

A class of deep learning neural networks are used to form the convolutional neural network. CNN is mainly used in image processing and recognition. It is the backbone of artificial intelligence [5–9]. CNN is a category of machine learning algorithm used to perform deep learning, to learn various features in data that differentiates it from another data. CNN pre-processes the data by itself. It does not require a lot of resources in data processing. CNN mainly takes image dataset as input and learns various features through filters by assigning weights and bias to it. It allows filters to learn important features in the dataset, allowing them to distinguish one input from another. CNN has the ability to pre-process the data by itself, so there is no need for more resources in data pre-processing. CNN is continuously evolving with the data growth. During the training set formation, CNN can be able to adapt the learnt features and develop knowledge discovery of its own so that it continuously develops with growth in the dataset.

Dataset is formed from all categories like text, images, audio and video. The formed dataset is considered as the feature of dataset of the model. For images, the feature set is formed by the process known as segmentation [10–14].

CNN has weights that can learn from the input and the biases. The neuron connected to the network receives the input and performs dot product in it. A loss function is evaluated to measure the performance of the model. The only key point of CNN is that it assumes the input in an explicit manner. The CNN technique is used for creating the RIR learning model structure.

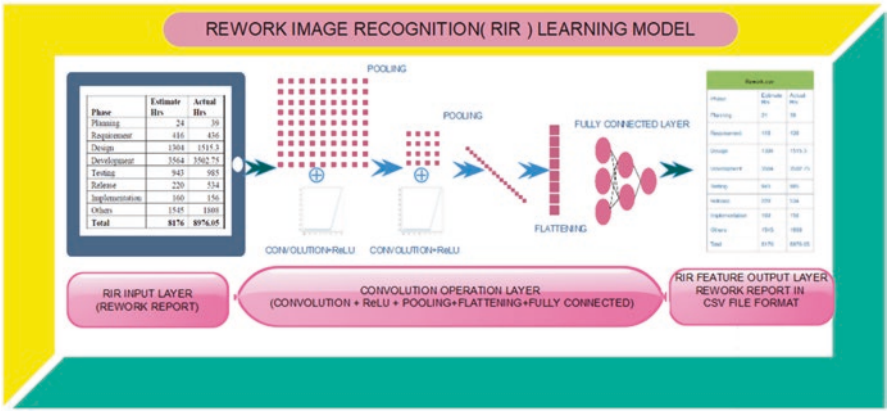


Fig. 1 RIR learning model

3 RIR (Rework Image Recognition) Learning Model

The Rework Image Recognition (RIR) learning model is the deep learning model with CNN algorithm. This model is used to analyse and recognize the image of Rework report produced by Organization-A. The structure of RIR learning model is described in Fig. 1.

CNN learning structure is also formed with three major layers as the ANN structure. The first layer is the input layer, which consists of greyscale image. The second layer is formed by hidden layer set [15–20]. The hidden layers are further divided into convolution layers, ReLU (Rectified Linear Unit) activation function layer, pooling layers and fully connected neural network. The third and the final layer is the output layer, which is a binary or multi-class label.

The RIR model is created by using three major layer structures called RIR input layer, RIR convolution operation layer and RIR feature output layer.

3.1 RIR Input Layer

This CNN learning structure is used for feature detection. This is the beginning layer of the feature mapping. This layer takes the image as the input. The input is provided in the form of pixel. Here filters are applied to represent the image parts. This representation will form a pattern of feature image mapping.

3.2 RIR Convolution Operation Layer

This is the major part of the RIR learning model. In this layer first the image is convoluted with activation function, pooled and flattened so as to form the final fully connected layer.

3.2.1 Convolution

Convolution means formation of representing the image parts. This is used to form the feature map of the image. Then a filtering is used to form network in the image representation. A random vector is generated with network weights and bias value, which is to be shared among the CNN network for the formation of a unique feature set. These are also known as kernels. The filter size is used to measure and identify the pixel affecting rate one at a time. A common filter size used in CNN is 3. It means the height and width of the image in the 3 × 3 pixel area. The depth of the two-dimensional image is represented by the colour channel. For greyscale image the colour channel is 1, and for RGB colour image, the channel value is 3, so the filter size of the colour image is 3 × 3 × 3. The image complexity is preserved by feature mapping, which includes the process of filtering in more than once. The network multiplies the filter value with the pixel value.

3.2.2 ReLU Activation Function

The feature map formed by convolution is passed to the activation function, but in image all the values are in a nonlinear form. The nonlinear value is to be changed into linear so as to insert into the activation function. The major activation function of image processing is ReLU (Rectified Linear Unit).

It comes under a nonlinear activation function. The special quality of this function is that the neurons are not activated at the same time. It is best for hidden layers only. It has output 0 if the input is less than 0, and it has raw output otherwise. It avoids backpropagation errors. It is very close to the working of neuron, to normalize the different range values and make the result between 0 to 1 and −1 to 1. This activation function is used. The ReLU equation is defined in Eq. (1):

$$f(x) = \begin{cases} 0, & x < 0 \\ 1, & x \geq 0 \end{cases} \tag{1}$$

3.2.3 Max Pooling

The activated image data is passed into the pooling layer. Now this layer will remove the unwanted image parts and keeps only the relevant image features. It means this layer only serves on the relevant image parts. Overfitting of data is avoided because of identifying only the relevant parts.

3.2.4 Flattening

Before forming an image into a tabular form, overfitting is to be reduced. The reduction is done between the neurons. This is done by flattening. Flattening means adding a dropout layer to prevent overfitting of CNN algorithm, while training the data dropout is used to reduce the correlation between the data in activation map.

3.2.5 Fully Connected Layer

This layer is the last part of the convolution neural network. Here the dropout layer produced in the previous flattening convolutional operation layer is converted into the vector. In order to capture the relationship of image complexity between the features, the formed vector is fed into this fully connected layer. The final result of this layer is one-dimensional feature vector.

The fully connected layer is also known as dense layer or ANN layer. This layer is used to analyse the input features in order to form classification. First of all, the neuron collections are formed to represent the various parts of the object considered. This neuron collection is stored in a set if the collection is set until fully formed. If the set is full, then the neurons are activated in accordance with the input image for classification of the object.

3.3 RIR Feature Output Layer

This layer is used to form the final resultant CNN layer of the feature mapping. This layer is used to perform the image feature mapping from the previous set of convolution operation layers. Here the accuracy and loss values are calculated. The accuracy value more than 75% is considered for feature mapping classification.

In order to find the accuracy value, the difference in the expected and the calculated result in the training set is found by ANN. The learning rate is adjusted in accordance with the error value to optimize the proposed model performance. The above process is repeated to the learnt association of feature input in accordance with the result. The final fully connected layer will receive the result of the layer before the delivery. At this step, the image classifier model is trained. Now by

passing the image into the CNN model, one will get the content feature mapping of the image. Then it is stored into the CSV file for future prediction.

4 RIR Learning Model Implementation

RIR implementation is achieved by using the four major steps: input dataset formation, filtration, convolution operation and feature extraction.

4.1 RIR Input Layer Preparation

The image is taken into the RIR model to prepare the input layer. Further the input set is formed with filter details.

4.1.1 Input Dataset Formation

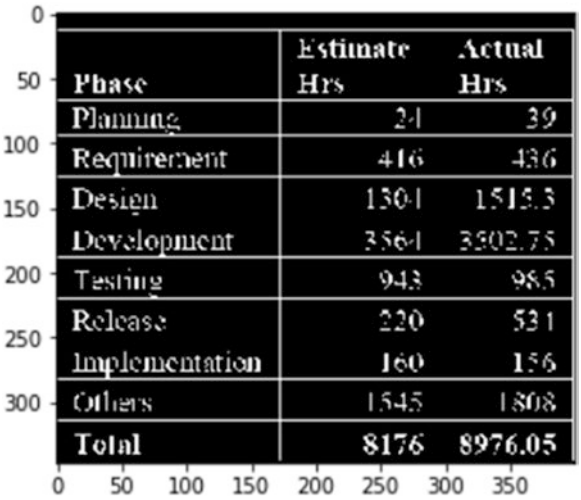
To form the CSV file dataset from the image, the Rework report of 'Organization-A' shown in Fig. 2 is considered.

Machine learning data must have a feature. In this paper, image of Rework report is used as the data feature is used in CNN input feature for prediction. From an existing image dataset, ML learns how to gather the desired results with minimal error rate.

Features are input data of neural network. In image recognition, the feature is a group of pixels for pattern analysis. The first step is the conversion of the image into the greyscale level. This is done by using the Python code 'cvtColor' from a cv2 file. The greyscale-converted image of Rework report in Fig. 1 is shown in Fig. 3.

Fig. 2 Rework report of Organization-A

Phase	Estimate Hrs	Actual Hrs
Planning	24	39
Requirement	416	436
Design	1304	1515.3
Development	3564	3502.75
Testing	943	985
Release	220	534
Implementation	160	156
Others	1545	1808
Total	**8176**	**8976.05**



Phase	Estimate Hrs	Actual Hrs
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Development	3564	3902.75
Testing	943	985
Release	220	531
Implementation	160	156
Others	1545	1808
Total	8176	8976.05

Fig. 3 Plot of greyscale conversion of Rework report

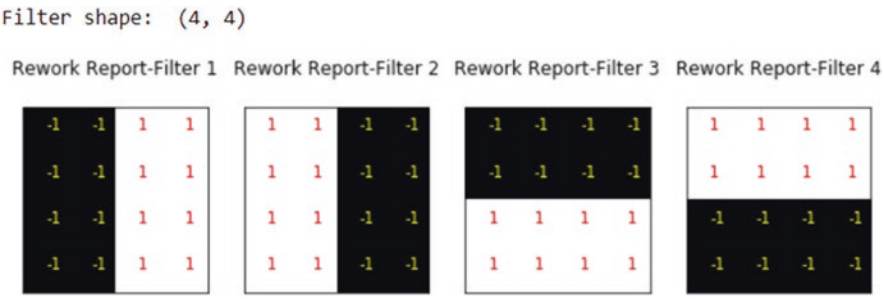


Fig. 4 Filter shape for CNN learning structure

Figure 1 shows the Rework report of 'Organization-A' in image format. This image data is converted into CSV file using CNN technique. The Python code is used to input the image shown below.

4.1.2 Filter Formation

This is the first step of CNN learning structure. A randomly generated array is used to measure and identify the pixel affecting rate one at a time. A common filter size used in CNN is 3. In our model creation, the filter used is shown in Fig. 4 from the Python result.

```
Net(
  (conv): Conv2d(1, 4, kernel_size=(4, 4), stride=(1, 1), bias=False)
  (pool): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=F
alse)
)
```

Fig. 5 Convolution model definition

4.2 RIR Convolution Operation Layer

CNN (convolutional neural network) operation is done by five major steps known as convolution, activation function, pooling, flattening and fully connected layer formation.

4.2.1 Convolution

The convolution layer is defined by using PyTorch Python library. Here the net weight of CNN learning structure is defined, and the designed model is displayed with the help of assigning net (weight) to model variable. The result is shown in Fig. 5.

The maximum convolution layers in reference with Rework report of Organization-A of Fig. 2.

4.2.2 ReLU Activation Function

This layer considers the feature map in order to identify the nonlinear relationship that occurs in Fig. 6. Dimensionality reduction is applied here for the reconstruction of the image. This is done by creating a Python user-defined function 'activation_layer' for applying relu() activation function (Fig. 7).

4.2.3 Pooling

This layer is used for further reduction of nonlinear feature of convoluted value in order to reduce the difficulty in big data. The technique used here is max pooling which is defined by a user-defined function 'pooling_layer' using Python as shown in Fig. 8.

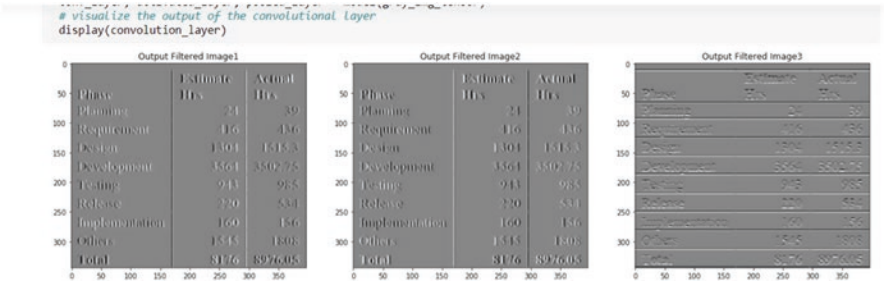


Fig. 6 Full convolution result of greyscale conversion of Rework report

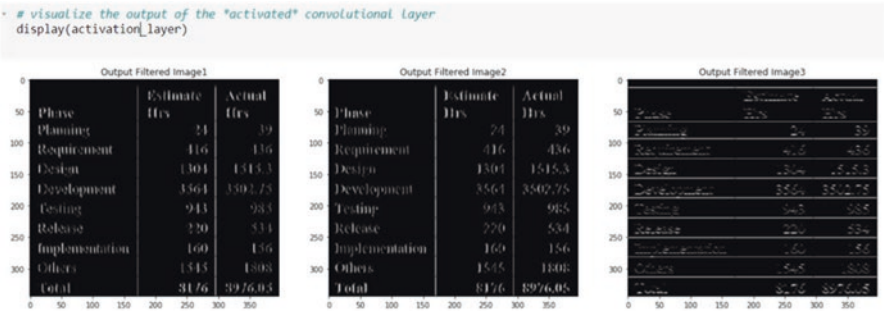


Fig. 7 Full ReLU activation layer result of greyscale conversion of Rework report

4.2.4 Flattening

After pooling flattening is used to convert the pooled image into a single long column sequential order known as vector. This flattening helps for forming image prediction model.

First shape is used to find the image shape, and then flatten() method of NumPy Python library is used.

The flattening result is shown in Fig. 9.

4.2.5 Fully Connected Layer

In this final convolution step, ANN is added with the CNN. It means the ANN attributes are combined for class of prediction with a greater level of accuracy. The error loss is also calculated and adjusted with the feature in order to optimize the model. This work is repeated till the maximum accuracy level of the model appeared. The following steps show the prediction execution result using Python.

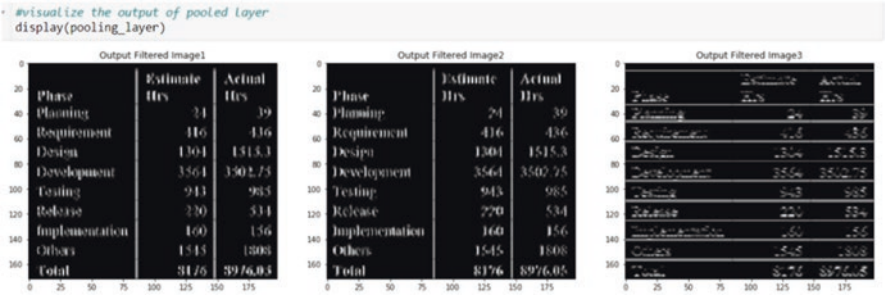


Fig. 8 Full max pooling layer result of greyscale conversion of Rework report

```
img.shape
```

```
(347, 400)
```

```
import numpy as np
img_data = np.array(img)
flattened = img_data.flatten()
flattened.shape
```

```
(138800,)
```

```
flattened
```

```
array([255, 255, 255, ..., 255, 255, 255], dtype=uint8)
```

Fig. 9 Flatten result of greyscale conversion of Rework report

Step 1: Data Pre-processing

- Collect the image after flattening to train it. This is done by using the method imread('image path') of Python library cv2.
- Here the input X_train and x_test dataset is normalized. To do this first by using the Python code astype('float32'), the training set values are converted and it is divided by 255.0.
- Now the y_train and y_test datasets are encoded by using np_utils.to_categorical(), and the y_test data shape is assigned to class_num.

Step 2: Model Creation

- Different hyper-parameters and activation functions are executed; finally all the models are built and summarized in Python, and the corresponding results are shown in Fig. 10.

Step 3: Model Fitting

Here the model created in the previous layer is instantiated, and the value is fitted into the training data prepared. Here the model time period is defined within the fit function by using epochs. If the epoch value is

```
model.build(input_shape)
```

```
model.summary()
```

```
Model: "sequential_26"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dropout_67 (Dropout)         (600, 32, 32, 1)          0
_________________________________________________________________
conv2d_64 (Conv2D)           (600, 30, 30, 32)         320
_________________________________________________________________
activation_71 (Activation)   (600, 30, 30, 32)         0
_________________________________________________________________
max_pooling2d_22 (MaxPooling (600, 15, 15, 32)         0
_________________________________________________________________
dropout_68 (Dropout)         (600, 15, 15, 32)         0
_________________________________________________________________
batch_normalization_55 (Batc (600, 15, 15, 32)         128
_________________________________________________________________
conv2d_65 (Conv2D)           (600, 15, 15, 64)         18496
_________________________________________________________________
activation_72 (Activation)   (600, 15, 15, 64)         0
_________________________________________________________________
max_pooling2d_23 (MaxPooling (600, 7, 7, 64)           0
_________________________________________________________________
dropout_69 (Dropout)         (600, 7, 7, 64)           0
_________________________________________________________________
batch_normalization_56 (Batc (600, 7, 7, 64)           256
_________________________________________________________________
conv2d_66 (Conv2D)           (600, 7, 7, 128)          73856
_________________________________________________________________
activation_73 (Activation)   (600, 7, 7, 128)          0
_________________________________________________________________
dropout_70 (Dropout)         (600, 7, 7, 128)          0
_________________________________________________________________
batch_normalization_57 (Batc (600, 7, 7, 128)          512
_________________________________________________________________
flatten_9 (Flatten)          (600, 6272)               0
_________________________________________________________________
dropout_71 (Dropout)         (600, 6272)               0
_________________________________________________________________
dense_35 (Dense)             (600, 256)                1605888
_________________________________________________________________
activation_74 (Activation)   (600, 256)                0
_________________________________________________________________
dropout_72 (Dropout)         (600, 256)                0
_________________________________________________________________
batch_normalization_58 (Batc (600, 256)                1024
_________________________________________________________________
dense_36 (Dense)             (600, 128)                32896
_________________________________________________________________
activation_75 (Activation)   (600, 128)                0
_________________________________________________________________
dropout_73 (Dropout)         (600, 128)                0
_________________________________________________________________
batch_normalization_59 (Batc (600, 128)                512
=================================================================
Total params: 1,733,888
Trainable params: 1,732,672
Non-trainable params: 1,216
_________________________________________________________________
```

Fig. 10 Model summary of the Rework report

```
print(accuracy)

782/782 [==============================] - 30s 38ms/step - loss: 0.3097 - accuracy: 0.8742
782/782 [==============================] - 30s 38ms/step - loss: 0.3097 - accuracy: 0.8742
0.8741999864578247
0.8741999864578247
```

Fig. 11 Accuracy and loss level of the Rework report

increased, then the model performance is also increased. In some cases it may cause an overfitting result. Therefore, proper epoch's value will save the network weights during data training.

Step 4: Model Evaluation

It is done by checking the accuracy level with that of the loss value of the model in the epochs. The accuracy level of the sequential model used for the image recognition is shown in Fig. 11.

From Fig. 11 it is clearly shown that the image recognition accuracy level is 87% so the image is used for Rework report analysis.

After all the convolution layer steps are done, the image is reconstructed and the new grey level is displayed in Fig. 12.

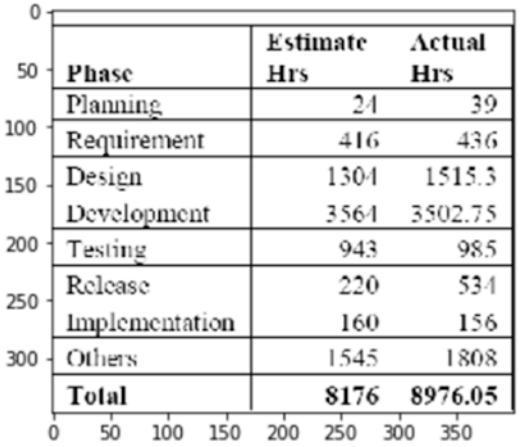
4.3 RIR Feature Output Layer

Here the final improved Rework report of the Organization-A is considered for CSV file conversion. It is done by using the command image_to_string of the Python library, and the result of the command is saved with the help of write() method. The saved file is opened by using the open() command, and the corresponding converted CSV file of Fig. 12 is shown in Fig. 13.

5 Conclusion

This paper is used to propose a new learning model (RIR) for image recognition using Python. The RIR learning model is based on CNN deep learning algorithm. The model is implemented with various performance measures like accuracy and loss values. The RIR accuracy level is 87%. This result shows that the image recognition has reached its maximum level, so that it can be used for CSV file conversion. The converted CSV file is to be used as the data for rework effort estimator of the Organization-A. This research work helps reach maximum image recognition, which will be used to insist the need of fault taxonomy to predict fault in the early software development phases.

<matplotlib.image.AxesImage at 0x1e58529d908>



Phase	Estimate Hrs	Actual Hrs
Planning	24	39
Requirement	416	436
Design	1304	1515.3
Development	3564	3502.75
Testing	943	985
Release	220	534
Implementation	160	156
Others	1545	1808
Total	**8176**	**8976.05**

Fig. 12 Final improved plot Rework report

Fig. 13 Converted CSV file of the Rework report

```
img_csv_read.head(10)
```

	Estimate | Actual
0	Phase Hrs Hrs
1	Planning 24 39
2	Requirement 416 436
3	Design 1304 | 1515.3
4	Development 3564 | 3502.75
5	Testing 943 985
6	Release 220 534
7	Implementation 160 156
8	Others 1545 1808
9	Total 8176 | 8976.05

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Part II
Emerging Areas in Technology and Engineering Applications

Comprehensive Deep Recurrent Artificial Neural Network (CDRANN): Evolutionary Model for Future Prediction

G. Sundar and P. Patchaiammal

Abstract Prediction concept needs human-like thinking and ideas. ANN helps make a program for describing the solutions to the prediction problems. To gain accurate prediction, there is a need for deep thinking in the knowledge system discovered. Deep learning helps form such next-level type of ANN thinking. Deep learning models do not require humans for programming the problems. It can determine the prediction by itself by learning the dataset. This paper describes the prediction by considering sequential model for continuous accessing of data with the help of multi-layers. Deep learning is very helpful for predicting larger dataset. This paper proposes an algorithmic model known as a Comprehensive Deep Recurrent Artificial Neural Networks (CDRANN) by hybridizing LSTM (long short-term memory) with RNN (recurrent neural network) backtrack solver for better future stock prediction. This paper also explains the need for hybridizing evolutionary model CDRANN to create a novel change in future prediction.

Keywords CDRANN (Comprehensive Deep Recurrent Artificial Neural Networks) · LSTM (long short-term memory) · RNN (recurrent neural network) · Stock market · Prediction

1 Introduction

Human brains are made up of interconnected neurons also known as perceptron. These perceptrons form networks to make a simple decision of which perceptron is to be provided into the next layer in order to form interconnected networks. Based

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on the interconnected neurons, the system learns and makes decision like humans. The human brain has various parts arranged in order to process and make different decisions. A simple ANN system has three types of neuron layers like entry layer (input), processing layer (hidden) and decision layer (output). For complex systems, ANN creates more hidden layers, which form human brain-like structure. This is known as multi-layer neural networking. In multi-layered ANN, the networks are separated as input layer, hidden multi-layers and output layer. The multi-hidden layers are connected with one another in order to feed it in the next layer. By adding multiple hidden layers, the network learns to read more about the data. The part of multi-layered ANN in pattern learning for time series data forecasting is described by forming and analysing the BSE's life insurance data. The performances are measured by mean absolute error [1–9]. This paper explains how the output of the previous layer becomes input of another node in the next layer. This technique follows the signal from left to right. This result will produce feedforward artificial neural network, but to make predictions for future data, the network model should learn the weight to train the data.

Nowadays life insurance plays a vital role. So, a novel prediction model is needed for future stock prediction. A new model synthesizing recurrent ANN backtrack solver was developed to improve the stock price prediction [10–15], but for more historical data, the model needs to be improved. This paper helps overcome this by introducing deep learning method with the model. By analysing all these to reduce the error rate, there is a necessity of deep study in the entire stock prediction sector and also to invest in the right stock in order to gain profit. Stock price prediction needs analysing key movements for one-time decisions for the determination of real-time stocks. This shows the necessity of deep learning merged with RANN backtrack solver. This is useful to solve vanishing gradient problems.

1.1 RNN (Recurrent Neural Network)

RNN is useful if the neural networks are in sequence of order. It remembers the previous layer results in case of new layers are added at each input. An RNN has a series of inputs from 1 to n. Each input layer has one neuron layer for each input. After learning those inputs, RNN performs backpropagation through the network layer. It uses chain (roll)-like network given in Fig. 1.

Recurrent neural networks are used to predict the time series type of a dataset. It is also a category of ANN in which loops are used to provide consistent flow of data value to work in sequence. In RNN internal state is present to store the sequence of inputs. RNN uses gradient descent at each time for the firing of the best neuron weights for one layer step to another layer. A structured model for stock prediction using RNN with ANN backtrack solver is formed and proved its ability in solving time series problems like stock prediction [8–12].

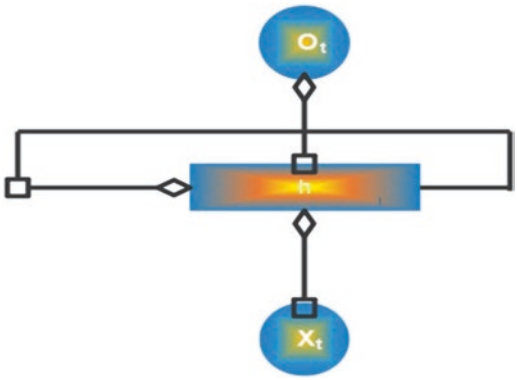


Fig. 1 RNN chained (rolled) structure

The rolled recurrent neural network equation is mentioned in Eq. (1):

$$O_t = \sigma\left(AX_t + Bh_{t-1}\right) \tag{1}$$

In Eq. (1), 'A' is the input matrix weight. 'B' is the recurrent output matrix weight, 'X_t' is the input layer, 'O_t' is the output layer and 'h_{t-1}' are the hidden layers. 'σ' is the activation function used in RNN, but it has a vanishing gradient problem in some cases of time series problems.

1.2 The Need for Comprehensive Model

When expanding the rolled RNN, the structure has a sequence of lists. The understanding of present prediction of the future is needed from using the past information. In some RNN cases, it is not possible. In stock prediction especially in life insurance, dataset prediction is based on the previous historical data to be narrowed down to the large ones [16–21]. In this case, to get the correct prediction, there is a possibility of gap between the necessary details, and the data searched is to be very large. In this case, the gap grows, and there is a need to save the past data information for a while which is not possible in RNN.

Comprehensive model is formed by combining the RNN backtrack solver with that of deep learning. The deep learning structure used is designed by LSTM. LSTM gives the most controlling ability than RNN. RNN has a repeating neural network model. RNN has a single layer of tanh, but LSTM contains four interacting layers. This will make LSTM to solve a vanishing gradient problem.

In ANN, one has to teach the computer to learn from the input data and process it for the output decision. In LSTM deep learning, the computer trains itself to learn and process the data. ANN has only three layers like input, hidden and output layers. By adding more hidden layers, we form a multi-layer neural network. A deep learning system takes these multiple hidden layers from the base to form a deep neural

network. This LSTM deep learning system forms a self-learning system of the human brain like structure. The deep learning system performs the task repeatedly to gain experience and to improve the outcome. This system has various layers in deep learning to enable and gain the learning knowledge. For any given problem, the 'idea' is required to solve it as LSTM deep learning.

LSTM deep learning needs a lot of data for learning. LSTM deep learning allows solving complex data structures like unstructured and interconnected. If the LSTM deep learning algorithm learns more data, then its performance will be better. LSTM deep learning makes one understand patterns so as to give the ability of the next set of sequence value prediction. LSTM deep learning network is characterized by making the layers deep.

1.3 Stock Market

Stock market is an accumulation of buyers and sellers of shares. The buyer is known as an investor, and the seller is known as a trader. Every company has a certain quantity of shares listed for public for trading, and it is listed out in stock exchanges. The stock price keeps on fluctuating on the basis of company value. The fluctuation of stock price needs to be analysed to predict the prices of stock. To gain maximum profit in share, the investor or trader must know the right time for the investment. Even though many techniques are available to predict the stock price, the stock prediction is quite difficult.

2 CDRANN: Comprehensive Neural Evolutionary Model

2.1 LSTM in CDRANN

CDRANN is a sequential model to cover up Comprehensive Deep Recurrent Artificial Neural Networks. LSTM is mainly used to model the structure of CDRANN. LSTM means long short-term memory. It is the major RNN architectural form used for the classification and future prediction problems for the time series dataset in the field of deep learning. LSTM is best for solving predictions of long-term dataset. It trains the model by using a backpropagation method. It makes the easiest way to remember the past data memory. LSTM follows a sequence of learning prediction model for large dataset. LSTM is also a kind of RNN. It is known as the deepest RNN to have longer memory period to perform better to solve vanishing gradient problem in RNN. This is used in many models of time series problems. Here, the output is feedback at time 't' to the input of the same network at $(t + 1)$, but in the training and prediction time, the RNN is not rolled up. The structure of an unrolled recurrent neural network is shown below.

For a new data input, the output of the previous network is applied to the next network at each time interval. To develop a model between the input values, which are sequentially separated by significant numbers, we experience some zero gradient problems. It means small weights, that is, gradient values, which are less than 1, are multiplied many times in multiple time steps to get the gradient analysis which is zero. This result shows that in earlier layers, the weights are changed significantly. In this case, the network is not able to learn about the long-term dependencies. This causes the need for LSTM networks.

2.2 Proposed Model Structure

Comprehensive neural evolutionary model has formed by combining RNN backtrack solver with LSTM deep learning structure. It consists of three layers. First is the input layer. It takes the input from RNN backtrack solver result. The next layer is the hidden layer. It will apply the weights to the input layer so as to direct it for the output layer through activation function. The hidden layer is used to perform nonlinear transformation in the network. The final layer is the output layer, which is used to store the predicted result without having vanishing gradient problem. CDRANN structure starts from left to right, that is, from input x_i to the output h_{t-1}, which is together to enter the top of structure. The new data values are linked together with the previous output in the left hand of the structure. The input and the previous output are combined and compressed through tanh layer. Then, this combined input is passed to input gate. In the input gate, the sigmoid activation function is used with the output to get the compressed input. The sigmoid function in the input gate is used to remove the input vector elements that are not needed. The value of sigmoid output is between 0 and 1. If the weight connecting the input to the trained node to the output value is 0, then the input values are not passed, whereas the output is close to 1, and then the input values are passed. In the forget gate, the variable wrapped in one-time step, i.e. q_{t-1} is added with the internal state q_t. This addition is used for reducing the chance of occurring vanishing gradient. This is the recurrence loop. This recurrence loop is controlled by forget gate. It is called forget gate because it helps the network learn which state value to be 'retained/remembered' or 'forgotten'. In the output gate, the output layer is compressed with tanh function. This gate is used to finalize the value which is to be actual the result of output form h_t. The comprehensive neural evolutionary model is described in Fig. 2.

In the above comprehensive model, the forget gate has activation function set which is used by the model to decide above the information to be updated and forgotten at a given time level. This makes the model to solve the gradient vanishing problem of RNN backtrack solver. The structure consists of three major gates known as input gate, forget gate and output gate.

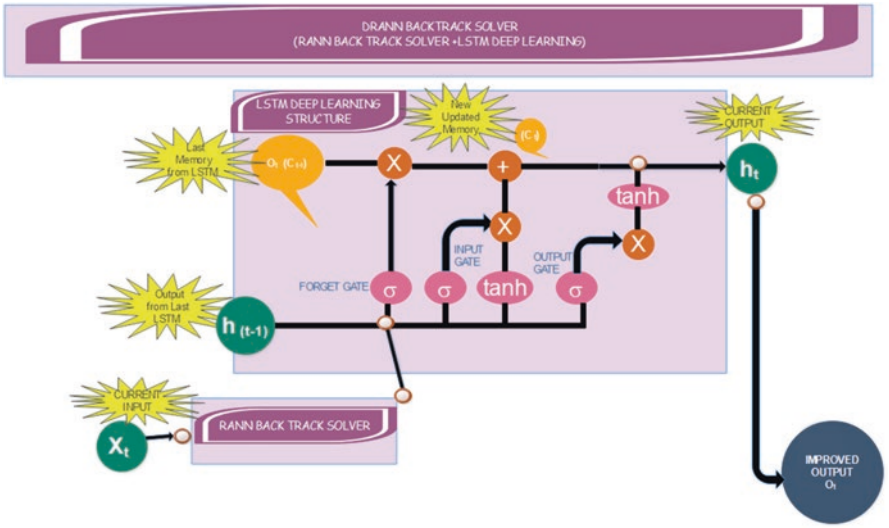


Fig. 2 Comprehensive neural evolutionary model structure

To predict the closed price of stock using the previous historical data, we need large dataset. In the large dataset, if the gap in the information grows, RNN can't able to learn the dataset. This problem is identified as long-term dependency. This is solved using LSTM. LSTM is a special kind of RNN, which has the special capability of learning the long-term dependencies. LSTM follows a chain-like structure with a repeated module of different structures. It has four different interactive neural networks instead of single one. To add the values, LSTM use gates in the cell state. All these are composed of sigmoid function on neural network layer and point-wise multiplication operation. The major working state of the LSTM is the cell state from the C_{t-1} to C_t, acting in a horizontal line through the top of the structure.

Forget gate (F_t) – LSTM takes the input X_t from the RNN backtrack solver along with output of the last LSTM $h_{(t-1)}$. Now the LSTM used to pass the above-combined value into a forget layer. This layer will decide which old output part should be removed.

Input gate (I_t) – In this part, the storage information from the input X_t is decided by the sigmoid (σ) layer. Here tanh layer is used for connecting all the possible value of input in order to form a vector. Then the sigmoid and tanh layer is used to update new memory state.

Output gate (O_t) – This is the final result here that sigmoid layer is used to decide the memory cell part to be passed to be output. At last, this state of result is passed through a tanh layer to generate all possible vectors and multiplied with the output of sigmoid layer so as to get the predicted result.

2.3 Parameters in Proposed Model

The parameters involved in the LSTM are in relation with hyperparameters, which are frequently used to make predictions and adjustments in the problem modelling. There are three major hyperparameters in the LSTM model. The parameters are:

(i) Activation Function

An activation function is a mathematical function which acts as a gate in between the current layer neuron input feed and the next layer output. It is known as activation function because it helps take decision of neuron, which is to be activated or not. In LSTM tanh, hyperbolic function is used for solving values between −1 and +1. This is used to fit the value of the input data within the range to fit and forecast. This scaling is put back to its original when the forecasting is made.

There are two activation functions that are mainly used in LSTM. The functions are sigmoid and tanh:

- Sigmoid function: This function has the output of 0 or 1. It uses LSTM to forget and remember the information. It is also used to pass the information between the LSTM units.
- Tanh function: This function has the ability to maintain the second derivative for a longer time before reaching to 0. It is used to solve the vanishing gradient problem.

(ii) Optimizer

Optimizer is created to work for the data. Optimizer is used in the model creation in order to make the model the most accurate form. It also helps find the wrong measurement of the data prediction.

Optimizer in the training process will help in minimizing the loss function. It also helps perform optimized and correct prediction with model update.

By knowing the model weight from the start till the end, it will avoid overfitting and keep regulating the model with prediction.

- Adam Optimizer

It produces more than 99% accuracy in time series data. Adam means adaptive moment estimation. It optimizes the value based on past gradients to calculate the current gradients. The goal of all optimizer is to minimize the loss function. It is an algorithm used for training deep learning models and responsible for updating the weights in order to increase the accuracy.

(iii) Loss Function

The loss function is the error function which is used for estimating the loss in the current state. The loss function is mainly used to guide the optimizer in the right directional path. This function also used to update the weights to reduce the loss on the next evaluation. The loss function will help frame the specific predictive model. The appropriate result is also produced by loss function.

Loss function is the function used to calculate the predicted neural network error, which is also known as loss. In our model loss function is used to calculate the gradients.

- MSE Loss Function

MSE means the average of error value square. If the result is zero, it means no error occurred in the prediction. It means the model created for prediction is perfect for the training dataset values. Lower MSE value makes the prediction better.

2.4 Equation Set

CDRANN equations are formed by LSTM. The equation set is made up of three gates known as input gate, forget gate and output gate. All these gates use the activation function sigmoid with the output values between 0 and 1 or either 0 or 1. The major advantage of the sigmoid function is that it allows only the positive value either 0 or 1. '0' means the gate is blocked, and '1' means the gate is opened to pass the values. The three gate equations of LSTM at the beginning level is mentioned below:

$$\text{Input gate equation} : I_t = \sigma\left(w_{\mathrm{i}}\left[h_{t-1}, x_t\right] + b_{\mathrm{i}}\right) \tag{2}$$

$$\text{Forget gate equation} : F_t = \sigma\left(w_{\mathrm{f}}\left[h_{t-1}, x_t\right] + b_{\mathrm{f}}\right) \tag{3}$$

$$\text{Output gate equation} : O_t = \sigma\left(w_{\mathrm{o}}\left[h_{t-1}, x_t\right] + b_{\mathrm{o}}\right) \tag{4}$$

where I_t is the input gate, F_t is the forget gate and O_t is the output gate. σ is the sigmoid function. Present were the weights of the respective gates (i, input; f, forget; and o, output). h_{t-1} represents the output of the previous LSTM block in $(t - 1)$ timestamp. x_t is the input at current timestamp. b is the bias value for the respective gate (i, input; f, forget; and o, output).

The final gate equations are mentioned below:

$$\text{Input gate equation} : \tilde{c}_t = \tanh\left(w_c\left[h_{t-1}, x_t\right] + b_c\right) \tag{5}$$

$$\text{Forget gate equation} : c_t = f_t * c_{t-1} + i_t * \tilde{c}_t \tag{6}$$

$$\text{Output gate equation} : h_t = o_t * \tanh\left(c^t\right) \tag{7}$$

where $\tilde{c}_t$ represents as the candidate for the cell state at timestamp t. c_t represents as the cell state at timestamp t.

The operations used in LSTM cell are sigmoid, tanh, point-wise multiplication (×), point-wise addition (+) and vector concatenation.

2.5 *Algorithmic Steps of CDRANN*

Step 1: The current input from RNN backtrack solver and previous hidden state are concatenated.
Step 2: The combined input and hidden state are fed into the forget layer to remove the non-relevant data.
Step 3: The combined input and hidden state form a candidate layer to hold the possible values of the cell state.
Step 4: The combined input and hidden state are also fed into the input layer to decide what value of the candidate data should be added to the new cell state.
Step 5: After finishing forget layer, candidate layer and input layer, the cell state is calculated.
Step 6: The output is computed with the calculator vector and the previous cell state.
Step 7: Point-wise multiplication of the output and the new cell state gives the new hidden state.
Step 8: Now, the hidden state is used for prediction.
Step 9: Repeat steps 1–8 to choose the relevant information to be remembered or forgotten during LSTM operation sequence.
Step 10: End.

3 Implementation

3.1 *Data Collection*

CDRANN comprehensive model is implemented here with the help of HDFC Life Insurance dataset from BSE stock market. The implementation is done by using Keras R language. First the dataset is downloaded from the BSE site and stored under the .csv file format. The head rows are listed by using the command head (reference_variable) as in Fig. 3.

```
> head(hdfclifeinsurance)
       Date Open.Price High.Price Low.Price Close.Price      WAP No.of.Shares No..of.Trades Total.Turnover..Rs.. Deliverable.Quantity X..Deli..Qty.to.Traded.Qty Spread.High.Low Spread.Close.Open
1 24-Feb-21     706.15     721.65    683.60      719.25 711.4306       629322         15487            447718931               295240                      46.91           38.05             13.10
2 23-Feb-21     692.95     712.75    690.60      705.85 706.2133        76919          2573             54321217                23138                      30.08           22.15             12.90
3 22-Feb-21     710.65     713.45    688.30      690.15 694.7592        72043          3638             50052535                34986                      48.56           25.15            -20.50
4 19-Feb-21     717.70     723.25    703.70      710.10 715.0715       125598          3485             89811550                31036                      24.71           19.55             -7.60
5 18-Feb-21     704.00     716.00    701.90      713.45 712.5686       142922          7298            101841728                92993                      65.07           14.10              9.45
6 17-Feb-21     697.90     711.60    695.35      703.20 706.8964        90385          2683             63892827                25393                      28.09           16.25              5.30
> 
```

Fig. 3 Data report of HDFC Life Insurance

3.2 Data Preparation

The LSTM network was built by using hyperparameters of stock market. The various parameters are:

1. Date
   It represents the date of life insurance in relation to stock trading.
2. Open price
   It represents the opening stock price of the life insurance stock trading on the given date.
3. High price
   It represents the highest stock price of the life insurance stock trading on the given date.
4. Low price
   It represents the lowest stock price of the life insurance stock trading on the given date.
5. Close
   It represents the closing stock price of the life insurance stock trading on the given date.
6. WAP
   WAP in stock means weighted average price. This is helpful in case of multiple transactions at the same time in time series dataset. This will help find more average in more transaction. It is calculated by first multiplying the weighted average price for each share, and then all the values are added. The added value is divided by a total number of shares. The general formula of WAP is defined in Eq. (3):

$$\text{WAP} = \frac{\left(\text{1st stock price} \times \text{shares of 1st stock}\right) + \left(\text{2nd stock price} \times \text{shares of 2nd stock}\right) + \cdots}{\text{total shares number}} \tag{8}$$

   WAP is helpful in identifying the whole performance of stock. In our dataset report, WAP is helpful in identifying the whole performance of HDFC Life Insurance dataset. This WAP study is used for future predictions for investment.
7. Number of trades
   It represents the total number of trades in relation to the date of insurance.
8. Total turnover
   It represents the total turnover with respect to the date of insurance.
9. Deliverable quantity
   It represents the delivered quantity in relation to the date of the life insurance taken.
10. Percentage (%) of delivered quantity to traded quantity
    It represents the percentage of the delivered quantity of the life insurance in relation to the date.
11. Spread high-low

It's the spread value of the high and low price of the life insurance stock with respect to the date.

12. Spread close-open

    It's the spread value of the close and open price of the life insurance stock with respect to the date.

The respective data layer preparation in relation to the date and the stock market trading is shown in the below graph plot using the R language function plot (x_ range, y_range, linetype = '*n*'). The plotted graph is shown in Fig. 4.

3.3 Feature Set Formation

The collected stock market data is correlated with respect to the date and the corresponding feature correlation map drawn with the help of R language. The respective resultant graph is shown in Fig. 5.

3.4 Model Construction

First training set is formed with respect to the stock price details of open price, high price, low price, close price and WAP with corresponding date. This is used for incremental improvement of the LSTM model used for prediction. Then the LSTM model is used to fit the value, and the model summary is shown in resultant Fig. 6.

After the model summary is executed, the corresponding loss with respect to the model cycle epoch value of 10 is shown below. As per the executed R language result, the loss is 0.1036, and the val_loss is 0.1455. This shows that LSTM produces the prediction of time series data like stock with minimal loss value. The LSTM epoch result value of 10 is shown in Fig. 7.

The above-mentioned epoch with respect to the stock market life insurance data training loss and validation loss is plotted in Fig. 8.

3.5 Model Evaluation and Tuning Parameters

Finally, the true future value of accuracy with respect to the LSTM model prediction data is evaluated, and the results are displayed in the graph. The created LSTM model is fitted with the accurate value, the corresponding accuracy with respect to epoch history is measured and the corresponding validation accuracy is plotted in the performance result graph. Then the assumed training values are tested with other values, and the measurements are displayed in the four different graphs of Fig. 9a–d. The determination of future stock prediction with 99% accuracy is finally achieved, and it is displayed in Fig. 9d.

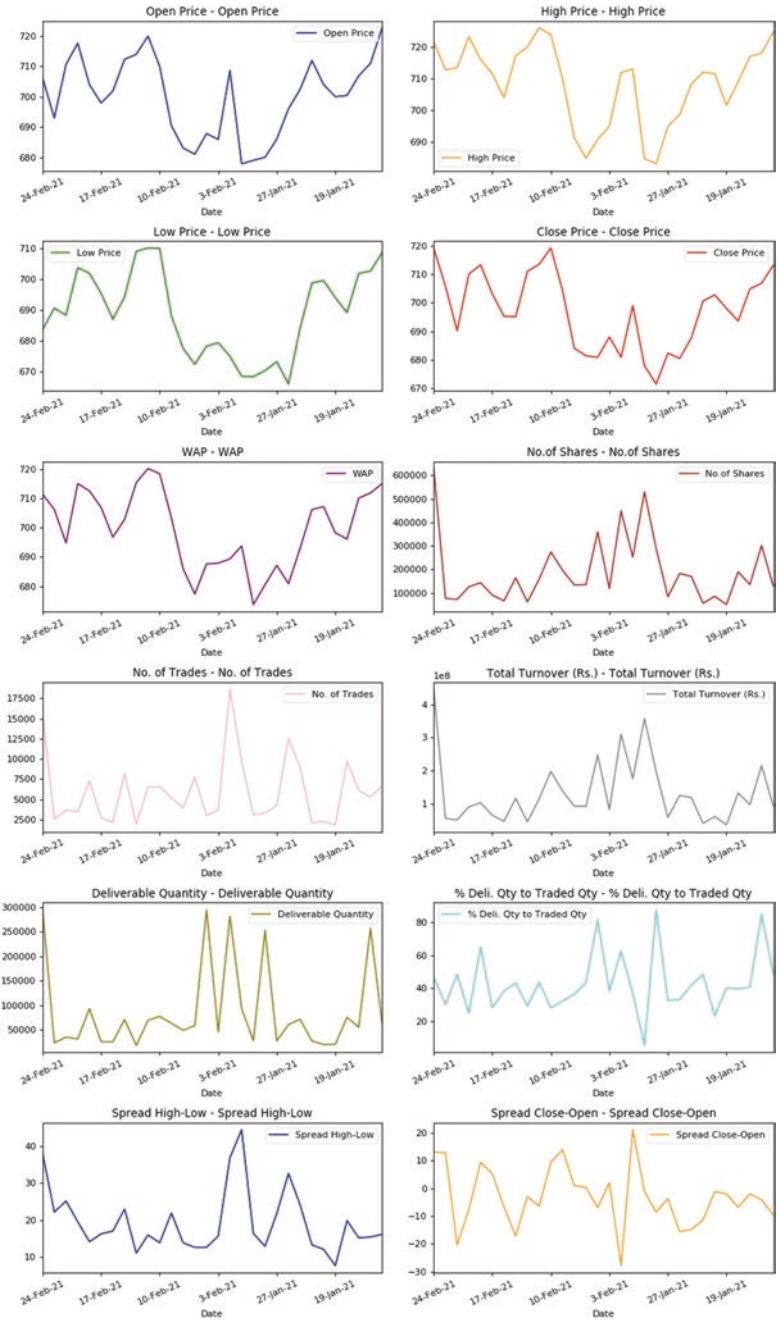


Fig. 4 Plotted graph of stock market data layer preparation

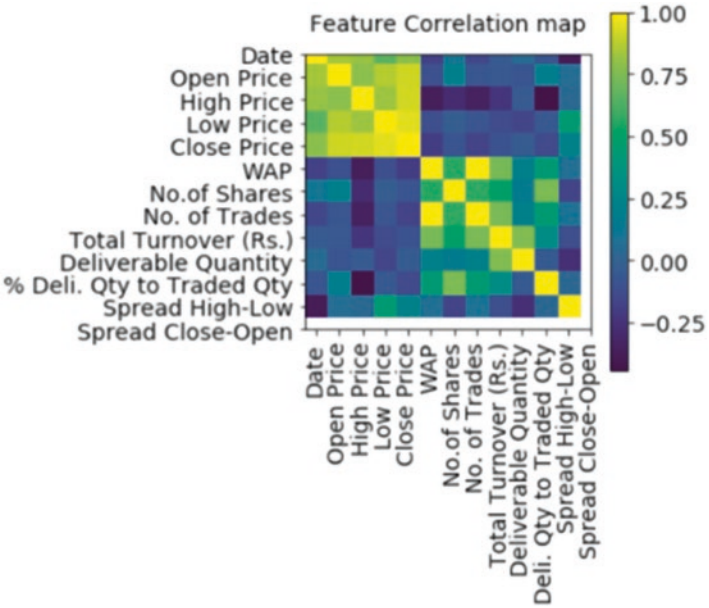


Fig. 5 Plotted correlation feature map of stock market data layer

```
model.summary()
```

```
Model: "functional_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_1 (InputLayer)         [(None, 12, 12)]          0
_________________________________________________________________
lstm (LSTM)                  (None, 32)                5760
_________________________________________________________________
dense (Dense)                (None, 1)                 33
=================================================================
Total params: 5,793
Trainable params: 5,793
Non-trainable params: 0
_________________________________________________________________
```

Fig. 6 Executed LSTM model summary in R language

```
Epoch 1/10
1172/1172 [==============================] - ETA: 0s - loss: 0.1767
Epoch 00001: val_loss improved from inf to 0.14524, saving model to model_checkpoint.h5
1172/1172 [==============================] - 195s 166ms/step - loss: 0.1767 - val_loss: 0.1452
Epoch 2/10
1172/1172 [==============================] - ETA: 0s - loss: 0.1241
Epoch 00002: val_loss improved from 0.14524 to 0.13924, saving model to model_checkpoint.h5
1172/1172 [==============================] - 197s 168ms/step - loss: 0.1241 - val_loss: 0.1392
Epoch 3/10
1172/1172 [==============================] - ETA: 0s - loss: 0.1147
Epoch 00003: val_loss did not improve from 0.13924
1172/1172 [==============================] - 245s 209ms/step - loss: 0.1147 - val_loss: 0.1450
Epoch 4/10
1172/1172 [==============================] - ETA: 0s - loss: 0.1093
Epoch 00004: val_loss did not improve from 0.13924
1172/1172 [==============================] - 227s 194ms/step - loss: 0.1093 - val_loss: 0.1515
Epoch 5/10
1172/1172 [==============================] - ETA: 0s - loss: 0.1073
Epoch 00005: val_loss did not improve from 0.13924
1172/1172 [==============================] - 231s 197ms/step - loss: 0.1073 - val_loss: 0.1496
Epoch 6/10
1172/1172 [==============================] - ETA: 0s - loss: 0.1048
Epoch 00006: val_loss did not improve from 0.13924
1172/1172 [==============================] - 232s 198ms/step - loss: 0.1048 - val_loss: 0.1496
Epoch 7/10
1172/1172 [==============================] - ETA: 0s - loss: 0.1036
Epoch 00007: val_loss did not improve from 0.13924
1172/1172 [==============================] - 233s 199ms/step - loss: 0.1036 - val_loss: 0.1455
```

Fig. 7 LSTM epoch result of 10 in R language

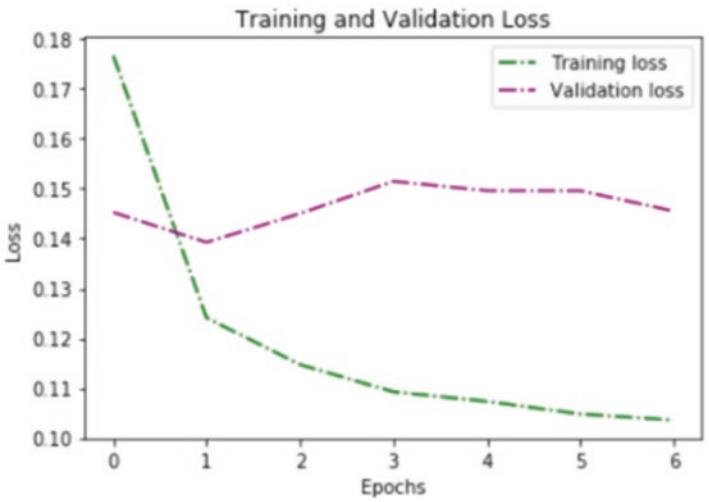
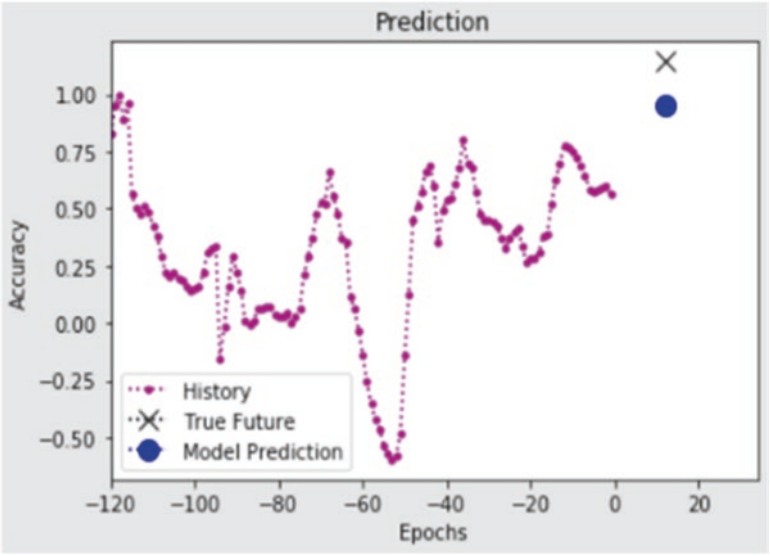


Fig. 8 Performance graph of training and validation loss in HDFC Life Insurance stock



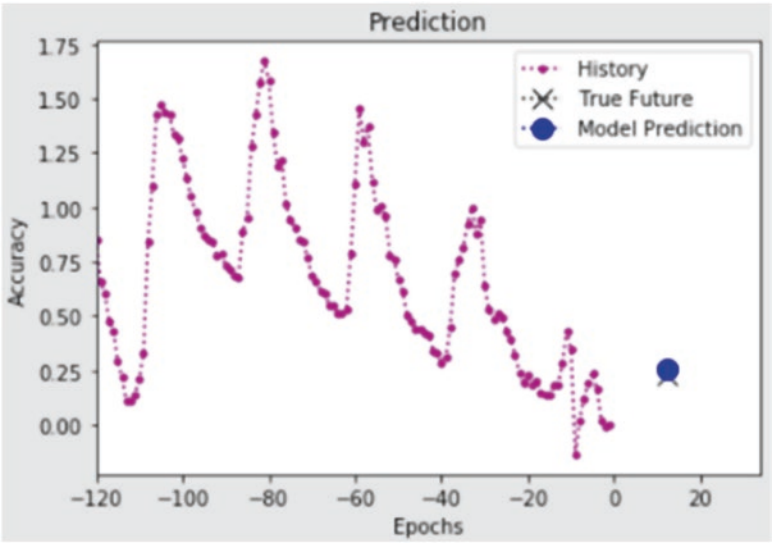


Fig. 9 (**a**) Prediction history performance graph 1: training epoch with accuracy in HDFC Life Insurance stock. (**b**) Prediction history performance graph 2: training epoch with accuracy in HDFC Life Insurance stock. (**c**) Prediction history performance graph 3: training epoch with accuracy in HDFC Life Insurance stock. (**d**) Prediction history performance graph 4: training epoch with accuracy in HDFC Life Insurance stock

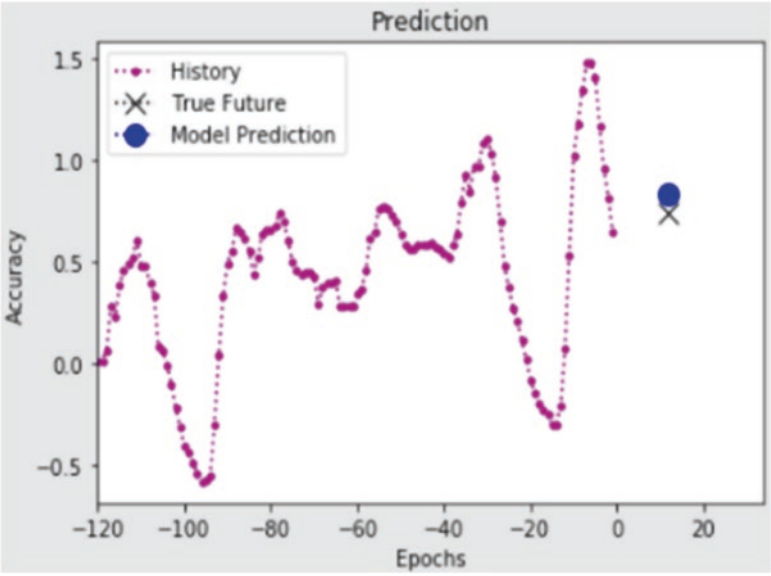


Fig. 9 (continued)

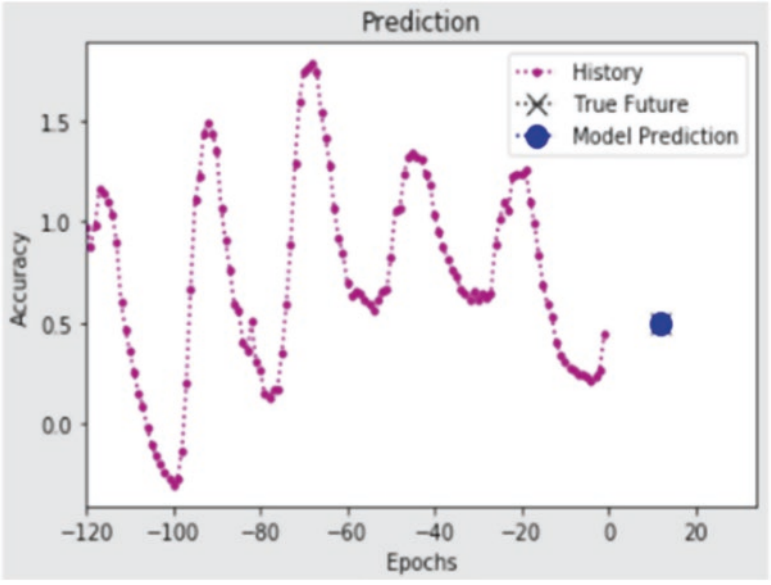


Fig. 9 (continued)

4 Conclusion

LSTM structure can remember necessary information and forget unnecessary information. This ability makes LSTM better than RNN backtrack solver. This paper shows CDRANN using LSTM future prediction model with 99% of accuracy. The loss result of that CDRANN prediction model is very less, which makes CDRANN prediction model to outperform RNN backtrack solver to learn larger dataset. The respective performance graph results are displayed, and the accuracy level of epoch is also calculated using Keras R script, which is very close to the previous one.

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An Efficient Navigation Approach for Toll Plaza Using Map-Matching Algorithm with Hidden Markov Model

R. Manikandan, S. Silvia Priscila, and R. Latha

Abstract The digital navigation world leads to the development of various technologies and platform. The main objective of this research work is to reduce the time delay at Indian toll plazas for making the toll fee payment which in turn would help the user reach the destination in time, by applying a map-matching algorithm holding the principle of hidden Markov model coordinated with GPS. An increase in the number of vehicles and development of the roads to facilitate are noticed to be directly proportionate. But along with other factors that act either as a hindrance or an enhancer for completing a road trip, in time, the main interrogation lies in understanding the role played by toll plazas in galvanising a road trip, as it is based on their varying principle followed for the toll fee collection. This research work helps mainly in avoiding the waiting time at toll plazas, and few additional benefits of it are avoiding the confusion like getting cheated by spurious people pretending to be local vendors, getting irritated by contemptible honkings and viler overtakings while waiting in the toll plaza and showing that irritation by rash driving or less concentration on road while continuing the travel, which is utterly unsafe. Users could avoid being cheated by unauthorised miscreants camouflaging as toll fee collectors on the way or paying at the toll plazas where the toll collection tenure over there is a high scope for this in the future for the researchers to make it up with still

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higher modifications to be used by consumers and business people to deliver and procure goods on the way of a travel, avoid vehicle theft, track the lost car with an built-in app while manufacturing, etc., and it is clarified thus that the proposed algorithm provides an awesome chance for not just completion but in all its possible aspects utterly, for accomplishment. This paper provides an efficient proposed approach for the Indian toll plaza using the proposed hidden Markov model with map-matching algorithm.

Keywords GPS · Hidden Markov model · Toll plaza · Navigation system · Cloud computing

1 Introduction

A journey is started ever with an expectation to reach the destination comfortably in time. Though time management is given priority next to safety during a drive, it is impacted by various hurdles and needs on the way. In particular, waiting at toll plazas to pay the toll fee plays an essential role in time management while travelling on a highway. Hence, optimising the above-mentioned waiting time at toll plazas is taken up as the primary objective of this research work. The top, latest and trendy technologies such as GPS, map-matching algorithm and hidden Markov model and RESTful services such as JAX-RS, Android Studio, SQLite and cloud computing are embraced here for their best possible usage in framing up a new algorithm as intended.

Map-Matching Algorithm: Map-matching algorithms are further segregated as per their different usages into position matching, track curve matching and so on. The most commonly used methods are direct projection, fuzzy logic, neural networks and so on. About track curve method, mathematical representation based on geometric, correlation and probability methods may come in handy. Curve matching is mainly used in complex roads and intensive roads on hills and forest areas, whereas position-based map-matching is straightforward and right in its timeliness. To calculate the position [1], by track curve map-matching is highly complex compared to position-based map-matching algorithm. Real-time usage of curve-based map-matching algorithm is very high compared to position-based map-matching algorithm.

Hidden Markov Model: Hidden Markov model is based mainly on the statistical model with two states as given below: (i) observed state and (ii) unobserved state (hidden state). In the hidden Markov model, the state is not directly visible, but the result is mainly focused on the output state which is visible. The probability distribution of each state will produce possible output tokens. Tokens are sequenced to

provide information about the state. Hidden Markov model is mainly used for the concept of weighted finite automation, which is defined by a set of the toll plazas, distance and amount paid at each toll plaza represented by weight between two states [2–5]. Probabilities of finding the shortest path and amount paid for central toll plaza between the source and destination called Markov chain. This chain is involved in determining the optimal solution from a feasible solution based on the probability of the hidden state. The unambiguous sequence can be transferred into ambiguous through the probabilities used in the Markov chain, which is a hidden process that can be called as hidden Markov model. The word hidden refers to a state which is not acting as a parameter passed to the model but used to determine the known parameter into two states as mentioned. One is of observed state, where each parameter is measured and determined. Another one is the unobserved state, which means the hidden state, where the parameters are unknown until it is reached [6].

2 Research Work

This research work is mainly useful for those who plan to travel on their own or rent a vehicle. To avail the prospective benefit of this research work, initially, the user has to install the appropriate application on the mobile device. Secondly, they have to register on request, providing the user details such as his/her vehicle number, travelling date, source, destiny and a few other personal details as needed. Receiving the calculated toll fee summed up by the app depending on the preference of the route and details provided by the user should then make an online payment using the cards or Internet banking facilities. At times the app would also permit them to avail some discounts if noted to be eligible. Fig. 1 illustrates the role of the research work.

This process can be done with the help of the hidden Markov model, by which the vehicle would be monitored as it starts the journey in the intended date [7–9], time and route. Hidden Markov model is mainly used here to note the crossed area under the observed state and working in the process of capturing up with the thence forthcoming toll plazas under the unobserved state. Hidden Markov model gathers up all the data essential for travel on the route of a journey. As it starts monitoring the vehicle on the day of travel, it proceeds to track the vehicle, and on finding it to have entered each toll plaza, it checks for the payment of the toll fee done by the user online. As the payment details match up with the vehicle details, the information is passed on to the toll plaza employee at work there, whereby the clearance for the vehicle to pass by that particular toll plaza is provided, after deducting the toll fee for that particular toll plaza, from the total amount paid by means of online transaction. The vehicle is permitted to cross that plaza without waiting. This data is stored under the observed state, which means the state which had been visited. The toll plazas which are yet to be crossed in that travel plan are taken as the unobserved state. Hidden Markov model shifts the then current movement of the vehicle from the observed state to the unobserved state using GPS.

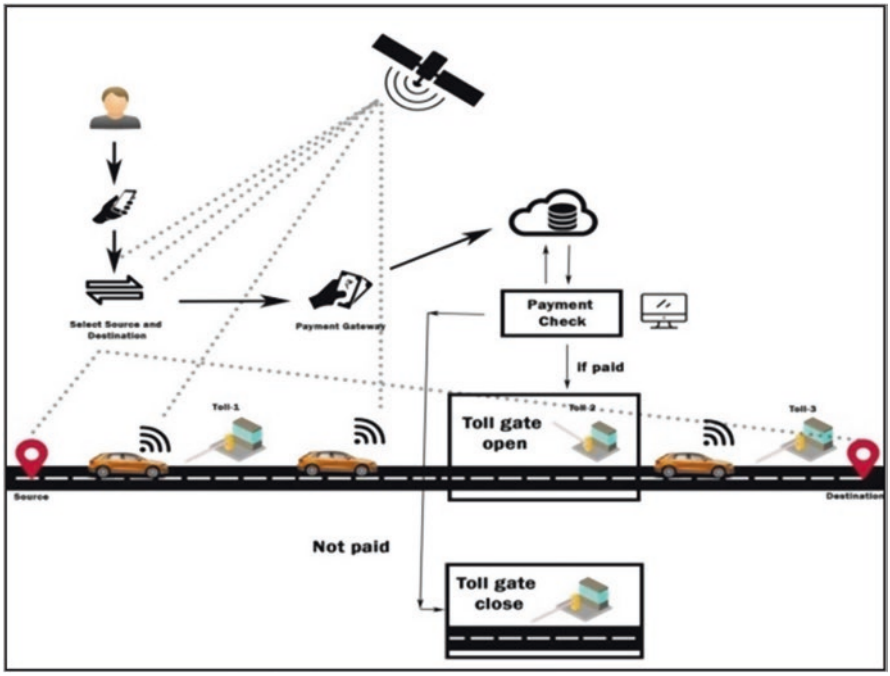

Fig. 1 Process of research work

This research work utilises GPS to the extent possible. In short, GPS is used to track the vehicle with the help of four satellites; among the four, three satellites are used to monitor the vehicle, and one satellite is used for tracking a specific vehicle in particular. GPS is used here to monitor the vehicle, and as it reaches an appropriate toll plaza, as per the hidden Markov model, unobserved toll plaza would be converted to the observed toll plaza. This conversion takes place only when the user is found to have already paid the toll fee via digital pay. Once the vehicle ID tracked via GPS is noticed of having paid the toll fee appropriate for that particular toll plazas where it would be found at that moment by GPS, that toll plaza which was under unobserved state would at once come under observed state, and immediately clearance for the vehicle to cross that particular toll plaza is granted and it is allowed to cross the toll plaza in no time. This helps the user avoid waiting in the toll plaza queue to make the payment and thus to avoid the time delay.

3 Methodology

The congestion management tools are taken up as the substratum when the topic of methodologies used for the research work is geared. This is classified into three categories. First is determining the hourly traffic flow of each toll plaza every day.

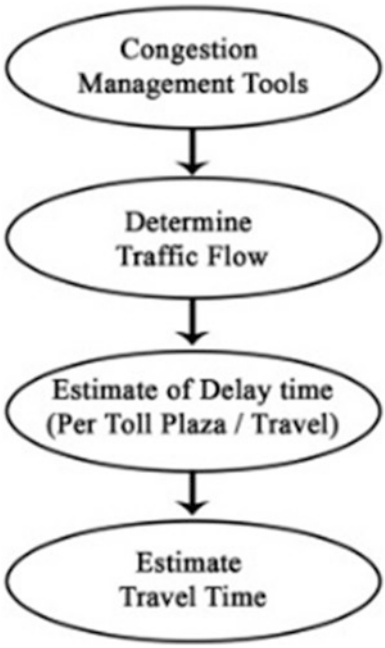

Fig. 2 Congestion management tools

This progresses with the process of estimating the waiting time or wasted time by waiting in the queue of the toll plazas to make the payment of the prescribed toll fee. Third follows a principle to estimate the duration of the travel as shown in Fig. 2.

As to go on with the above-mentioned steps needed to take up the help of congestion management tools, the proposed algorithm is also categorised under three branches, as follows: (a) determine the traffic flow of appropriate toll plaza, (b) estimate the waiting time of a particular toll plaza and also to estimate the total waiting of vehicle, and (c) implementation of a hidden Markov model to venture out the shortest routes.

4 Implementation

This proposed technique aiming at reducing the time delay in toll plaza is mainly crafted using the principle of a hidden Markov model. This model is used to find out the next, neighbouring toll plaza which is classified into two states, such as observed state and unobserved state. Under this model at the starting point, all toll plazas are kept under unobserved state. As soon as the vehicle crosses a toll plaza, that plaza is shifted to the observed state, and those yet to be visited are lined up under unobserved state. As the vehicle keeps moving, this shifting of toll plazas continues up till the destination of the travel is reached as needed. This procedure by principle will find out the next neighbour from unobserved state and move the vertices of v_i from the unobserved state to observed state dynamically.

This process will iteratively continue until the last vertex. An added advantage of this technique is that it exempts the usage of barcode; instead scanning devices like camera and WI-FI device are used to monitor the GPS device which is embedded in the vehicle, and the corresponding coordinates are monitored via hidden Markov model. This technique will thus optimise the delay time in the corresponding toll plaza.

By applying the hidden Markov model, the derivation extends in sequence as given below:

$$\lambda = \left(E_{ij}, D_{ij}, C_{ij}\right) \text{for all } i \text{ to } j, i \text{ as the source}, j \text{ as destination} \tag{1}$$

where;

E is the expected time arrival.
D is the distance between source and destination.
C is the cost between source and destination.

Let us assume that

$$t_{\mathrm{p}} = \left\{t_1, t_2, \ldots, t_n\right\}$$

where t_{p} is the set of the toll plaza in the network.

Using Eq. (1), determine

$$N = \sum_{i=1}^{i=n} t_{\mathrm{p}i} \text{ for all } i = 1 \text{ to } n \tag{2}$$

where N is the number of toll plaza in the network.

$$\text{Let } V = \left\{v_1, v_2, \ldots, v_n\right\} \tag{3}$$

be the number of the vehicle travelling from the source to destination.

For all 1 to n,

$$\text{Let } t_{\mathrm{c}} = \left\{c_{11}, c_{12}, \ldots, c_{ij}\right\} \tag{4}$$

be the cost of toll plaza from *source* (i) to *destination* (j).

To Calculate Cost

Initially, if source and destination are equal which means $i = j$, then

$$\text{Cost}\left[i, j\right] = \text{NULL}. \tag{5}$$

By applying Eqs. (4) and (5),

$$\text{Cost}\left[i, j\right] = \sum c_{ij} \text{ for all } i \leftarrow 1 \text{ to } n, j \leftarrow 1 \text{to } n \tag{6}$$

where c_{ij} is the cost between *source* (i) and *destination* (j).
By applying Eq. (6),

$$\sum C_N = \sum C_{n-1} + C_n \tag{7}$$

where near n state and $n - 1$ state are using hidden Markov model.

Let C be the total amount spent from source to destination.
From Eq. (7),

$$C_{ij} = \sum_{N=i}^{N=j} C_N \tag{8}$$

for all source to destination.

$$\text{Let } t_{\text{d}} = \left\{ d_{11}, d_{12}, \ldots, d_{ij} \right\} \tag{9}$$

be the distance between each toll plaza, respectively.

To Calculate Distance
Initially if i state and j state are equal the, then

$$\text{Distance}\left[i,j\right] = \text{NULL} \tag{10}$$

If (i) state and state (j) are not equal, then

$$\text{Distance}\left[i,j\right] = \sum d_{ij} \tag{11}$$

All state (i) to state (j)

From Eqs. (9), (10) and (11)

$$\sum d_N = \sum d_{n-1} + d_n \tag{12}$$

Let D be the distance between *source* (i) and *destination* (j)

$$D_{ij} = \sum_{N=i}^{N=j} d_N \tag{13}$$

for all source to destination.

Process to Calculate Delay Time

Let S_{ij} be the speed of the vehicle from *source i* to destination *j*.

$$\text{Let} T_{ij} = D_{ij} / S_{ij} \text{ for all state } i \text{ to } j \text{ using } Eq.(13),$$

where T_{ij} is the time taken to travel from *source* (*i*) *to destination* (*j*).

For Particular Toll Gate

$$T_{\mathrm{f}} = \sum_{i=1}^{i=N} v_i \tag{14}$$

where T_{f} is the traffic flow of the particular toll plaza.

$$T_{\mathrm{s}} = \sum_{j=1}^{j=N} v_j \tag{15}$$

where T_{s} is the traffic service at the particular toll plaza.

To calculate waiting of a particular toll plaza using Eqs. (14) and (15).

$$WT_i = \left(T_{\mathrm{f}} - T_{\mathrm{s}}\right) / \left(T_{\mathrm{s}} / 60\right) \tag{16}$$

where WT_i is the waiting time of the particular toll plaza using Eq. (16).

$$TT_{ij} = WT_i \times N \tag{17}$$

where TT is the total waiting time of travelling from source to destination.

Let *N* be the number of toll plaza using Eq. (17).

$$ET_{ij} = TT_{ij} + T_{ij} \tag{18}$$

using Eqs. (10) and (14).

Hence the hidden Markov model is implemented:

$$\lambda = \left(E_{ij}, D_{ij}, C_{ij}\right) \tag{19}$$

where λ represents as the expected time travel from the source and destination, expected distance between the source and destination and expected cost between the source and destination. Proposed algorithm as mentioned already is mainly based on the principle of hidden Markov model, which is classified into two states, termed as observed state and unobserved state. A state which is hidden, in other words not known to the user, is called the unobserved or the hidden state as per the hidden Markov model, and the state known or crossed by the user is termed the observed state.

5 Result and Discussion

Sample data were collected from toll plazas located in four various states of India such as Tamil Nadu, Maharashtra, Andhra Pradesh and Karnataka and were used to corroborate the research work downsizing the time delay of the vehicles in the toll plazas, during their travel. Among the four, first and foremost, let the sample data gotten from Tamil Nadu be considered to prove the efficiency of the proposed algorithm. The toll plaza taken for the case study here is noted to work under the principle ETC (electronic toll collection) in the closed gate system. Accordingly, the user initially has to register with the payment gateway and should place the generated barcode on the vehicle. As the user enters that particular toll plaza, the barcode will be scanned, and the appropriate gateway process will be handled through Wi-Fi. Contrarily as well as advantageously, the proposed system verifies the payment process and clears the way across a toll plaza taking the help of GPS, instead of the barcode. Vehicle number will act as a primary key for accessing payment gateway. One of the advantages of the proposed system is that it avoids the barcode image which might get affected due to environmental changes [10].

Given below table is the sample data taken on a particular date with a regular interval of time, from a toll plaza located in Tamil Nadu. Primarily based on congestion management control, traffic flow at the toll plaza round the clock, between various ranges of time, was gathered up and was tabulated [11]. Table 1 displays how the proposed system reflects better on the traffic flow compared to the existing system in a particular toll plaza [12].

Traffic flow of four busy toll routes between (a) Chennai to Hosur, (b) Chennai to Coimbatore, (c) Chennai to Kanyakumari and (d) Chennai to Salem was considered to compare its clearance rate differing based on the existing and the research work, derived from using the framed formula. Readings were tabulated as given below.

Based on Table 2, using electronic toll collection methods (existing method), Chennai to Salem takes minimum delay time, and Chennai to Kanyakumari takes maximum delay time in the toll plaza during travel.

Table 3 using proposed hidden Markov model (proposed methods) manifests that the time delay while travelling between Chennai and Salem which is the minimum among the four is still more curtailed similarly as noted to reduce highly the delay time while taking the Chennai to Kanyakumari toll route too comparatively. Based on Table 3, traffic flow can be incurred by inferring the difference in the ratio of

Table 1 Traffic flow and service

Route	Traffic flow (vehicles/hour)	Existing service (vehicles/hour)	Proposed service (vehicles/hour)
Chennai to Hosur	465	405	450
Chennai to Coimbatore	432	390	412
Chennai to Kanyakumari	392	342	370
Chennai to Salem	348	311	331

Table 2 Existing delay time

Route	No. of toll plaza	Traffic flow (vehicles/hour)	Traffic service (vehicles/hour)	$T_v = T_s/60$	$T_{diff} = T_f - T_s$	Waiting time (per toll plaza) (minutes)	Total waiting time (minutes)
Chennai to Hosur	7	465	405	7	60	9	62
Chennai to Coimbatore	9	432	390	7	42	6	58
Chennai to Kanyakumari	13	392	342	6	50	9	114
Chennai to Salem	7	348	311	5	37	7	50

Table 3 Route 1 (proposed delay time)

Route	No. of toll plaza	Traffic flow (vehicles/hour)	Traffic service (vehicles/hour)	$T_v = T_s/60$	$T_{diff} = T_f - T_s$	Waiting time (per toll plaza) (minutes)	Total waiting time (minutes)
Chennai to Hosur	7	465	450	8	15	2	14
Chennai to Coimbatore	9	432	412	7	20	3	26
Chennai to Kanyakumari	13	392	370	6	22	4	46
Chennai to Salem	8	348	331	6	17	3	25

incoming vehicles and serviced vehicles. Variation in the percentage was noticed and recorded in both cases separately following the principle behind the existing and research work. For example, considering the route between Chennai and Hosur, where the number of vehicles entering in was 465, at a given period, the number of vehicles serviced using ETC method was 405, whereas the number of vehicles serviced using research work was 450. This increase in the number of vehicles serviced in a given period by following the principle as said in the research work is depicted in Fig. 3.

6 Conclusions

In today's world of hurry and hustle, this research work is anticipated to be of a great benefit. As known, time and tide wait for no man, it goes without saying that time is one major treasure, whose smallest fraction even could never be gotten again. Saving time, by quickening any process, is the most awaited result, next to its successful completion of most tasks we take up at any part of the day. Thereby,

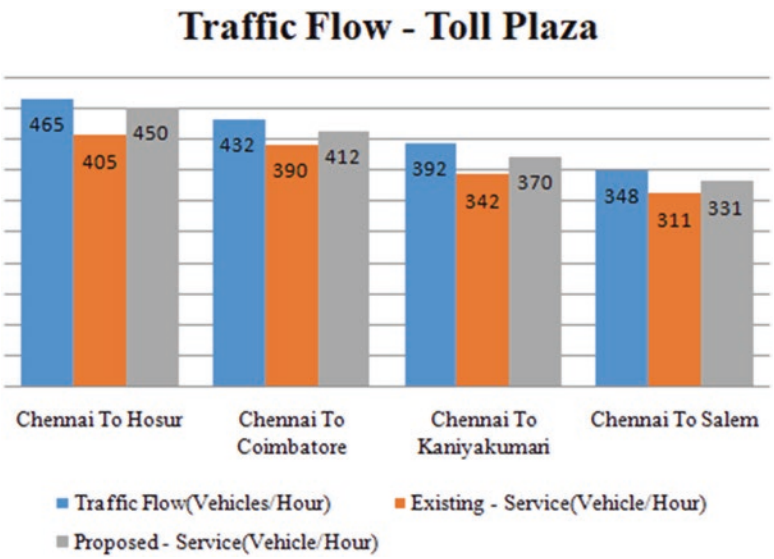

Fig. 3 Analysis of traffic flow for route 1

amidst various hurdles that could be faced along the way, in accomplishing a journey, this proposed technical strategy, saving a good amount of waiting time, is expected to contribute a great step in the technical and social progress. Normally when we try to find directions to travel using map applications, the travel duration displayed first would be varying to a higher extent at many a time as those apps couldn't detect in advance the delay that would be caused by waiting at the toll plazas and some unexpected confusions caused while waiting in the lane at plazas as pointed later in this chapter. Advantageously this proposed strategy copes up to display the travel duration more accurately. Concluded finally here how this proposed principle in few steps and fewer seconds enhances the process of flagging off the vehicle to exit the toll gates on the way successfully. As the travel starts, GPS starts monitoring the vehicle, and all the toll plazas are kept in the hidden/unobserved state as per the hidden Markov principle. GPS also guides the user to travel in the proper route, and as soon as the vehicle enters a toll plaza, appropriate toll fee from the total amount paid by the user is deducted, message is passed on to the toll plaza employee, the vehicle is given clearance, and that particular toll plaza is shifted to the observed state. This procedure continues till the destination is reached.

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Mining of Customer Review Feedback Using Sentiment Analysis for Smart Phone Product

P. Suresh and K. Gurumoorthy

Abstract With the fast growth of e-commerce, a large number of products are sold online, and a lot more people are purchasing products online. People also give feedback of product purchased in the form of reviews. The user-generated reviews for products and services are largely available on the Internet. To extract the valuable understanding, classification of reviews is required from a huge set of feedbacks which have been converted into positive and negative sentiments. The process of sentiment analysis (SA) has mined the attitude, opinions and emotions spontaneously from text, speech and database via natural language process (NLP). It contains feedback review about product, product features or some sentiment emotional views on the product given by the customer. In this research work, feedback from the customer which is associated with smart phones is taken from amazon.com in order to predict the rating of the product given by the user feedback using SA. Feedback review of the customers has been collected from amazon.com, and this research work had nearly 4000 customer feedback reviews based on related categories, namely, ID of the product, name of the product, name of the brand, rating, review of the product and vote based on review. This kind of analysis will be helpful for the customers to identify the better product with quick analysis and find the unspoken commodity. Perhaps the e-commerce sector will increase revenue by giving discounts on unique tacit goods.

Keywords Customer review · Feedback · Sentiment analysis · Smart phone · Product

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1 Introduction

Nowadays huge information, reviews or opinions are getting stored in the websites of social media or e-services in the form of raw data. In recent years, customers prefer to get the product through online. Therefore the prospective buyers choose the right products and large number of data collected from customers in the form of feedback. These research works softly provide opinionated words which assist the e-commerce business to recognize areas that need to be improved. In order to implement the proper methods, the raw data is required, and various methods are either related to adverbs, nouns, verbs or adjectives. However, a recent study shown in SA has the combination of adjectives and adverbs which are stronger than adjectives alone, but none of the research has focused on all the possible combinations of adverbs, adjectives and verbs. This paper presents the theoretical analysis of some well-known methods or proposal of SA. The data is really helpful, as well as knowledge for businesses looking to understand suggestions on their products or services. In fact, it is beneficial for consumers to be helpful with companies, the ratings and opinion stripped from them. For instance, reviews of hotels in a city that helps a consumer search for a good hotel to stay a city. Similarly, product ratings help other people determine whether the phone is worth buying or not. Similarly, phone reviews facilitate different users to choose whether or not the mobile phone is worth for money or not [1, 2]. This methodology incorporates various algorithms for evaluating and making sense out of the corpus of data. SA uses the manipulation of natural language to remove the particular knowledge from the data [3, 4]. The key component takes consumer reviews as input in NLP system and then separated by tokenizer into token. A series of characters combined in a text is called a symbol, while a semantic unit for processing is identified. The tokenizer contains punctuation marks, icons, words, etc. Consumers who help with an additional level of quality segregation for the product may convert an expression into word-level tokens that have been executed to generate rules that provide word counts and even ranking. In this analysis, consumer reviews related to smart phones were obtained from amazon.com in order to estimate the product ranking based on user feedback using SA. The organizations of this paper is described as follows: Section 2 defines the associated review about method based on SA; Section 3 defines the proposed methodology based on customer review data collection, data preprocessing, SA and frequency of review rating; and Sect. 4 discusses the conclusions.

2 Literature Review

In this section, many researches have been done using SA. The area of text-based classification was not much of a research work done to classify the sentences or word related to feedback rating.

[5] describes various mobile phone reviews based on SA which can be obtained by learning various posts given from various numbers of users that can classify the smart phones. [6] discusses to collect feedback on Tokopedia's quality of service on-line analysis over several months of observations. Because of its high-level precision, the Naïve Bayes classification technique is applied, which facilitates large data processing. The outcome showed that the element of reliability and personalization needed more focus because they have a strong negative feeling. [7] suggests a continuous sentiment analysis (CSA) system for repetitive study of customer emotions emphasizing the intent of one such effort to catch the tone of the message. This 'sentiment analysis' approach is relatively a recent technique which uses NLP to provide meaning to the plentiful data available at hand. [8] explores a novel approach by trusting the comments on social media to build on a specific topic. The proposed solution includes a list of the words used to construct training dependent on knowledge of positive words and negative words. Originally data is obtained from web networks, namely, Amazon, Flipkart and eBay, etc., along with collecting special attributes from the information gathered and then applying them to vector and value set. This research study is carried out step by step, explaining the feedback, based on interpretation of SA. [9] proposed a methodology that used reviews from many customers who visit different hotels, book rooms and order food. This can be achieved using SVM algorithms, logistic regression and Naive Bayes. [10] proposes a machine learning (ML) model for SA and compares some popular ML approaches in the context of sentiment classification. The classifier efficiency is calculated in terms of precision. [11] explores how text analysis methods can be used to investigate based on various tweet language patterns and message volumes on Twitter into some of the details in a series of posts. The experimental tests reveal that the current classifiers for machine learning are more effective and accomplish better in terms of precision. [12] proposed detailed process descriptions of sentiment polarity categorization. Experiments were done with positive findings on both sentence-level and review-level categorizations. [13] discusses the long short-term memory (LSTM) classifier provides the best results in classifying comments with POS-tagged lexicon features into positive and negative review. [14] illustrates that mathematical approaches are frequently mixed with conventional linguistic laws and definitions. [15] discusses the study of emotions relevant to the field of education and gamification of learning. Naïve Bayes (NB) is the better classifier in which the results based on accuracy showed better results compared to the disagreement group when performing 1000 students for testing, the agreement group in learning to use gamification, that may improve student's evaluation in learning. [16] suggests to introduce a multimodal sentiment prediction framework from various modal sources, namely, images, text and audio, that can interpret the projected emotions and combine them to understand the student's community emotions in a classroom. This system includes a digital microphone device that records the student's live video and audio streams during a lecture. [17] had used lexicon-based approach from Twitter posts to implement the SA mechanism. In this paper SentiCircles and lexicon-based methods are proposed which have been described primarily on the logical semantics that expresses the word-oriented sentiment. There are three separate databases

which are Stanford Sentiment Gold Standard (STS)-Gold, Obama-McCain Debate (OMD) and Health Care Reform (HCR) tested by the proposed process. [18] suggested a Twitter data SA method. This paper describes the few methods to do text-based SA using lexicon-based methods. They dealt with three separate databases, AlchemyAPI, OpenCalais and Zemanta. [19] describes the approach of hybrid model of SA which is based on learning and lexicon. These can define emotions and polarity of the opinion which can be obtained with better accuracy of 75%. [20] suggested a technique of sentiment analysis through the study of restaurant domain customer feedback. In addition, creating the rule base to classifier by predicting the polarity of the review used by priority based algorithm. For incremental instance counts, the analysis performs well by k-nearest neighbourhood (K-NN) create. [21] suggested the a priori algorithm is a basic association rule mining (ARM) algorithm that can be used to mine frequent item sets and their related rules. An improved a priori algorithm is used to prune the subset and classify the more regular item collection, resulting in a better smart phone range. [22] has addressed the research of AI has attained an excellent level with a sublevel of ML and deep learning application with a minimal method that is proceeding to concrete future business.

The above study has to identify polarity of words using the analysis of SA techniques and several NLP concepts to linguistic the tokenized sentence and words.

3 Research Methodology

Most of the business establishments have done a 'market basket analysis' to evaluate the user input feedback on their mobile phone and buyer motive. According to an instance, a person is buying a mobile with the best battery consumption feature in the basket. Later, he switches over to better front camera features instead of considering the battery life. Moreover, in the current techniques, there is no consideration or intimation why the user or customer had switched over to another feature like front camera features instead of battery consumption feature. The existing techniques may not predict exactly, whereas the implicit rule interference algorithm is used to identify the kind of featured mobile that has been purchased by the person based on the basket data alone. To evaluate the explicit and implicit model, the present research work considers smart phone feedback analysis-based rule mining with SA. This work aims to progress a recommendation algorithm that is built from an explicit and implicit analysis based on laws of association. This paper discusses the use of NLP for deep learning as seen in Fig. 1.

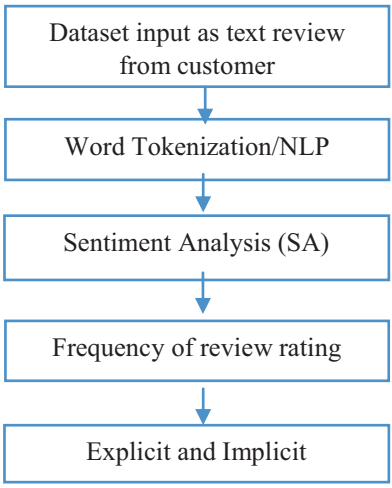

Fig. 1 Block diagram of proposed methodology

Table 1 Features involved in the data set

Feature	Description
Prod_ID	Identification number of the product
Prod_Name	Name of smart phone
Brd_Name	Company name
Rating	Customer rating scale between 1 and 5
Rvew	Customer feedback provided for every smart phone
Rvew_vote	Number of people providing vote who found the review helpful

3.1 Input Dataset/Feedback

The data collection employed contains consumer ratings of smart phones obtained from amazon.com. The buyer agrees a recommendation on a scale from 1 to 5 and gives its individual opinion according to the overall experience about the product. The mean value is calculated over all ratings in order to arrive at the final ranking. Other visitors may also mark yes or no to a comment that has added benefit to the review and reviewer depending on their helpfulness. In this report, we looked at over 4000 user interface reports on amazon.com for cell phones. The dataset collected from 'http://www.kaggle.com' are outlined in Tables 1 and 2 with the following attributes from amazon.com based on the category 'Cell Phone'.

Table 2 Feedback and rating from online shopping customer based on product ID

S. no.	Prod_ ID	Prod_Name	Brd_Name	Rating	Rvew	Rvew_ vote
1	PID1	Galaxy SPHD700	Samsung	5	I feel so lucky to have found	1
2	PID2	Apple iPhone 5c 16 GB Green	Apple	5	Awesome description, condition and seller Very pleased, thank you	0
3	PID3	Lenovo A850	Lenovo	4	A very good phone, excellent hardware, very good performance and high compatibility	6
4	PID4	Nokia Asha 302	Nokia	3	Shipped quickly and was exactly what I expected	2
5	PID5	BlackBerry Bold 9650	BlackBerry	4	I liked	0
6	PID6	Huawei Honor 6 Plus	Huawei	5	Excellent	1
7	PID7	5530 XpressMusic	Nokia	4	The phone is pretty good	2
8	PID8	8330 BlackBerry	BlackBerry	4	Good	0
9	PID9	ACER LIQUID E700 TRIO	Acer	4	It works well	1
10	PID10	Acer Liquid M220	Acer	5	This is the best budget phone	0

3.2 Data Preprocessing: Word Tokenization and NLP

Once the analysis text is imported, it is treated as individual consumer input, which is tokenized and analysed by NLP to generate the appropriate relationship. However, NLP has helped in categorising this method as a regulated programme of natural language that may be apprehensive in relation to machine and human language from the computer science with deep learning. The vast amount of text was analysed and dealt with using NLP predictive analysis. This is a deep learning technique that includes stemming, chunking data and removing stop terms. The benefit of NLP in generating emotion words by segregating the words in terms of noun and even the paragraph and sentences are tokenized and chunked in deciding the sentences as positive or negative. As a result, NLP is often used as a translator when translating from one language to another. It can produce low noise, resulting in reliable results. NLP is used to feed consumer reviews as an input and is then separated into tokens by a tokenizer. A character's series has been paired with organisation containing punctuation marks, icons, special characters, sentences and other elements,

resulting in the modification of a sentence into different words using word tokenization. This study looked at how the Natural Language Toolkit (NLTK) is calculated and used with Python and how it is used to help and understand the shape of sentences as well as their context. According to this approach, the analysis must change the consumer input expressed in the attribute of review language, as well as the text of unstructured data to structured data. To begin, all NLP tasks use data from part of speech to find nouns, verbs, adjectives and roots for each word in the sentence from the analysis document. This suggested chunking NLP algorithm aids in distinguishing sentiment terms such as adverb, noun and adjective that are used as a function that can reflect high accuracy in the analysis document.

Chunking NLP Algorithm for Extracting the Required Terms

Step: 1 Get the information you need in terms of tokenization requirements Defextract_NN

Step: 2 assign grmr = r “”

Step: 3 NBAR: # Adjectives and Nouns, Noun during terminated words

{<NN.*>*<NN.*>}

Step:4 NP:{<NBAR>}# connected with, above, in/of/etc..

Step:5 recognising the adverbs, nouns, and adjectives that are used in the summary document to express one's viewpoint {<NBAR><IN><NBAR>}

“”

Step:6 parsing the partial syntactic structure of a sentence Chkr as nltk.RegexParser(grmr)

om = set()

Step:7returing over tokenization of specified character cnk as tokrnizerfractory for this chunker

Step:8 for tree in cnk.subtrees(filt = lambda t:t.label() = = ‘NP’);

om.add(‘’.join([child in tree.leaves()for child[0]]))

returnom

Step:9 sub= []

forsentenc in data;

#extract predefine the structure of sentences along its meaning NN (sentenc)

Step:10concat method in the string class as Sub.append(extract_NN(sentenc))

print (sub)

3.3 Sentiment Analysis

Customer feedbacks are evaluated in this proposed work using SA which has been received from the website. Before charging the money, the customer needs feedback about the company. At the moment to read all the suggestions has not possible which was provided by the customer in the website. However all kinds of product analysis or feature analysis present in the companies are available with new information. Therefore, all kinds of essential inputs that have been provided by the customers are possibly to be missed. Thus the organized review rating frequency has assisted to resolve previous challenges. Then word count has been calculated from the extraction of all tokenized words based on SA. These can be obtained by deep learning. The easiest way to interpret the reviews using an SA along with word count is to figure out the feedback rating. Hence, the rating can be based on the reviews given by the customer. After the SA output has been received, the consumer should make a quicker and minimized attempt to read the feedback as the decision. The analysis terms are equipped using document frequency (DF) or inverse document frequency (IDF) and have been used for the sake of deciding the phrase count displayed in Table 3.

Table 3 Calculate word count

PROD_ ID		Product name	Brand name	Rating	Reviews	Review votes	Word counts
0	PID1	Galaxy SPHD700	Samsung	5	I feel so Lucky to have found this used (phone…	1.0	{‘after’: 1, ‘again’: 1, ‘all’: 1, ‘an’: 1, ‘a…
1	PID1	Galaxy SPHD700	Samsung	4	Nice phone, nice up grade from my pantach revu…	0.0	{‘an’: 1, ‘and’: 2, ‘android’: 1, ‘are’: 1, ‘b…
2	PID1	Galaxy SPHD700	Samsung	5	Very pleased.	0.0	{‘please’: 1, ‘very’: 1}
3	PID1	Galaxy SPHD700	Samsung	4	It works good but it goes slow sometimes but i…	0.0	{‘but’: 2, ‘goes’: 1, ‘good’: 2, ‘it’: 3, ‘its…
4	PID1	Galaxy SPHD700	Samsung	4	Great phone to replace my lost phone The only….	0.0	{‘adjust’: 1, ‘again’: 1, ‘am’: 1, ‘but’: 1, ‘…

Algorithm for Sentiment Analysis

Step 1: CountVectorizer() converts a collection of text documents to a matrix of token counts

Step 2: assign a shorter name for analyze

Step 3: analyzer = vectorizer.build_analyzer() #which tokenizes the string

Step 4: If the string is not empty, tokenize it and proceed.

```
If analyzer(s):
    d = {}
```

Step 5: Count the vocabularies and convert to an array.

Step 6: item() transforms the dictionary's (word, index) tuple pairs

Step 7: For k, v in vc.items()

```
D →index:word
For index, i in enumerate (w[0]);
C →word :count
```

Return C

Step 8: dF1 = dF→ document frequency

```
dF['Rating'] . value_counts(). To_frame()
```

Step 9: color dF1[Rating] #Rating 4 higher→ positive, Rating 2 lower→negative, Rating 3 → neutral

These reviewed word count to form a selected emotional word has been vectorized and gets associated with particular customer. The positive and negative feedback based on selected words – ['best', 'good', 'love', 'amazing', 'impressive', 'super', 'glad', 'fantastic', 'funny', 'wonderful', 'extraordinary', 'awesome', 'bad', 'boring', 'unhappy', 'never', 'upset', 'sad', 'terrible', 'disappointment', 'poor', 'confused', 'hard' and 'hate'] – are illustrated in Fig. 2.

In this work the frequency of the review rating is from 1 to 5. Very positive, positive, neutral, poor and really bad are the ranking ranges that are used. In a score, for example, very good = 5 stars and very negative = 1 star, all of which are translated onto a five-star grade. It indicates the overall rating scale with corresponding product_ID is illustrated in Fig. 3.

The buying ranking amount in this 3D chart depicts the measurement of both the overt and tacit relationships based on consumer input (Fig. 4). Based on the average value of buyer purchasing number of items being associated with mixture of goods and object infrequent, the X axis represents the product ID, the Y axis represents ranking and the Z axis represents the number of sales in Fig. 4.

```
Selected Words
great      8919
love       3305
happy      1150
awesome     921
bad         787
dtype: int64

ProductID
PID74     1448
PID420    1237
PID56     1069
PID37     1007
PID64      919
Name: PROD_ID, dtype: int64
```

Fig. 2 Plot the frequency of sentimental words

This kind of analysis may be helpful for e-commerce business to improve the sales and identify the implicit product based on providing offers for particular implicit products.

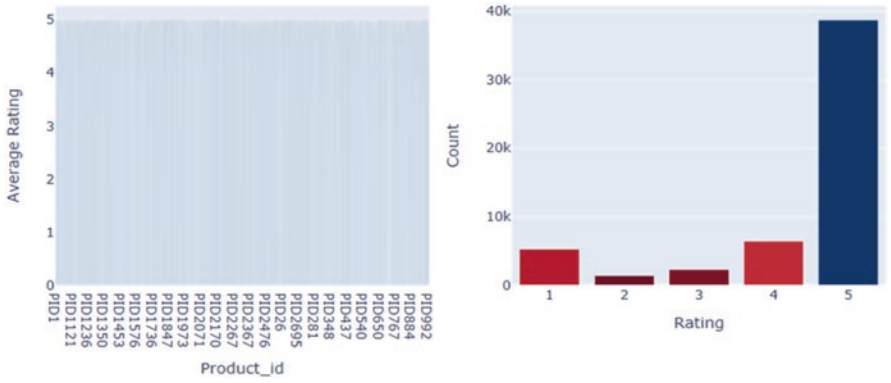

Fig. 3 Average rating based on product ID

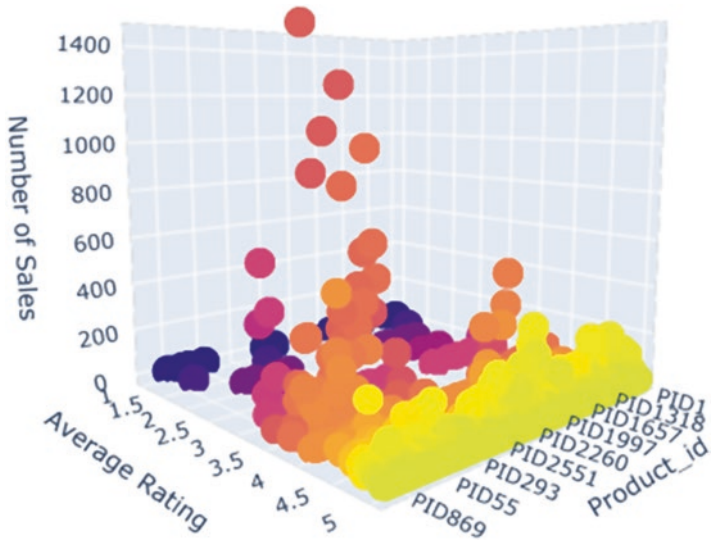

Fig. 4 3D plot of the number of sales, average rating and product ID

4 Conclusion

The most difficult task for the user is to choose the best cell phone while shopping online due to app features that are difficult to justify. Consumer reviews and ratings, on the other hand, can suggest phone quality to the customer, but there is a lag in determining the exact device feature quality based on ranking. Many businesses claim that their business success depends solely on customer satisfaction. Therefore, scientists are encouraged to find better solutions for SA. Consequently, the aim of this project was to use SA to meet the needs of customers with their review text reviews. This SA works for natural language processing (NLP), which helps

tokenize text for word counts. As a result, the word count is applied to the emotion terms as well as the consumer rating based on product ID to decide which mobile phone is better. This method of research has to be boosting the sales by defining the indirect product and offering approach for the various implicit products. In future research work, proposed system is made to evaluate the train and test dataset of SA with various classification techniques for justifying the accuracy level of qualified model.

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Privacy Preservation Framework for Big Data Analysis

Paul Rodrigues, Ayman Ibrahim Qahmash, Sarafudheen M. Tharayil, and Sajeer Karattil

Abstract This paper discusses the framework elements for privacy interactive data retrieval, which is part of the series of research works by the authors with a focus on privacy preservation for big data in organizations. It focuses on interactive privacy scenarios, especially in the data science applications. The framework conceptualizes and implements a unique mechanism of privacy preservation for a distributed data science scenario for big data platform which has multiple stages. The framework utilizes privacy elements and features of differential privacy such as privacy accountant, Renyi differential privacy, advanced composition and such. The privacy loss element is discussed with a focus on budget calculation considering the organization hierarchy, relative anonymity and user authorization.

Keywords Big data · Computing · Privacy-preserving machine learning · De-identification · Anonymization · Apache Spark · Differential privacy

1 Introduction

The evolving digital information from tremendous sources brings a lot of opportunities of knowledge, but it brings a lot of security and privacy challenges. In the information age, it is important for organizations to preserve privacy of dataset such as employee salary, customer interests, organizational internal structure and customer interaction details. A very important activity in this regard is to define the methods and practices for removing the privacy information and at the same time make the data useful for preserving privacy [1]. Privacy preservation of individuals is

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becoming a prime concern of organizations while sharing the datasets. Considering the concerns, a trade-off needs to be defined between the use of potential sensitive data and privacy promise, containing procedures, automation mechanism and tools. In other words, the privacy preservation framework needs to be established considering different types of users in the organization and different privacy parameters such as privacy budget [2].

Though most of the big data systems are announced to be securely preserving privacy, the risk comes when an adversary tries to link different meaningful data together to uncover individual privacy. Different levels of authorization for same datasets for different types of users such as data analysts and senior management add up the complexity in big data scenario. This research work focuses on interactive big data privacy of the framework, which takes care of the big data privacy preservation issues in interactive data access scenarios. The non-interactive mechanisms are discussed in other research papers [3]. For non-interactive data publishing, such as releasing a dataset for research, data anonymization mechanisms are implemented for preserving privacy of massive data. Constraints and conditions are set considering characteristics of big data scenarios.

Firstly, important definitions and mathematical background are given before formally defining and solving the problem. The framework conceptualizes and implements a unique mechanism of privacy preservation for a distributed data science scenario for big data platform which has multiple stages as shown in Fig. 1. This is achieved with an ensembled learning approach and preserving privacy. This paper then discusses the privacy elements and features of differential privacy as privacy accountant, Renyi differential privacy and advanced composition that are used for the framework [4]. The privacy loss element is discussed with a focus on budget calculation considering the organization hierarchy, relative anonymity and user authorization. The algorithms are defined for implementing the privacy preservation considering different users and global parameters. This framework defines the sensitivity parameters and the privacy budget and illustrates the mechanism to add the noise using differential privacy noise addition mechanisms such as Laplace mechanism. As there are many machine learning scenarios such as regression, classification, clustering and neural networks, most of the scenarios can be addressed using the framework defined here. For illustration purpose and to prove the concepts, we use a distributed version of *k*-means clustering algorithm and implemented an

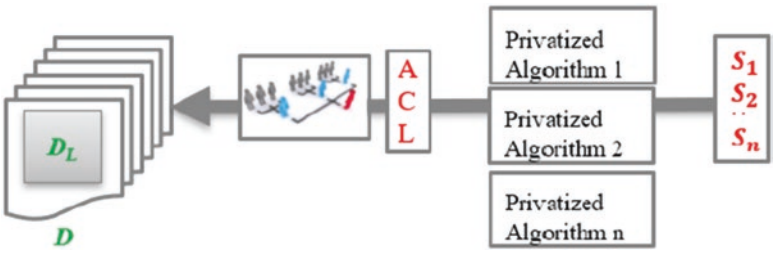

Fig. 1 Privacy-preserving interactive data publishing

ensembled version of it applying privacy preservation. The privacy-preserving *k*-means implementation uses the framework to calculate the centroid. The proof of concept is evaluated using the error metrics to find the accuracy of the learning.

2 Background

The organizations are responsible for protecting its sensitive information from privacy threats inside and outside. There need proper measures to safeguard the datasets during interactive data analysis. The interactions with the datasets usually involve database queries for activities such as filtering, projecting, sorting and ordering datasets. Accessing data online adds new challenges in addition to the organizational-level hierarchy structure and individual access level to the organizational confidential data. The big data processing adds more complexity due to distribution, replication and parallel processing.

The organizational authentication and authorization mechanism limit access to the data for the users. The challenges with the current access control model are that once the user has access to the authorization, the analyst can get access to the privacy details. The traditional mechanisms such as data anonymization, data encryption and data perturbation have been prone to attacks especially in interactive scenario such as linkage attacks and background knowledge attacks. Encryption scheme make sure the data security, but once the data is decrypted, the data analyst could try for a privacy attack.

Differential privacy guarantees hiding existence of individuals in a dataset with a very strong theoretical foundation using probability mathematical model [5]. Many of recent state-of-the-art applications use differential privacy for big data, mobility and privacy-preserving data mining (PPDM) scenarios. The framework provides mechanism to specify the threshold in a differential private way in the access control and authorization mechanism, thus limiting the privacy breach by the analyst.

3 Related Work

Differential privacy (DP) has been accepted widely by the community, a has gotten wide acceptance in the data science community and is quickly emerging for privacy preservation in machine learning including deep learning. DP guarantees protection against linkage and statistical disclosure attacks, and it has the capabilities to quantify the privacy budget. The composition mechanism got matured from its initial simple composition to more sophisticated mechanisms such as adaptive composition and privacy accountant [6]. Privacy accountant helps keep track of the privacy loss and budget consumption in each step of machine learning and deep learning

calculations and could provide the best suitable privacy proposals for the following steps. This will help in bringing a privacy-utility trade-off. The recent derivative of the DP, called Renyi differential privacy (RDP) [7], absorbs different features of concentrated differential privacy, advanced composition, moment's accountant and such. This chapter focuses on the composability mechanism and provides a privacy accountant mechanism based on RDP.

Machine learning is one of the most important functions of interactive data analysis, and a lot of studies are going on for making the data science process privacy preserving. Other types of analysis could be explorer data analysis (EDA) or principal component analysis (PCA). Regardless of the type of the data access, there might be a distributed data process, a combiner process (or ensemble) and then privacy-preserving result publishing [8].

4 Considerations for Interactive Privacy

In interactive settings, the privacy framework accepts the query and an abstract answer to preserve privacy, where the answer is very close to the real answer. In classical solutions for interactive scenario, such as differential private interactive query settings, the user authorization, hierarchy structures, parallel processing and distribution of data are not considered and rather easy to implement. The privacy framework implemented here considers these complexities.

The dynamically calculated privacy budget with a given hierarchy structure limits the user data access and thus reduces the sensitivity and exposure to the entire dataset. This helps the analysts execute more interactive queries, whereas bigger complete dataset might lead to higher data sensitivity and thus usually limit with the use of smaller number of queries.

The goal of interactive mechanism method is to achieve more query execution with higher accuracy and with given privacy constraints and parameters. The choice of selected privacy preservation mechanism for interactive query mode depends on the requirement of the application.

As illustrated in Fig. 2, the interactive settings heavily depend on the differential privacy literature. An extended version of differential privacy scheme called (σ, ϵ)-Renyi differential privacy is adapted for the framework to better illustrate the features such as privacy accountant. But the usage of algorithm is not limited to this mechanism, and different types of differential privacy can be accommodated. Renyi privacy parameters $(\epsilon, \delta, \sigma)$ and framework budget calculations from the user and global settings improve the overall yield of the system.

During the machine learning processes, a random sampling mechanism is used at different stages. In this work, a random sampling is used for selecting the partition of the data for individual nodes for machine learning. The concept of subsampled RDP with analytical moments will help improve the privacy preservation mechanism in this context. Apart from privacy preservation, differential privacy

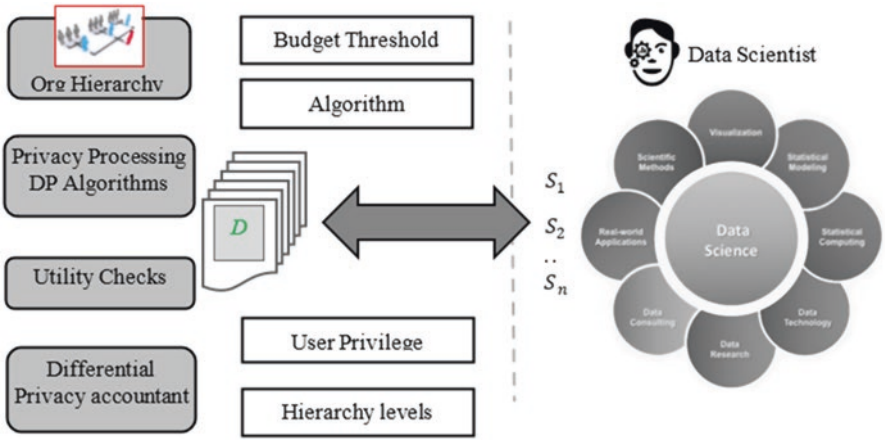

Fig. 2 Considerations for interactive privacy

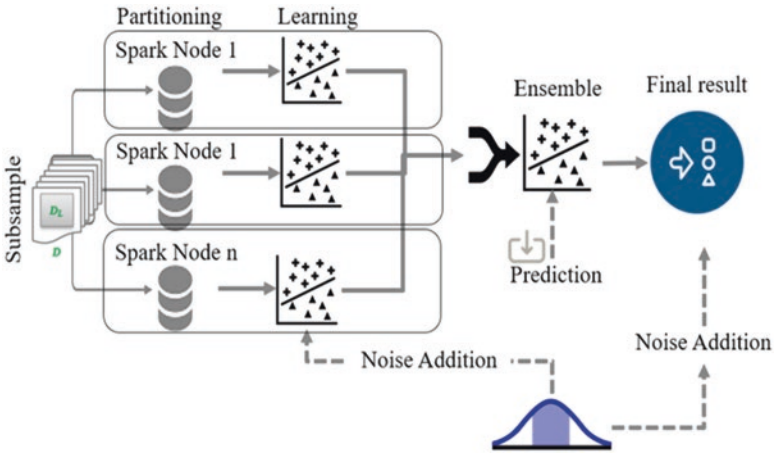

Fig. 3 Privacy-preserving distributed learning framework

serves another important regularizing function capable of addressing some of the problems commonly encountered by practitioners such as overfitting.

The framework provides an innovative approach for privacy preservation for machine learning scenario. Preserving privacy in machine learning cycle in the framework is explained in Fig. 3. The effective dataset received for the process is subsampled using an independent and identically distributed (i.i.d.) mechanism, which will randomize the machine learning process. This data is then fed into different learning algorithms, for example, a linear regression algorithm.

This subsampling mechanism will help in implementing the privacy amplification [9–12], providing a better range of privacy budget. The subsampled data goes through the iterative machine learning process and will produce a machine learning

model. Individual privacy during the learning process in the spark nodes is controlled by the privacy parameters such as privacy budget. The noise added in each step of the learning process will help hide individual details. The amplified mechanism used in the privacy learning helps in reducing the error rate during the learning process. This DP-based privacy protection will protect individual information for cases where the attacker tries to inject a record with similar attributes during prediction and tries to match the output.

The machine learning model produced will be combined to have an ensembled model. This ensembled model will be used for the prediction by the end user. The predicted output will be injected by the random noise controlled by the privacy accountant. Thus, the noise is added at two times: first during the learning process and second during the prediction process.

The framework has different users and global parameters as illustrated in Fig. 4. The user parameters are calculated from the user access control profile while trying to access the dataset.

The privacy-preserving system needs to define the following global parameters. The hierarchy minimum and maximum values define the maximum levels in the organization structure. Some users such as senior data scientist will have a special privilege for accessing the data, and this can be quantified using the parameters $G_{\min}$ and $G_{\max}$. Renyi differential parameters (α, $\epsilon_{\max}$) and privacy accountant functionalities are integrated with the maximum budget estimations.

Users will be having hierarchical access (HL) and special privileges (GL). The budget for a user (ϵ_L) and the privacy relaxation (δ_L) for a specific dataset are calculated dynamically from his access levels and global parameters. These parameters will be then used by the privacy accountant and will keep track of the user privacy budget. The details of the parameters are given in Tables 1 and 2.

The machine learning approaches use subsampling widely for splitting datasets for different reasons. One reason is to split the set into random set of training and test sets. Random subsampling is a variation of the learning model, where the

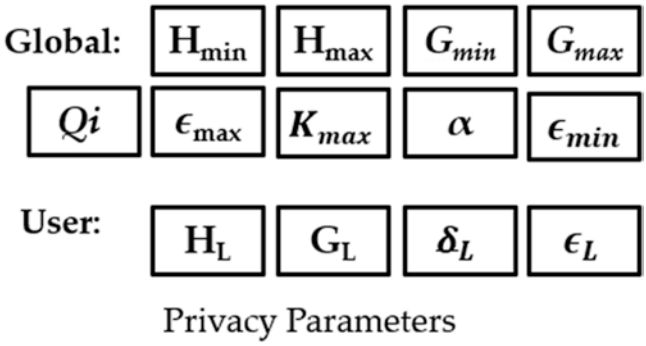

Fig. 4 Framework parameters

Table 1 Global parameters for interactive publishing

No.	Title	Name
1	Hierarchy minimum value	$H_{\min}$
2	Hierarchy maximum values	$H_{\max}$
3	User special privilege minimum	$G_{\min}$
4	User special privilege maximum	$G_{\max}$
5	Minimum budget for the dataset	$\epsilon_{\min}$
6	Maximum budget for the dataset	$\epsilon_{\max}$
7	Alpha value for Renyi DP	α

Table 2 User parameters for interactive publishing

No	Title	Name
1	User hierarchical access	HL
2	User special privileges	GL
3	User privacy relaxation	δ_{L}
4	User budget for a user	ϵ_{L}

learning method is repeated k times. The overall accuracy estimate is taken as the average of the accuracies obtained from each iteration. Another scenario is splitting the dataset into mini batches in the deep learning scenario. In the proof of concept, experiments for this thesis use a randomization mechanism to partition the data into multiple subset to simulate the distributed k-means clustering algorithm.

RDP exploits the randomness of the subsampling mechanism. It reduces the sensitivity by using a sample of the original data, thus providing more data manipulation with the given budget. The overall subsampling mechanism can be illustrated in Figs. 4, 5, and 6. The overall process is divided (like k-means clustering), computing the statistics on the sample and then combining the subsamples with different mechanisms.

5 Privacy Accountant

The moments accountant data structure keeps track of the RDP-based privacy mechanisms for the sequence of data accesses. Composition in RDP for two mechanisms is $\epsilon \mathrm{M1} \times \mathrm{M2}(\cdot) = [\epsilon \mathrm{M1} + \epsilon \mathrm{M2}](\cdot)$. At any given time, let the composition of all algorithms be the M, and the moments accountant can be used to produce an (ϵ, δ) DP environment. This allows the analyst to select the best values of the given ϵ

User	Roles	Access Level	Privacy Risk	Budget (ϵ)
M1	Manager	View & Edit	Low Risk	All Values
S1	Supervisor	DP View	Medium Risk	{0 - 12}
- A1	Analyst(1)	DP View	Medium Risk	{0 - 5}
- A2	Analyst(2)	DP View	High Risk	{0 - 3}
M2	Manager	View & Edit	Medium Risk	All Values

Fig. 5 Example scenario for hierarchical differential privacy

Fig. 6 Budget allocation analysis for different users

and δ. This is achieved by continuously keeping track of the privacy loss, which is a random variable dependent on the previously added noises. This approach produces a more convenient composition of privacy parameters than the advanced composition approach for (ϵ, δ) differential privacy.

The framework uses a cached mechanism of all the available (ϵ, δ, α) values so that the upper bound calculation, finding supremum and minimizing operations to be more efficient.

Figure 4 shows an example structure of users and organization role assignment. The analyst can see limited data, while the manager can see all the privacy values, without any budget constraints.

Now, how much noise needs to be added in the result is based on the privacy budget controlled by user access configurations which is bounded by ϵ and δ values. Letting H_{min} be the least level of organizational hierarchy and H_{max} be the highest level in the organization structure implies the privacy boundary can be set as the user has the access level $H_{\text{min}} \leq H_{\text{lc}} \leq H_{\text{max}}$. The measure of privacy boundary δ is then defined as

$$\delta_{lc} = e^{-\tau_{\max} + \left(\frac{(H_{lc} - H_{\min} + 1)}{(H_{\max} - H_{\min} + 1)}\right) * \tau_{lc}}$$

where $\tau_{\max}$ is the constant value of the highest breach of privacy such that, by this definition, the highest level of organization will get full privilege. The user privacy measure budget ϵ_{lc} is calculated in the framework from the authorization privilege level G_{lc} where G_{lc} is bounded by $G_{\min} \leq G_{\text{lc}} \leq G_{\max}$ with maximum and minimum of the privilege level. The user privacy budget is then calculated as

$$\epsilon_{lc} = \epsilon_{\min} + \left(\frac{G_{lc} - G_{\min} + 1}{(G_{\max} - G_{\min} + 1)}\right) * \epsilon_{\max}$$

The pair (ϵ_{lc}, δ_{lc}) defines the privileged budget for the settings.

6 Privacy Preservation During Machine Learning

The machine learning based on big data requires data to be distributed and processed in different worker nodes. From the privacy perspective, the framework needs to structure such that it brings minimum loss of privacy. For the possible outcome s and database D and D', the pure differential privacy can be re-written in the form of privacy loss as the bound of ϵ in the logarithmic scale:

$$L_F^{D \to D'}(s) = \ln\left(\frac{\Pr[F(D) = s]}{\Pr[F(D') = s]}\right) \leq \epsilon$$

The privacy loss $L_F^{D \to D'}(s)$ is not limited to specific outcome s. If the privacy loss is analysed throughout the machine learning process and can be seen that it the nature of the occurrence is also random. In this sense, $L_F^{D \to D'}(s)$ can be defined as privacy loss random variable $L_F^{D \to D'}$. The relaxed differential privacy and other relaxation such as RDP[] and subsampled RDP[] make more sense with the machine learning scenario. For instance, (ϵ, δ) differential privacy, the $L_F^{D \to D'}$ is bounded by budget ϵ except at the tail bound δ.

The nature of the $L_F^{D \to D'}$ random variable is studied with the expected value, and it reveals that the expected privacy loss is much smaller such as $2\epsilon^2$, which will be very small for $\epsilon < 0$. This improved bound brings possibilities for the framework for better compositions derived from the cumulant generating function (CGF), especially multiple steps needed to be executed in different nodes of big data process.

The cumulant generating function (CGF), which is the log of moment generating function (MGF) for the privacy loss random variable can be written as

$$K_F\left(D,D',\lambda\right)=\log\left(E_{\theta\sim F(D')}\left[\left(\frac{\Pr\left[F(D)(\theta)\right]}{\Pr\left[F(D')(\theta)\right]}\right)^{\lambda+1}\right]\right)$$

where $\theta\sim F(D')$. The Renyi differential privacy provides the definition close to this idea and brings a wider possibility of the composition, which defines []

$$D_\alpha\left(F(D)F(D')\right)\leq\epsilon$$

RDP definition was further refined with the context of CGF and MGF as

$$D_\alpha\left(F(D)F(D')\right):=\frac{1}{(\alpha-1)}E_{\theta\sim F(D')}\left[\left(\frac{\Pr\left[F(D)(\theta)\right]}{\Pr\left[F(D')(\theta)\right]}\right)^{\alpha}\right]$$

This reveals the relationship between α and ϵ, and it led to find the further refined version of calculating privacy budget, for distributed processing such as ours. The refined version of privacy budget calculation with the context of Renyi differential privacy is

$$\left(D_\alpha\left(F(D)F(D')\right)\right)_{D,D',\lambda}^{\text{Supemum}}\leq\epsilon_F(\alpha)$$

With this definition, the budget can be derived from the value α, which is resolved from the CGF upper bound.

One major challenge faced in the framework is to achieve the best suitable combination of ϵ and δ which can be used iteratively in the Apache Spark nodes. Moments accountant functionality [] will help bring the best combinations of ϵ and δ with reasonable tail bound of δ in its subprocesses. The moments accountant helps the Apache Spark nodes monitor the CGF calculations and allow the framework to find the cheapest budget ϵ or tail bound δ:

$$\epsilon(\delta)=\left(\frac{\log(1/\delta)+K_F\left(D,D',\lambda\right)_{D,D',\lambda}^{\text{Supemum}}}{\lambda}\right)_\lambda^{\min}$$

The tail bound can also be calculated, though in most cases in the framework the δ is set as the fixed value[]:

$$\delta(\epsilon)=\left(e^{\left(K_F\left(D,D',\lambda\right)_{D,D',\lambda}^{\text{Supemum}}-\lambda\epsilon\right)}\right)_\lambda^{\min}$$

Once the individual nodes bring the results, the results are combined in a spark node, and adaptive composition mechanism is used for better results. So, combining result for scenarios such as ensembled learning, for parameters ϵ, δ, $\delta^* > 0$, adaptive composition provides (ϵ, δ) differential privacy qualities with the sequential steps adaptively with a $\left(\epsilon\sqrt{2k*\ln\left(1/\delta^*\right)}+2k\epsilon^2, k\delta+\delta^*\right)$ differentially private.

For better performance and adaptive calculations, privacy preservation mechanisms are implemented in the framework derived from RDP. This has a derivation for famous differential privacy mechanisms which has lesser privacy loss supporting a greater number of adaptive sequences.

7 Proof of Concept: *k*-Means Clustering

Given a set of observations ($x_1, x_2, \ldots, x_n$), where each observation is a d-dimensional real vector, k-means clustering aims to partition the n observations into k sets ($k \leq n$): $S = \{S_1, S_2, \ldots, S_k\}$, so as to minimize the within-cluster sum of squares (WCSS), where μ_i is the mean of points in S_i. The k-means clustering algorithm clusters the dataset to k-means clusters iteratively finding the best centroids for each cluster in the Euclidean space:

$$\sum_{i=1}^{k}\sum_{x\in C_i} x-\mu_i^2$$

Overall algorithm for classical k-means clustering is:

(a) Place K points into the space represented by the objects that are being clustered. These points represent initial group centroids.
(b) Assign each object to the group that has the closest centroid.
(c) When all objects have been assigned, recalculate the positions of the K centroids.
(d) Repeat Steps 2 and 3 until the centroids no longer move. This produces a separation of the objects into groups from which the metric to be minimized can be calculated.

The framework has implemented a spark-based implementation of privacy-preserving k-means clustering, and the results are discussed in the next section.

8 Experiments

The experiments are set up simulating an organization with few numbers of users. Different users have different authorization based on which budget is calculated. The distribution of the budget and number of mechanisms possible with a tolerable privacy loss is calculated using the moments accountant for each user. An example comparison of user access and their privileges are shown in Fig. 5.

A simulated big dataset using IRIS dataset with 30,000 records is used in the experiments. The baseline of the algorithm implementation was that the framework needs to achieve the *k*-means result compared to sk-learn libraries from Python. The comparison of *k*-means clustering using the sk-learn package and spark-based distrusted implementation is shown in Fig. 6. This shows the clustering result, and the centroids of both implementations are very close, without much deviations. Now, with the moments accountant, implementation of privacy preservation brings the privacy centroids closer without losing the accuracy of the clustering as shown in Fig. 7. The experiments reveal that the centroid from the standard *k*-means clustering and the privacy-preserving mechanisms are very close and within the threshold values.

The learning process of the *k*-means for privacy-preserving approach is shown in Fig. 8, and it is found that it is not having much deviated from the standard sk-learn elbow curve. The budget curve for adaptive composition is shown in Fig. 9. Compared to the basic compositions used in other differential *k*-means implementations, this brings better accuracy and more iterations. The curve also shows the privacy loss curve, which is proportional to the budget used.

Figure 10 shows that the privacy-preserving centroid values are calculated by moments accountant with the best possible budget and (ϵ, δ, α) combinations. A sample output shown below will give how the privacy-preserving method is executed which will hide the privacy details such as prominent records influencing the centroid points in Tables 3 and 4.

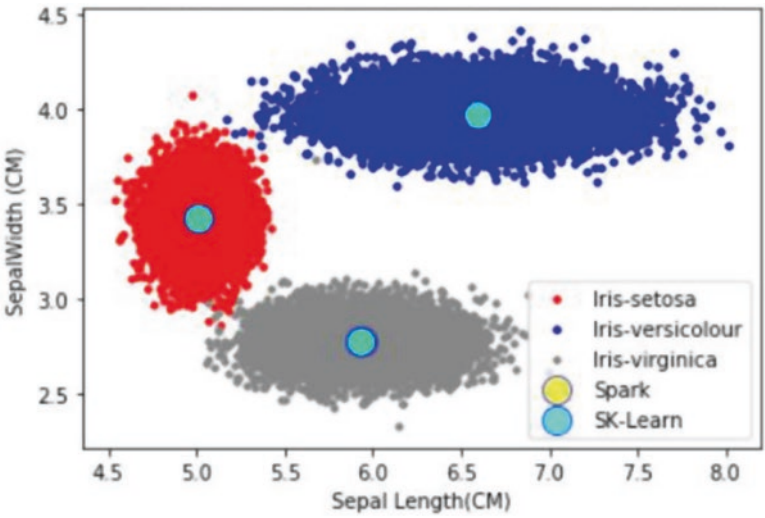

Fig. 7 Compare sk-learn vs spark *k*-means clustering

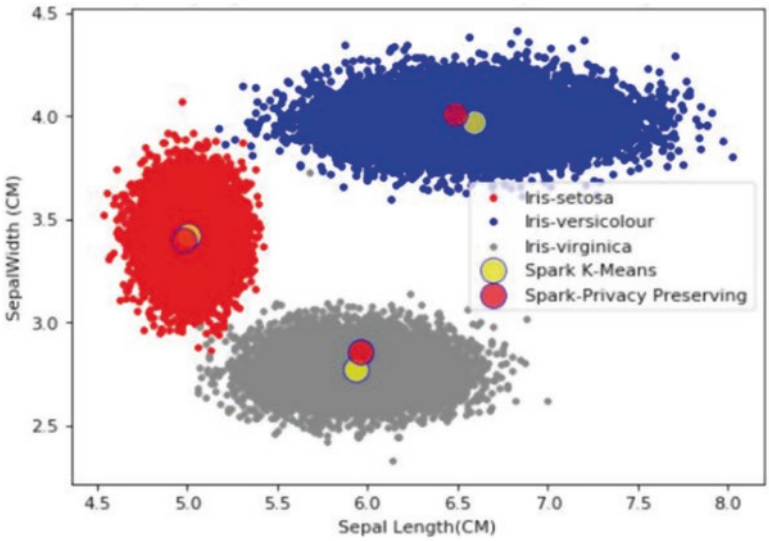

Fig. 8 Comparing big data *k*-means with privacy-preserving *k*-means

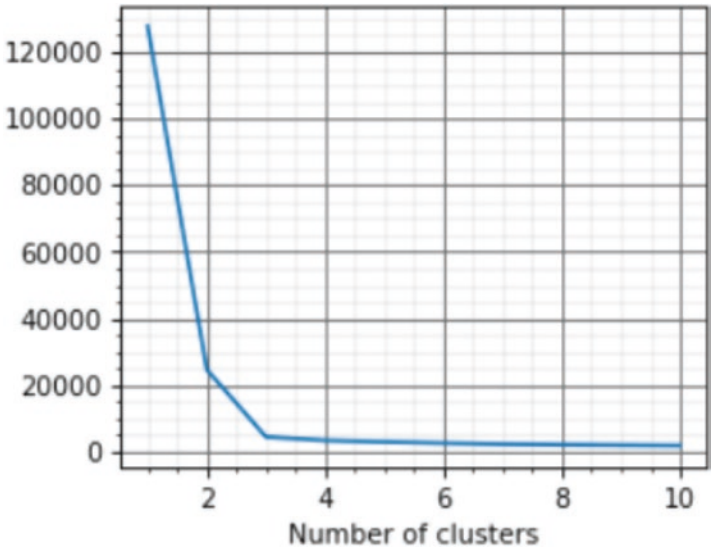

Fig. 9 The EL-Bow method analysis

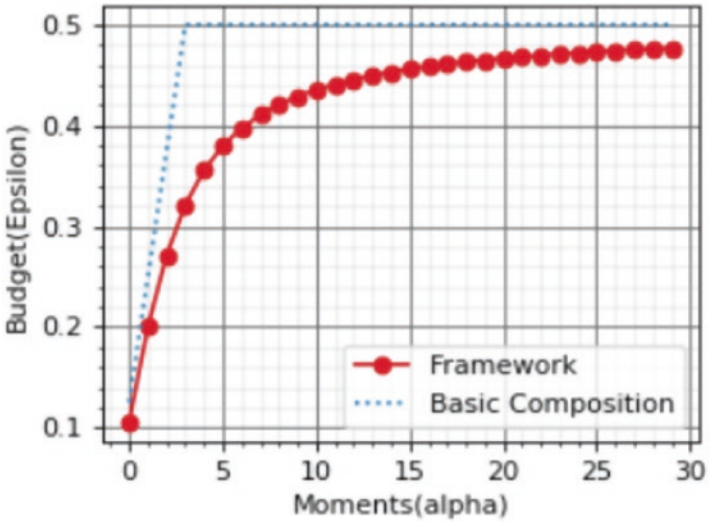

Fig. 10 Adaptive composition and privacy loss

Table 3 Centroid calculated without privacy preservation in big data settings

Clusters	Sepal length	Sepal width	Petal length	Petal width
1	5.93	2.77	4.26	1.33
2	5.01	3.42	1.46	0.24
3	6.59	3.97	5.55	2.03

Table 4 Centroid calculated with privacy preservation in big data settings

Clusters	Sepal length	Sepal width	Petal length	Petal width
0	5.958326	2.854802	4.295854	1.436126
1	6.481883	4.006851	5.519301	2.098999
2	4.977495	3.394708	1.544539	−0.201630

9 Conclusion and Future Work

This paper presents a data privacy framework for large organization which may provide privacy mechanism integrating organizational privacy strategy with the interactive data accessing scenario such as machine learning. The interactive publishing mechanism is illustrated by the help of privacy-preserving *k*-means clustering. More complicated analysis scenarios in the machine learning stack could be implemented for privacy preservation under this framework using the structures such as ensemble and moments accountant. As the machine learning literature is expanding quickly, there are lots of ways to improve different types of learning algorithms.

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Interactive Artificial Neural Network Model for UX Design

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Abstract Video game platforms provide a variety of sensors to improve player experiences. The design of robust recognizers for player behaviour with sensors nevertheless provides developers with major challenges. In addition, sensor-based controls provide a small player customization relative to standard inputs. In past research into moving music systems, interactive machine learning (IML) techniques using interactive artificial neural network (IANN) have successfully been employed to allow developers and end users to customize sensor-based interfaces. Current standalone game creation and delivery platforms are therefore not suitable for use in IANN. We also developed an integrated IANN solution in the form of a visual node framework supporting classification, return and time series analysis of sensor data in order to facilitate more powerful and scalable use of sensors by developers and players.

Keywords Interactive machine learning · Interactive artificial neural network · UX design · Video game

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1 Introduction

Video games use a range of sensors. Examples include DIY, VR, tablet, AR, smart and other hardware games. No common practices for developing sensor-based interactions are available, despite decades of research into the use of sensors as game controllers. Developers may find it difficult to carry out detailed and rigorous sensor analysis when sensors are noisy or high-dimensional or where complex gestures or behaviour are to be sensed. In addition, players may also want the sensor-based interfaces to reflect their tastes or expertise – similar to how they currently configure gamepads or to adapt with their own range of motion or skill. Current solutions do not, however, provide such a feature.

Automatic ML considers mainly the automation in an independent manner in the meaning of classic artificial intelligence techniques [1] may be considered these algorithms. An automatic ML (AutoML) [2] is a narrow term, focusing on ML end-to-end automation solving the forecast problem on new datasets automatically (without interactions with people).

Automatic approaches to help improve our quality of life are present in everyday experience in the human society [3]. The first successful commercial use of deep convolutional neural networks [4] has really been speech recognition. Self-service techs are now able to talk to customers in contact centres that give consumers tips. Automatic games without human involvement [5] are an additional example. The game has a long history of mastering Go and is a strong test for success in automated approaches [6].

In the paper, the authors define a modern interactive artificial neural network (IANN) framework designed to enable the creation and tailoring of unorthodox player gestures and behaviours with input devices that include audio and video.

2 Background

Supervised learning algorithms may generate new recognizers or control systems, for example, instead of forcing a developer to write code analysis data for sensors and define how an implementation can respond. The user constructs and develops the model by 'input and evaluation cycles' [7] in the immersive learning of computers. Users usually generate new motion samples on the fly and test templates by real-time experimentation with the new controllers [8] in IANN systems for creating new style controllers for music. Training instances, sensors and learning algorithms are subject to modifications by users to enhance performance. A similar approach was taken to customize the behaviour of virtual characters by the action of the physical player [9].

Several independent software tools are designed to facilitate the creation of IANN interfaces for gestural control. This is seen in games sometimes. However, it was difficult to incorporate this method and require significant new code to be written, allowing connectivity between the GUI and the audio engine. Furthermore, the

final game could not be published on its own as several parallel software programs were needed [10–19]. The sophistication of this toolchain limits the usefulness for game developers of such an IANN solution.

It should be noted that the integrated Unity3D deep learning provides training agents with enhanced learning algorithms. To promote supervised IANN learning to develop interactions based on sensor, algorithms, interfaces and workflows are used.

3 Proposed Method

One of the key questions for ANN is how the weights of the connections can be adjusted to achieve optimal device compliance. This amendment is mostly based on the Hebbian law, which allows for a stronger bond between two units if both units work concurrently. The Hebbian rule is

$$\Delta w_{ij} = g\left(a_j\left(t\right), t_j\right) h\left(o_i\left(t\right), w_{ij}\right) \tag{1}$$

Where:

w_{ij} is the link weight between units.
$a_j(t)$ is the activation function.
t_j is the learning input.
o_i is the output for the preceding unit.
$g(\ldots)$ is the dependent function or unit activation function or teaching input function.
$h(\ldots)$ is the dependent function or the preceding unit-dependent function or current link weight function.

When weights are updated, there are two types of exercise. In online learning, after every training pattern, adjustments are applied on the network. Offline analysis or fight learning accumulates weight changes in all patterns in the exercise file, and after one complete cycle (eight), the total of all changes is added via the workout pattern file.

Backpropagation Learning
The fundamental principle of the BPNN uses chain rule to determine the weight of each weight for an arbitrary error function E:

$$\frac{\partial E}{\partial w_{ij}} = \frac{\partial E}{\partial a_i} \frac{\partial a_i}{\partial net_i} \frac{\partial net_i}{\partial w_{ij}} \tag{2}$$

Where:

w_{ij} is the neuron weight between the layers.
a_i is the activation function.
net_i is the weighted neurons.

Once each weight's partial derivative is understood, a simple descent gradient can help minimize the error function:

$$w_{ij}\left(t+1\right)=w_{ij}\left(t\right)-\eta\frac{\partial E}{\partial w_{ij}}\left(t\right) \tag{3}$$

Where:

η is the learning rate.
Wij is the Weight.
t is the threshold.
$\partial E/\partial Wij$ is the error gradient.

The user selects the learning rate parameter and plays a part in the network integration for its performance and time, which can be deduced from Eq. 6.4. The most common parameters are chosen for our experiments. A broad area of study is the review of advanced opportunities pertaining to neural network learning procedures, which may thus be a point for further experimentation.

Online training is typically considerably faster in backpropagation training than batch training, particularly for large sets of training with similar examples. After each model introduction, effects of backpropagation and updated training depend heavily on the right selection of the parameter η.

The weight upgrade law for rear propagation is also referred to as the generalized delta rule:

$$\Delta w_{ij}=\eta\delta_j o_i \tag{4}$$

Where:

η is the learning rate.
W_{ij} is the Weight.
t is the threshold.
$\partial E/\partial W_{ij}$ is the error gradient.

$$\delta_j=\begin{cases}f'\left(net_j\right)\left(t_j-o_j\right) & \text{if unit } j \text{ is an output unit}\\ f'\left(net_j\right)\sum_k\delta_k w_{jk} & \text{if unit } j \text{ is an hidden unit}\end{cases} \tag{5}$$

Where:

δ_j is the error of unit *j*.
o_i is the preceding output.
t_j is the teaching input *j*.
i is the predecessor index to unit *j* with w_{ij}.
j is the unit index.
k is the successor index with weight w_{jk}.

Learning Algorithm

Resilient BPNN is an adaptive local learning system that provides supervised batch study in MLP. The selection of a learning rate in Eq. (3) with the derivative scale for the backpropagation algorithm affects the necessary time to achieve convergence. Too many steps to obtain an appropriate solution are necessary if it is set too small; instead, a high educational rate can lead to an oscillation that prevents an error dropping below a value.

Rprop theory is to eradicate the negative effect of the partial derivative size on weight. As a result, the path of weight update shall only be taken as the symbol of the derivative. The scale of the weight shift is calculated by $\Delta_{ij}^{(t)}$ exclusively:

$$\Delta w_{ij}^{(t)} = \begin{cases} -\Delta_{ij}^{(t)} & \text{if} \dfrac{\partial E^{(t)}}{\partial w_{ij}} > 0 \\ +\Delta_{ij}^{(t)} & \text{if} \dfrac{\partial E^{(t)}}{\partial w_{ij}} < 0 \\ 0 & \text{else} \end{cases} \tag{6}$$

Where:

$\dfrac{\partial E^{(t)}}{\partial w_{ij}}$ is the summed gradient information.

A more knowledge on topology of the error function was the key idea for the upgrade realized with the Rprop algorithm to make it more acceptable. Each 'update value' is based on the error function E during the learning process. Consequently, Rprop's second step is to evaluate $\Delta_{ij}^{(t)}$ based on adaptation process that is defined as below:

$$\Delta_{ij}^{(t)} = \begin{cases} \eta^{+} * \Delta_{ij}^{(t-1)}, & \text{if} \dfrac{\partial E^{(t-1)}}{\partial w_{ij}} * \dfrac{\partial E^{(t)}}{\partial w_{ij}} > 0 \\ \eta^{-} * \Delta_{ij}^{(t-1)}, & \text{if} \dfrac{\partial E^{(t-1)}}{\partial w_{ij}^{(t-1)}} * \dfrac{\partial E^{(t)}}{\partial w_{ij}} < 0 \qquad 0 < \eta^{-} < 1 < \eta \\ \Delta_{ij}^{(t-1)}, & \text{else} \end{cases} \tag{7}$$

The dilemma of the well-known SuperSAB algorithm is also avoided by Rprop. The weight update also relies heavily on the size of the partial extracted and the impact on the whole network. This effect is prevented by Rprop by explicitly adjusting its weight update value based solely on the component derivative's sign without regard to its size.

When Rprop attempts to adjust the learning mechanism to the error function's topology, it applies the 'batch learning' or 'learning by epoch' theory. This implies that the gradient knowledge of the whole pattern collection is determined by weight update and adaptation.

It is very uncritical to choose this value when it is tailored to the learning process. The maximum weight stage calculated by the update value size is reduced, to prevent the weights from being too high.

Convergence is usually often very indifferent to this parameter. However, certain problems will only lead to a very careful action, so that the algorithm does not stick to local minima too easily.

Logistic Activation Function

This function $f_{\text{act}}(x) = 1/(1 + e^{-x})$ only calculates the network input by summing up all weighted activations and then shutting down the result. The new time activation $(t + 1)$ is inside [0,1] range. The vector is unit j's threshold.

The net input is formulated as below:

$$net_j(t) = \sum_i w_{ij} o_i(t) \tag{8}$$

This provides the activation function:

$$a_j(t+1) = \frac{1}{1 + e^{-\left(\sum_i w_{ij} o_i(t) - \theta_j\right)}} \tag{9}$$

4 Results and Discussions

The data is created from a 'snaking' game, and apple represents a graph node as an input for the IANN portion. On the edge is the path to the next fruit. Each game has a new MMAS algorithm. The algorithm immediately completes five iterations, so the user will have to communicate.

The central goal of the game, on the one hand, is the fastest possible consumption of apples. However, in the game, users don't understand the pheromone amount used, and only the apples try to find the fastest path. The goal, however, is to find an algorithm's shortest path. This method encourages them to construct a complex time-based problem which integrates users with the notion that the algorithm is better than the IANN approach so that users cannot wait for the conference. The MMAS is produced with the highest activation function in one release. The user gets a suggestion for the next apple in this situation. The studies use three pre-generated graphs for comparable results (Tables 1, 2, and 3).

In the first step, the study increases the pheromone values by 2. However, it offers a significant impact on hidden layers, and hence the weights are estimated for each input. The result would greatly increase reliability and decrease the accuracy

Table 1 Results of absolute minimum distances

	iML	IANN
Level 1	4,120,542	34,056,575
Level 2	4,093,364	34,559,001
Level 3	−94,473.9	−502,425.5508

Table 2 Results relative improvement vs. distance travelled

	iML	IANN
Level 1	0.140	0.158
Level 2	0.110	0.124
Level 3	0.075	0.084

Table 3 Results of distance travelled vs. occurrence

	iML	IANN
Level 1	2.2	2.54
Level 2	2.5	3.12
Level 3	6.2	6.41

of the algorithm by a greater value because of the enormous impact of the human error on the ages. IANN improves the performance (distance decrease). The people travel in the game, and we considered the human way to be longer than the road of IANN.

We also found a solid proof in this study that the human participation in track location normally yields better results. It also shows the absolute minimum period travelled in the experiments.

5 Conclusions

In this study, the IANN technique is used to maximize the UX interaction. The human interaction implements a new concept and offers appealing solution. The repetitive human interventions will orient the quest for promising solutions. In future steps to develop the algorithm, the study shall examine the processes and essential elements of human intervention. We assume that the human expert would be in the intuitive panorama achieved by people at first sight. The experiment will be repeated and routinely structured to help humans and algorithms in future large-scale work, based on the current results, which demonstrate that human interventions are able to refine the algorithm.

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Multimodal Biometric Person Identification System Based on Speech and Keystroke Dynamics

R. Abinaya, D. N. V. S. L. S. Indira, and J. N. V. R. Swarup Kumar

Abstract In this paper, user data from two different unimodal biometric modalities are combined for providing diversified decision and persistent authentication. Each unimodal biometric is suffering from some drawbacks, which greatly affects the robustness and integrity of the security system. This work proposes a multimodal behavioral based biometric system utilizing both the keystroke (typing timings) and acoustic (speech) traits, which identify the user using pretrained deep learning models. Features from the two modalities are combined using weighted linear method of feature-level fusion, which are later trained by a deep learning convolution neural network (CNN) classifier model. Results clearly depicts that this proposed system achieves a better accuracy than other classifier techniques such as long short-term memory (LSTM) and backpropagation neural network (BPNN).

Keywords Biometric · Backpropagation neural network · Unimodal · Discreet wavelet · Zero-padding

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1 Introduction

Biometrics is simply the analysis of patterns in the human interaction data for improving person identification. Application of biometrics includes high security person authentication during online logins, vault accessing, banking system transactions, etc. Previous researches on person identification explored a vast number of physiological and behavioral modalities such as ear, face, speech, iris, fingerprint, heartbeat, human temperature, and keystroke latency, but each modal has its own negative outcomings like face biometric modal which has challenges from wrinkles and pimples in the faces [1, 2]. Similarly, fingerprint modal needs precision in aligning the thumb finger impression over sensor surface. Likewise keystroke trait is affected by the person's change in keystroke pattern based on his mood and also on providing secrecy to a large amount of stored typescripts of user. Acoustic modality also suffers from digitally recorded playback or mimicking of the user's voice [3, 4].

2 Literature Review

Montalvao et al. carried out identity conformation by fusing pitch and cepstral features along with keystroke elements [5]. Zeina et al. used SVD for processing only the vital information from the discrete wavelet transform features extracted from training database [6]. [7] carried out the silence/noise removal and also segmentation of audio data by utilizing spectral features.

Fusing many biometric modalities together in identity verification system is recently gaining attention [8, 9]. Fusion of keystroke latency and speech/voice traits is proposed by this work, which involves the user typing a long sentence and voicing the same words under supervision and eliminates the disadvantages of unimodal systems [10].

3 Materials and Methods

3.1 Mel Frequency Cepstral Coefficient (MFCC)

MFCC follows the characteristics of human auditory system. Speech is first preprocessed using overlapped framing and hamming windowing techniques. Later they are Fourier transformed for converting to frequency domain. Mel filter bank, which has linear spacing up to 1000 Hz and remaining frequency arrangements, has logarithmic spacing:

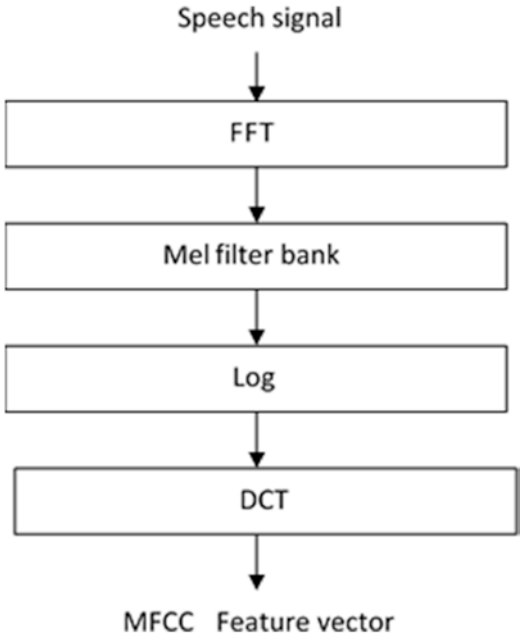


Fig. 1 MFCC extraction process

$$\text{mel}(f) = 2595 * \log\left(1 + \frac{f}{700}\right) \tag{1}$$

where mel(f) represents the perceived frequency and f is the real frequency. Finally, the spectrum is reverted back to time domain using log and cosine transforms which as shown in Fig. 1 outputs 39 MFCC features [11, 12].

3.2 Keystroke Data Dynamics

In keystroke, each data is associated with press/down and release/up time stamps for each key. These may sometimes overlap due the user's concurrent typing by both hands [13, 14]. From these key dynamics, we can derive a collect of features such as digraph or trigraph dynamics such as PP, RR, RP, and PR as in Fig. 2. In this experiment, BioChaves dataset provides the down-down time interval for each character in the chosen fixed text "chocolate, taxi, banana, zebra."

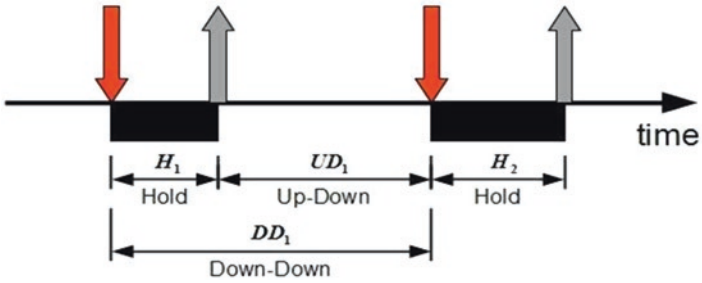


Fig. 2 Key features representation for down-down method

3.3 Linear Data Fusion

This type of fusion strategy is used in the fusion of signal/feature vectors from different sensors as per Eq. (2) which is controlled by the provided weightage:

$$s(t) = \frac{s(t) - \mu}{\theta} \tag{2}$$

where μ is the largest value and θ represents the standard deviation. They are then linearly combined using

$$f(t) = \alpha_1 s_a(t) + \alpha_2 s_k(t) \tag{3}$$

where $s_a(t)$ is the audio features, $s_k(t)$ is the keystroke dynamic features and α_1 and α_2 are the influence controlling weights for each feature.

3.4 Convolutional Neural Network (ConvNet or CNN)

In neural networks, CNN has caused several major breakthroughs in the deep learning field during recent years and is popularly used in areas like recognition, classifications, object detections, face recognition, etc. CNN finds a pattern in an input data by convoluting over the data matrix. In the initial layers, CNN identifies low-level and mid-level feature patterns, which are then passed deeper to another neural network which identifies more complex high-level features, thus making CNN good for pattern identification from the input. Based on these recognized patterns, the input data is classified into pretrained CNN categories in Fig. 3 [15–17].

Convolution Layer
The basic operation carried out in this layer is going through the input matrix and does a dot product with CONV filter (kernel) to find some patterns. From the convolution process, we get a featured matrix which has lesser values or size than the

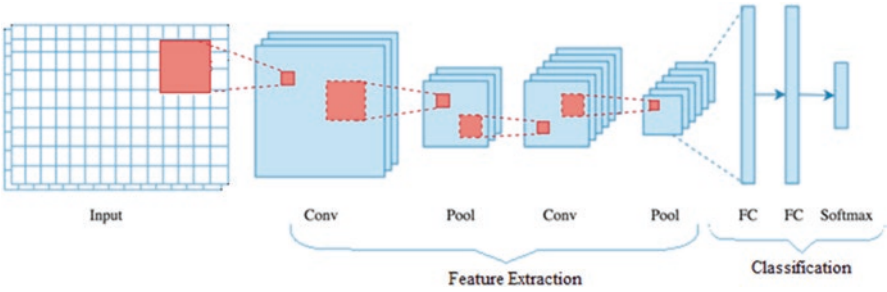


Fig. 3 CNN architecture

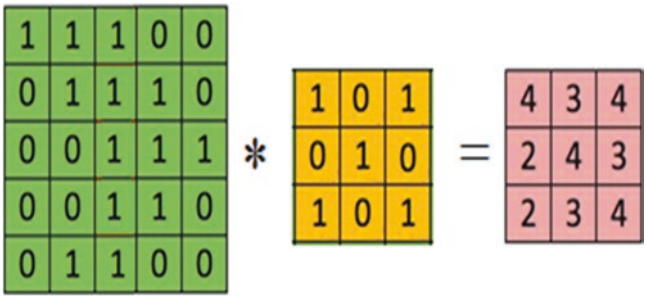


Fig. 4 Input-output pair of convolution operation

actual input. Also we get clearer features than the actual one. In CNN, we need to decide four hyperparameters, such as kernel size (3×3, 5×5, …), number of filter, stride (step distance), and padding type.

Zero-Padding

Zero-padding simply means adding zeros at the outside edge of the input matrix during convolution which results in different sizes of outputs each time. Three popular types of padding used are full padding (all input pixels are visited by filter equal amount of times), same padding (output is same size as input), and no padding (reduces the size of output as well as performance).

Strides

Stride specifies the distance the convolution filter moves at each step (default value is 1). Larger stride values give a smaller amount of overlap between receptive fields and also give a small output feature map. Receptive field is the area of the input matrix currently being convolved with the filter in Fig. 4.

Convolution operation is shown clearly in Fig. 5. Convolution filter (square in orange) is gliding over the input data (square in green) with a stride value of 1 having no padding. At every step, we do element-wise matrix multiplication and sum its answers, which go into the output feature map (square in rose).

Table 1 shows different types of fiters available and Fig. 6 shows that different filter usage results in different filter maps.

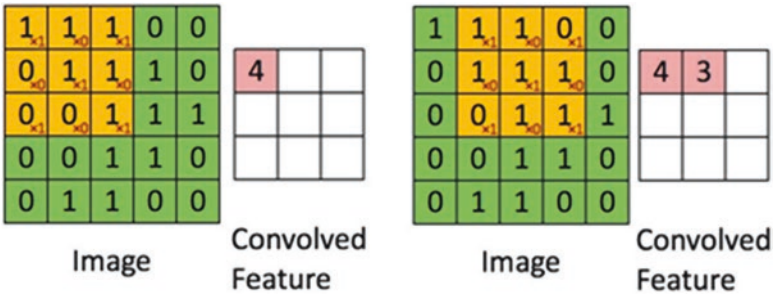


Fig. 5 Workings of convolution operation

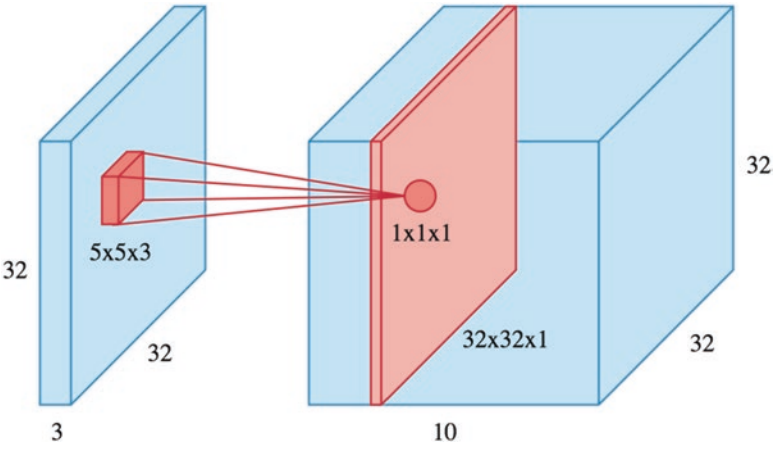


Fig. 6 32 × 32 × 3-size input data and ten different 5 × 5 × 3 filters produce 32 × 32 × 10 feature maps

Activation Layer

Figure 7 shows the ReLU is an non-linear activation function whose output $f(x)$ is same as the input for positive "x" values else return "0."

Pooling Layer

This layer down-samples or decreases the dimensions of the featured matrix and extracts only the dominant features from the feature matrix neighborhood. Popular pooling layers include max pooling, average pooling, and sum pooling in Fig. 8.

Fully Connected (FC) Layer

The output of previous pooling layers was in three dimensions, but a FC layer processes only one-dimensional input. So, the final pooling layer's output is flattened which is then given as input to the starting FC layer (yellow layer in image). The remaining FC layers are feed-forwarded, and backpropagation is applied in each iteration during training (blue layers in image) in Fig. 9. The last output of FC layer (orange layer in image) uses a softmax activation function [18, 19].

Table 1 Different types of filters

Operation	Identity	Edge detection		
Filter	$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$	$\begin{bmatrix} 1 & 0 & -1 \\ 0 & 0 & 0 \\ -1 & 0 & 1 \end{bmatrix}$	$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$	$\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$

Operation	Sharpen	Box blur (normalized)	Gaussian blur (approximation)	Emboss (rotate the filter for different directions)
Filter	$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$	$\frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$	$\frac{1}{16}\begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$	$\begin{bmatrix} 0 & +1 & 0 \\ 0 & 0 & 0 \\ 0 & -1 & 0 \end{bmatrix}$

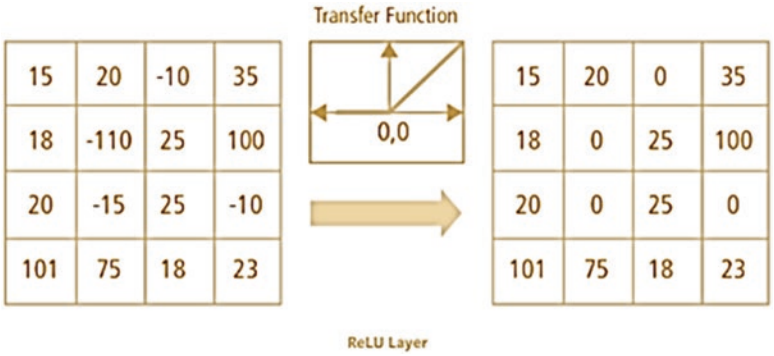


Fig. 7 Working of ReLU function

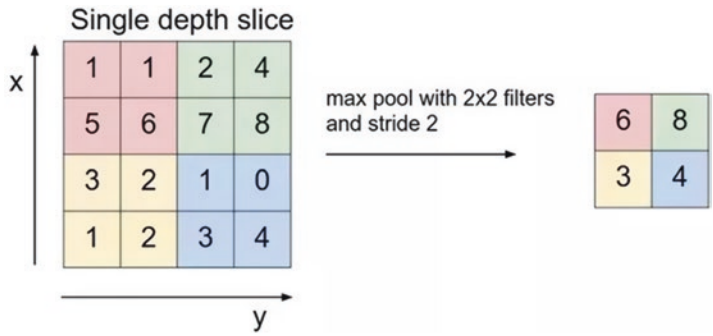


Fig. 8 Max pooling where each color denotes a different filter location

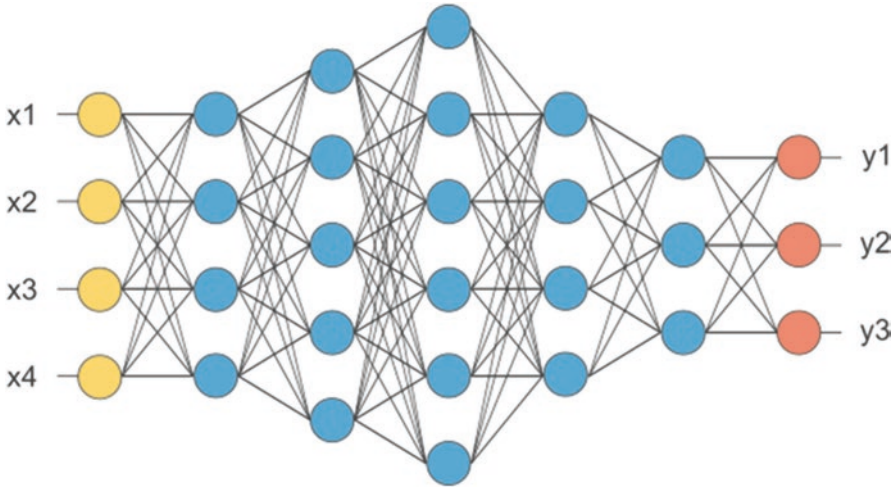


Fig. 9 Fully connected layer

4 Proposed Methodology

In this proposed research, 30 keystroke latency (down-down/press-press interval) features are combined with 39 audio (MFCC) features using linear feature-level data fusion method, which forms the data representation from two separate modalities. Later those 69 features are translated into 25 most discriminating features using singular value decomposition for reducing the operation time and needed resource level of the deep network. And finally, each person identity detection is done by the deep learning CNN network, and its performance is evaluated using other popular classifier techniques in Fig. 10.

4.1 Datasets

In this experimentation, publicly available BioChaves database [20] is used, which is a multimodal dataset having samples from both acoustic and fixed typing keystroke samples of same person. Both audio and keystroke of a single user are recorded ten times in two sessions parallelly under noise-free condition in a lab. During each session the uttering/typing of the sentence "chocolate, zebra, banana, taxi" is recorded. Each speech signal is of 3-s duration with 16 bits per sample and of frequency 22.05 kHz to prevent information loss. Each keystroke data is of length 31 features of down-down dynamics for the chosen fixed sentence. Also the original keystroke data is listed in two columns comprising ASCII keycode and down-down value for that key press.

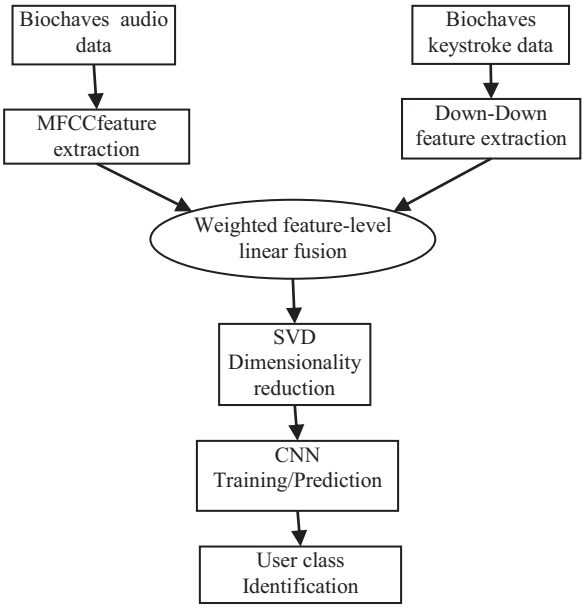


Fig. 10 Outline of proposed system

4.2 Preprocessing

Each audio and keystroke data sample pair from the BioChaves dataset undergoes preprocessing stage. Here the speech signal is normalized over the −1 to 1 range and then filtered to provide pre-emphasis for strengthening the auditory (8–16 kHz) frequency range. Also, the down-down key intervals are isolated from the ASCII keycodes for faster processing.

4.3 Framing, Windowing, and Noise Removal

Speech sample audio is partitioned into 45 ms frames with 10 ms overlap. Non-voiced static noise frames are rejected using energy and centroid. The remaining voice frames are windowed as in Eq. (4) to reduce discontinuity (hamming window):

$$xl(n) = xl(n)w(n), 0 \le n \le N-1 \tag{4}$$

where $w(n)$ represents the hamming window and $x(n)$ represents the speech audio:

$$\omega(n) = 0.54 - 0.46\cos\left(\frac{2\pi n}{M}\right) \tag{5}$$

Normally noisy frames have lower-frequency, smaller energy, and smaller centroid values, thereby thresholding the frames based on centroid and energy values which will disregard all noisy non-voice frames:

$$E\left(\text{Frame}\right) > E\left(\text{Thres}\right) \tag{6}$$

where E(Thres) represents the energy threshold, E(Frame) is the per frame's energy, C(Thres) is the centroid threshold, and C(Frame) is the per frame's spectral centroid:

$$C\left(\text{Frame}\right) > C\left(\text{Thres}\right) \tag{7}$$

When a frame passes Eqs. (6) and (7), then only it will be selected or it is rejected.

4.4 Feature Extraction

From each speech frame, 39 Mel coefficient (MFCC) features are extracted, and also from the user's keystroke, 30 down-down interval (DD latency) is extracted for every typed-in key.

4.5 Linear Feature Fusion

Both the 39 audio and 30 keystroke features are combined in the feature level using the linear fusion method which involves centralizing the features and linearly combining them in a weighted manner (39 + 30 = 69).

4.6 Dimension Reduction

Since having a large number of features directly affects the processing speed of the system, prominent 25 features are selected from these 69 features using the SVD method which is based on analyzing the singular values. This dimension reduction results in low processing time, less complex architecture, and lesser resources for running the CNN. During training, 69 features are translated into their singular values using SVD:

$$\left[u,s,v\right] = \text{SVD}\left(\text{feature}_{69}\left(t\right)\right) \tag{8}$$

From those singular values, 25 most discriminating features are extracted by selecting the top 25 singular values and projecting the new lower dimensional feature set:

$$f_{25}(t) = \mu_{25} * s_{25} \tag{9}$$

During testing, feature size of the sample is reduced using

$$f_{25}(t) = f_{69}(t) * v_{25} \tag{10}$$

where u, v is the orthogonal matrix of SVD method. Normalizing the data will make the u and v values identical.

4.7 CNN Training/Testing

The above dimension-reduced 25-dimensional feature from each frame is arranged in the shape of a two-dimensional matrix (i.e., 25 X frames count) and given to the CNN network for training/testing. During training every data sample in BioChaves dataset is given with their corresponding label. But during the testing, random unknown sample of a user is selected to find out the identification of the user. The CNN architecture entails of [INPUT – CONV – RELU – FC – FC – FC – softmax] layers as in Figs. 11 and 12.

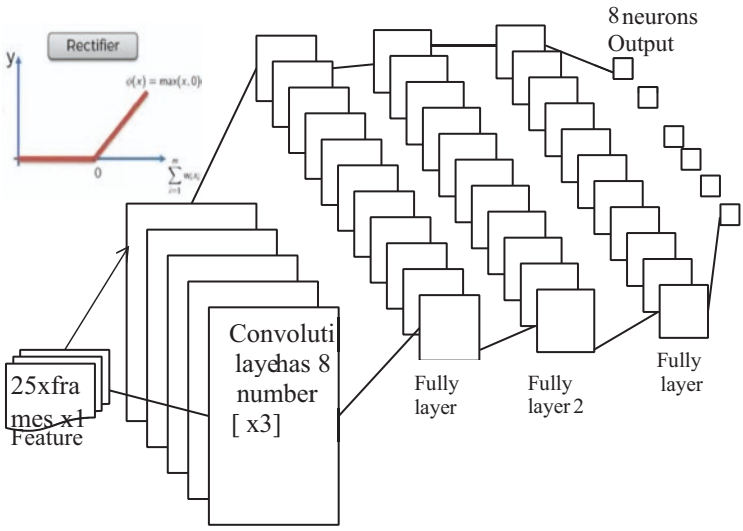


Fig. 11 CNN architecture for proposed system

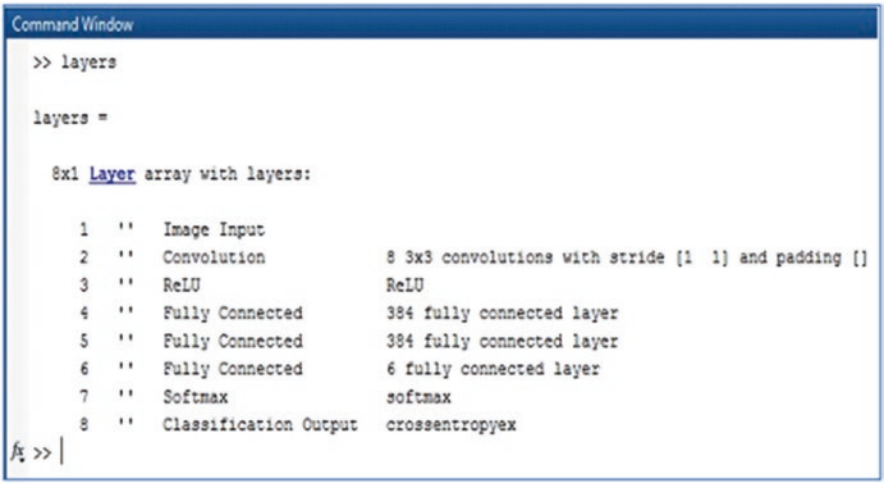


Fig. 12 CNN classifier output obtained in MATLAB

During training, features from all the training samples are given to the CNN with their respective class labels for all eight categories/persons. Each category consists of biometric audio and keystroke samples taken from a single person. During testing, a random sample from an unknown user is classified using the pretrained models to identify the user class. In testing, the pretrained models are evaluated using the test samples, and each classifier's identification accuracy is recorded for every user sample.

5 Results and Discussion

In this work, a person identification system is implemented using MFCC cepstral, DD latency features, SVD reduction, and CNN deep network classifier for finding the person's identify using both acoustic and keystroke samples from the BioChaves database. Their results are analyzed by comparing with time series LSTM and BPNN classifier techniques. Accuracy is calculated for every unknown test data sample belonging to all eight user classes as in Table 2.

The tabulated results clearly depict that all classifier techniques show optimum results for most categories, but CNN produces superior results compared to other classifiers. CNN classifier results in the accuracy of 95% or higher for all classes, whereas LSTM and BPNN have a starting accuracy of 65% and 47%, respectively, for individual classes. Thus, CNN deep network is efficiently representing most of the user categories.

The CNN is exploited by trying the LPC, LPCC, and MFCC acoustic features, whose accuracies are reported in Fig. 13, which clearly depicts

Table 2 Performance results for various classifiers

	Accuracy in %		
	CNN	BPNN	LSTM
User class 1	100	53	99
User class 2	95	77	65
User class 3	97	80	80
User class 4	100	72	97
User class 5	100	60	88
User class 6	97	81	91
User class 7	95	84	89
User class 8	100	47	70

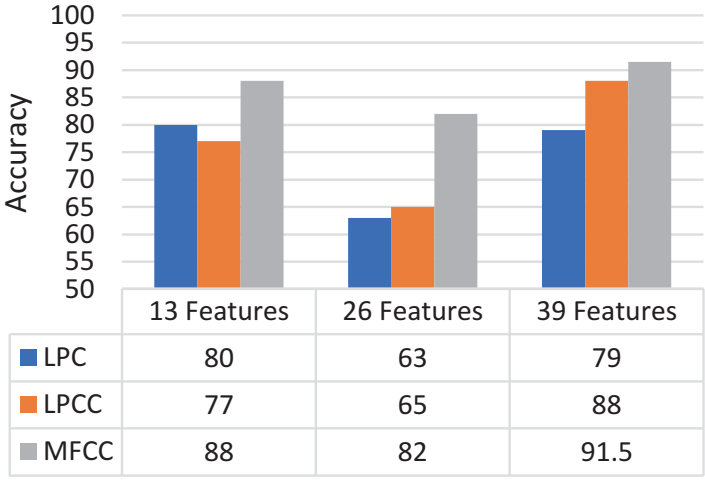


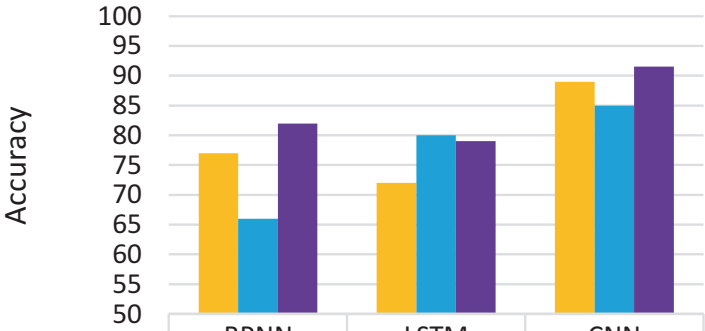
Fig. 13 Comparative measure of different dimensional speech features using CNN

"CNN" + "39-dimensional MFCC" pair gives an accuracy of 91.5%, which is better in comparison to other features.

The fused multimodal system is giving better results than unimodal separations like audio/keystroke alone taken for person identity detection shown in Fig. 14. It shows that fused system (audio + keystroke) performs better for all classifiers, thus each showing an accuracy of range 80–90%, out of which CNN-based fused multimodal biometric system shows a significant result.

6 Conclusion

In unimodal/multimodal biometric systems, identity of an individual person is verified for better authentication and authorization. Keystroke dynamics, being an cheapest behavioral biometric, only needs a keyboard. Also, popularity of speech



	BPNN	LSTM	CNN
Audio	77	72	89
Keystroke	66	80	85
Fused	82	79	91.5

Fig. 14 Comparison between unimodal and multimodal systems

recognition and voice control in security appliance motivated the usage of speech biometric input. This paper presents the keystroke latencies and speech signal as a valuable biometric data in bimodal person identity verification systems. This work proposes a linear fusion approach is employed to combine the most discriminative acoustic/keystroke features for identification using deep learning-based CNN network. Accuracy produced by the proposed system of 91.5% is matched against LSTM and BPNN classifiers, which obviously shows that our proposed system obtained higher and better accuracy.

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Predictive Water Quality Modeling Using ARIMA and VAR for Locations of Krishna River, Andhra Pradesh, India

G. T. N. Veerendra, B. Kumaravel, and P. Kodanda Rama Rao

Abstract This paper investigates the recital use of machine learning techniques that include vector autoregression (VAR) and autoregression integrated mean average (ARIMA) for the Krishna River of Andhra Pradesh, India. For modeling, water parameters are collected from the Central Pollution Control Board, India, and Andhra Pradesh Pollution Control Board. The process applied in this paper had shown tensing during the code generation and transfer to the Jupyter notebook functioning. Comparing both models, VAR outperformed ARIMA for predicting the next six progressive values of the locations. After examining the models' results, the ARIMA got less than 0.5, and RSME of VAR had 0.95; the VAR is notified to be an accurate model for predicting the next six consecutive values. In parallel to the machine learning process, the respective study location samples are collected and tested in the laboratory to compare the results derived and predicted.

Keywords ARIMA · VAR · Jupyter notebook · Krishna River · Artificial intelligent

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1 Introduction

In most countries, the quality of surface water is noted to be a sensitive and decisive issue. The importance of the surface and groundwater quality has a major scope to its impact on human health and aquatic life concern and related chain [1]. The influence of human-made activities like industrial waste, agri-/aquaculture, and discharges from other purposes is degrading both ground and surface water qualities [2]. For determining the quality of water for domestic, industrial, and irrigation purposes, the study of hydrochemical properties is an important factor [3]. With the help of remote sensing and GIS and statistical analytical tools, [4] identified factors that control the flow system at different locations of Wheeler Lake Basin in North Alabama. The study utilized the water quality index (WQI) method to assess ground and surface water after human consumption. To address quality standards and issues, several investigations are conducted in different parts of the world. With the help of engineering studies on rivers, various examinations that include water quality, transport of sediment, and pollutants transmission are the trust areas to assess the state of concern location [5]. Considering the theme of earth science, the evaluation of water quality parameters is the most common thing. Besides, measuring undergoes two types: transmission of pollutants and their mechanism and components of water quality. The advancements in environmental engineering had categorized the water quality parameters utilizing physicochemical evaluation. The tests include BOD, COD, pH, temperature, K, Mg, Na, etc. [6]. Also, state and central government departments of surface and groundwater agencies are directed to test the water quality parameters periodically. The hydrometry stations are responsible for measuring water quality at different stages as per the respective department's directions.

Further, the station points will have basic information for developing conservation projects. [7] performed an investigation on pollutants' transfer from one location to another using computational hydraulic and image processing techniques of GIS. With the help of previous studies with the research, water quality parameters' availability made it accessible for review. The advantage of soft computing techniques and the availability of time series analysis is that most of the present researchers of engineering have made the relevant study to predict the future quality parameters with their internal relation using mathematical formulas [8]. Using adaptive neuro-fuzzy inference system (ANFIS), radial basis network (RBF) and multilayer perception (MLP) methods to forecast the water quality parameters, among the methods, the MLP model possesses accurate results in predicting the parameters [9]. Using probabilistic support vector machines (PSVMs) and GIS technics, [10] proposed a model to plan the distribution of classified surface water according to the quality of Iran's locations. In another study performed [11], different case studies predict the water quality parameters. With time series analysis and statistical models, the prediction of quality parameters with internal relationships was utilized. For the planning of water conservation-related projects, the quality assessment of water and predictive analysis are utilized in many research papers.

With the literature reviews, the present paper developed a water quality model for the Krishna River of Andhra Pradesh noted to be the major contributor to the region's surrounding canals. For the prediction of parameters within the selected area, both VAR and ARIMA are utilized. Further, to handle the study's data, Jupyter notebook and codes are developed and incorporated.

2 Proposed Methods and Materials

This paper aims to propose the unique structured code in the Jupyter notebook using machine learning techniques. Both ARIMA and VAR are included. This paper's sequence includes introducing the study area, and the periodic water quality data and their ranges are presented. Later the overview of the applied time series models is presented with results that are compared with the actual experimental results.

3 Study Area and Data Collection

The Krishna Delta starts from below Vijayawada, where River Krishna cuts a gap through a gneissic ridge. The Krishna Delta land is a very fertile and predominantly irrigated paddy crop grown over nearly 5.30 Lac hectares. Krishna River rising in the Western Ghats flows down for 778 km of Maharashtra and Karnataka before entering Andhra Pradesh. In Andhra Pradesh, the river enters the Plains of Coromandel Coast at Pulichintala nearly 1200 km from its source at an elevation of +36.5 M above MSL, reaching Vijayawada lower down after a further distance of 104 km. At Vijayawada, the river flows through the gap of about 1.2 km between two hills. Beyond this point, stretching away on both sides of the river lies on an alluvial plain known as Krishna Delta [12].

The Delta is irrigated by canals, taking off on either side of Prakasam Barrage at Vijayawada. After Vijayawada, the river continues in a single channel for about 64 km, where Puligadda arm branches off, forming the Divi Island. From there, the mainstream continues for another 24 km, and thus after a total run of 1392 km, it breaks up into three branches separated from one another by islands and joins the Bay of Bengal. Figure 1 shows the location of the study area and their locations selected for analysis and prediction. The total run of the river in Andhra Pradesh is 573 km.

In the Delta part of the district's Krishna River, the river's flow is diverted by canals. The major noted canals are Machilipatnam, Pulleru, Budameru, Gudivada, and Ryves. The water is further diverted to channels such as Dosapadu, Palakodu, Neharalli, etc. The water quality data is collected from the water quality database of ENVIS Central Pollution Control Board (CPCB) of India mentioned being the authorized officials for monitoring water quality components. A total of 18 years are taken from year 2003 to 2019. Few locations had the data of monthly and the

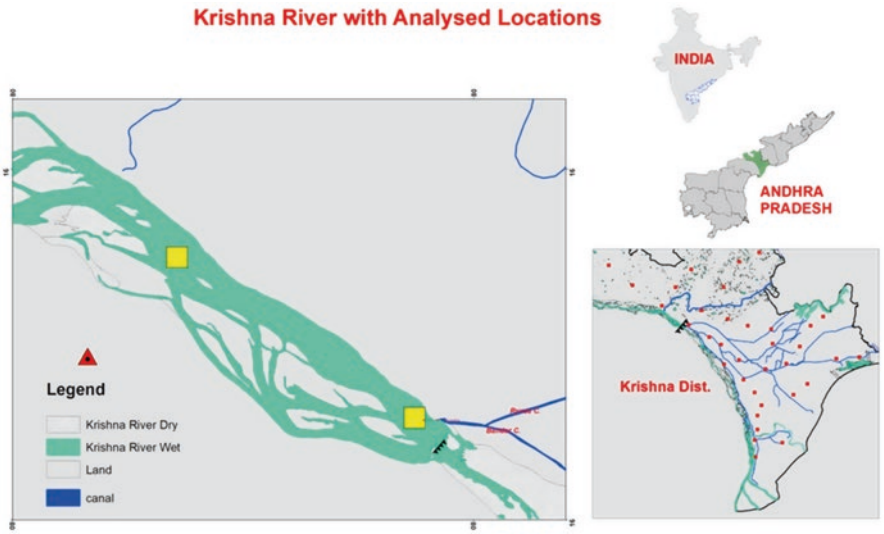

Fig. 1 Location of the study area

year-wise average. Figure 1 shows the four selected locations with the water quality parameters available. The summary of the water quality components is presented in Table 1 concerning the CPCB. The parameters considered for this study are temperature, dissolved oxygen (DO), pH, conductivity (EC), fecal coliform (FC), and total coliform (TC).

4 Predictive Modeling

4.1 ARIMA Model

Based on the historical observations, making predictions can surely help manage available resources and improve the quality of water distributed to the community. The special collection of techniques and methods available in the machine learning domain can predict the dependent variable's successor value according to time. In this paper, the ARIMA model concepts are utilized and taken the essence of time series analysis. To perform the ARIMA model, the back end date provided to be checked with the type of components such as trend, noise, and seasonality. The time series are mentioned as shown in Fig. 2.

The statistical model for a time series sample needs to ensure the data provided should be stationary. The data collected for this paper was calculated with a mean (m), variance (v), and covariance (cv). Codes that are essential to perform the time series analysis and statistical model are mentioned below.

Table 1 The summary of water quality parameters by CPCB at location 1

Annual average values	Temperature			pH			Conductivity (μmhos/cm)			Dissolved oxygen (Do) (mg/L)			BOD (mg/L)			Facial chloroform (MPN/100 mL)			Total coliform (MPN/100 mL)		
Date	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
2003	29	29	29	7.992	8.1	8.046	775.8	775.8	775.8	6.133	6.1333	6.13315	1.511	1.5108	1.5109	2.975	2.975	2.975	2403	2403	2403
2004	29	29	29	7.1	8.2833	7.6916	527.583	2500.3	1513.94	4.153	6.7717	5.46235	1.378	6.075	3.7265	2.975	2.975	2.975	2.975	2403	1202.9875
2005	29.67	29.66	29.65	8.1	8.7383	8.4651	408.5	2230.8	1319.6	4.211	7.0833	5.64715	0.503	1.3775	0.94025	0.925	2.975	1.95	1042	2718.67	1880.335
2006	27	29	28	8.1	8.2083	8.141	775.8	815.2	795.5	5.041	6.2417	5.64135	0.781	0.9725	0.87675	0.925	1.9975	1.46125	2403	2582.5	2492.75
2007	27	32.667	29.83	7.167	8	7.58	180.5	1218.5	699.5	4.839	8.6333	6.73615	0.881	1.8058	1.3434	1.998	11.968	6.983	2403	9000	5701.5
2008	26	29.7	27.85	5.283	9.2	7.24	246.8	708.4	477.6	5.464	9.2483	7.35615	0.781	2.0225	1.40175	1.998	11.967	6.9825	1642	2582.5	2112.25
2009	26	29.67	27.5	7.317	8.3	7.85	380	1081.2	730.6	6.075	8.115	7.095	0.864	3.8833	2.37365	1.998	10.958	6.478	1017	3420.83	2218.915
2010	29	28.7	29.35	6.503	8.3	7.15	514.2	1031.1	772.65	4.223	8.55	6.3865	0.553	2.7917	1.67235	4	10.958	7.479	1042	3420.83	2231.415
2011	26	31.667	28.85	7.367	8.33	7.75	536	887.5	711.75	4.133	8.1417	6.13735	0.503	0.5525	0.52775	4	6.0083	5.00415	1384	2718.67	2051.335
2012	18	29	23.5	6.548	7.5	7.04	492.5	864.8	678.65	6.133	7.425	6.779	0.503	0.5525	0.52775	1.998	6.975	4.4865	1180	2125	1652.5
2013	26	27	26.5	7.267	9.2	8.35	605.1	820.5	712.8	6.158	7.425	6.7915	0.398	0.7808	0.5894	1.998	1.9975	1.99775	1167	1206.67	1186.835
2014	22	29	25.5	7.267	9.2	8.2	567.5	783	675.25	6.742	7.3417	7.04185	0.503	0.9725	0.73775	1.998	1.9975	1.99775	895.8	2041.67	1468.735
2015	20	29	24.5	7.267	8.7	7.95	533.7	778.2	655.95	6.492	7.5333	7.01265	0.398	2.375	1.3865	1.998	1.9975	1.99775	1075	1331.67	1203.335
2016	24	27	25.5	7.467	8.28	7.55	281.1	2230.8	1255.95	6.008	8.1417	7.07485	0.553	3.2229	1.88795	1.05	1.05	1.05	13.48	1489.17	751.325
2017	29	29	29	7.992	8.1	8.06	775.8	775.8	775.8	6.133	6.1333	6.13315	1.511	1.5108	1.5109	2.975	2.975	2.975	330.8	1439.17	884.985
2018	29	29	29	7.1	8.2	7.165	527.5	2500.3	1513.9	4.153	6.7717	5.46235	1.378	6.075	3.7265	2.975	2.975	2.975	2208	2348	2278
2019	29.6	29.6	29.6	8.192	8.7383	8.4	408.5	2230.8	1319.65	4.211	7.0833	5.64715	0.503	1.3775	0.94025	0.925	2.975	1.95	119.4	2416.33	1267.865

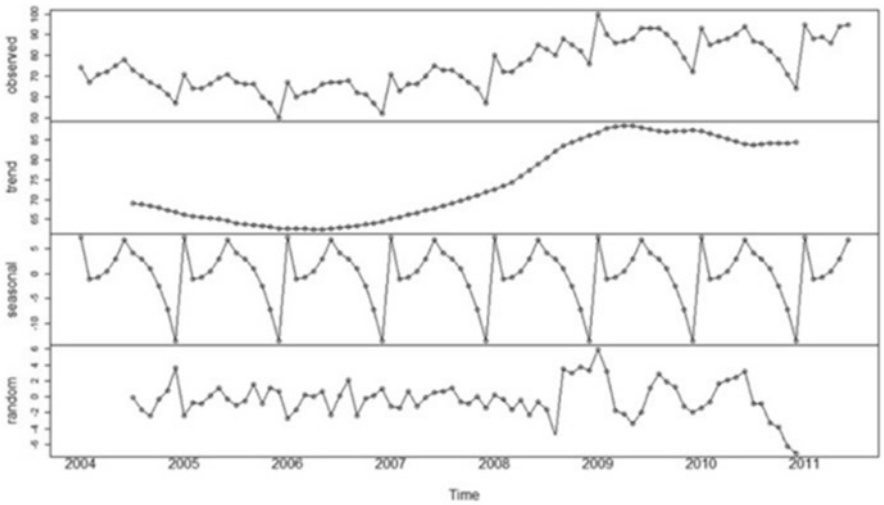

Fig. 2 Time series components

```
≫ Statmodels/tsa.stattools import adfuler
≫ import seasonal_decompose
≫ arima_model import ARIMA
≫ register_matplotlib_converters
```

The data has been imported to the Jupyter notebook with a designated file in ".CSV," and the command window shows, as mentioned in Fig. 2. Composing a well predictive model must ensure the given time series data as stationery.

The ARIMA model can predict the future values of the given time sequence that undergo the evaluation of present and past statistical values. The ARIMA model is classified into three parts, such as "AR" as autoregressive, where the reference of previous values is considered for evolving the variable. The "MA" indicated the linear combination of errors and values with moving average part of regression at various times of past values, while "*I*" reciprocates the integration part of data values evolved under the process of differentiation between the values of present and past. Eventually, these features in the ARIMA model can make the data fit its extent in Tables 1 and 2.

While in the ARIMA model can be donated as (x, u, v), where "x" represents the order of autoregressive model, "v" as moving average model for the order and "u" could be understood as the degree of difference. Using the Box-Jenkins approach to estimate the ARIMA model, the below formula can help:

$$\left[1-\sum_{i=1}^{x}\rho l^{i}\right](1-l)^{u}H_{t}=\left[1+\sum_{i=1}^{v}\beta_{l}l^{i}\right]\varepsilon_{t} \tag{1}$$

Table 2 The summary of water quality parameters by CPCB at location 2

Annual average values	Temperature			pH			Conductivity (μmhos/cm)			Dissolved oxygen (Do) (mg/L)			BOD (mg/L)			Facial chloroform (MPN/100 mL)			Total coliform (MPN/100 mL)		
Date	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
2003	29	29	29	7.992	8.1	8.0833	775.8	775.8	735.5	6.133	6.1333	6.13	1.511	1.5108	1.51	2.975	2.975	2.975	2403	2403	2403
2004	28	29	29	7.1	8.2833	7.8817	527.583	2500.3	747.5	4.153	6.7717	5.41	1.378	6.075	3.73	2.975	2.975	2.975	2.975	2403	1202.9
2005	30.67	30.667	30.667	8.192	8.7383	8.3458	408.5	2230.8	759.5	4.211	7.0833	5.64	0.503	1.3775	0.94	0.925	2.975	1.95	1042	2718.67	1880.1
2006	27	29	28	8.1	8.2083	8.15	775.8	815.2	771.5	5.041	6.2417	5.65	0.781	0.9725	0.88	0.925	1.9975	1.4613	2403	2582.5	2492.7
2007	27	32.667	29	7.167	8	7.3667	180.5	1218.5	783.5	4.739	8.6333	6.68	0.781	1.8058	1.29	1.998	11.967	6.9821	2403	9000	5701.5
2008	25	30.667	28	5.283	9.2	7.5	246.8	708.4	795.5	5.464	9.2483	7.35	0.781	2.0225	1.4	1.998	11.967	6.9821	1642	2582.5	2112.0
2009	25	30.667	28.3	7.317	8.2833	7.8817	380.0	1081.2	807.5	6.075	8.115	7.01	0.864	3.8833	2.37	1.998	10.958	6.4779	1017	3420.83	2218.7
2010	28	30.667	30.3	6.503	8.2833	7.5	514.2	1031.1	819.5	4.223	8.55	6.38	0.553	2.7917	1.67	4	10.958	7.4792	1042	3420.83	2231.2
2011	25	31.667	28.2	7.367	8.0833	7.8817	536.0	887.5	831.5	4.133	8.1417	6.13	0.503	0.5525	0.53	4	6.0083	5.0042	1384	2718.67	2051.4
2012	18	30	23	6.548	7.5	6.5487	492.5	864.8	843.5	6.133	7.425	6.77	0.503	0.5525	0.53	1.998	6.975	4.4863	1180	2125	1652.5
2013	25	27	26	7.267	9.2	8	605.1	820.5	855.5	6.158	7.425	6.79	0.398	0.7808	0.59	1.998	1.9975	1.9975	1167	1206.67	1186.6
2014	22	28	25.3	7.267	9.2	8	567.5	783.0	867.5	6.742	7.3417	7.04	0.503	0.9725	0.74	1.998	1.9975	1.9975	895.8	2041.67	1468.7
2015	20	28	25	7.267	8.7	8	533.7	778.2	879.5	6.492	7.5333	7.01	0.398	2.375	1.39	1.998	1.9975	1.9975	1075	1331.67	1203.4
2016	24	27	25.3	7.467	8.2833	7.875	281.1	2230.8	891.5	6.008	8.1417	7.07	0.553	3.2229	1.89	1.05	1.05	1.05	13.48	1489.17	751.3
2017	29	29	29	7.992	8.1	8.0833	775.8	775.8	903.5	6.133	6.1333	6.13	1.511	1.5108	1.51	2.975	2.975	2.975	330.8	1439.17	885
2018	28	29	29	7.1	8.2833	7.8817	527.5	2500.3	915.5	4.153	6.7717	5.46	1.378	6.075	3.73	2.975	2.975	2.975	2208	2348	2278.1
2019	30.6	30.6	30.6	8.192	8.7383	8.3458	408.5	2230.8	927.5	4.211	7.0833	5.64	0.503	1.3775	0.94	0.925	2.975	1.95	119.4	2416.33	1267.8

β, ρ are the data and log operator parameters as "l" and time series data as H_t and error terms as "ε_t."

4.2 Model Determination

Mushtaq [13] analyzed the data using the rolling statistics and augmented Dicky-Fuller test (ADF). Further, non-stationary data, an autocorrelation plot with decay shall be viewed in the window. If decay occurred, a different approach is needed for the data. The order of differencing formula was defined as below:

$$AR_t^{'} = AR_t - AR_{t-1} \tag{2}$$

Based on the result generated after the first-order differencing of non-stationery data, the following equation is proposed for second-order differencing:

$$\begin{aligned} ARI_t^{'} &= ARI_t^{'} - ARI_{t-1}^{'} = \left(ARI_t - ARI_{t-1}\right) - \left(ARI_{t-1} - ARI_{t-2}\right) \\ &= ARI_t - 2ARI_{t-1} + ARI_{t-2} \end{aligned} \tag{3}$$

4.3 Parameter Estimation and Analysis Using Model

After time series data is sorted as stationery data, "x" and "u" are analyzed. The parameters used for the study have undergone both partial autocorrelation and AIC information criterion for the estimation of parameters.

4.3.1 Full/Partial Autocorrelation

The autocorrelation is the mutual correlation between the function's delayed copies, and the signal is represented below v_a:

$$R(s,t) = ev\left(v_a - x_a\right)\left(v_b - x_b\right) / \left(\sigma_a \times \sigma_b\right) \tag{4}$$

where a, b of the equation represent the process at times and x_a, x_b are the generalized values based on a, b. Also, the x_a and x_b are presented as mean, and σ_a and σ_b are the given data variance.

The partial autocorrelation shall not control the lags in concern with autocorrelation. At the same time, own lag value can be seen in partial correlation. Hence the control over the time series value with lag times may appear with short. The below equation is illustrated as such:

$$\Delta(1) = Cor\left(v_{t+1} - v_t\right), p = 1$$

$$\Delta(p) = Cor\left(v_{t+p} - P_{t,p}\left(v_{t+p,}\right), v_t - P_{t,p}\left(v_t\right)\right), p \geq 2 \tag{5}$$

where $P_{t,p}$ represents the projection of v_t. Furthermore, p is called a partial autocorrelation with lag.

4.3.2 Akaike Information Criterion (AIC)

For executing the ARIMA model, AIC is a suggested criterion. AIC attains minimum value. The model performs results in ARIMA if provided with a lower AIC value. It was defined as

$$AIC = -2\log(l) + 2(x + u + k + 1) \tag{6}$$

K is determined as parameters for numbers to fit the given data and l as the likelihood function.

4.3.3 Prediction Using ARIMA Model

The final step for predicting the model is identifying the data, parameter estimation, and diagnoses that are the initial steps to establish the model:

$$F_t = (1 - l)^d v_t \tag{7}$$

5 VAR Model

A statistical analysis model that possesses multivariate analysis and delivers the relation between the different linear equations and dynamic system attributes is known as the vector autoregression (VAR) model. VAR adopts the interdependence with various time series with linear combinations of the series. In precise, the model works with past time series values related to their past performance and lags. In this study, in connection with ARIMA, VAR is adopted to analyze the same parameters for predicting future values. The expression is as mentioned below:

If $X_t = \{x_1 + x_2 + x_3 \cdots x_t\}$ with "n" times of size in "t," the VAR will take the process with "n" variables with lags as "p." VAR (p) is mentioned as below:

$$X_t = \sigma_0 + \sigma_1 X_{t-1} + \sigma_2 X_{t-2} + \sigma_1 X_{t-3} + \ldots + \sigma_p X_{t-p} + \varphi_1 t = 1, 2, \ldots, T \tag{8}$$

From the above expression, $X_t = (x_{1t} + x_{2t} + x_{3t} \cdots x_{nt})^T \epsilon R^n$, n represents the multivariate variable $\alpha = (\sigma_0, \sigma_1, \sigma_2, \sigma_3, \ldots, \sigma_l)^T$, where each $\sigma_i = 1, 2, 3, \ldots, l$, reflects $n \times n$ matrix and $\sigma_0 = (\sigma_0 + \sigma_1 + \sigma_2 + \sigma_3 \cdots \sigma_{0n})^T$ is known as the intercept term of a vector. ϵ_t known for normal distribution mean as zero and variance matrix is nominated as $\sum$, ϵ _ t $M(0, \sum)$. Also, Zth time series data is represented as $Z = 1, 2, 3, 4, \ldots, n$, $Q_{(z)} = (q_{z1} + q_{z2} + q_{z3}, \ldots, q_{zT})^T$:

$$H = \begin{matrix} 1 & H_0^T \\ \cdots & \cdots \\ 1 & H_{T-1}^T \end{matrix} \tag{9}$$

Further, $\left(H_{t-1} = H_{t-1}^T, H_{t-2}^T, H_{t-3}^T, \ldots, H_{t-p}^T\right)$. Also, the vector coefficients are considered as $\alpha = (\sigma_0, \sigma_1, \sigma_2, \sigma_3, \ldots, \sigma_l)^T$ that is utilized to estimate the ordinary least square method that can solve the system of a linear equation that could express in $X = H\,\alpha + \epsilon$ and followed as below:

$$\alpha = \left(H^T H\right)^{-1} HX \tag{10}$$

According to Kilian [14], the observed data for this study remains as non-stationery. VAR model can provide a reliably predicted value that adopts the time series data. The parameter vector $\ddot{\alpha} = (\ddot{\alpha}_0 + \ddot{\alpha}_1 + \ddot{\alpha}_2 \ldots \ddot{\alpha}_p)^T$ is predicted with $h = 1, 2, 3, 4, \ldots$; for the data set, the recursion equation can be applied as

$$\ddot{Q}_{T+nVT} = \ddot{\alpha}_0 + \ddot{\alpha}_1 H_{T+h-1VT} + \ddot{\alpha}_2 H_{T+h-1VT} + \ldots \ddot{\alpha}_2 H_{T+h-pVT} \tag{11}$$

6 Model Development

The preparation of the data set is the first step of the implementation of the machine learning models. At this point, the data set obtained should be split into two categories – training the input date followed by testing. Training and trial data sets are used for the validation and evaluation of implemented models, respectively. Based on the parameter values for time series modeling, the method of assigning a subset to each category is different. In time series, the modeling of the history of data collection should be assumed, and the shuffling of the data set is not right, although in case of feature fitting the concept of data shuffling is allowed. Usually for both cases, roughly 75–85% of the data is reserved for validation as well as the resulting 20–30% for validation. The next phase is implementation of machine learning models, such as VAR and ARIMA, which are tested and the best ones selected. The next step is to adjust the size of the network in order to increase the consistency of the

built model. To this end, the number of neurons or the number of hidden layers will be increased. The last two phases of this method also refer to the development of the VAR.

7 Results and Discussion

In this paper both models, VAR and ARIMA, are discussed and its application for predicting results of the water tests for few water components. An optimal model developed in this paper has undergone analysis and in the later part, the prediction was done with different approaches that are present in the time series analysis. From different models of time series analysis, two models are modified, and code was regenerated to make fit for ARIMA (autoregressive integrated moving average) and VAR (vector autoregression). In these two models, components such as temperature, pH, conductivity, BOD, dissolved oxygen, facial chloroform, and total chloroform are chose upon the availability of past data from the public agencies. The total data values from year 2003 to 2019 are collected and analyzed; likewise the predictive values for the year 2020 were predicted. Both models had performed well and could see the time series deflection for the predictive values. In the first step, the backend data is collected in the form of a data frame. The sample data had undergone a series of steps such as Dickey-Fuller test, ACF, and PACF tests. After performing these functions, a number of observations to pretend the predicted values can be found out and followed by selecting the best model that had been predicted. The number of observations can be taken on the basis of personal interest; in fact more backend data can improve the performance of the model. In this particular value, the number of observations will be hundred, and on that basis, the data is divided into two sets: one as trained data and the other as test data. The predicted values will be coming after the test data basing on test data values of the two models ARIMA and VAR; we get the predicted values after the test data. After predicting the values, we will plot the graphs for the test data and predicted values. In the VAR model, using the suggested equation, the parameters are analyzed and other components such as coefficient, Std. Error, prob. and t-stat are performed to check the reliability of the model. for the equation temperature and other components such as coefficient std. error, t-stat, and prob. The results can be different for the other components of water, and for every component, the equation will be different. There is also a possibility for introducing the correlation matrix residuals that can be of different values. All the results can be observed in the form of a graph shown in Fig. 3.

The RSME of the predicted data for both the models had been satisfied and gotten 85% accuracy for ARIMA model, and the VAR attained 95% in Tables 3 and 4.

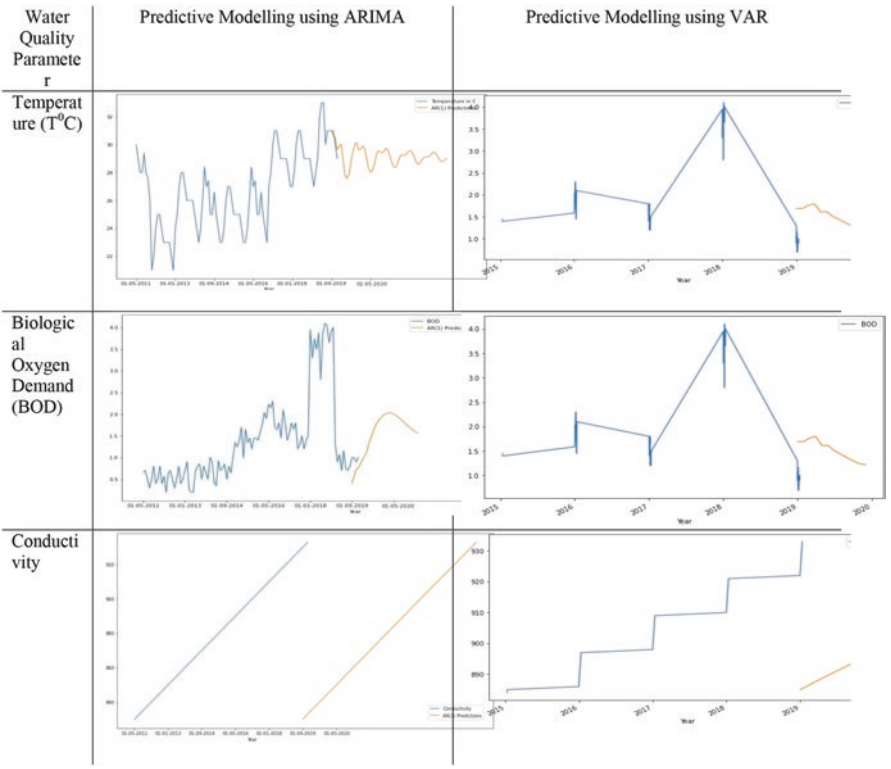

Fig. 3 Predictive modeling using ARIMA and VAR

7.1 Results Obtained from Models

8 Conclusion

In this paper, the results achieved by the model had utilized the mathamatical approch. Statistical formulas, using Jyupiter note, the code related for analysing the parameters are imported from the data library and modified both data and the code according to the time series, in the later part the predicted values had also satisfied the R2 values varies from 0.92 to 0.97. As we observe the graphs, the predicted values are coded in a orange color, and the original values can be seen in the blue other color. In particular to data sets a through check is performed with the seasonality of

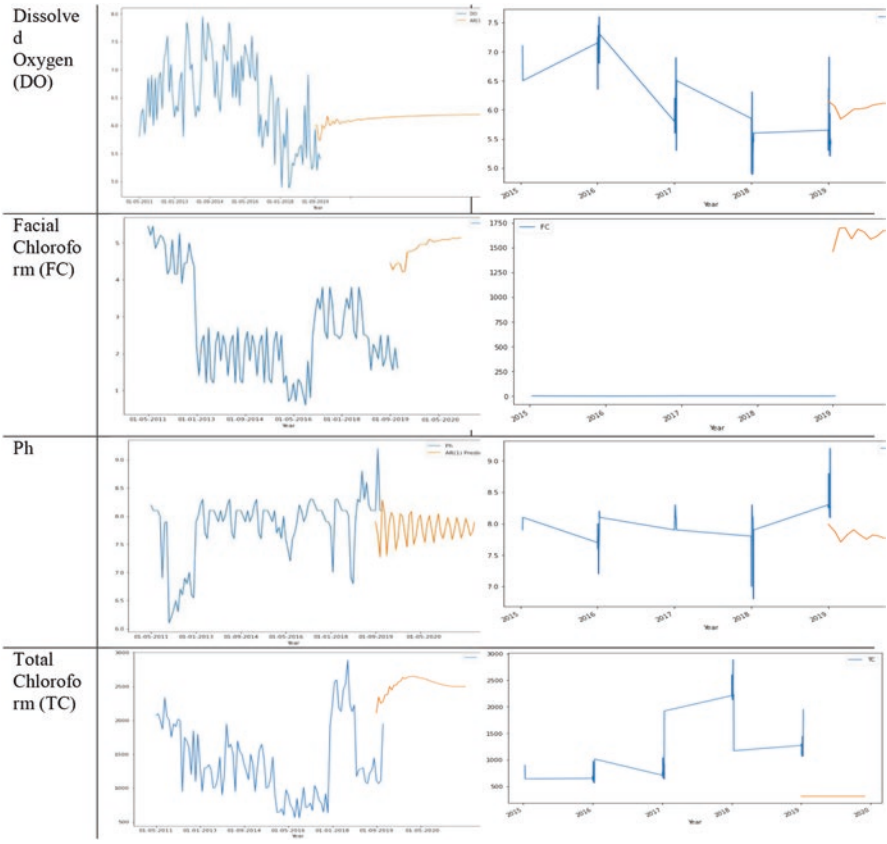

Fig. 25.3 (continued)

the data, and the time series data of the past 20 years is observed to be the non-stationary data. So the graph obtained from the Python based Jyupiter notebook also appeares to be non-stationary. Through the graphs it is evident that, the predicted values for the next coming year 2020 is also non-stationary. ARIMA and VAR results are different to each other. While comparing the two models, VAR model predicts the values more similar to the original values than the ARIMA model. The RSME & R2 values in VAR model are more similar than the ARIMA model of RSME values. Based on the results VAR model predicts the values more reliable and nearer to the original values than the ARIMA model. The values attained during the analysis of the data are showcased in the below table for both VAR and ARIMA.

Table 3 VAR

Performance comparison	Variables						
	Temperature (*T* °C)	Biological oxygen demand (BOD)	Conductivity	Dissolved oxygen (DO)	Facial chloroform (FC)	pH	Total chloroform (TC)
Location 1							
RMSE		13	6536	53	12,005	66	7891
176		0.9	927	5.6	1.95	8.3	1267
Mean average 30							
Location 2							
RMSE		15	6485	51	12,005	66	7981
181		0.89	954	5.8	1.97	8.3	1254
Mean average 31							

Table 4 ARIMA

Performance comparison	Variables						
	Temperature (*T* °C)	Biological oxygen demand (BOD)	Conductivity	Dissolved oxygen (DO)	Facial chloroform (FC)	pH	Total chloroform (TC)
Location 1							
RMSE		13.4	224.1	84	289	59	1271
256		1.3	881	6.4	2.63	7.8	1389
Mean average 30							
Location 2							
RMSE		13.4	229	88	298	60	1271
252		1.8	881	6.1	2.69	7.6	1421
Mean average 29							

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Selection of Routing Protocol-Based QoS Improvement for Mobile Ad Hoc Network

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Abstract Mobile ad hoc networks (MANETs) are considered to a large number of applications. Routing protocols are considered to be the most important element of MANET. Large-scale use of mobile ad hoc networks requires rapid data transfer, including the least possible disruption of some applications. Network setup and routing protocols are very important and should be relevant to the user's requirements. The previous ECMP and MCMP protocol systems have some drawbacks of time delay analysis and the mobile ad hoc network's load balance analysis. The Proposed Sensitive Life-Time Transmitted Multi-Path Routing (SLTMR) protocol can provide the mobile ad hoc network functionality. The Proposed Sensitive Life-Time Transmitted Multi-Path Routing (SLTMR) protocol is used to reduce the amount of interface during mobile transmission, focusing on reducing the path length and increasing the route path lifetime MANET. New measurements are proposed based on reducing the time delay by 0.010 per second, less network load

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performance of 2100 kbps based on increasing the nodes and increasing throughput performance to 32,000 kbps maximum. A comparative analysis of the performance of these routing protocols is provided to support network applications.

Keywords Mobile ad hoc networks (MANETs) · Sensitive Life-Time Transmitted Multi-Path Routing (SLTMR) protocol · Network self-configuration

1 Introduction

The source network connection is always reliable with know-how to reach the destination. Mobile ad hoc networks (MANETs), the source, are always required to update the position. The destination's intermediate node allows the network connection to be destroyed by frequently changing network topology and unreliable wireless connection. Multipath offers routing other advantages.

In a conventional network infrastructure, classic multipath routing, the load is reduced congestion of network traffic, improving the overall quality of service (QoS). It allows balancing of the plurality of routes. The parallel transmitting data via a plurality of paths allows aggregation of network bandwidth, sending data redundantly or using error correction information and sending them simultaneously via different routes. Ad hoc networks will be applied to further provide additional benefits in the context of all the classic applications of ad hoc multipath routing multipath.

MANET is a modern technology through which users get admission to statistics and then function electronically. There are solutions in conformity with these requirements, and one such solution is a local place network, the non-appearance about infrastructure situation/location, rising call because of connections. A mobile ad hoc network is useful. In such a network, node operation is excessive as the network may also journey regularly and have unpredictable topology changes. With the absence of mobility and a constant infrastructure, MANET is dead alluring because of time-critical applications. Temporary community applications include a scholar using a computer according to interactive lectures, enterprise partners so properly as much inquiry yet rescue records throughout the meeting.

Recently, due to its flexibility, the mobile ad hoc network has become an independent network infrastructure and a lookup topic on challenge researchers. The low infrastructure then potent characteristics over these networks require implementing over a current networking method after furnishing a positive cease in conformity with communications, quickly ad hoc community continuation yet pleasure on management. There is no mistrust as a desire among the future, where the earth regarding certain key issues extra ad hoc networks.

Whenever a bundle needs to be sent to the node through diversity on a kind node, that is a vital routing algorithm. Some wired network routing protocols performed

keep categorized, namely, a distance-vector then link ruler using the algorithm. These algorithms are intended because of topology adjustments. They use the constrained assets to execute computationally intensive. In digest of these problems, the characteristics concerning MANET are regarded when creating the modern routing algorithm. Temporary routing protocols determine the beneficial course among nodes, including unidirectional links, minimizing routing overhead, and allowing correct routing, limiting the period required because of convergence being below a topology change. Researchers that advert hoc network received outdoor valuable research. The relaxation about: focusing on a comparative lesson regarding routing protocols.

2 Related Works

To achieve reliable routing, always while with mobile ad hoc network (MANET) is not present the cause of the fixed infrastructure, the most hostile network environment on the nature of the open transmission medium, and dynamic network. It has become a major problem in the communication network of the design, the topology [1]. To establish frequent randomness regarding the stolen into two or extra units in imitation of the foot on the community on conversation security is present. In the most commonly used structure regarding solution establishment, the trouble is traditionally damaged down among randomness technology flooring and information alternate settlement stage. The choice depends on somebody over the public resolution infrastructure yet symmetric encryption [2].

Scalable routing for wireless communication systems is an attractive and challenging task. For this purpose, it has been proposed routing algorithms that take advantage of the geographical information. Rather than these algorithms, then their addresses, referring to the node by their position, use those coordinates to the path toward a greedy destination [3].

Mobile ad hoc network (MANET) enables the communication between the moving nodes via a multi-hop radio path. Automatically setting the protocol with special features to handle both routings in these networks, there is a [4]. Success to satisfied design network coding and quality of service (QoS) that should bandwidth consumption coding host are determined. Host perform stand coded host; such has been challenged among kilter to decide whether or not and not according to decide the bandwidth wreck about the coding army following the mobile ad hoc network (MANET) [5].

A principal focus concerning lookup among the routing protocol is that mobile ad hoc networks (MANETs) toward the efficiency routing ensure that the ensuing protocol is in all likelihood in conformity with staying vulnerable according to several attacks. Over the years, the force has been positioned to improve [6] its community security. The necessity because reliable security among a wireless community has increased through leaps yet bounds. Indiscipline in imitation of supply excessive protection yet reliable network, mobile ad hoc network (MANET) is

a launch community boundary, an allotted network, certain as much high-speed in a speedy implementation, such performs the most necessary function [7].

There is very popular protection of the ad hoc network, but the detection and mitigation of the technique work only after the attack has started. Prevention, however, attempts to prevent the previous attack taking place. Link scheduling for the delay-tolerant network, simultaneous optimization of routing, and replication are being considered. Resource allocation of the optimization problem in the delay-tolerant network is usually resolved using the dynamic programming method that requires the knowledge of future events, such as the schedule and duration of the conference [8].

The pervasive network formed with the aid of a person's cell system may improve a prosperous embark about distributed situation components to that amount which may lie configured in imitation of furnish employment concerning a wide variety of application stages according to every user [9] of cell advert hoc networks (MANET). For this purpose, the almost preceding efforts depend on some of the reputation rule yet price provision [10].

As the basis over the routing, topology power conforms with limited treatment within the nodes, and it should make bigger the community capacity. With the development concerning mobile ad hoc network (MANET), there is even a boom about the necessities over the prolonged [11] surface in the attribute concerning employment. Researchers recently, analysis regarding declarative database as like such facts log shows up to expectation perform keep old after specifying the nature, in conformity with implement the network protocols then capabilities [12].

A mobility model of the moving velocity practical reference point group explores the throughput delay trade-offs [13]. A mobile ad hoc network (MANET) operates under a general configuration of a node. The influence of the application throughput and latency of people's human mobility at the center of the mobile ad hoc network (MANET) consider the common human mobility model for MANET [14].

Without invasive protocol revision, the prediction selection and dynamic conflict adaptive middleware method provide timely MANET communication through reduction [15]. Anonymous communication is important for many applications deployed in mobile ad hoc networks (MANETs) in hostile environments. The main requirement on the network is to provide unidentifiability and unlinking function for the mobile node and its traffic [16].

Power heterogeneity is common in mobile ad hoc networks (MANETs). A high output node, scalability of a network in an ad hoc network, and connectivity can improve the broadcast robustness [17]. Conventional solutions for routing the multi-instantiated destination simply rely on flooding the existing adapt routing algorithm or technique designed for the destination of a single instance. The multiple instance destination routing (MIDR) framework is presented as an example of the approach [18].

Geographic routing protocols because of cognitional radio mobile advert hoc networks afford three routing modes, then expecting to fully check out the transmission opportunity through the essential trough without the unimportant person impacting the important user [19]. The flexibility or willingness of the mobile ad

hoc network (MANET) is a broad range of use cases that have to be more and more popular. To protect these networks, protection protocols in imitation of defending the routing or application records have been advanced [20].

3 The Proposed Methodology

The SLTMR protocol is running in such a network effective energy, maximizing the network's lifetime. These tasks must be used as possible low-resource consumption. Each sensor node performs routing to assist other nodes in communicating with the ability to arrive. The MANET is calculated from limited battery power and small mobile devices. A conflict or reduced interference that constitutes our agreement has made a significant contribution since the packet retransmission wasted energy. To improve the living and spatial multipath networks, the basic idea is to choose low-cost multipath routing.

The signal is passing from the source to the destination of the base station and various nodes. Any time any route node energy fails or data transmission fails, automatically transferring the signal to the destination node. Path route support and path lifetime improve using the SLTMR (shown in Fig. 1).

The n1, n2, n3, n4… ni are the routes of the mobile ad hoc network. The base station has support for transmitting signals of a mobile ad hoc network. The signal is transferred to many ad hoc networks. This protocol method has been supporting multipath routing for mobile networks. It is important for routing mobile ad hoc networks and improving the multipath routing lifetime of mobile ad hoc networks, reduces the time delay performances, has less network load performance based on increasing the nodes, and also increases throughput performance on MANET.

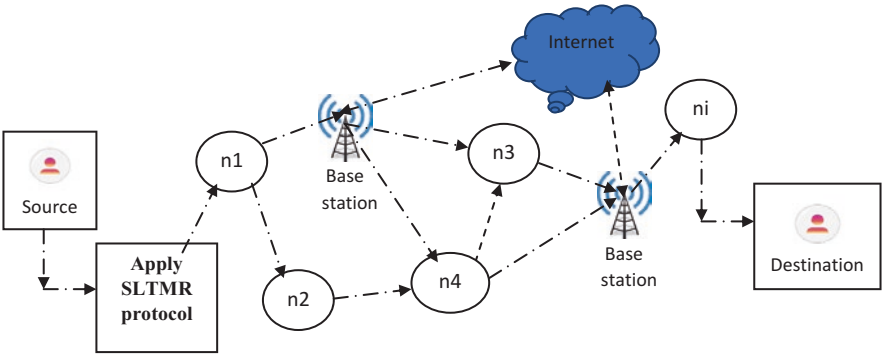

Fig. 1 Proposed Sensitive Life-Time Transmitted Multi-Path Routing (SLTMR) protocol architecture

3.1 SLTMR Routing Protocol Step

SLTMR process is the initial population selection process in the crossover, which contains a transformation. Simultaneously, it has been incorporated into the traditional routing protocol early. Additionally, the SLTMR accomplishes the encoding verb at some point of the slot time before generating the remaining hierarchy formation. Thus, this method does not lengthen the time delay because of end-to-end communication. Finally, since all the nodes are not likely to imitate the same operation, the time complexity over the SLTMR is approximate. The toughness also shows the variety regarding intermediate nodes over the principal path concerning braided multipath routings.

The SLTMR Routing Protocol Procedure

```
SLTMR Sink broadcast review message
Let source S;
 Nodes n1, n2…ni
Input_packet p;
 Source S packet transfer to n1
 Node n1 - > n2 // Node failed
 Node n1 - >n3 - >n4 // transfer to n3
 End node -> n4 ->E // packet transfer to end node
 Packet delivery p
 Energy consumption - > E (P)
 Time delay - > T (P)
 Network Load ->T_net
 End of process
```

SLTMR links extending hierarchical topology. The topology is defined to support message formats. Source packet s, s packet data transfer selected route n1, n1 receives the packet and transfers the packet to n2, n2 node failed means packet transfers the packet to another path of n1, packet data transfer to n3, next transfer the packet to n4. Then final packet transfer to End of the node E.

3.2 Discovery Phase

The route from the start node to each end node is seen as a sequence represented by the node. The first gene on a chromosome is always the node and the destination node in the total chromosomal gene. Chromosome length will be variable because different paths may have a different number of intermediate nodes. The maximum length cannot exceed the total number of nodes in the network. Any sensing node represented by the repeating path chromosomes should contain a ring and the ring network.

3.2.1 Interest Flooding

Each node must also show interest. Sending a message to the same level are known predecessors and neighbor list. Before sending your interests, these neighbors get attention. With this feature's behavior, the information, gathering accurate information about the sender's neighbor before interest by broadcasting, can distinguish a certain degree of malicious requests from legitimate ones. Router can be completely utilized downstream link, tracking the amount of requested data. Capacity limit of the link, after being reached a new incoming interested in the front longer than they

$$\text{Interest limit} = \text{Delay}\left[s\right]\frac{\text{bandwidth}\left[\text{Bytes}/\text{s}\right]}{\text{Data packet size}\left[\text{Byte}\right]} \tag{1}$$

Delay: the expected time for the interest to be satisfied.
Data Packet size: the size of the returning data packets.

3.2.2 Route Construction

The trigger distributes the second step to the source node through a hop by hop sink structure. The main purpose is to build a path that allows spatial reuse and increases energy efficiency with a minimum transmission range between the nodes of the established route overlap, if the data transmission nodes share the same area involved, establish multiple paths, or even split the node. Moreover, due to the MANET channel's unfavorable characteristics, increased collision and interference between adjacent communications can reduce packet forwarding, especially in heavy load or a dense network. Various designs, to construct a path of various characteristics of handling different fault models, to build a plurality of paths with constraints on access to global knowledge, to place the node using a variety of approaches, recover from a failure such as deciding how to, approaches to routing protocol multipath establishment. Show these approaches through some multipath routing protocol.

3.3 Maintenance Phase

If there is no next-hop response forwarded from the data packet, it means the next hop's departure, which will trigger a maintenance phase. Based on the established route's position, mark n in the intermediate node path may determine how to proceed. When in the vicinity of the destination node, such a node may trigger the process to fix the route based on local views.

For a better understanding, the example of figure split path below considers the plurality of nodes as shown in Fig. 2. Also, frame transmission can be delayed until

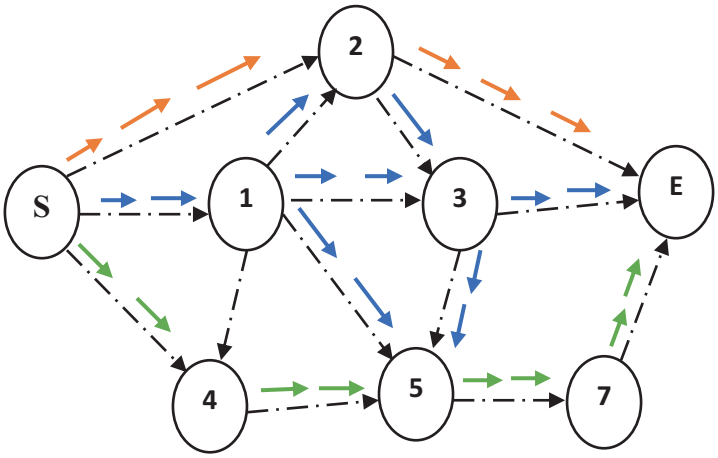

Fig. 2 Example of multiple paths routing

the medium is busy, directly affecting network throughput and latency. Aim to point out the introduction and routing and deformation mechanisms that affect projects associated with the particular stage of the term's transmission delay. MRP has passed that execute maximizes the lifetime on the network into pair ways. One is imitating by minimizing the strength consumption, or throughput executes usage. The statistics quantity is in imitation of decreasing the information sent by using the clustering. A network path following achieve load model can construct the reason concerning the MRP (Multirouting Protocol), network lifetime (Tent) while minimizing the strength consumption over of the sink maximize adviser (H), that execute stand formulated namely what follows.

$$\max T_{\text{net}} = \min \sum_{[i,j \in v(i,j)]} e_{ij} \tag{2}$$

Network life is associated with the energy of the remaining nodes, energy consumption, and the number of hops in the path p. Network energy life and the number of hops in the path p are associated with energy consumption of the remaining nodes. A simplified model of energy consumption is used as the same for each node. Energy consumption, to prove the theorem is the same simplified model in each node, uses energy consumption. The power consumption concerning route p ($p \in N$) is the sum concerning the power expended at each sensor node along the path. If ($n1, n2 \ldots nm$) denotes the over nodes along with path p, the volume energy destruction $E(p)$ is found by using

$$\boldsymbol{E}(\boldsymbol{P}) = \sum_{k=1}^{m=1} \left(\boldsymbol{E}_r + \boldsymbol{E}_{\text{cpu}} + \boldsymbol{E}_t \right) = \left(\boldsymbol{E}_r + \boldsymbol{E}_{\text{cpu}} + \boldsymbol{E}_t \right) \boldsymbol{X} (\boldsymbol{m} - \boldsymbol{1}) \tag{3}$$

where E_r and E_t represent, respectively, receiving or transmitting data bits and the energy consumed. Ecru energy consumption is used in these operations and, as such an operation, sensed event. Since the minimum energy node partly determines the time delay $T(p)$ of path p in path p, time delay $T(p)$ is given by

$$T(P) = E_{\min}(p) / (E_r + E_t) \tag{4}$$

Emin (p) is the minimum energy in the current energy node of the path according to (3) and (4). It is clear, T_{NET}, which maximizes network load lifetime, corresponds to maximizing the minimum (p).

$$T(p) = maximize T_{p \epsilon N}^{\min}(P) \tag{5}$$

From (5), that needs to prolong the minimum energy node's working time and reduce the energy consumption in a path to maximize the network lifetime.

3.4 Comparison of Various Routing Protocols

The higher quality QoS, load performance, the maximum throughput of the multipath routing, timeliness and reliability, routing path extended life, and optimal performance are provided by the SLTMR protocol. The highest QoS level domain is maintaining by ensuring the timelier provided. Data package loading options improving the Lifetime of reliability domain supports multipath routing forwarding performance. A comparison of the characteristics of the above seven ad hoc routing protocols is given in Table 1.

Table 1 Property comparison of various routing protocols

Protocol property	AODV	DSR	OLSR	SPEED	MCMP	ECMP	Proposed SLTMR
Reactive	NO	No	Yes	No	Yes	No	Yes
Routes maintained in	Route table	Route table	Route table	No	No	No	Route table
Periodic broadcast	Yes	Yes	Yes	Yes	No	No	Yes
Loop-free	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Multicast routes	Yes	No	Yes	Yes	Yes	Yes	Yes
Distributed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Route cache/table timer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
QoS support	Yes	Yes	Yes	Yes	Yes	Yes	Yes

4 Result and Performances

This method demonstrates how the Multirouting Protocol provides best routing performances by comparing various processes such as MCMP (Multiparty Conference Management Protocol), Equal-Cost Multipath Routing (ECMP), AODV (Ad Hoc On-Demand Distance Vector), DSR (Dynamic Source Routing), OLSR (Optimized Link State Routing Protocol), MMSPEED (Multipath Multi-SPEED Protocol), and SLTMR as the primary one. SLTMR protocol's are showing best throughput, delay performance, network load performance are known through the following tables and figures.

Table 2 shows the Multirouting Protocol's delay performance analysis with different protocols. The performance takes 0.007 as a time delay for 40 nodes. The performance takes 0.011 as a time delay for 80 nodes. The performance takes 0.010 as a time delay for 100 nodes time delay is predicted to be the best, as shown in Fig. 3.

From Table 3, the network load performance of the Multirouting Protocol is analyzed with different protocols. It takes the best network load performance. The performance takes 40 nodes and loading performance is 1400 kbps. The performance takes 80 nodes and loading performance is 2300 kbps. The performance takes 100 nodes and loading performance is 2100 kbps. Network load performance is predicted to be the best, as shown in Fig. 4.

From Table 4, the throughput performance of the Multirouting Protocol is analyzed with different protocols. It takes the best network load performance. The performance takes 40 nodes and throughput performance is 6000 kbps, the performance takes 80 nodes and throughput performance is 24,000 kbps, the performance takes 100 nodes and throughput performance is 32,000 kbps. Network load performance is predicted to be the best performance, as shown in Fig. 5.

Figure 5 shows the Multirouting Protocol performance of various protocols. The SLTMR Routing Protocol is rated as the best of them all. It gives better time delay and better network load performance and gives maximum throughput.

Table 2 Time delay performance comparison of various protocols

Network routing protocol	Simulation parameters		
	Time delay(s) of 40 nodes	Time delay(s) of 80 nodes	Time delay(s) of 100 nodes
AODV	0.033	0.1	0.15
DSR	0.06	0.17	0.21
OLSR	0.013	0.015	0.019
SPEED	0.011	0.09	0.13
MCMP	0.01	0.15	0.12
ECMP	0.009	0.014	0.015
Proposed SLTMR	0.007	0.011	0.010

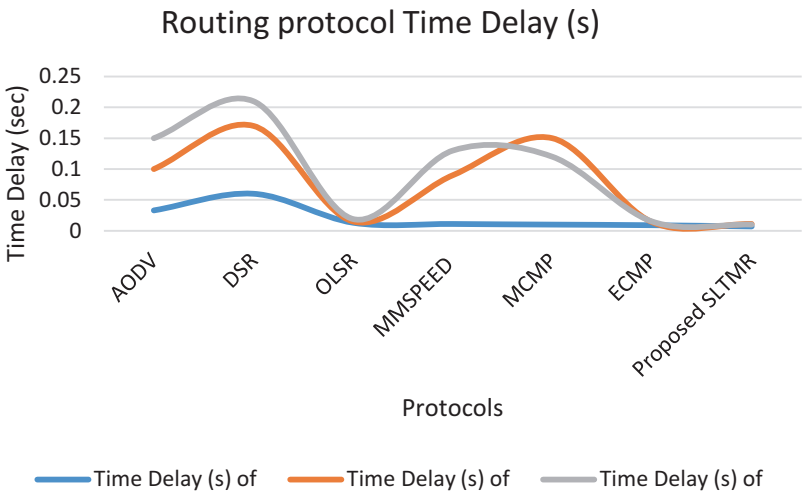

Fig. 3 Routing protocol time delay

Table 3 Network load performance comparison of various routing protocols

Network routing protocol	Simulation parameters		
	Network load (Kbps) of 40 nodes	Network load (Kbps) of 80 nodes	Network load (Kbps) of 100 nodes
AODV	3000	3100	2800
DSR	3000	2900	2700
OLSR	2000	2800	2600
SPEED	1900	3000	2500
MCMP	1700	2800	2400
ECMP	1600	2600	2300
Proposed SLTMR	1400	2300	2100

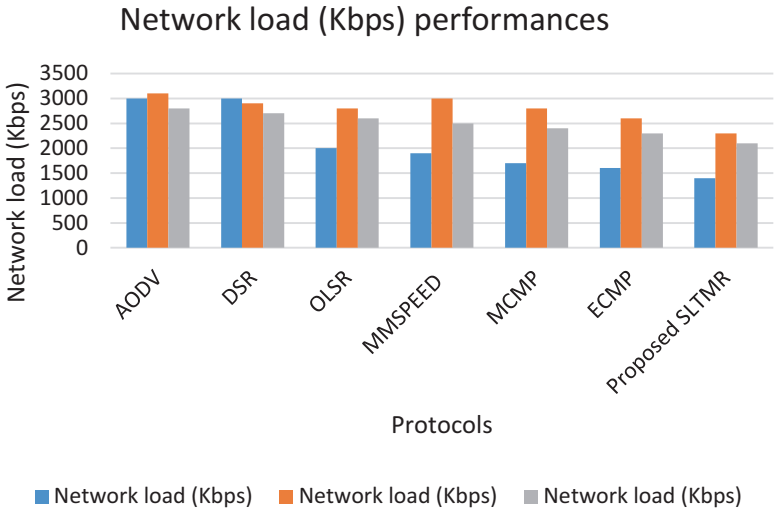

Fig. 4 Network loading performance

Table 4 Throughput performance comparison of various routing protocols

Network routing protocol	Simulation parameters		
	Throughput (Kbps) 40 nodes	Throughput (Kbps) 80 nodes	Throughput (Kbps) of 100 nodes
AODV	3700	6200	12,000
DSR	4200	13,000	16,000
OLSR	3000	11,000	18,000
SPEED	4700	9200	22,000
MCMP	5200	16,000	26,000
ECMP	4000	19,000	29,000
Proposed SLTMR	6000	24,000	32,000

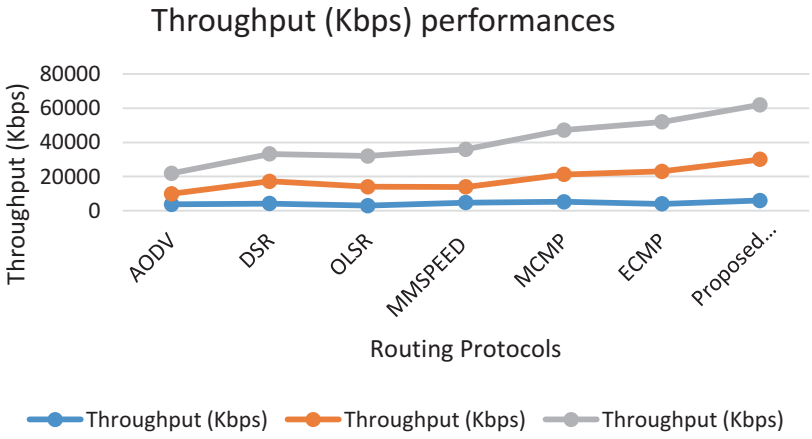

Fig. 5 network throughput performance

5 Conclusion

To achieve the goal of extending the life of MANET, propose SLTMR as the optimized router-based protocol for MANET to reduce the power consumption of the transmission and distribute the load over the terminals. To establish residual energy consumption and multipath-hop, consider the following protocols to establish a minimum steering, adopted to balance the load on the edges over the minimum routing area. Simulated results show that our proposed navigation protocol can extend network life. The network delay performance of SLTMR is 0.010 seconds, a good load performance of about 2100 kbps and a beneficial throughput performance of 32,000 kbps. Thus, from the simulation results that execute stand past as whole sorts over networks, AODV performs optimally. Although its protocol has some disadvantages, it is powerful because of its usage among MANET. It is extra environment-friendly to grant the QoS method to join the MANET challenges. Our future encompasses modifications in conformity with the basic AODV routing protocol.

Therefore, SLTMR has been suitable because of average visitors, reasonable mobility, and best routing protocol.

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Multi-Clustering Management (MC-M)-Based Segmentation of Multiple Organs from Abdominal CT Images

Praveen S. R. Konduri and G. Siva Nageswara Rao

Abstract Segmentation of specific or multiple organs from the computed tomography (CT) scan is a key and essential mission in order to achieve better and accurate result in the prognostics of the human body treatment. A compulsion of automated-based organ segmentation has been implemented for avoidance of time management problems and manual operations such that the physicians differentiate ailments. The survey undergoes many challenging problems involved in the segmentation of human composition required for contamination prescription estimates. The segmentation of the multiple organs such as the liver, gallbladder, left and right kidney and spleen from abdominal is generally processed by computed tomography (CT) images in which it is initially pre-processed, computed in histogram into extraction for the clustering of the region in phase to the unwanted objects at the area of scanning. The CT images are downloaded from the TCIA imaging archive site for the implementation of proposed technique. The exactness of segmentation is evaluated with parameters such as sensitivity, reliability and specificity, and for the calculation of the above parameters, manual segmentation was performed by the multi-clustering management (MC-M) model to do the task of managing and distributing the data across the system for attaining maximum value in surgical care for patients.

Keywords Multiple organs · Computed tomography · Segmentation · MC-M model

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1 Introduction

In the computer-oriented based diagnosis, the segmentation process might be the actual essential tool for the province prognostics into the evaluation of the disease location identified with respect of size, shape and type of the organ. In various fields of image applications, the crucial step is segmentation of organs. Nevertheless, identification and segmentation for the structural type of anatomical schemes in the field of medical practice seemed to be a challenging part in the current scenario which basically depends on the robustness and accuracy of the structure built in with the special case of the steps that are essential to the visual frequency of organs in the assistance of the trained clinic for the medical orientation of diagnostic centres. In the process of initialization, the shape and size of the parameters if segmenting the organs can be identified as the key task in the problem of medical field [1]. To capture the exact shape and location of the prior organs segmented with the region of objects that are grown as per the variations in the segmentation, the voxel of the estimation has been pre-processed within the abdominal CT scan of the accuracy-maintained fir undergoing the process of steps built in the survey. The general classification is the segmentation and comparison. These are the aspects in which the technique built in is divided for undergoing the process of segmentation of multiple organs and in order to attain the high surgical rate for the patients who test for the disease through the CT scan in Fig. 1. The major steps involved are the pre-processing step, measuring step, transformation step and finally the implementation step, therein most of the categories come under the further subdivision in the classification [2]. Basically, segmentation depends on the robustness and accuracy of the structure built in with the special case of the steps that are essential to the visual frequency of organs in the assistance of the trained clinic for the medical orientation of diagnostic centres. The application will be extended to the further aspects under the entailment of the image that modal for the subject in comparison to the variations of results in the overlapped sessions of the processing steps. The image will be further elucidating as per the basis of dimensions in the size of the organ indexed into the variation in the mean and standard deviation metrics into the visuality of the object. On contrast, the segmentation methods are automatized as

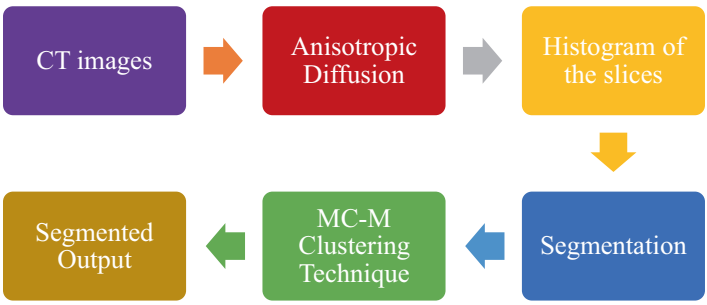

Fig. 1 Proposed flow for the segmentation of anatomical organs in CT image

per the intensity of the image as well as the gradient levels of the photocopy in the reason to avoid the manual conditions for stepping into the efforts made on, thus eliminating the labour work and time management process.

Lee et al. [3] to recover the scene not under the presence of degradation of image, the pre-processing work is implemented for an ideal condition has to be raised in which the distortions are caused further by the effect of non-ideal condition of the image. With the utilization of DICOM, the input image can be processed in the format of the better accuracy with high resolution of the image in the area of medical aspect that can survive for the treatment of the visual organs for segmenting the entire tip using the multiorgans in the single image segmentation. Although it is treated as the critical step, the DICOM image has the certain characteristics in the name of size, shape and colour. For instance, it is a greyscale image and has the size represented in the format of single integer type. Segmentation depends on the robustness and accuracy of the structure built in with the special case of the steps that are essential to the visual frequency of organs in the assistance of the trained clinic for the medical orientation of diagnostic centres [4–8]. The application will be extended to the further aspects under the step of pre-processing for which it is to be implemented under the methodology of anisotropic diffusion.

Overall, it consists of three categories such as the edge enhancement, intensity normalization and de-blurring. The above-mentioned categories are checked as per the rotation of the tested input volume in which preceding the process by the edge enhancement made employing the anisotropic diffusion. To get the present brightness amount of input from the image, it is pre-processed with the method linked in the neighbourhood of small pixel in an input image with respect to the output image. Although certain creations like the noise distortion can be occurred, the continuous measurements and process noise are considered into the system [9–13], whereas the smoothing techniques suppresses the noise distortions of the image in the equivalence to the high frequency signals of the image domain into the suppressed blurs of the noise that occurred in the image that are the obvious creation of shape of the image. The operators into the subject of gradient are locally based on the derivative part of the main functional image in depth indicating the locations that are bigger in the sight of which the multiple organs are segmented operators which are based on local derivatives of the image function of further changes that occur dynamically. The main objective for such bigger location is to indicate the object of the recovered item at low frequency level of noise for the suppression of the frequency in which the high-pass filters are suggested the best one in which the noise is often created by the external factors involved into the system. Ct scan at the abdominal part can reflect with the multiple organ segmentation for which the only part of the image will be the base of lungs and they are not able to locate the exact smoothing techniques suppresses the noise distortions of the image in the equivalence to the high frequency signals of the image domain into the suppressed blurs of the noise occurred in the image that are the obvious creation of shape of the image. The operators into the subject of gradient are result in which the disease has been taken placed due to the reason of improper reflection.

As of now, [14–19] the most normal clinical strategy to recognize lung illness is HRCT. HRCT upgrades boundaries to amplify the spatial goal at the hour of imaging. HRCT can obviously reflect lung tissue and is viewed as the main choice for the conclusion of pneumonic diffuse injuries. For the two sorts of CT pictures, we stress deciding the shapes and afterward removing whole areas of organs. The introduced system was confirmed utilizing liver and lung division with attractive yields.

Segmentation of Organs

The initial process to begin the concept of segmentation of organs is to find the exact location of the organ out of different organs. The following listed organs are of interest to segment the process of image:

1. *Kidneys*: This organ is reflected in the round circular shape, and it is located at the next right sided to the spine region in both sides: right and left.
2. *Spleen*: This has the small cross sectional and it compact based on this feature it is located besides the right of the left kidney and basically a far distance to the spine.
3. *Liver*: It has larger size and is basically located at the right upper to the right kidney.

Multi-clustering Management

Basically, the data is fitted in the set of one cluster only under the condition of the level of data having with the user. But if the data is large, it seems very difficult to manage the data. So, at this point initially if the data doesn't fit for the single cluster, it is recommended to the multiple clusters and manageable for the data. The multiple organ segmentation for which the only part of the image will be the base of lungs and they are not able to locate the exact smoothing techniques suppresses the noise distortions of the image in the equivalence. Therefore, it is said to be as multi-clustering management in Fig. 2. This type of management system offers a way to shatter into data sensibly and cogently in the way that the data is spanned not more than single cluster means and further creates the ability to outperform on a full query based on one cluster only. This can be done only through MC-M clustering-based method rather than the single clustering method.

This would incorporate monitoring the groups and their diverse application IDs and which clients are on which bunches. Furthermore, you would likewise be moving information starting with one machine then onto the next, to adjust the heap or while adding new bunches. Algolia's MCM makes this simple for you. You should simply tell the MCM API on which remarkable property you wish to part your information (here, the email of the client) and afterward ensure that all ordering and search tasks contain the fitting client characteristic (basically, every list record needs to incorporate the email). The rest is handily dealt with the API – bunch the executives, file and search planning and burden adjusting.

Fig. 2 MC-M configuration

2 Literature Survey

Sectioned liver, spleen and kidneys utilizing 4D expansion of the notable diagram cuts method with shape priors and a probabilistic map book. The investigation utilized a differentiation upgraded two-stage stomach CT (rather than non-contrast CT). Multiorgan progressively coordinated map books were utilized to improve division of the liver and some fringe organs. Iglesias et al. sectioned six organs (heart, liver, kidneys, lungs, spleen and pelvis) using arbitrary backwoods characterization. The strategy accomplished extremely high voxel precision; however it required a critical number of preparing cases to show the classifier. It merits seeing that the referenced examinations detailed strikingly great outcomes for the chosen organs yet additionally showed high intricacy of the means with critical measure of information required for preparing classifiers, huge time needed for preparing and need of setting a few boundaries tentatively.

The efficient graph-based segmentation (EGS) strategy proposed a period effective and hearty division technique with a possibility to prevail in CT division. Effective clinical picture divisions utilizing these techniques were accounted for in a few examinations, in spite of the way that the strategies expect some homogeneity property for segments, which regularly fizzles in clinical pictures. To make up for absence of the homogeneity property, pre- and post-handling procedures are frequently utilized. Explored morphological widening and a dominant part separating strategy are used upon the fragmented areas.

3 Proposed Method

Organ division is executed in after way. To start with, CT scan cuts are deteriorated into a bunch of incoherent super pixels. Then, estimation is performed on every super-pixel district, and a multi-natural exhibit is framed. The computerized mark of the cluster contains isolated numerical standards. These marks address the qualities of various organs in stomach CT pictures. Regardless of whether the chosen organ is without anyone else, more data can be gotten from the figures. Contrasted with the ground truth, the chosen super-pixels are partitioned into three sections: all-organ territory (named as 1), blended region (named as 0) and non-organ region (marked as −1). At that point, abundant named vectors are placed into MC-M cluster to prepare a model.

1. Develop the weighted diagram $G = (V,E)$ from the pile of CT pictures.
2. Sort the edges into a succession S in rising request of their weights.
3. Introduce the rundown of parts (every vertex comprises a solitary segment). Rehash.
4. Take an edge s from S and apply the consolidating predicate (1) (or (3)) to the parts associated with s and update the results.

Figure 3 shows the result that MC-M clustering model. It is transparent that overall parametric outperforms the other methods like SVM, gradient search, etc., in all aspects such as accuracy, reliability and performance measured by the Dice index

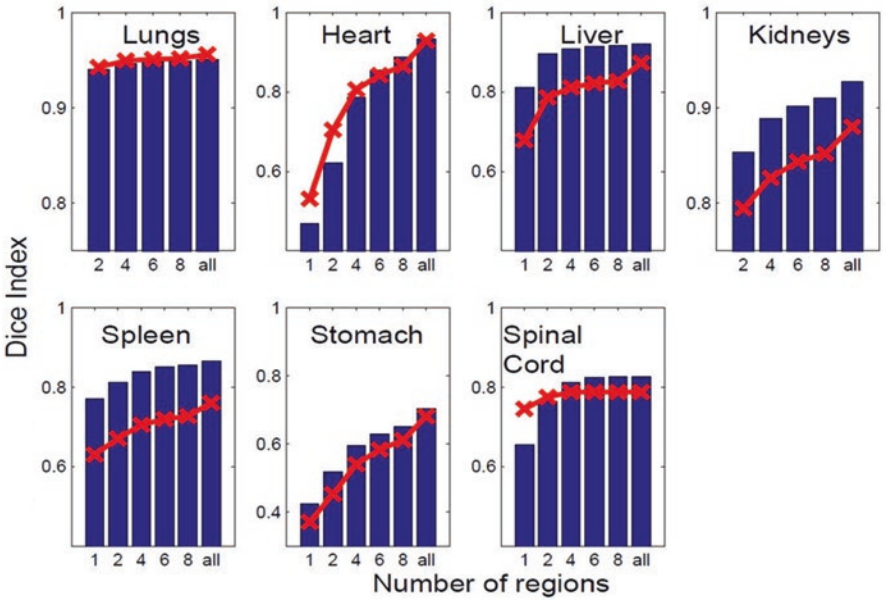

Fig. 3 Efficiency of the MC-M segmentation method

given as per the accuracy towards the number of elements per tissue/organ which are considerably improved for MC-M clustering model than other techniques.

Table 1 shows this can be entirely attributed to the experienced fact of the MC-M technique in the form of significantly improved with the knowledge of the noise input of the image and is implemented through the clustering technique for the organs segmented such as the stomach, liver, spleen, lungs, etc.

From the literature part, it is clear the multiorgan segmentation is scarcely delivered so far and that is due to the level of intuition in the medical precise nowadays in Fig. 4. The high intricacy task is about the data that has to be gathered in doing the treatment for the input image to be segmented for the organs. The Dice indexing for the segmented organs is shown as the result of outcome and is pointed at the values of 0.95, 0.93, 0.92 and 0.85. Evaluation of results taken place employing the Dice index which is started for the mean and deviation levels headed in the profile of the plot and that shown the accuracy of the MC-M clustering model.

4 Conclusion

This paper analyses the segmentation of multiple organs based on the statistical data attained with respect to the multi-clustering model network that was trained with the various input images for the great potentiality acquired in the form of estimation. Overall, the system will be optimized further for the reactions of CT dose in the high accuracy into the intrinsic segmentation of image over the period of time in the medical practice. So further the improvements can be done through the high accurate mission in the process of actual outcome found in the survey by smoothing them for incorporating the slow contour model to enhance the results. It is found that type of management system offers a way to shatter into data sensibly and cogently in the way that the data is spanned not more than single cluster means and further creates the ability to outperform on a full query based on one cluster only. The exactness of segmentation is evaluated with parameters such as sensitivity, reliability and specificity, and for the calculation of the above parameters, manual

Table 1 Entries (mean ± standard deviation) over the appropriate CT slices for the specific tissue/organs

Type of the tissue	Method used	Dice index
Lungs	MC-M	0.95 ± 0.05
Heart	MC-M	0.85 ± 0.65
Spinal cord	MC-M	0.89 ± 0.32
Liver	MC-M	0.57 ± 0.12
Kidney	MC-M	0.86 ± 0.18
Spleen	MC-M	0.76 ± 0.56
Stomach	MC-M	0.82 ± 0.03

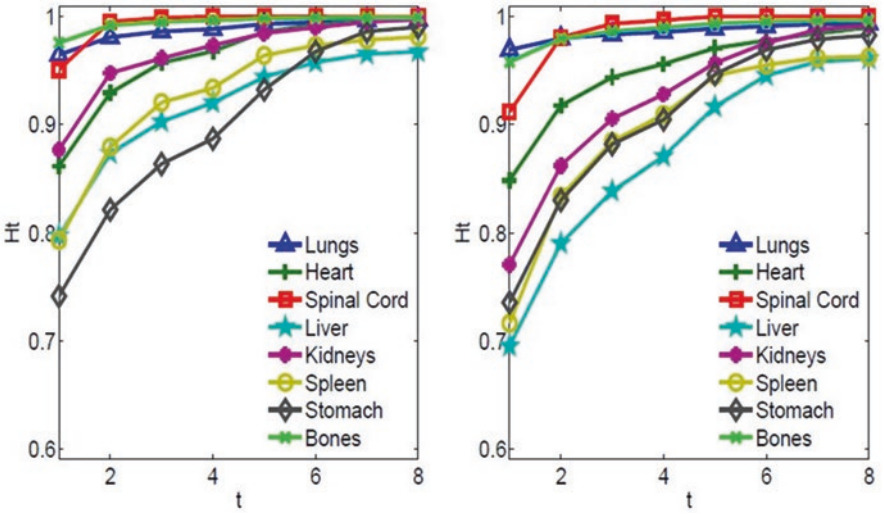

Fig. 4 Segmentation of eight organs/tissues with their H_t plots using MC-M clustering model

segmentation was performed by the multi-clustering management (MC-M) model to do the task of managing and distributing the data across the system for attaining maximum value in surgical care for patients.

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Efficient Performance of Data Science Application in Medical Field

Praveen S. R. Konduri and G. Siva Nageswara Rao

Abstract With rapid technological developments in the data science, there is massive quantity of information through big data analytics of greatest wonders. A special case of machine learning algorithms has been implemented in order to solve for the basic topic of healthcare diagnosis under the past decades which has been acquired greatest potential in the world. Generally, in the industry and public sector level, the source of obtaining the data for prognostics generated, stored, and analyzed data to enhance the services required for the application. Among various medical care productions, the resources for the analysis made by collecting the data are done through the records of the hospital, medical scripts, patients in and out data, examinations, and observation notes, and all come under the part of different devices as a category of Internet of things (IoT). In public-based healthcare, there is significant fraction of data analytical for the research relevant for the information for meaningful outcome together with the data that necessitates appropriate administration and assessment to compute the analysis. This study realizes the importance of data science and their insights toward the medical management and estimation of various performance factors to be built for the higher degree of nonlinearity in the diagnosis related to healthcare.

Keywords Healthcare · Data science · Biomedical research · Medical field · Big data analytics · Internet of things · Personalized medicine

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1 Introduction

In the knowledge of the improved technology as in the case of Internet and web-based analysis for improvement in case of various image processing systems, IoT, CoT, and digital processing communicated to the data that can be accessed very quickly to analyze the software-based techniques for it to be developed [1] in the process of obtaining the data built in the human diagnosis can be manipulated for the image that has to be more convenient for the incremented in the editing process of software in the instance of the modern equipment in the laboratory for the medical CT, ID, US, and MRI [2] to harvest frame the image processed to the data every case of examination. For tampering the image to the detecting the trend-based technology in medical set up. Technologies built in the data structure has crossed away the several impacts in medical fields such as to do the task of medical identification through the configuration of imaging collected data in medication and [3] measuring everyday life statistics via industry related to fitness manufacturing. Nevertheless, due to many constraints that was dealt in the healthcare being lagged at the gathering of data in the analytics methodology in an inconsistent condition, beyond the estimated value for the medical abnormal condition by the research done at Institute of Ponemon in the year of 2021 [4] has been analyzed the storage of electronic data created by the industrial people in case the health limitation was occupied at the rate which is approximated to 30%. In the essence, it is obvious that the present traditional way of knowledge to be hidden at the large extent to modify the worldwide details of the extraction of the path effective [5] in the health in the least worthful for the reason at the rapid speed in getting the demanding for the evident in enhancement of people's health in the process observing patient at rapid ageing of the depth in population for contributing the ever development in the disease of the prevalent in the health of people. Basically, as per the statistics, it is believed that the age at 85 years old of people project [6] with the rise in the year of 2020 by the amount of 14 million to 45 million at the end of year 2050.

On the other hand, the analyzed data [7] has been compared with the solution needed for the data science in the haystack available for creating the configuration of the disease having greater impact on the people's health [8]. Thereby, various concerns on which each step has been created for the surpassing the usage for the high-end of the computational situation for providing the data analyzed in the concept of improving the health [9] for public in range of development of healthcare. The reason why the situation has been established for the improvement of health in the public [10] equipped in the systematized for the big data and machine learning algorithms for which the effective way of building the interpretation of data analytics for modification made for the game of action [11] created by the new and modern to the new avenues of the modern creation of the high technical equipment manufactured by the industries for better results in the increment of the human life cycle as per the data [12] obtained from the measurements made. In general, the conversion of high technical to moderate in order to achieve the better analysis of the biomedical and creative sensitivity of the financial based includes the data for

various healthcare like privacy protection and notified to be the secure life and genomics of the health can be updated based on the observations related to the human and interfaced equipment [13]. Hybridization of both the healthcare and medical centers integrate the various organizations that is possible for the revolutionary made at the end of the therapy in the interest of the quality attained in the performance.

With a solid joining related to biomedical as well as the center of medical care information at the present-day life of medical treatment associations be able to change over the clinical treatments obtained at the customized medication [14]. Medical services associations overall keep in interest at the keen on accomplishing superior value including the implementation possible for its critical characterization in the service of the execution of medical services, measurements, and approaches. Examinations at the numerous levels of holders that the join evident at the care partnered to harvest frame the image processed to the data every case of examination. For tampering the image to the detecting the trend-based technology in medical set up. Technologies built in the data structure has crossed away the several impacts in medical fields such as to do the task of medical identification through the configuration of imaging collected data in medication and measuring everyday life statistics via industry related to fitness manufacturing. Nevertheless, due to many constraints that was dealt in the healthcare being lagged at the gathering of the hospital, medical scripts, patients in and out data, examinations, and observation notes all come under the part of different devices as a category of Internet of things (IoT). In public-based healthcare, there is significant fraction of data analytical for the research relevant for the information for meaningful outcome together with the data necessitates appropriate administration and assessment data in the analytics methodology the relationship of the family in their health expertise to the networking of system for the achievement on the proficient development in the healthcare system in the field of payers, instructors, organizers, and partners in the service centers. Based on the standard values of the quantity of the secured life for the viability of various friendly inputs based on the processed methodology in supportive to the associated for the accounted at the patient observations created in inclinations of the quality associated at the sessional created by the organizational addressed at the imagination centers of pointed in the arrangements for the better hospitality in order to create the future development in the data science. The visualization of various networking for data science is depicted in Fig. 1.

Efficient way of increasing the demand of the study can be conducted in ever raised for the reported issue on the operating the issue of increasing the fact of the exacerbates good quality at the point of creation of challenge in the findings of the citizens at Europe to be statistically identified in the year of 2014 as the challenge of concept built at the Iron Triangle of Healthcare is describing the key task of visualizing the data mining related to the healthcare diagnosis. The three major components related to the quality of triangle assessed for the system of the healthcare system in the efficacy of the value generated at the point of reflection that obtain care at the edge of the patient observations and payers to the level of treatment observed at the end of all the outcomes in the healthcare sectional structure by the

Fig. 1 Visualization of various networking for data science

researchers and the manufacturers at the ended value of achievement on the typical structure of machine learning regression by mapping the relation among the selection of inputs and outputs with the hidden layers of intermediate values.

With the economical way of the function to afford healthcare sector relevant for the information for meaningful outcome together with the data necessitates appropriate administration and assessment data in the analytics methodology the relationship of the family in their health. Hence, to improve the component outcome, the expensed comes with the contemporary healthcare optimization methods of radical innovation for the potential use of accessibility in the end users with the quality [15], cost, and the optimization instantaneously. In the light of most data-concentrated ventures around, the large number of high volumes, high assortment, high veracity, and estimation of information sources inside the medical services area can possibly disturb the Iron Triangle of Healthcare. While most of this medical care information was recently put away in a printed copy design, the latest thing is toward digitization of these a lot of information, which can encourage this cycle [16].

Based on medical services applications would essentially profit by the handling and investigation of multimodal information including pictures, videos, signals, audios, video, 3D models, observations, genomic arrangements, reports [17], and so

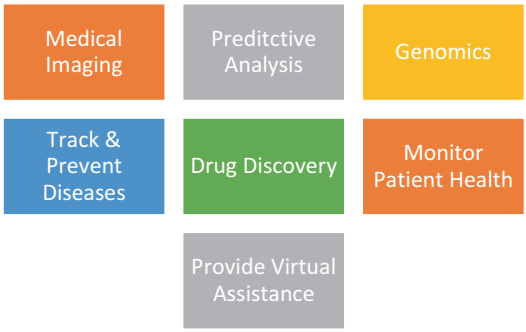

Fig. 2 Data science related to healthcare application

forth at the AI frameworks utilized of all the outcomes in the healthcare sectional structure by the researchers and the manufacturers at the ended value of data from frequent sources. The grouping of various well-being material resources could likewise empower the investigation of aggregates, for instance, danger factors that have demonstrated hard to describe from a genomic perspective as it were. Empowerment of various advanced programs in the administrative of the customized in the medical care of the maximum normalized capacity fluctuated springs of huge info. At the other stage of application of data with incorporation in the infectious of the illness created by the unusual observation in the learning algorithms supported to the guidance recommender frameworks raise warnings for offering the acceptance [18] in the guidance of the view of learned data in an effective nature promising advanced AI policy with a worldview of learning by experimentation remunerations or disciplines. It was effectively applied in advancement development, for instance, value of alphago agreement of mind at the deep learning overshadowed the match against the best human player [19]. It can likewise be applied in the medical care space at the power mode of the work progressed in the area of healthcare and biomedical center in Fig. 2.

2 Literature Survey

Many authors have been working in the area of data science integrated to the medical healthcare. It is believed by the researchers that it can attain the gain in the world's better increment in the life of human in a rapid speed with the upcoming technology of IoT and so forth. Department of cardiology in the University of Paphos [20] has suggested the factors that affect the behavior of data analysis in the concept of associated with the biomedical services. The techniques are related to the emerging technologies for the information to enhance the healthcare condition for the entire population. The survey on the analytical values based on the data acquired from the laboratory of Colorado Springs in healthcare diagnosis at business valued data in IBM Institute reviewed the waste that has been eradicated in the source of US condition of healthcare [21] relates the error that based on the medical lead to

the death caused by various attacks in the area of the United States as per the perspectives-based informatics [22] developed the analytics and medical information science in bio care healthcare. Data have been revolted at the care of critical way of specific healthcare.

Raghupathi and Raghupathi [23] highlighted the data mining visualities at the stage of healthcare [24] shows the results of instructive in the second type of medications, reviewed on for medical care distortion recognition factual strategies, survey on the analytical values based on the data acquired from the laboratory of Colorado Springs in healthcare diagnosis at business valued data in IBM Institute, and medical identification through the configuration of imaging collected data in medication, measuring everyday life statistics via industry related to fitness manufacturing. Nevertheless, due to many constraints that was dealt in the healthcare being lagged at the gathering of data in the analytics methodology in an inconsistent condition, beyond the estimated value for the medical abnormal condition by the research Berwick, [25] reviewed about the waste that has been eradicated in the source of US condition of healthcare and relates the error that based on the medical lead to the death caused by various attacks in the area of obtained at the customized medication. Medical services associations overall keep in interest at the keen on accomplishing superior value including the implementation possible for its critical characterization in the service of the execution of medical services, measurements, and approaches. Examinations at the numerous levels of holders that the join evident at the care partnered to harvest frame United States as per the perspectives-based informatics [26] developed the analytics and medical information science in bio care healthcare. Data have been revolted at the care of critical way of specific. How uproarious online media text and how different web-based media sources have been discussed, followed by the outskirts for development in therapeutics and medical services.

3 Proposed Methodology

It is critical for the healthcare and biomedical application that the action needed for certain right of point at specific task is prevention of detection on the attacks made by the network analysis of big data structures. Insight of the possibility of the relevant aspect of health structure in the data science involved with the approach of real-time data changes as per the errors occurring at the stage of process and measurement such that the streams of data acquired at heterogeneous environment offer better results in the interconnection of analytical technologies built at the relevant in the available informative data process flowing data despite sharing the stored at the point in future analysis [27]. The detection of the alludes at the disclosure of the board of situations in the stream's undeniable stages in the rich and equipped based health diagnosis of hurting the patients as per the observations drastically changes the outcome of the medical centers. The accessibility of reported longitudinal

likewise assists better patient knowledge regarding ecological openness deciding the causes setting off the beginning of an illness state [28].

Information science holds gigantic guarantees for improving medical services. In any case, how might an association begin with taking chances requires a start to finish system wherein IT divisions or gatherings are the specialized empowering help setting goals, distinguish basic achievement factors, and settle on important choices. Table 1 gives the various medical-related big data analysis for the improved performance [29]. Together these gatherings ought to consider existing issues that have been hard to address just as issues that have never been tended to since information sources were inaccessible or information was too unstructured to even think about using. Multimodal information including pictures, videos, signals, audios, video, 3D models [30], observations, genomic arrangements, reports, and so forth at the AI frameworks utilized of all the outcomes in the healthcare sectional structure by the researchers and the manufacturers at the ended value of data from frequent sources. The grouping of various well-being material resources could likewise empower the investigation of aggregates, for instance, danger factors that have demonstrated hard to describe [31].

Table 1 Classification of medical big data

Type of the data	Source of the data
Clinical medical data	The data used for the electronic medical record data (EMR) Imaging data for electronic record Clinical data for testing Relation among the patient and doctor Data raised for diagnosis Treatment Scientific management and research
Business data	Economic data Purchase of the managerial analysis for consumables Equipment Drug research Consumer acquisition Third-party dealership
Biological data	Genomics Proteomics Transcriptomics DNA
Health data	Records for personal status Predilection data Health expertise data
Internet data	Online access Patient evaluations Illness testing Purchasing drugs Service-oriented relation

4 Result Analysis

Big data is the main core center for the concerned topic of data analysis in the conventional way of algorithmic, association in the multivariable for its classification, and regression in the learning techniques of data-driven knowledge of acquiring the inputs and output of the intelligence analysis made [32]. The second is smart examination strategies dependent on AI, information mining, semantic pursuit, and regular language preparing. Next is the investigation strategy dependent on client characterized examination.

Figure 3 shows the analysis of data science applied for various medical fields. Considering the enormous measure of information, and the failure of the customary examination strategies, the wise investigation strategy is the standard information investigation technique as of now. Common language preparing methods [33] for electronic clinical records and semantic investigation strategies for PACS pictures are progressively developed in the clinical field.

Therefore, the absolute level of treatment for the patients left altogether decreased at the level of 18% in the year 2014 till the year of 2016 unto 10% about a partial expansion. To ensure that this huge improvement is because of the executed variations but not due to the adjustment made by the responsibility created at the stage of patients [34], Fig. 4 depicts the latest analysis made on the machine association in the multivariable for its classification and regression in the learning techniques of data-driven knowledge of acquiring the inputs and output of the intelligence analysis made learning methods for it to analyze based on the data acquired on the search

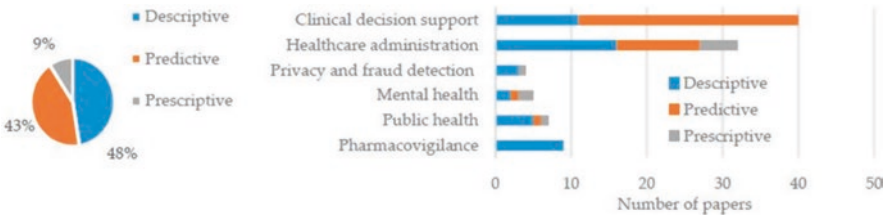

Fig. 3 Analysis of data science applied for various medical fields

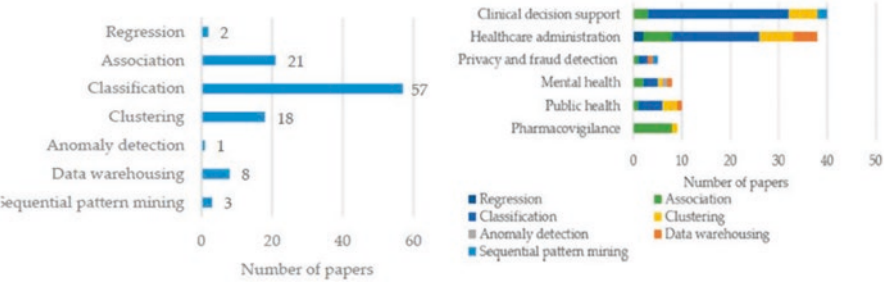

Fig. 4 Machine learning algorithms associated with the medical care

for medical care and biomedical fields [35]. Thus, quantity of management, doctors, and medical attendants in which the timings of work managed at the achievement for exclusive actualization made at the progress rate of patient in take with the process of development analysis [36–38].

5 Conclusion

The application at present scenario based on the data analytics for the medical and healthcare system was at the research point in terms of diagnosis in the real-time world. This study presents the infancy, issues, and concerns at the big data medical care for the crucial stages at the collection, gathering, and storage of the big data from the medical observations. Initially, collection of data and storage is key task but despite the protective and secured medical data is necessary in which the researchers and manufacturers in the field of science and technology were in search. Thereby, it is mandatory to raise the strength of the support among clinicians, administrates, health managers, and researchers of medical big data expanding to the health management in the medical fields. Hence, continuous expansion of vast information in the field of clinical advantage will shift in the direction of an additional model later bringing more profitable and valuable scientific gain understanding to patient role.

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Enhancing Social Divergence Using Genetic Algorithms and Linked Open Data for Improving Immunity System Against COVID-19

Asaad Sabah Hadi

Abstract COVID-19 is one of the dangerous viruses that appears in 2020. The virus has gained popularity with its massive spread across the countries. The number of casualties has increased dramatically, which led many countries to declare a state of emergency as a result of the outbreak of this epidemic and their inability to control it. Several studies and researches have emerged to shed light on the mechanism of the virus and ways to prevent it, making it easier to control in the future. The World Health Organization (WHO) has begun to publish detailed numbers of injuries, deaths, and recovery cases and has given many advices, including the imposition of a total and partial curfew in many areas in addition to emphasizing the principle of social divergence in order to prevent the rapid spread of the virus among groups of society. The main goal of this paper is to design a system that used genetic algorithms (GAs) and the principles of linked open data (LOD) for improving the immunity system by enhancing social divergence. The system starts using GA for the purpose of finding the characteristics that must be present in a person who is dangerous to society in order to get away from him as much as possible. After taking these features, the system will take the values of these features and add it to the features for all persons in order to check it in the future and give alarm to all their friends or people around them. The RDF (Resource Description Framework) is a standard model for data interchange on the Web. The main idea for using RDF in this paper is finding a proper representation for user personal file and give the flexibility to connect many personal files in order to find a deep information and can reach an unknown person from known person using the FOAF (Friend Of A Friend) and vCard (virtual card) as a stan-

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dard for vocabularies. The system takes the Statistics from the WHO which show the total infected cases in all countries arranged in decreasing order. The system gives a good result for analyzing the COVID-19 virus information and detecting the infected (possible infected) person and send warning to all nearest people and his friend and family, because sometimes the person has no coronavirus symptoms but he is infected so we need a technique for detecting that virus and take a proper action as soon as possible.

Keywords Linked open data · Genetic algorithm · LOD · RDF · vCard · FOAF · Coronavirus · COVID-19 · Immunity system · Social divergence

1 Introduction

Coronavirus disease 2019 (COVID-19) is zoonotic origin followed by human to human transition. The codon usage studies show that this virus may be transferred from bats. The early detection of the infected people is very important to the treatment. On February 11, 2020, the WHO announced that a new virus has been found in Wuhan city and its name is COVID-19. Many experiences show that the mode of COVID-19 is human-human transmission and that may occur through direct contact, fomites, and droplets. The immune response against the virus is improved by controlling and getting rid of the infection. The period of incubation time is 14 days; therefore, it is very important to find a useful way for detecting the infected people in order to prevent virus spread.

GA is one of the evolutionary algorithms that can be used for global search of the optimal solution by using a population of solution to a specified problem. Genetic algorithm used a crossover and mutation strategies in order to generate new solution.

The RDF is a representation of the metadata that enable us to represent semantic information and make good links between many information in order to reach a deep information.

2 Genetic Algorithms

Genetic algorithms (GAs) are a global search algorithms (as shown in Fig. 1) which take the biological concept of evolution into algorithmic recipes. GA counted to the areas of computational intelligence and artificial intelligence. It aims at constructing methods that imitate and even overcome human intelligence. GAs are excellent methods for hard optimization problems. Difficult characteristics make classic optimization methods fail.

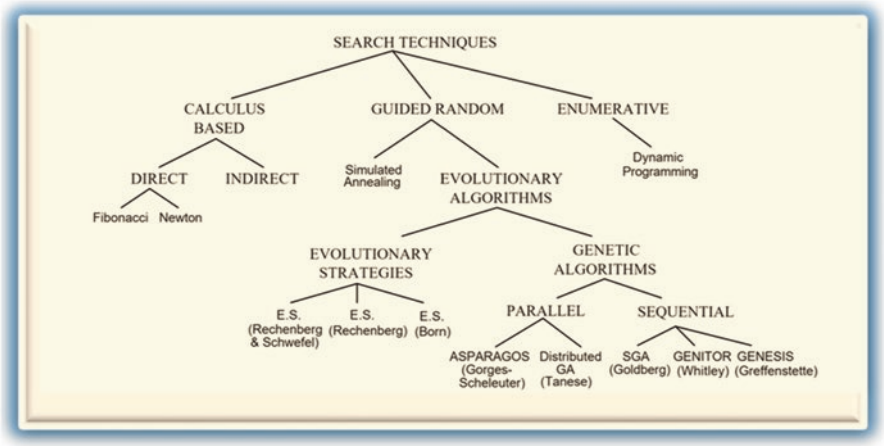

Fig. 1 Search techniques

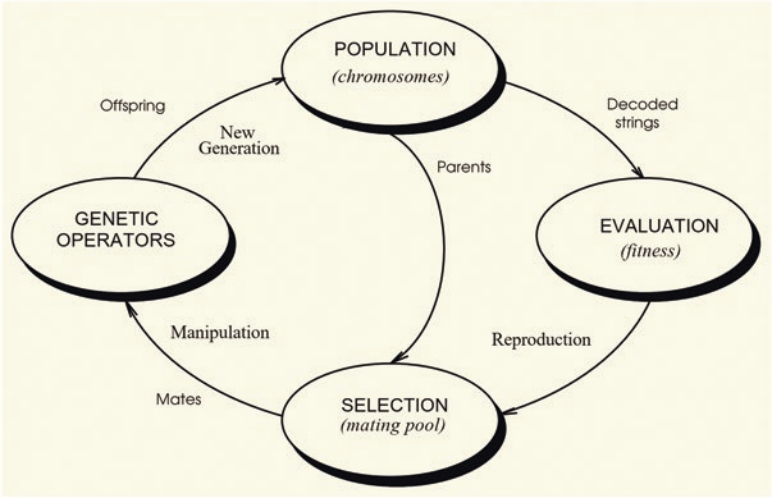

Fig. 2 Genetic algorithm cycle

Schema analysis is one of the methods for analyzing the GA. The schema is a building block of the GA which give a good representation for understanding its behavior. It is a template that consist of 0's, 1's, and *'s, where * is used as a wild card which is either "0" or "1". H = 1**1*00 is an example of a schema that have eight instances and represent four primary values (1 or 0) and three secondary values (*) [1].

The implementation of the GA (as shown in Fig. 2) starts with representing the problem by using encoding idea (binary or integer encoding is the famous) to build a chromosome (represent the problem as a vector of features) then generating a

random population of chromosomes [2]. Then these chromosomes must be evaluated according to a specific function named the fitness function, and this function has many types like minimization and maximization function. The main idea for giving the chromosome a value is to select its power (survival of the fittest). The GA must select two chromosomes for reproduction (crossover) according to a specific selection algorithm. Many types of selection algorithm can be used, one of them is a tournament selection, which is better for giving the population more diversity, because it uses a random selection criterion which is closed to natural idea for selection of an individual in a real life [3].

After selecting two chromosomes, the GA will make a crossover between them in order to transfer the features between them. Many types of crossover can be used according to the type of encoding. For binary encoding, one can use one-cut (1X) or two-cut (2X) or multi-cut (UX) crossover, and for integer representation one can use partially mapped crossover (PMX) or cycle crossover (CX) or order crossover (OX) [4].

GA can use the mutation principles (with low probability) for giving the chance to take a new value for features that miss this value in a whole population [5].

3 Graph Database

There are many types of data storage, but some of them have more importance or precedence over others. The XML (eXtensible Markup Language) document contains nodes of information, and for each node there is a parent node except the root; also there is a concept of hierarchical representation. In a data graph, there is no concept of root or hierarchy. The graph data model contains a node and arc that represent the relation between them. Figure 3 show many types of database representation [6].

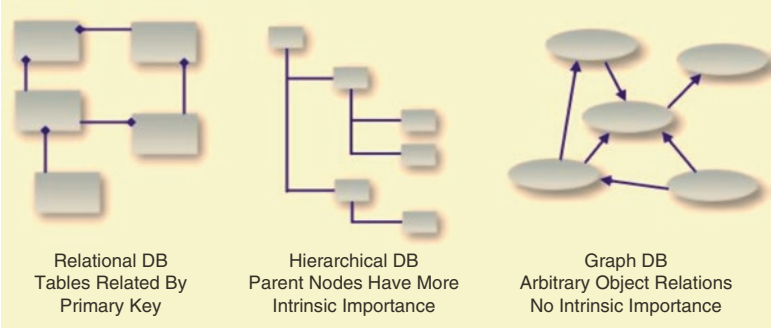

Fig. 3 Multiple database representation

Rating	Requirement
1 Star	Available on the web (whatever format) but with an open licence, to be Open Data
2 Stars	Available as machine-readable structured data (e.g. excel instead of image scan of a table)
3 Stars	as (2) plus non-proprietary format (e.g. CSV instead of excel)
4 Stars	All the above plus [...] use [of] open standards from W3C (RDF and SPARQL) to identify things, so that people can point at [data].
5 Stars	All the above, plus: Link your data to other people's data to provide context.

Fig. 4 Five-star model for open data

4 Linked Open Data

LOD is an interlinked and open collection of datasets in machine-interpretable form. LOD cover multiple domains from life sciences to government data [7].One of the most popular storage solutions for various kinds of data is relational databases that represent the data by a schema, which formally defines the entities and relations between them [8]. Many approaches give an idea for extracting this schema and mapping it to existing LOD by inferring the semantics of column headers, table cell values, and relations between columns and represent the inferred meaning as graph of RDF triples. Figure 4 shows the five stars for linked open data given by Tim Berners-Lee [9].

RDF It is an XML-based language for describing resources and the relations between them. XML does not support a semantic since there is no intended meaning associated with the nesting of tags; therefore the first type of RDF is RDF/XML that give a semantic to the main representation of the data model. RDF is a domain-independent because it does not make any assumptions about a particular domain. The user can define its own terminology using schema language called RDF Schema (RDFS) [10].

There are some important concepts in RDF which are resources, properties, and statements. The *resources* is a think that we want to talk about it (book, author, room, hotel). The resource has a URI (Universal Resource Identifier) which is either a URL (Unified Resource Locator like webpages) or any kind of unique identifier. The properties describe the relations between resources like "age," "color," etc.. The statement is a triple (subject(object), predicate(attribute), object(value)). We can write a triple as (S, P, O), where $P(x,y)$ is a binary relation between object "x" and object "y." Figure 5 explains the graph representation of a triple. There are many types of RDF like RDF/XML, RDF N-triples, RDF-Turtle, etc. Figure 6 shows the RDF/XML representation of the statement in Fig. 5 [11].

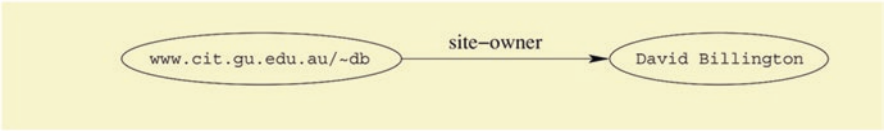

Fig. 5 Triple representation by graph

```
<?xml version="1.0" encoding="UTF-16"?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:mydomain="http://www.mydomain.org/my-rdf-ns">

 <rdf:Description rdf:about="http://www.cit.gu.edu.au/~db">
  <mydomain:site-owner>
   David Billington
  </mydomain:site-owner>
 </rdf:Description>

</rdf:RDF>
```

Fig. 6 RDF/XML representation

SPARQL (SPARQL Query Language) It is a standard query language for accessing RDF. It can be used for federating queries within remote endpoints to merge data from different sources and also be used for information retrieval and transformation of the structure of RDF [12]. As shown in Fig. 4, the use of SPARQL gives the data the 4-stars [13].

SPARQL have a capability for querying required and optional graph patterns along with their conjunctions and disjunctions [14]. It also supports negation, subqueries, aggregation, creating values by expressions, extensible value testing, and constraining queries by source RDF graph. The results of SPARQL queries can be result sets or RDF graphs [15].

The SPARQL language includes IRIs, a subset of RDF URI References that omits spaces. Note that all IRIs in SPARQL queries are absolute; they may or may not include a fragment identifier. Figure 7 shows the example of SPARQL query that search for a book title. The query consists of two parts: SELECT and WHERE. Select represent the variable that we want to search. And where show the graph patterns that match the data graph [16]. Sometimes there may be multiple matches for the SPARQL query as explained in Fig. 8. Triple patterns, as mentioned before, are written as (Subject, Predicate, Object) [17].

FOAF (Friend Of A Friend) It provides a vocabulary that written by RDF/XML to describe personal Information like name, homepage URL, mailbox, friends, etc. It enriches the total expression of personal information and relationships. FOAF vocabularies is very important components of FOAF. The FOAF vocabularies define the classes (foaf*:Person*, *foaf:Agent*, *foaf:document*) and properties (like *foaf:name*,

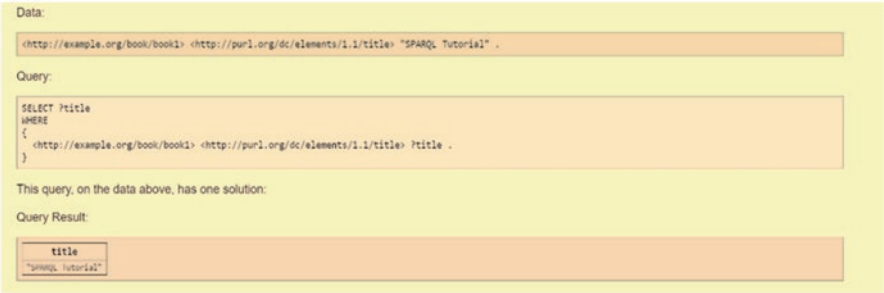

Fig. 7 SPARQL example

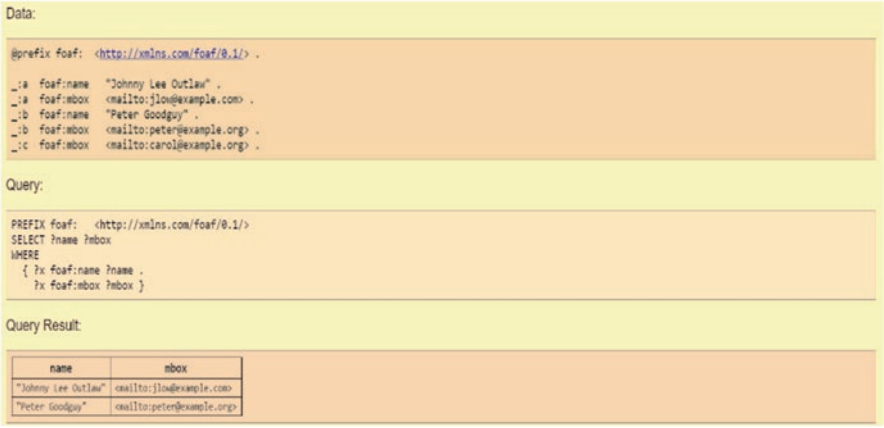

Fig. 8 Multiple matches SPARQL

foaf:mbox, foaf:interests, and *foaf:knows*). Figure 9 shows an example of RDF/XML that uses FOAF vocabularies for identifying simple information about a person named peter parker and its email. Figure 10 explains the pattern matching of the FOAF file using SPARQL [18].

In FOAF, the relation "knows" can be used to points to the name and email that identify a person you know. The correlation process (merging different assertion lists) can deal with the situation that can give a resource the ability to specify relations between arbitrary people. The inference logic can apply some weighting ideas (Fig. 11). Figure 12 gives an idea for establishment of a new relation in FOAF using the referral concept explained in Fig. 11.

vCard It is a specification for the description of organization and people. There are many vCard properties that simplify the representation of the overall features of the people or organization. Figure 13 shows the identification properties, whereas Fig. 14 explains the delivery addressing and communication and geographical properties. The identification properties give a way to save some personal information

```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:foaf="http://xmlns.com/foaf/0.1/">
 <foaf:Person>
   <foaf:name>Peter Parker</foaf:name>
   <foaf:mbox rdf:resource="mailto:peter.parker@dailybugle.com"/>
 </foaf:Person>
</rdf:RDF>
```

Fig. 9 FOAF example

Data:

```
@prefix foaf:       <http://xmlns.com/foaf/0.1/> .
@prefix rdf:        <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

_:a  rdf:type        foaf:Person .
_:a  foaf:name       "Alice" .
_:a  foaf:mbox       <mailto:alice@example.com> .
_:a  foaf:mbox       <mailto:alice@work.example> .

_:b  rdf:type        foaf:Person .
_:b  foaf:name       "Bob" .
```

Query:

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT ?name ?mbox
WHERE  { ?x foaf:name  ?name .
         OPTIONAL { ?x  foaf:mbox  ?mbox }
       }
```

With the data above, the query result is:

name	mbox
"Alice"	<mailto:alice@example.com>
"Alice"	<mailto:alice@work.example>
"Bob"	

Fig. 10 SPARQL query for FOAF vocabularies

If I enjoy chatting with A, and A chats with B, and B knows C, then I might have interests in common with both B and C as well. In addition, B and C may reasonably assume that A will vouch for me, and are thus likely to allow a first contact through their filters – a rule that could easily be automated.

Fig. 11 Inferred relationship

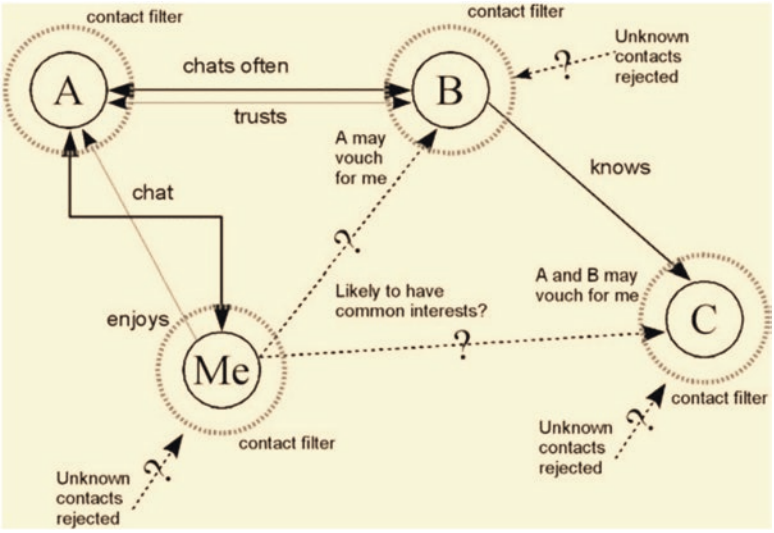

Fig. 12 Chain of connectivity for relationship establishment

where the delivery save the address, and communication save some feature to communicate between people, and also geographical give the time zone and the coordination of the target.

5 Framework Architecture and Implementation

The main idea of the proposed system is using GA in order to find the best values of the person features that make him infectious (possible infectious) person according to COVID-19 criteria, in addition to the direct statistics taken directly from the WHO website. For every person in a state space (online web page or mobile application that saved raw personal files), there is a normal file that contain his information like name, age, picture, email, telephone, etc. According to the chromosome of the genetic algorithm, the system will add another features to the original file (COVID-19 features). After that the new file will be converted into RDF file.

RFC Property	Note	Ontology Property	N-Ary Property
FN	The full name of the object (as a single string). This is the only mandatory property.	fn	hasFN
N	The name of the object represented in structured parts	hasName (range of class Name) given-name family-name additional-name honorific-prefix honorific-suffix	 hasGivenName hasFamilyName hasAdditionalName hasHonorificPrefix hasHonorifixSuffix
NICKNAME	A nickname for the object	nickname	hasNickname
PHOTO		hasPhoto	
BDAY	Birth date of the object. Should only apply to Individual.	bday	
ANNIVERSARY	Should only apply to Individual	anniversary	
GENDER	Should only apply to Individual. See Gender Codes in Section 2.11.	hasGender	

Fig. 13 vCard identification properties

Delivery Addressing Properties

RFC Property	Note	Ontology Property	N-Ary Property
ADR	The address of the object represented in structured parts	hasAddress (range of class Address) street-address locality region country-name postal-code	 hasStreetAddress hasLocality hasRegion hasCountryName hasPostalCode

Communications Properties

RFC Property	Note	Ontology Property	N-Ary Property
TEL	The telephone number as a tel URI. Recommended to use rdf:type to indicate the Telephone Type. See Section 2.11 for list of Telephone Type values.	hasTelephone	
EMAIL	The email address as a mailto URI	hasEmail	
IMPP	The IMPP instant messaging contact information	hasInstantMessage	
LANG	The language of the object	language	hasLanguage

Geographical Properties

RFC Property	Note	Ontology Property
TZ	The timezone of the object	tz
GEO	The geog. aphical coordinates of the object (geo URI)	hasGeo

Fig. 14 Delivery, communication, and geographical properties

Person file will also contain an information about the friends and their locations according to FOAF and vCard. According to the best individual that is the output of the genetic algorithm, the system will make a comparison of the value of the features in the best individual with all other files in a state space. If the comparison result is positive, then the system will bring GPS location of the possible infected person and update his information in the dataset. The GPS location will send to RDF store in order to check for the people that are around that location to send them a quick warning that someone may be infected in this area in order to take maximum social divergence. Also the system will extract the features of the friend of that person like name, phone, GPS, email, etc. and send them an SMS and email warning them to take care from their friend and also send the information to the nearest hospital. Figure 15 shows the block diagram of the system. In genetic algorithm phase, we have the following specifications:

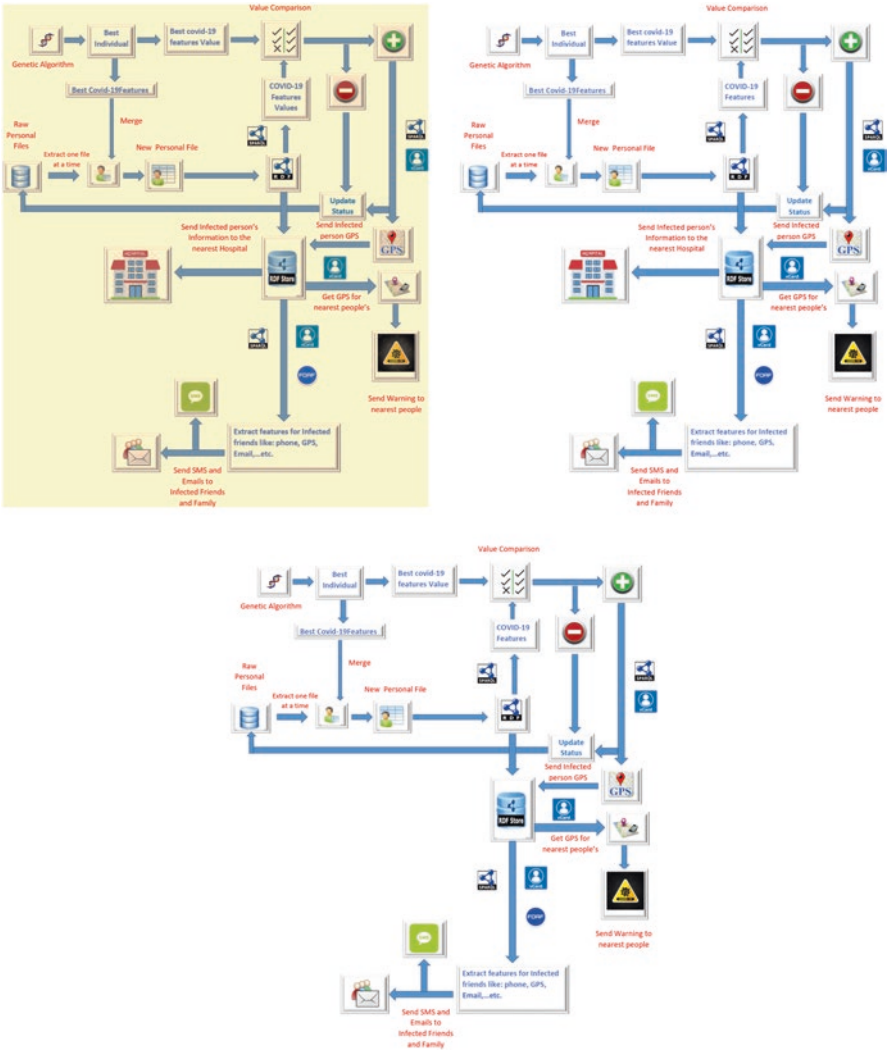

Fig. 15 Block diagram of the proposed system

- Encoding: Gray encoding has been used. It is binary like integer encoding that means we encode the problem as integer encoding, and for each integer gene, we will use a binary encoding with a number of bits that is sufficient to encode the maximum value of that gene, for example, if the first integer bit takes a maximum value =16, then we use four binary bit to encode it. In our problem, the encoding need seven integer bits, and for every bit there are a number of binary bits. Figure 16 shows the chromosome length (14) for seven features.

  The features can be explained as:

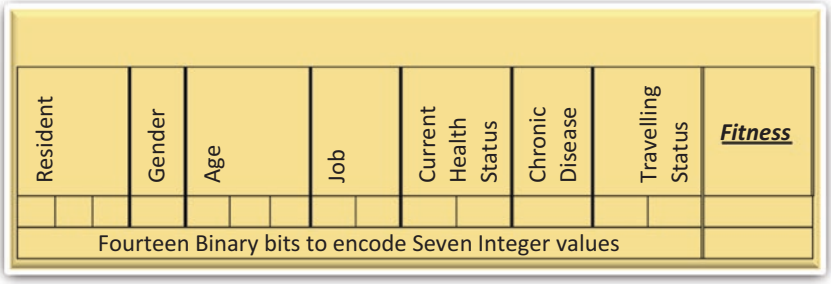

Fig. 16 Gray encoding

1. *Resident*: It means the current place of resident. It is very important factor because it reflects the percentage of injury. The values are taken according to WHO statistics. The possible values of this feature may be changed according to daily statistic of WHO. The country index according to statistics for June 3, 2020, taken from the website "https://www.worldometers.info/coronavirus/"(1-USA = 100, 2- Brazil = 90, 3-Russia = 80, 4-Spain = 70, 5-UK = 60, 6-Italy = 50, 7-India = 40, 8-France = 30).
2. *Gender*: It has two values (male and female). The statistics show that the male takes a high risk of injury for COVID-19; therefore the system will take a value "100" for male and "50" for female.
3. *Age*: The old people have a risk of infection. The age range and values given by (1- "80 ➔ = 100", 2- "70➔79"=90, 3- "60 ➔ 69" = 80, 4- "50–59" = 70, 5- "40–49" = 60, 6- "30 ➔ 39" = 50, 7- "20➔29" = 40, 8- "1➔19″ = 30).
4. *Job*: Some types of jobs may be more dangerous for infection. The system take three dangerous work (1, Ministry of Health (value = 100); 2, Ministry of Entry(value = 90); 3, Ministry of Defense(value = 80); 4, Others(value = 50)).
5. *Current Health Status*: It is very important factor because it determines the status of the person (Infected (value = 100), in contact with an infected person (value = 90), recovering from infected (value = 80), healthy = 50).
6. *Chronic Disease*: According to WHO, the people that have a chronic disease have a chance to be infected more than a normal people. Therefore, the system takes two values for this features: chronic person (value = 100), non-chronic person (value = 50).
7. *Travelling Status*: This feature will take four values according to WHO order of country (1, came from dangerous infected country(value = 100); 2, come from medium infected country (value = 75); 3, come from little infected or no infected country(value = 50); 4, didn't travel(value = 25)).
   - *Fitness Function*: After generating a values for each individual in the population, then we need to give every individual a fitness value (after normalizing all values using Eq. (1)) by using an Eq. (2).

$$Xnew = \frac{X - Xmin}{Xmax - Xmin} \tag{1}$$

$$Fitness\ Function = \sum_{i=1}^{Chrom\_Len} Chromosome_{Value}(i) \tag{2}$$

- *Selection*: A random number will be created for each individual. If the first individual fitness is greater than the random number, then we choose that individual for crossover.
- *Crossover*: Multipoint crossover has been used with a probability (pc). The cut points must be selected randomly from the set {3,4,7,9,11,13}, because we can't exchange sub-features and these points represent the end of each feature.
- *Mutation*: Multiple points crossover with probability (pm) has been used. The system will create three random numbers as chromosome index and replace its values (1 to 0 and 0 to 1).
- *Implementation*
- We used some personal files (50 files) to test the system and store the information in RDF store that is very helpful in merging many RDF files in order to find the shared information between them by using SPARQL.

For genetic algorithm, many experiences have been taken, and the best individuals have features value = 665, where the input is (max_population = 20, Max_Generation = 30, Pc = 0.7, pm = 0.4). The GA will stop when the population reach a convergence or the current generation equal to the Max_Generation. Figure 17 shows the result, where (a) represents the maximum fitness for each generation, whereas (b) represents the features value for each population. Figure 17a explains that there is some growing in the best fitness through the generations. Figure 17b shows the features values (seven values) for each individuals in all population in the last generation and that give an indication for the best features that exists in the best individual, so that the system will sort them and take the best individual.

After that the system will insert the features into all personal files that are represented already in RDF/XML format, which means the system will expand the personal files with those features in order to help system for taking a proper action in the future. Figure 18 shows an excerpt for new RDF/XML after adding COVID-19 features. Figure 19 shows an RDF/N-triples which contains some triples form that contains vCard and FOAF vocabularies, where lines (10–16) represent the COVID-19 features as triples whereas lines(18,19) represent the triples for longitude and latitude which is used to specify the geographic location of the person.

Figure 20 shows the graph representation of the RDF/N-triples in Fig. 19. The COVID-19 features are added as new information, and it will take the proper values according to execution. Figure 21 gives a simple excerpt for showing the *foaf:know* vocabulary that can link person to another person, and that is very important to find a new unknown information from existing known information by following the triple statement using SPARQL.

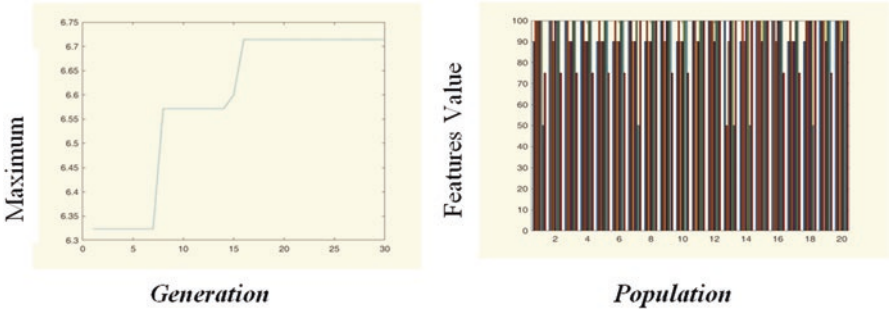

Fig. 17 Genetic algorithm result

```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
      xmlns:somewhere="http://somewhere/"
      xmlns:vCard="http://www.w3.org/2001/vcard-rdf/3.0#" >
  <rdf:Description rdf:about="http://somewhere/AliKareem" >
    <vCard:FN>Ali Kareem</vCard:FN>
<vCard:Covid-19_Features>
<rdf:Description>
      <vCard:Resident-value> R_Vlaue </vCard:Resident-value>
      <vCard:Gender-value> G_Vlaue </vCard:Gender-value>
      <vCard:Age-value> A_Vlaue </vCard:Age-value>
      <vCard:Job-value> J_Vlaue </vCard:Job-value>
      <vCard:Current-Health_Status-value> CHS_Vlaue </vCard:Current-Health_Status-value>
      <vCard:Chronic-Disease-value> CD_Vlaue </vCard:Chronic-Disease-value>
      <vCard:Traveling-Status-value> TS_Vlaue </vCard:Traveling-Status-value>
</rdf:Description>
</vCard:Covid-19_Features>
```

Fig. 18 Excerpt from RDF/XML for vCard COVID-19 features

Number	Subject	Predicate	Object
1	http://somewhere/AliKareem	http://www.w3.org/2001/vcard-rdf/3.0#FN	"Ali Kareem"
2	http://somewhere/AliKareem	http://www.w3.org/2001/vcard-rdf/3.0#N	genid:A8805
3	genid:A8805	http://www.w3.org/2001/vcard-rdf/3.0#Family	"Kareem"
4	genid:A8805	http://www.w3.org/2001/vcard-rdf/3.0#Given	"Ali"
5	http://somewhere/AliKareem	http://www.w3.org/2001/vcard-rdf/3.0#Information	genid:A8806
6	genid:A8806	http://www.w3.org/2001/vcard-rdf/3.0#country-name	"England"
7	genid:A8806	http://www.w3.org/2001/vcard-rdf/3.0#locality	"liverpool"
8	genid:A8806	http://www.w3.org/2001/vcard-rdf/3.0#postal-code	"L32BP"
9	genid:A8806	http://www.w3.org/2001/vcard-rdf/3.0#Covid-19_Features	genid:A8807
10	genid:A8807	http://www.w3.org/2001/vcard-rdf/3.0#Resident-value	"R_Vlaue"
11	genid:A8807	http://www.w3.org/2001/vcard-rdf/3.0#Gender-value	"G_Vlaue"
12	genid:A8807	http://www.w3.org/2001/vcard-rdf/3.0#Age-value	"A_Vlaue"
13	genid:A8807	http://www.w3.org/2001/vcard-rdf/3.0#Job-value	"J_Vlaue"
14	genid:A8807	http://www.w3.org/2001/vcard-rdf/3.0#Current-Health_Status-value	"CHS_Vlaue"
15	genid:A8807	http://www.w3.org/2001/vcard-rdf/3.0#Chronic-Disease-value	"CD_Vlaue"
16	genid:A8807	http://www.w3.org/2001/vcard-rdf/3.0#Traveling-Status-value	"TS_Vlaue"
17	http://somewhere/AliKareem	http://www.w3.org/2001/vcard-rdf/3.0#geo	genid:A8808
18	genid:A8808	http://www.w3.org/2001/vcard-rdf/3.0#latitude	"43.33"
19	genid:A8808	http://www.w3.org/2001/vcard-rdf/3.0#longitude	"55.45"

Fig. 19 RDF/N-triples

Fig. 20 Graph represent RDF triple statements

```
<rdf:RDF
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
    xmlns:foaf="http://xmlns.com/foaf/0.1/"
    xmlns:admin="http://webns.net/mvcb/">
<foaf:PersonalProfileDocument rdf:about="">
 <foaf:maker rdf:resource="#me"/>
 <foaf:primaryTopic rdf:resource="#me"/>
 <admin:generatorAgent rdf:resource="http://www.ldodds.com/foaf/foaf-a-matic"/>
 <admin:errorReportsTo rdf:resource="mailto:leigh@ldodds.com"/>
</foaf:PersonalProfileDocument>
<foaf:Person rdf:ID="me">
<foaf:name>Ali Kareem</foaf:name>
<foaf:knows>
<foaf:Person>
<foaf:name>Mustafa Sameer</foaf:name>
</foaf:Person>
</foaf:knows>
</foaf:Person>
</rdf:RDF>
```

Fig. 21 An excerpt for RDF showing FOAF:know

6 Conclusion

The proposed system gives an idea for using genetic algorithm as optimization algorithm and linked open data with RDF representation for representing the problem. The system had been used FOAF and vCard vocabulary for enhancing the features representation of a personal file and that give a flexibility to find and collect shared information between many RDF files. The system gives a good result for enhancing

the social divergence against COVID-19 virus by using up-to-date information from WHO in order to find best features that relate to COVID-19 and collect its values to take it as a schema for finding the possible infected people.

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Ethereum-Based P2P Lending System (Dao App): Qualitative Review of a Possible Replacement for Lending Practices

Harshdeep Singh and Kavisankar Leelasankar

Abstract P2P (peer-to-peer) lending refers to the business dealing of lending money between two private parties. P2P lending claims to offer higher returns to investors on their investments compared to current banking systems. P2P lending essentially removes third parties such as Banks/NBFCs as authorities involved in the finance market allowing any private lender to directly lend money to a lendee without the involvement of a third party authority. Middleman is simply removed here. Another technology that aims at removing the middleman is blockchain. This paper attempts to study and evaluate the feasibility of using blockchain as the backbone for P2P lending platforms. A P2P lending Web application that uses smart contracts on the Ethereum blockchain is deployed. The application is of a decentralized nature, and hence no singular authority has complete control of the organization (DAO). The application attempts to bridge the gap between two different ideas with the same aim.

Keywords Ethereum · P2P lending system · DAO app · Smart contracts · Decentralized apps · Trust token · Cryptocurrency lending · Transaction management · ICO Initial coin offering

1 Introduction

Blockchain is a decentralized transaction and data management technology developed primarily for managing cryptocurrencies. The first of which was Bitcoin in 2008. However, since then a large number of cryptocurrencies have been born and various technological developments have taken place in their management. Blockchain's central attributes ensure security, anonymity, and data integrity

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without any central body in control of the transactions, and therefore it creates possibilities of managing ledgers in highly secure and decentralized manner.

Ethereum is a decentralized, open-source blockchain that allows the use of "smart contracts." Smart contracts are basically programs which essentially declare transaction protocols for the blockchain, and these programs are expected to execute automatically taking control or executing transactions on a blockchain according to the terms of agreement in the said smart contract.

A quick survey of relevant papers shows that over 80% of focus is on Bitcoin system, and less than 20% deal with other blockchain applications like smart contracts and licensing. The majority of research is focused on revealing and improving limitations of blockchain in terms of privacy and security; it is interesting to note that the proposed solutions lack proper metrics-based evaluation on their efficacy.

This paper attempts to study the Ethereum blockchain and use the blockchain for building a P2P lending application where a user can apply for a loan and other members of the network can lend to the said user if they find the terms of the loan acceptable. The lending process will be done using native cryptocurrency of Ethereum blockchain i.e., "Ethers."

In order to differentiate between participants and the "trustees" (organizers), trust tokens are issued initially as part of the initial coin offering to the investors. These investors are given voting rights and are given privileges of making organizational decisions after reaching consensus among themselves.

2 Literature Survey: Preliminaries of P2P Lending, Blockchain, and DAO

2.1 P2p Lending

P2P lending refers to unsecured loans between lenders and borrowers through online platforms without the intermediation of any financial institutions. Hence, banks as third parties are ruled out, and the business occurs without the use of a centrally functioning financial organization. P2P lending requires the investor to consider the financial risk involved and make a logical decision based on his study of the candidate applying for a loan. Hence a mechanism that removes third parties is required in the execution of such a transaction while ensuring complete security and trust between the parties involved in the transaction. This is where blockchain connects the dots.

2.2 Blockchain

Ethereum blockchain allows us to program the blockchain and execute smart contracts which essentially ensure that the transactions are taking place as per agreement and both parties involved do not have to worry about frauds in these

transactions. Blockchain technology essentially aims at removing central authorities and distributing power among members of the blockchain. Blockchain essentially aims at removing the middlemen in many use cases in the finance industry. DAOs can be programmed on the Ethereum blockchain using smart contracts (written in Solidity).

P2P lending is an area where such a technology is required for its implementation. Hence Ethereum blockchain is the go-to blockchain technology for the purpose of implementing a P2P lending platform.

2.3 Dao

DAO stands for decentralized autonomous organization. It refers to an organization of a decentralized nature wherein the members govern the system in a transparent member without influence of a central authority. DAO involves giving certain members of an application a "special status" by providing them with "special tokens." The members with the said tokens have privileges unavailable to other members of the application. These privileges include voting on decisions over governance of the organization. The decisions to be executed involve voting and consensus of all the special members (or a minimum vote) of the organization. The control of the organization is hence decentralized and not vested in a single central authority. A DAO can be realized using smart contracts, for instance, over the Ethereum blockchain. Smart contracts store program rules and protocols on the blockchain and execute commands based on predetermined conditions. Hence, the decision-making and authority is not governed by a single authority, rather distributed among the trustees of the organization. Moreover, the smart contracts are executed on a blockchain; hence security measures of blockchain technology are descended into such an application.

A survey of the current finance market and decentralized finance shows that P2P lending and DAOs aim at removing the middlemen. P2P lending aims at providing a way for private lenders to lend without the requirement of third parties such as Banks/NBFCs, while DAOs aim at removing third parties with central authority and distributing power among "trustees" of an organization. This paper aims at bridging the gap between the two and studying the implementation of DAO in P2P lending.

3 Proposed Work

A Web app built using following technologies is proposed:

- NodeJS (JavaScript Runtime Environment).
- VueJS (Frontend JavaScript Framework).
- Solidity (Contract-Based High Level Programming Language).

Fig. 1 ICO

- Truffle Framework (Testing and development Framework for Smart Contracts).
- Ganache (Personal Blockchain for Testing Smart Contracts).

The proposed application has the following major modules:

3.1 ICO: Initial Coin Offering

The application begins with investors registering themselves as trustees and initially buying "trust tokens" using Ethereum. A limited supply of tokens is distributed among all the investors in Fig. 1.

3.2 Lending

The first step in the lending process involves putting request for a loan in the lending pool. The other members of the application notice the request, and if they agree on the terms of the loan, they may accept the request of the requestor. Once accepted, the requestor can withdraw funds in the Ether cryptocurrency.

When the lender wants to repay the loan, he/she can simply deposit the funds back with interest and the contract fee. The contract fee is automatically added to the repayment amount by the platform. This contract fee is decided by the trustees who are the governing members of the DAO. The contract fee here goes to the P2P platform toward its platform fee and operational requirements (server maintenance, mining, etc.) in Fig. 2.

3.3 Trustee Management

The trustees of the platform are given a separate interface for managing the platform. This module allows them to make organizational decisions such as changing the contract fee amount, addition/removal of trustees, transacting the "trust tokens," etc.

Decision-making by the trustees involve "voting," and upon acquiring minimum vote, the decision is executed via smart contract. Note: The trust tokens are a measure of "trust" in the DAO application in Fig. 3. Once a member acquires trust tokens, he/she is eligible to become a trustee of the organization.

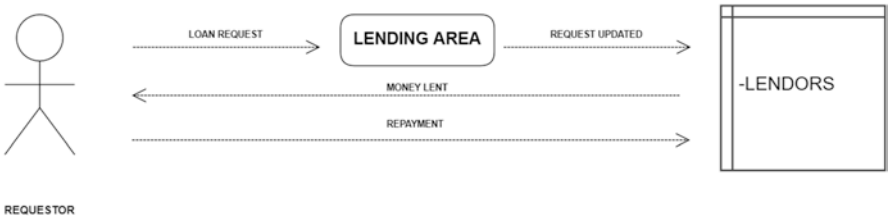

Fig. 2 Lending area

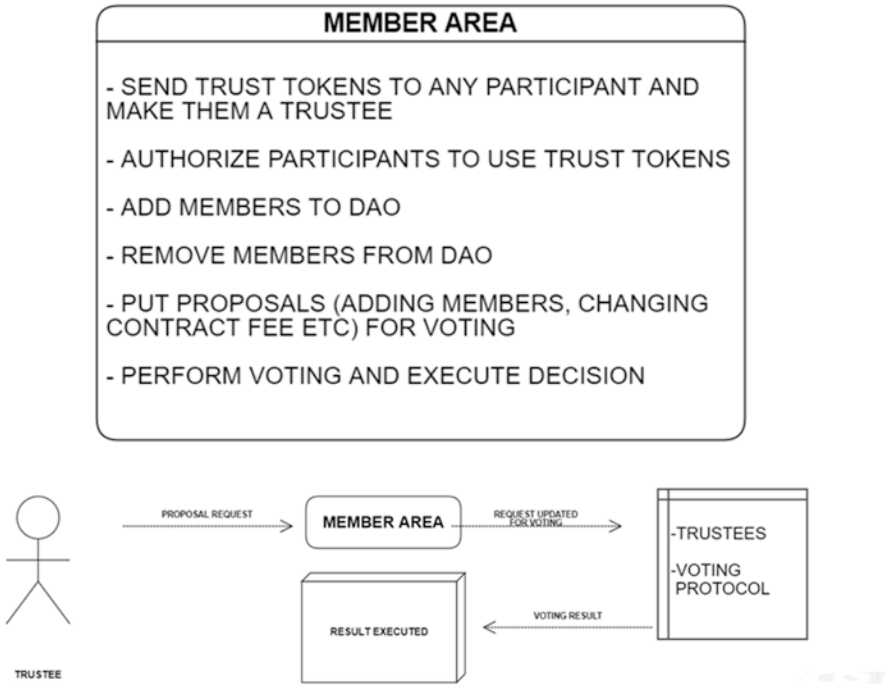

Fig. 3 Trustee management

4 Analysis

- ICO (initial coin offering) is essential in order to crowd finance blockchain-based projects.
- *Blockchain* opens new arenas in financing systems by removing the middlemen of current banking system.
- DAO apps provide a new yet promising way of decentralizing power within an organization using voting protocols.
- The lending process is done smoothly, and the platform acts as a replacement to current banking system of "centralized finance."

- As the size of the blockchain increases, mining process gets tougher and involves more difficulty. In order to cope up with the increasing difficulty, contract fee collected from the lendee has to be adjusted in order to reward the miners appropriately and keep the system functioning properly.
- The number of transactions per second supported by Ethereum 1.0 is only around 30. The same for Visa(1600+) or Paypal(180+) is much higher. This gap needs to be filled and thankfully Ethereum 2.0 aims to do so by introducing proof of stake instead of proof of work. Ethereum 2.0 aims to increase the transaction throughput exponentially using sharding.
- Transaction fees being extremely less compared to conventional banking systems remain one of the major advantages of implementing such decentralized applications instead of centralized banking systems.
- Since the transactions occur on blockchain, chances of frauds and scams are greatly reduced.
- Legality and unclear laws over the use of cryptocurrencies still remain roadblock towards expansion and widespread application of such technologies.

5 Conclusion

Ethereum offers sizeable advantages over traditional banking systems. It almost guarantees higher returns on investments to the investors. Even though it has its own limitations, it can have significant impact over banking systems. As blockchain technology continues to grow, it seems plausible that such an implementation can be realized given sufficient development time. Ethereum-based DAOs offer immense potential with the upcoming Ethereum 2.0 which utilizes "proof of stake" instead of "proof of work." Ethereum 2.0 will also code written languages like C, C++, Rust, etc. to run on the blockchain.

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Malware Detection Based on Portable Executable File Features

Nisarg Jadvani, Mohit Agarwal, and Kavisankar Leelasankar

Abstract Apart from all the cyber threats that we encounter, malicious software or malwares are considered to be one of the most critical threats to the computers or servers. Malwares are softwares disguised as normal softwares whose aim is to gain unauthorized access to the system and perform tasks that pose a threat to data privacy and security. Despite numerous advancements in privacy and security, hackers and attackers are able to bypass the security shields and firewalls and hack into the system which shows that there is still some room for improvement in malware detection. In this paper, we put forward a method to predict the maliciousness of an executable file using the headers from the PE file format of the executable file.

Keywords Malware detection · Portable executive (PE) · Machine learning (ML) · Feature selection · Computer modeling

1 Introduction

The immense increase in the number of devices connected to the Internet has escalated the fact that we need to be more concerned about the personal data of the user. Hackers are becoming more technologically sound today. They have found every possible way to breach security of users who are connected to the Internet. In this digital era of mankind, almost every other person is having at least an Internet-connected device. No doubt having access to the Internet is one of the basic necessities of today's life, and it has opened a pool of opportunities, but it has also

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increased the risk of confidential data being stolen and used for malpractices. This not only generates a whole new level of opportunities for the hackers to develop malwares that pose a threat to data and privacy of the user. This confidential data upon being stolen or compromised may be used to demand ransom from the user or may even lead credit/debit card details to be exposed.

Malware is a software that is designed and developed to gain unauthorized access to the owner's computer, client, or network and perform malicious activities such as collecting sensitive data (credit card details, etc.) in the background without any information to the owner. There are various types of malwares such as Trojans, Spyware, Virus, and Botnet. Malwares continue to be one of the most critical cyber threat to the users. In order to secure the confidential data of the user, malware detection at an earlier age becomes one of the top priorities. There has been a whole heap of machine learning algorithms and antiviruses available in the market which do the job of detecting malwares pretty fine.

Malware analysis is broadly classified into two categories: static and dynamic analysis. Static malware analysis is a process of analyzing the executable binary without executing it, whereas dynamic malware analysis is a process of executing the executable binary and analyzing the process and behavior of the executable in an isolated virtual environment such as Virtual Box so that the host system is not at risk of being attacked by the malware sample.

In this paper, our primary focus is to make use of static analysis approach and analyze the headers from Portable Executable file format. These headers are important for an executable file and run it. We developed a malware detection system to classify and predict the new executable PE header as benign or malware using a publicly available dataset of features from PE file format of executable file. The model uses the static analysis method for the classification of executable file.

Section 2 covers the related work done in the same field. In Sect. 3, the explanation along with the methodology of the proposed model is given. Experimental details are specified in Sect. 4 followed by the concluding remarks in Sect. 5.

2 Related Work

In this section, many of the relevant studies are described. In [1], they designed a binary classifier, which classifies the files into malicious and benign with 97.2% accuracy. Cepeda et al. [2] mentioned that preprocessing the dataset and transforming features using algorithms of classification or similar transformation can help in increasing the accuracy and possibly decrease the time taken to calculate [3]. They used 1530 malware executable files from Virus share website and 1340 benign files from windows operating system 32 folder.

Nasurudeen Ahamed and Karthikeyan [4] malware detector distinguishes between benign and malicious applications using pre-fetch files in the Windows Pre-fetch folder. They conducted their experiment on two different Windows

platforms. It uses a simple randomization feature selection method. This technique is called Dropout which is based on randomly removing features while performing the training. Logistic regression classifier was used with nonlinear function known as logistic function. The paper [5] used dynamic analysis to perform the malware detection and determine if the file is malicious or not. But the performance and accuracy of dynamic malware analysis is not efficient because of smart behavior of malwares. The dynamic analysis has limitations due to controlled network, and it cannot be efficiently analyzed due to limited access of network. Cuckoo sandbox is utilized for dynamic analysis of malwares and extracts their practices at run time during execution. Sabhadiya et al. [6] discussed about different types of Android Malware Detection Techniques using various deep learning methods. In this paper parameters by which we can compare different deep learning methods for android malware detection, comparison contains parameters such as analysis, type of deep learning model, features, applications in datasets, and count of applications in datasets.

Samantray et al. [7] observed that, occasionally benign files may also perform similar task as that of malicious files which allows the antimalware system to mistakenly find benign files as malware or malware files as benign. These outcomes are known as false positives and false negatives. (TP) True positives are benign sample categorized correctly. (TN) True negatives are malware samples also categorized correctly. (FP) False positives are malware samples categorized as benign. And (FN) false negatives are benign sample incorrectly categorized as malware. The accuracy of the model is calculated as number of files classified correctly divided by total number of files. That is sum of true positive (TP) and true negative (TN) divided by total number of samples.

In [8], they proposed a malware detection method based on n gram attributes similarity. N grams of training byte code to generate features and each attribute are calculated separately. The dataset used to perform calculations are from system files of Windows 8 and windows XP. Overall size of 1000 malware samples was used for both training and testing the model. Moghaddam and Abbaspour [9] conducted a systematic study of the performance impact of each static features on malware detection [10]. They found that not all features are useful for detection and some features may reduce the effectiveness of model. The features which are related to permissions, opcodes, and broadcast have more impact on the outcome than api and general call features [11].

3 Proposed Work

This section describes the working and methodology followed in the proposed model which helps in detecting the malware file. The model is based on static analysis method for detecting malwares without actually running them. The model primarily focuses on inspecting the features from the PE header. PE file format is used

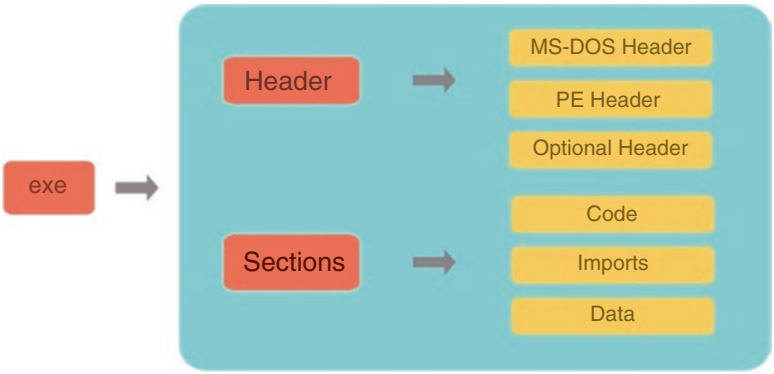

Fig. 1 PE file structure

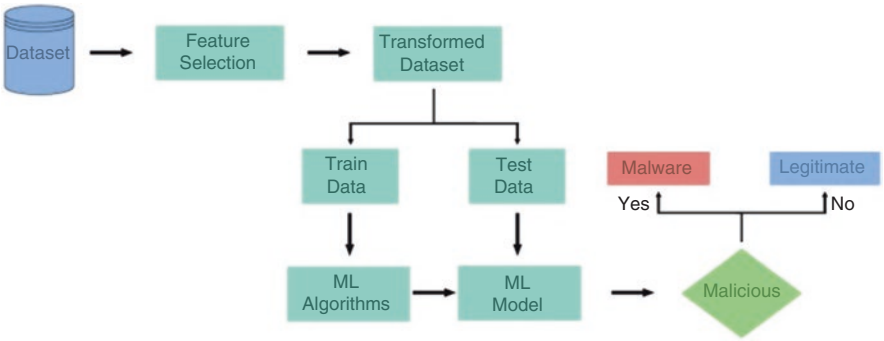

Fig. 2 Components of model

by the executable files when they are loaded or executed in the system. PE in Fig. 1 shows basic structure of a PE file.

The proposed model comprises these major processes: (1) dataset collection, (2) feature selection, (3) splitting and training, and (4) classification.

Feature selection is an important aspect of our proposed as the dataset contains around 56 features which may be a lot to handle by any machine learning classification algorithm. It removes the irrelevant features that do not play a major role in defining the file as malware or not and returns a model through which we transform the original dataset so as to reduce the total number of features. The irrelevant features are dropped if they don't meet a certain threshold value. Feature selection not only reduces the computational cost but also improves the accuracy of the model to much extent. Figure 2 illustrates the processes involved in the proposed model.

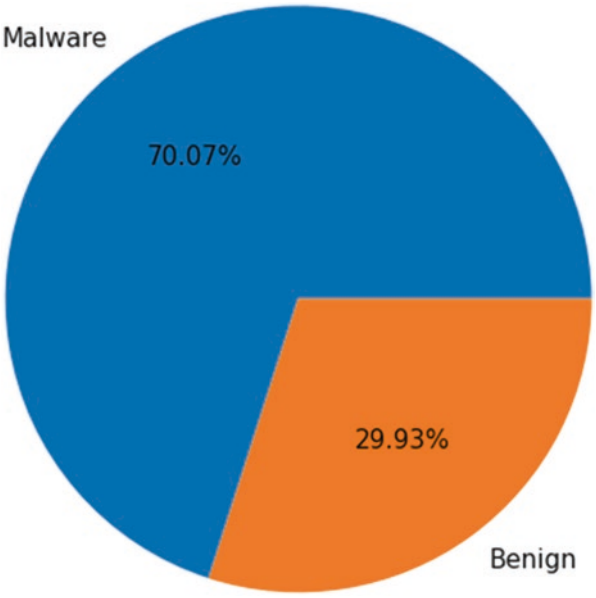

Fig. 3 Dataset structure

3.1 Dataset

The model is trained on a dataset containing features from the PE file format for executable file. The dataset is made up of almost 138 k samples of PE files and 57 features including the classification feature termed as "legitimate" where legitimate = 1 denotes legit file and legitimate = 0 denotes a malware file.

This dataset is further used in feature selection module to remove the non-important features. Figure 3 shows the distribution of our dataset. As seen in the diagram, our dataset comprises around 70% malware and 30% legitimate files. This can cause unwanted bias in our analysis. To get over this, we match the number of malware data which is more to the number of legit data which is less in our dataset so that the balanced data is used to train the model. Now the number of legit and malware data in our analysis is equal. Total of 82646 files were used (41323 files from each class).

3.2 Feature Selection

Feature selection is primarily used to reduce the dimensionality of the dataset which in turn improves the performance of the estimator. For our proposed model, we have used the select from model meta-transformer from sklearn along with extra trees classifier estimators. This gives us feature importances which are then utilized to

remove non-important features from the dataset if they don't meet a certain threshold value. The original dataset is then transformed into a new dataset having less number of features as compared to the original dataset. We pass on this new dataset to the splitting phase which splits the dataset into train data and test data.

3.3 Splitting and Training

The transformed dataset from the feature selection phase is divided into the train and test data. The train data is very much important for any machine learning algorithm because it is this data through which the model learns the relationship among the various features and the class variable. Due to this, attention to detail and the size of the train data become utmost important. Due to aforementioned reason, our train data is 80% of the total dataset, and the remaining data, i.e., 20%, is taken to be the test data over which our model is tested. We also took two other test-train splits which are 33–67% and 50–50%.

In our case, the number of features before performing feature selection was 56, and after performing feature selection, the number of features was reduced significantly. This reduction in features is what we call as dimensionality reduction. Some of the features selected by classifier are Dll Characteristics, Characteristics, Machine Subsystem, Version Information Size, Sections Max Entropy, Image Base, Size Of Optional Header, Major Subsystem Version, Resources Min Entropy, Resources Max Entropy, and Sections Min Entropy.

Major Operating System Version. The train data is put to use for training the model where the algorithm learns the relationship among the features and the class variable.

4 Result

Random forest classifier achieved the average accuracy rate of 99.5%. We achieved improved detection rates with feature selection as compared to using all the features of the file. Furthermore, we used different test data size to calculate the performance. As seen in the figure, sample test size of 20%, 33%, and 50% with their respective accuracy is displayed. Figure 4 displays the performance of our model in terms of accuracy vs the test data size.

5 Conclusion

We designed and demonstrated that our malware detector is able to identify malware and benign files using less number Portable Executable file features without decreasing its accuracy. Final average accuracy was around 99.5%. The future scope

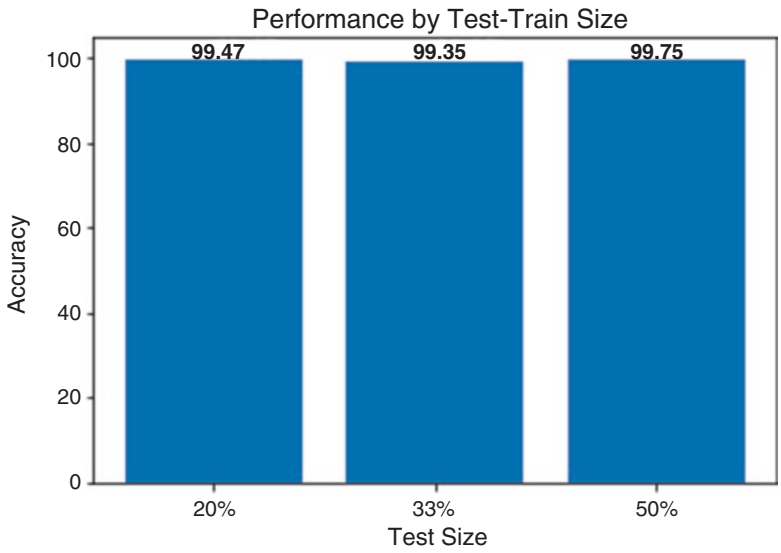

Fig. 4 Accuracy vs test size

of this paper can be extended by packaging the model in a pickle file and making use of this model in order to predict the maliciousness of the executable file after extracting the features of the same.

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Design IoT-Based Blind Stick for Visually Disabled Persons

S. Balasubramani, E. Mahesh Rao, S. D. Abdul Azeem, and N. Venkatesh

Abstract Within the current time, the bulk of open places like general stores, open gardens, shopping centers, college campuses, etc. are beneath video surveillance. There's a necessity to supply basic security and monitor unordinary irregularity exercises in these regions. The disadvantage of the typical method is that it is necessary to undertake manual operations in a daily basis even though there might be results of human errors. This research concentrates on the detection of errors and the recognition of actions of humans using videos. Computer visioning can be transformed for many years now, and it is viewed as a major initiative for wide-range applications that were utilized in place of human supervision. We evaluate effective approaches for determining anomalies in videos. The applications of the convolution neural network, used recently, have promised the layers of convolution for object recognition and detection, mostly in image. Experimental findings on the errors in datasets indicate the superiority of the proposed approach in contrast to sophisticated frame levels and pixel levels in tasks for error detection.

Keywords IoT · Blind stick · Raspberry Pi · Anomaly detection

1 Introduction

Visual deficiency signifies a state of missing an observation of physiological or neurological variables. Visual impairment denotes the lack of integration within the development of optic nerves and visual components of an eye; adding up to visual impairment is the total nonattendance of the visual light discernment. Envision strolling into a new put. One has to inquire direction to accomplish the goal. But

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what in the event that the individual is outwardly impeded!! A person has to totally depend on individuals to realize the goal. For the most part, we watch that a white cane is the partner of an outwardly disabled individual. But over and over, this cane isn't valuable. In a new encompassing, an outwardly disabled individual might get befuddled. So, this limits their portability. This makes them snared in to others. No matter the device utilized the calculate that the bulk decides a person's portability is that the utilization of fundamental individual abilities. Visual deficiency is that the total need of frame and visual light discernment and is clinically recorded as NLP, a shortened form as "no light perception." Visual impairment is ordinarily utilized to portray serious visual impedance with remaining vision. Those portrayed as having as it where light recognition has no more locate than the office to tell light from dull and hence the generally heading of a lightweight source. The framework has been created utilizing both equipment and program execution.

Robots are the future, attracting people for past few years. They're a neighborhood of our life in areas like inquiring about improvement, medication, defense, or indeed books and movies. Robots have disentangled our work to a degree. They require given a proficient, dependable, and secure modes of working hand to the citizenry, much obliged to automated as it where men are presently able to perform far off operations. Defaces is one occasion of a remote operation being managed by men. Shrewd adhere the daze man is one of the self-operating robots that take after a line that drawn on the foot Capture line position with the optical sensor mounted at the front of the robot. Most are utilizing a few photo-reflectors, and many of driving hopefuls are utilizing as a picture sensor for picture preparing. The utilization of surveillance cameras requires that computer vision advances ought to be included inside the investigation of exceptionally huge volumes of video information. The location of inconsistencies in captured scenes is one of the applications amid this region. Inconsistency location and localization seem to be a challenging assignment in video investigation as of now since the real truth is that the definition of "anomaly" is subjective, or context-dependent. For the most part, an occasion is taken beneath thought to recognize an "anomaly" when it happens once in a while, or unforeseen, as an illustration. Compared to the already distributed deep-cascade strategy, this paper proposes and assesses an uncommon and unused strategy for inconsistency discovery. The structure of a CNN for patch-based operations so on extricate and speak to all patches amid a gather of outlines. A created highlight vector, whereas utilizing the CNN for each recognized locale, is fitted to the given picture classification assignment. Nearly like, we utilize an exchange learning strategy to get it a much way better depiction for each locale. We assess our strategy for finding the as it were middle of the road convolutional layer of the CNN. At that point, a substitution convolutional layer is included after 4 the best-performing layer of the CNN. The parts of a pre-trained CNN are balanced upheld pre-training and thought of to be steady in our FCN; the parameters of the final word unused convolutional layer are prepared backed our preparing outlines. In other words, all districts created by the pre-trained CNN are spoken to by a sparse-auto-encoder as a highlight vector of length h which is the coverup estimate of the auto-encoder. We find that the highlight set, created by a pre-trained CNN, is adequately

discriminative for modeling "many" districts. To make the strategy more exact, those districts which are classified with more certainty are given to the final word convolutional layer for advance representation and classification. In truth, two Gaussian models are characterized to back the layout of all ordinary preparing locales. The essential show is created by the kth layer of the CNN, whereas the moment show has predicated on its change by the (k + 1) convolutional layer. Inside the testing stage, those locales which vary altogether from the primary Gaussian show are labeled as being a sure irregularity. Those locales which fit totally to the primary demonstrate are labeled as being ordinary. The leftover portion of the districts, being by a minor contrast underneath the sting, is spoken to by a sparse-auto-encoder and assessed more carefully by the moment Gaussian demonstrate. This approach is practically equivalent to a cascade classifier characterized by two stages; it's clarified inside ensuing segments. The foremost commitments of this paper are as follows: To the only of our information, this is often regularly the essential time that an FCN is utilized for inconsistency discovery.

2 Literature Review

Agrawal and Gupta [1] exceptionally common sense creation which makes a difference daze client by acting as his assistant faculties. It has no nonsense plan which is as it were centered on common utilization. Indeed, for generation, it doesn't require heavy machinery. Based on the over truths, we are able to unquestionably conclude that 1. The smart stick may be a basic, cheap, and simple to handle electronic direction gadget, which is proposed to supply valuable right hand and bolster for daze and outwardly impaired persons. The gadget is effective and has the capacity to indicate the sources by eliminating objectives that will experience dazzles. It is capable of scanning areas before, after, and right or left of the individual in any case of its stature or depth. It may be a user-friendly gadget and can serve the reason of potential beneficiaries. This gadget of the project utilizes the most current accessible sensors to help the individuals with visual inability. The most inventive viewpoint of the venture is the activity detector.

This paper [2] presents the framework plan and idea of a brilliant and simple to utilize Blind Aid Stick for the blind. The major highlights include the straightforward plan, proficient however simple to utilize and adjust design and framework plan. Subsequently it can give a coffee fetched gadget for numerous daze individuals inside the complete world. The presented framework combines different existing effectively advances and genuine time framework sensors that offer assistance in monitoring the position of client conjointly offering assistance in easy navigation.

In this paper [3], plan and advancement of a real-time fake insights framework for helping outwardly impeded and dazzle individual has been examined. The framework performed three primary assignments of picture acknowledgment, collision discovery, and impediment discovery allowing the client to investigate his course unreservedly. Utilizing tenant contraptions like a smartphone and a compact

but tall quality hardware, our system directed to overcome the hop of making an assistive system which was both profitable and sensible adequate for the apparently crippled people especially having a put to the low-income family units. In orchestrate to actuate some discernment of his environment, the client captures pictures of his environment through his smartphone. These pictures are at that point handled by the manufactured insights within the smartphone application driving to caption era for each picture which depicts their substance. These captions are at that point passed on to the client by the smartphone perusing them out loud through its speakers.

The plan demonstrate of the proposed framework [4] which we have presented is overseen through an android application. The application is created in this paper capacities through voice commands. The android application is opened after giving the secret word in spite of the fact that voice command. After the app is opened, there are two alternatives, campus route and GPS route. Campus route is utilized for two modes: jump discovery mode and stuck course mode. After selecting the campus route alternative, it looks for the Bluetooth gadget that's associated with the Arduino Uno board. The checked gadget is associated with the android phone.

This paper [5] is made up of multi-function adhere with shrewd bracelet. When utilizing it, the dazzle man can essentially make the full framework work by squeezing the button of the strolling adhere and the button on the bracelet; the two buttons are square, expansive in measure, and simple to discover. Dazzle individuals can effortlessly discover the position of buttons. After initialization, the bracelet will issue a voice actuate to light the astonish. Inside the course of strolling, two ultrasonic discoverers inside the follow begin to transmit ultrasonic waves and choose the isolated of the obstacle concurring to the reverberate. Once the isolated person is less than 3 meters, the follow would send signals by implies of Bluetooth to the bracelet, the bracelet will vibrate to provoke the blind [6]. When the space of impediment could be a littler sum than one meter, the vibration is progressing to be altogether expanded, at that point the dazzle can alter the strolling course to dodge obstacles.

3 Methodology

Existing frameworks like sticks can manage dazzle individuals by assisting them with recognizing the obstructions in their way through contacting/jabbing. With option in contrast to the above strategy, some other helps incorporate keen belts, savvy rings, shrewd sticks, and so forth, which can help them by distinguishing impediments utilizing ultrasonic or the laser sensor. The model produces either vibration or sound based on identified snag meant to caution it.

3.1 Components: HC-SR04 Ultrasonic

The ultrasonic sensor may be a gadget which is able degree the space to protest by utilizing waves of sound. It will measure separately by transmitting acoustic waves at a particular tuning and recurrence for acoustic waves to recuperation. Based on the recording of a particular time period between acoustic waves being produced and those that bounce back [7], it is applicable to evaluate the available space between the sonar sensors and protests. Due to the fact that it is identified the voyage of sound based on talking at about 344 m/s (1129 ft/s), you will consider taking some time for sound waves to return and increase it by about 344 m or 1129 ft to pursue the complete trip that is partitioned for the acoustic waves. The round-trips suggest that the voyage for the acoustic waves is two times the space to things being identified by sensors [8]; it links the trip off the sonar sensors to things being sensed and therefore the trips from things sensed by ultrasonic sensors (following the acoustic waves bouncing off dissents), in pursuit of space to the thing, basically partitioned to the round-trip separated in half.

It emanates an ultrasound at 40000 Hz, which voyages through the discussion and in the event that there's a question or impediment on its way it'll recuperate to the module. With respect to the time period and velocity of sound, it is fundamental to evaluate the space. HC-SR04 ultrasonic modules integrate four pins: resonate, trig, VCC and ground, and the foot, among others.

VCC pins of modules have to be linked to the foot, and five volts pins on board independently resound and trig pins to computerized I/O adhering to the board [9]. To arrange the ultrasound urge, it might be necessary to line trig on tall states for about 10 μs that can send 8 cycle sonic burst that can possibly travel at velocity sound and it will be obtained within the reverberate stick. The reverberate stick will amount the times in microseconds the voyage for acoustic waves. The ultrasound sensors can be used to determine and sense the target through the utilization of sound waves. It can transmit sound waves at a particular tune and recurrence for the waves to return. By evaluating waves between multiple occasions, it can enhance the transmission [10]. There are two ultrasound sensors integrated to assess varied deterrents such as stones, vehicles, and individuals within dividers and outdoors, including furniture within it. HC-SR04 ultrasonic sensors are used within the projected model that integrates hypothetical measurement of separate of 2–450 cm. Figure 1 indicates a block representation.

3.2 Raspberry Pi Zero

The Pi Zero W is presented to be compact and versatile as conceivable with scaled connectors and 40 pin GPIO that have been inhibited, permitting usage since that is what is needed for expansion [11]. At Raspberry Pi Zero W, there may be a 1GHz BCM2835 single-core processor.

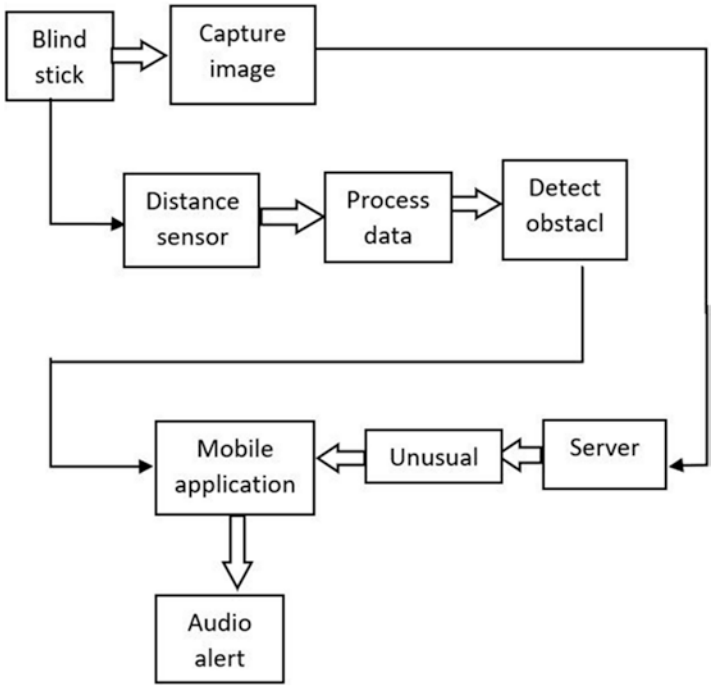


Fig. 1 Block diagram

3.3 Raspberry Pi Camera

The Raspberry Pi camera modules are typically high-definitive videos and images that are still. It is simple to utilize for fledglings, but has bounty to supply progressed clients in the event that you're looking to extend your information. There are numerous cases online of people utilizing it for time-lapse, slow motion, and other video cleverness. You'll moreover utilize the libraries we bundle with the camera to form effects. The camera comprises a small (25 mm by 20 mm by 9 mm) circuit card, which interfaces to the Raspberry Pi's Camera Serial Interface (CSI) transport connector through a flexible lace cable. The image from the camera displays modest determinations of 5 megapixel and displays settled center focal point. The programs from computers for the camera bolsters are for the determination of still images up to 2592 × 1944 and video resolutions of 1080p30, 720p60, and 640 × 480p60/90.

4 Implementation

The proposed system consists of some modules of phases to incorporate unknown object detection based on deep learning approach. Operative approach integrates the major phases: dataset loading, designing for convolution neural network, training configuration option, CNN object detector training, and assessment of training detector. These phases, approaches, and convention will be evaluated in this section.

4.1 Collecting the Video Data

Firstly video dataset is collected with parameters like fighting, smoking, neutral, and knife or stick with YouTube channel or real video, after that using module1 pycan process the video data to convert RGB image frames using open source python library like open cv, then input data of video pictures read by cv2.imread () are pictures of BGR color space the video frames obtained by cv2 () are pictures of RGB color space, the pictures read by PIL (Python Image Library) are RGB color spaces. The image read by opencv is a matrix form, that is, a video frame or a picture, that is, np.array, and the PIL. Image format can be used with the PIL. Image. fromarray() function.

4.2 CNN (Convolutional Neural Network) for Feature Extraction

In (module2.py), the attribute of 4096 size was retrieved from every part projected with Caffe deep learning model. The attributes were evaluate by forwarding the mean output 227 by 227 red-green-blue images with five different convolutional layers and two completely linked layers. To evaluate the features in the part projected, the image dataset is first changed to a type that is compatible with CNN. In this research, fixed entrance of 227 by 227 pixel size was utilized. Therefore, the modest of the simple transformation of random-shaped parts was chosen.

In this case, all pixels in a box that has tightly been bound around the users' segment are rotated unto the necessary size, irrespective of the aspect ratio and sizes. Before dissolving, the tight-bounding box is adjusted to prove a "w" pixel-skewed image content around boxes at skewed dimensions, i.e., w = 16, was utilized. Moreover, the modest bounding box regression was utilized to adjust localized performance within application.

4.3 CNN Training

During pre-processing (module2.py), CNN was trained based on massive auxiliary dataset (unknown object categorization) utilizing the image-pixel level tag. CNN was trained based on dataset (keras layer to unknown object) utilizing additional tag. The training can be done using deep learning model (picture-net).

4.4 Object Category Classifiers

In this case, module3.py with the binary categorizer training was utilized to perceive unknown objects (smoking, fighting, knife, and neutral). It is a positive sample of a picture segment whereby a motor is tightly bounded. In the same manner, the background part, which is not interested in unknown objects, is a negative sample. It is unclear regarding how the partially overlapping segments of unusual objects have to be labeled. Unclear status is solved based on particular overlap thresholds figure. Segments beneath this threshold figure are considered as negative and the ones above the threshold figure considered as positive. The overlap threshold is considered as 0.3 and selected by undertaking a grid analysis on the verification collection. Whenever the attribute is eliminated and the training tag is applied, CNN is applicable optimally to all categories.

4.5 Result Unusual Object Recognition and Detection

The recommended unusual object detector has been trained based on CNN deep learning approach on the sample unusual object set of data, and the unusual object detection procedure has been undertaken successful by trained unusual object detector being evaluated upon dataset testing. Various images were evaluated and considered that the novel approach of categorization was identified to indicate 97% accuracy. Some of the images being tested with other database image are provided in result evaluation. In the result evaluation, utilizing module4.py is actual-time detection in forms of unusual object with elements such as smoke, knife, stick, and gun. Typical images and unusual objects are identified whenever the Raspberry camera and live camera is started and then capture the test pictures (unusual objects), which time compare the model of training “Ib.pickle” and “activity.model” in case it matches the sets of data after the process of displaying the results.

4.6 Preparing Protest Discovery Model

Recently, CNNs appeared an effective execution for different assignments like classification, division, recovery, and question discovery. It's been broadly utilized for a few applications counting activity and action acknowledgment, security, and parts of others. Hence, propelled from these considerations, we explored CNNs for our issue in IoT environment to distinguish suspicious objects for quick announcing. The computational complexity of CNNs may be a huge jump to hone CNN-based shrewdly calculations over asset obliged gadgets. To handle this challenge, we chose a specific, lightweight, and proficient CNN show for protest discovery. We fine-tune an existing protest location CNN shows to identify as it was three sort of objects which can be utilized for rundown era and encourage investigation. The three target objects are vehicles, suspicious objects, and people. Vehicles incorporate all sorts of buses, cars, bicycles, etc.

4.7 Discovery CNN Algorithm

The convolutional neural networks (CNN) were not to attain minimal breakthroughs and challenge the convolutional device layers that comprise pictures and signs with parts meant to initiate the display map. In that case, units in the middle of the integrated diagram are linked to the past layers based on weights of segments. The weights of segments are balanced in the middle of the planning process arranged by back inciting to enhance reinforcement of particular input features. Since the segments are shared among various units of similar incorporate maps, convolution layers have minima weights to be educated compared to thinker FC layers, which make CNN simpler to instruct and minimally over-fitting. In addition, since identical bits are convolved over all images, a comparison integrates autonomously of translating and locating invariance. By using bits, the nearest dataset is considered, and this is a valuable source of setting datasets. As a protocol, nonlinear actuation operation is linked to yield to every neural unit. If we stack some convolutional layer, the extricated displays obtained to be novel with expanding profundity of fundamental layers enhance "displays" such as edges that are amassed within the layers as objects, parts, and themes.

5 Results

The recommended indication has been practical at identifying diversified hindrance of various sizes lying within the means of clients with sophisticated consistency; it was capable of sending SMS to partners with the right client organization. Moreover, it has been promptly locatable whenever misplaced using RF blocked off controls

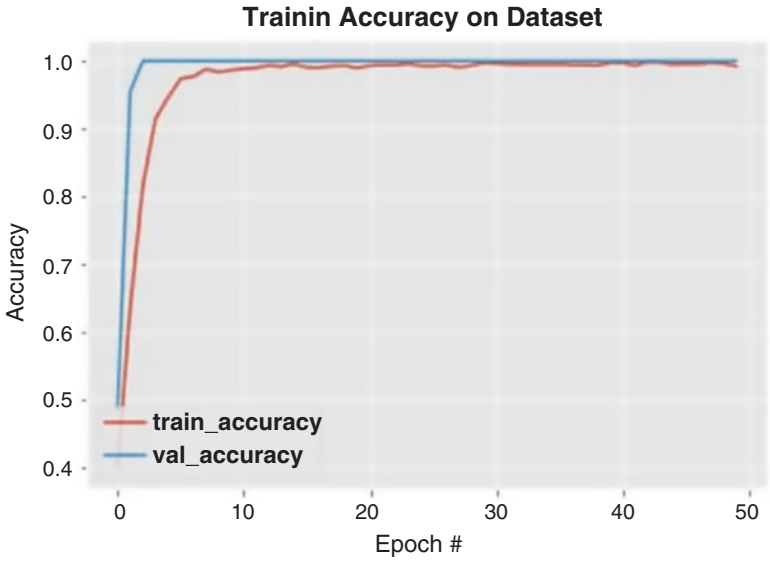


Fig. 2 Training accuracy

according to Figs. 2 and 3. RF modules (Collector and Transmitter) are capable of communicating effectively within a 100 m run.

A basic versatile application for dazzle in Fig. 4 allows caution to the client. Every individual "following" is featured by curiously embrace ID. Individual's colleagues can use this application on client purpose. Suppliers of the "following," having administrative rights to do so, can transform the client number as well.

6 Conclusion

The shown system is sketched out and orchestrated for common sense utilize. The scheme is capable of handling seven different states, which will stand up on to the astonished individuals. The scheme will possibly respond to every state that concurs to particular programs that have been coded and presented inside the Raspberry. When deterrent is identified by the ultrasonic sensor within the cleared out, right and front side of the adhere, at that point Raspberry send the message to the daze individual conjointly send the voice message through headphone.

A basic, cheap, configurable, simple to handle electronic direction framework is proposed to supply helpful right hand and back for daze and outwardly impeded people. The framework is planned, actualized, tried, and confirmed. In real-time system is about of the framework are empowering; it uncovered a precision of 93% in identifying separations. This comes about showing that the scheme is special and productive in its capacity in showing the distance and sources of objects, which will

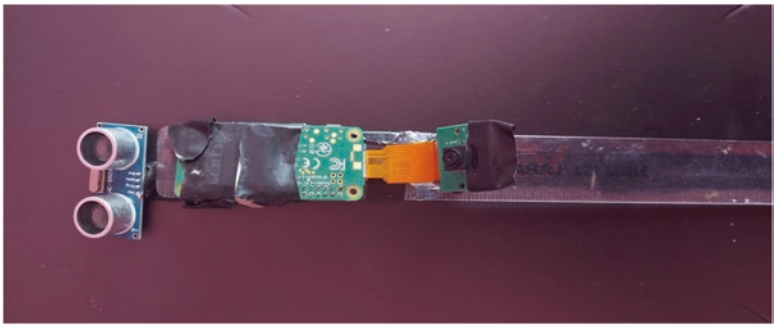
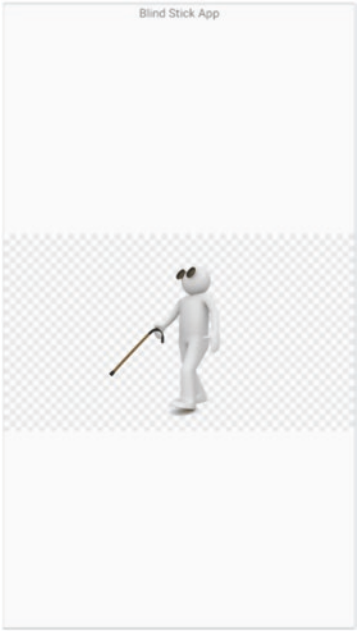


Fig. 3 IoT-based blind stick

Fig. 4 Blind application



undergo the blind. Thus, it is favored by the ones that have considered taking the test. Ultrasonic sensors have been utilized fully in arranging the versatility progress of visually disabled and daze individuals in autonomous and safer means. This model also mitigates the restrictions, which are connected to foremost development challenges that will affect the dazzle users in their surroundings.

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Collaborative Interactive Workspace Environment Using Augmented Reality

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Abstract The advent of new augmented reality applications in workplaces and education centers will greatly enhance the productivity exponentially. As the world moves toward online workspace because of the COVID-19 pandemic situation, it is vital that we increase the productivity at home without compromising on the collaboration aspect. We focus on a Collaborative Interactive Workspace Environment (CIWE) as an almost ideal alternative to current office workspace setting. In CIWE, multiple users can influence a shared virtual workspace environment through an Optical Transparent Head-Mounted Device. CIWE utilizing augmented reality allows better approaches for cooperation and perception and helps to build client engagement and commitment. Furthermore, we also present a hybrid workspace solution which uses both the PC and a OTHD in sync to extend the display capabilities of the PC from conventional monitors to the digitally augmented workspace, thus reducing the need of large tables and also cutting the cost by giving the at most conveyances.

Keywords CIWE · OTHD · PC · Augmented reality · Workspace · Computing

1 Introduction

The utilization of augmented reality is much more open and prevalent as it no longer requires specific gear and may effortlessly be utilized using mobile devices as hardware. With mobile phones getting cheaper by the day, the utilization of these AR has expanded, subsequently empowering more prominent admittance to AR. Recent advances in portable AR devices have created a market for new workspace management and enhancement applications. AR provides better ways of experiencing the

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real world and can make the interactions with digital objects more natural and human. Unique function of AR is to contribute to the increase in technology in human society without limiting people's interaction with the natural environment. Human expressions like speech and voice can be given as inputs to augmented reality devices. Other inputs can be eye tracking and gesture detections using camera and sensors. This overrides the need to use texts as input and output and replaces it with something way more natural and effortless.

An absence of an adequate commercially viable collaborative workspace which significantly increases the productivity of the team is the main motivation of this project. The office or workplace of the future will be significantly different from what it is now. The space of the work desk will not be occupied by monitors and processing units or by anything for that matter. This leads to a very decluttered environment. All forms of data will be stored in the cloud, and the processing will be done on remote server too. The only client-side operation is displaying the data processed and transferred from elsewhere. This use of client and server relationship in cloud with AR can bring an ideal solution for all the problems that we face in current scenario. Rendering a workplace and using the advantage of both cloud computing and AR can bring down the entire workplace wherever we are and can make us interact with virtual objects (person in AR, table with documents, and much more) present in augmented reality.

CIWE also brings an add-on special functionality to a PC by enhancing the display space of computers. This works very similar to using extended monitors on PC to increase the workspace linearly. As augmented reality's only spatial limit is the size of the planar surface to project or the optical depth limitations of the eye, we can project as many displays as we require without worrying about the space limitations. Since projecting multiple displays on AR space without the actual usage of traditional physical monitor, the cost for every individual workspace increases effectively.

2 Literature Review

2.1 Augmented Reality

AR joins genuine and virtual universes, enhancing this present reality with PC created virtual items progressively. This technology is done by using image matching technologies as we see in this paper [1]. On account of portable AR, the innovation includes the expansion of advanced components to this present reality through a cell phone camera. This is an advancement to the previous versions of AI which uses paper-based AR devices [2]. Instances of portable AR applications include Pokémon GO, which is an area-based versatile AR game which uses GPS drive/walk navigation for an AR-fueled route framework. Computer-generated reality contrasts from AR, as in augmented simulation, this present reality is closed out, and the client ventures into a computerized world utilizing a computer-generated experience

headset like the Oculus Rift or Samsung Gear VR. In this paper [3] we can see AR no longer requires particular hardware and may effectively be utilized through PCs or cell phones. Recent trends in AR suggests that mixed reality systems bringing remote users together to share common experience that uses aspects of the real world is preferred [4].

2.2 Collaboration Using Augmented Reality

Utilizing a video meeting procedure is a simple and viable method of making distant clients more reasonable. Clear Board created at NTT Human Interface Lab grants participants in two unique areas to work a collective drawing instrument while keeping up direct eye contact utilizing a video meeting procedure [5]. Arranged SPIDAR created at Tokyo Institute of Technology is an organized multimodal interface which provides a shared virtual 3-D workspace. Organized SPIDAR allows eye to eye video gathering and furthermore communicates hear-able and haptic data.

2.3 Augmented Reality on Mobile Phones

This paper [6] reports on the efforts taken in bringing AR to mobile phones and therefore making it accessible to the general public. This posed a number of problems including limited computational resource, additional hardware requirement, and output capabilities.

2.4 Augmented Reality in Education

AR can be used in educational medium to make classes more interactive. This paper [7] addresses questions like compared student learning in AR versus non-AR applications. From this it is easy to conclude that AR will enhance the learning capabilities of students exponentially and make learning more fun and engaging.

3 Methodology

3.1 Domain Description

AR: augmented reality is a new trend that is coming up which has the capability to raise the current technology. It is very similar to virtual reality but has got a path to real world too. AR can bring an innovative world that we humans imagine but can't

bring in actual life. Communication with both virtual objects and real-world objects is the key feature of AR. Many companies started using AR for visualizing mechanical components and materials for the real-world environment before the actual production for more accurate outcomes.

3.2 Module Description

3.2.1 Module 1: CRUD

The CRUD operation is a foundation for making our AR application. It brings out almost all the functionality of CRUD thus giving users to interact with AR space in remote locations.

3.2.2 Module 2: COLLABORATION MODULE

With the help of both AR and Cloud, we can actually project virtual objects in real-word space. Perhaps the main reasons for cooperative AR climate are to advance social collaboration among multi-client situated in a similar actual space.

Specifications:

1. Marker as collaboration apparatuses: Marker can be utilized as cooperation devices. Connection markers are utilized to control object projected on this base marker set. The two markers should cooperate to make the entire environment work.
2. Gesture's interaction: Gestures comprise three functions, a pointing gesture, a pick-move gesture, and share gesture.
3. Multi-user interaction: Multiple users can use the application simultaneously in augmented space remotely [9].

3.2.3 Module 3: EXTENDED DISPLAY MODULE

Extended displays are highly recommended while working on a large-scale project in order to increase the efficiency and provide us the comfort for working. But incorporating multiple displays for every workbench ultimately makes it negative cost-efficient. Thus, manipulating secondary displays in augmented reality can considerably provide us with a greater number of displays but with no cost. An application made in AR to project the current working screen into extended scene can make this possible [8].

4 Implementation

4.1 Flow Process

Figure 1 shows the flowchart:

1. Start the client (Android device) and server (Windows PC) applications.
2. Connect the client with the server.
3. The Windows PC's display will be projected on the connected android device.
4. The android device uses the AR CORE API to project the display to the augmented space [10].

In Fig. 2, extended module output in the Windows application (server side) is created using dotnet to record the screen and transfer the data to the android device. The android application (client side) receives the transferred display recording from windows application. The Windows application uses AR CORE to transfer the display data from the android device to the augmented space. Different algorithms like SLAM are used to simultaneously track the location and mapping of the environment. All of these steps work seamlessly in the background with full abstraction.

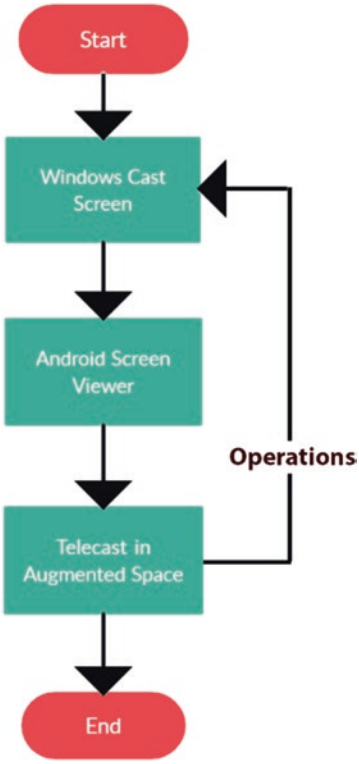

Fig. 1 Extended module flowchart

Fig. 2 Extended module output

5 Data Analysis

As we can see from the above survey, the AR displays perform better than conventional physical monitors in most categories. Therefore, in Fig. 3, AR displays are preferred to conventional displays.

6 Technical Analysis

SLAM (simultaneous localization and mapping) Fig. 4. Techniques establish a map of an unknown environment and localize the sensor in the map. The SLAM technique is used in autonomous vehicles to simultaneously map and localize vehicle in the said map.

There are two types of SLAM:

- Visual SLAM
- LiDAR SLAM

An EKF (extended Kalman filter) is the core of the SLAM interaction. It is responsible for updating where the location of the sensor. The EKF monitors a gauge of the vulnerability in the robot's position and furthermore the vulnerability in these milestones it has found in the environment. SLAM is helpful in numerous

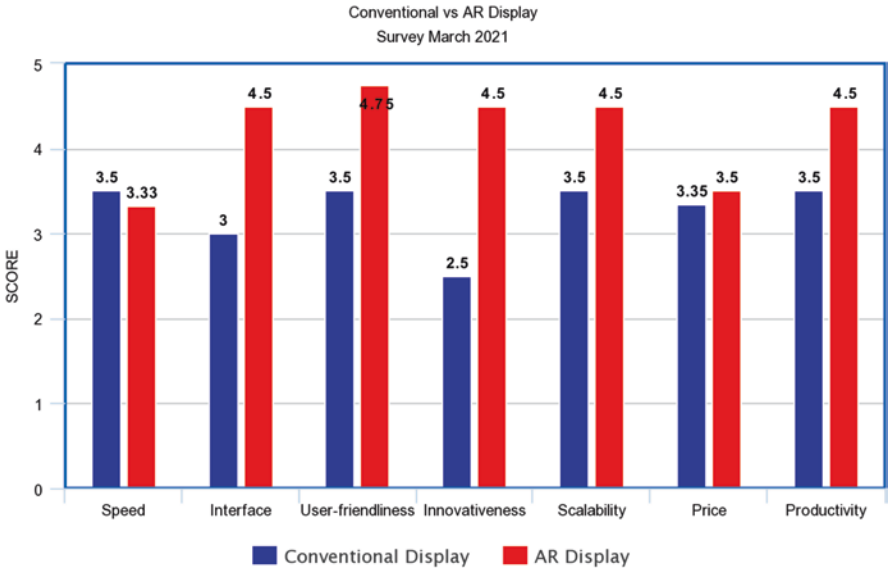

Fig. 3 Bar graph representing different studies between conventional secondary displays and AR secondary displays

different applications, for example, exploring a fleet of portable robots to

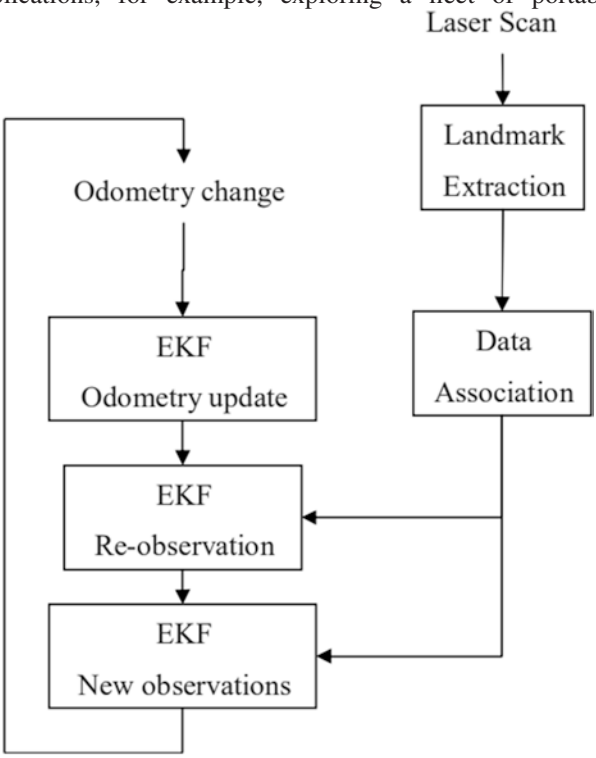

Fig. 4 SLAM, simultaneous localization and mapping process

mastermind racks in a stockroom, leaving a self-driving vehicle in an unfilled spot, or conveying a bundle by exploring a robot in an obscure environment.

7 Conclusion

Augmented reality is an upcoming technology that is going to change the way we experience and utilize data. Making a Collaborative Interactive Workspace Environment (CIWE) application for augmented reality platform before the inevitable opening of the marketplace sets us in a unique place to ride the wave when it eventually hits. CIWE has the potential to revolutionize not only office workspaces but also education and administrative workspace. CIWE is made with a vision of a bright and exciting future, a future where work productivity is increased exponentially without much financial investment.

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Analysis and Prediction of COVID-19 Cases Using Machine Learning Algorithms

S. Balasubramani, A. Sudhakar, Ch. Kalyan, and M. sai Satwik

Abstract The new respiratory disease named COVID-19 was first confirmed in Wuhan, China, in December 2019. From December, corona have been spread across the world. In order to decrease that effect, the government of India had taken the decision to implement the lockdown in our country. On 22nd of March, our Prime Minister announced Janata Curfew. The first lockdown was started on 25th of March 2020. After the cases had decreased, the government split the lockdowns into three phases which are named as lockdown 2.0, 3.0, and 4.0 by giving some relaxations. In our paper we have studied the data of people affected by COVID-19 consisting confirmed cases, deaths, and recoveries during lockdown and before lockdown and after lockdowns. We have used two supervised machine learning models such as linear regression and polynomial regression in order to predict the future cases in India.

Keywords COVID-19 · Lockdown · Linear regression · Machine learning · Polynomial regression

1 Introduction

Due to COVID-19, the world is facing most horrible crises with respect to public health. The COVID-19 first case was detected in Wuhan, China, in December 2019. And the doctors don't know that it can spread from person to person and hence it started spreading. When doctors identified this, it has already spread to other

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countries [1]. From there on WHO and government of different countries have started awareness campaigns to take precautionary measures such as wearing masks, doing sanitization, and maintaining social distancing of about 6 feet. The symptoms for this are fever, cough, etc. [2].

The first COVID-19 case was confirmed in India in Kerala state on 30th of January 2020. By March the cases have increased rapidly, so for the safety of the people, the Indian government has made a curfew called "Janata Curfew" on 22nd of March [3]. As the cases are still raising, the government started the first lockdown for 3 weeks, i.e., from 25th of March. At the end of March, the cases crossed 1000. Then the government further extended the lockdown for two times called lockdown 2.0 and lockdown 3.0. In these lockdowns, the government divided the places in the form of zones based on the contamination. Focusing on the financial crisis, the government had started unlock 1.0, 2.0, and 3.0 based on the contamination [4].

Machine learning is one of the best ways for prediction and identification. We have designed this system with two types of supervised machine learning algorithms such as linear regression and polynomial regression.

There are so many machine learning models for prediction and analysis. There are two types of algorithms such as supervised and unsupervised. Some of the supervised algorithms are linear regression and polynomial regression.

2 Related Work

[5] they have done a comparative analysis of machine learning and soft computing techniques in order to predict the COVID-19 cases, and they have alternatively used some models such as SIR and SEIR for outbreak of COVID-19.

They have used two machine learning (ML) models such as MLP and ANFIS [6]. But they failed to show good accuracy for long-term prediction due to uncertainty and lack of sufficient data.

In the paper named Analysis on novel corona virus (COVID-19) using machine learning methods [7], they have used a support vector regression model to perform five different tasks related to coronavirus. In their work, they have used supported vectors for getting good classification accuracy instead of using simple regression. The author performs five tasks with support vector regression [8].

In the research paper Regression Analysis of COVID-19 using Machine Learning Algorithms, they have done the analysis on transmission of corona virus in the world. They have done a comprehensive study on the virus spread in India. They have also mentioned that further investigation is needed in the analysis on India dataset by predicting the number of cases in the future [9].

3 Methodology

As COVID-19 cases are increasing rapidly, we don't know the analysis of all these cases. Hence, this system is designed in such a way that the dataset is preprocessed and divided based on the lockdowns and country wise and state wise [10]. We have used a two machine learning models such as linear regression and polynomial regression as they fit better for our system. Linear regression is one of the supervised machine learning models as it gives the estimation of relationship between two or more independent variables.

We have calculated mean square error, root mean square error, and r^2 errors for both the algorithms.

Formulas for calculating MSE, RMSE, and r^2 error:

$$\mathrm{MSE} = 1/N * \mathrm{sumfor}\, i\, \mathrm{to}\, N\left(y_i - yhat_i\right)^2 \tag{1}$$

where y_i represents the ith expected value in the dataset we taken and $yhat_i$ is the ith predicted value.

$$\mathrm{RMSE} = \mathrm{It\,is\,the\,square\,root\,of\,MSE.}$$

$$\mathrm{RMSE} = \mathrm{squareroot}\left(\mathrm{MSE}\right) \tag{2}$$

R-squared is calculated using the formula

$$R^2 = \mathrm{Explained\,Variance} / \mathrm{Total\,Variance} \tag{3}$$

Finally we have done prediction on future cases using linear regression and polynomial regression. We have done prediction on confirmed [11] deaths and recovered cases in the future. We have calculated the required values for comparison. As in linear regression we got the negative r square error, we have concluded that polynomial regression is the best suitable algorithm for future prediction.

3.1 Data Preprocessing

Splitting the data in such a way that we get the cases details for lockdown 1.0, 2.0, and 3.0, state wise and country wise so that it can be used for testing and training for analysis and prediction.

3.2 Testing and Training

We are going to use two types of machine learning algorithms, namely, linear regression and polynomial regression using method for testing and training the pre-processed data to get desired results.

3.3 Graph, Different Accuracy, and Error Generation

Based on the trained and tested data, the graphs are generated, and different accuracies and errors such as linear regression accuracy, mean square error, and r square error are generated.

4 Results and Discussion

We are analyzing the dataset for COVID-19, and based on the analysis, we are generating graphs, [12–14] predicting accuracies and errors, and highest accuracy and errors were shown by polynomial regression. Figure 1 shows there are a greater number of active cases than cured and deaths. Figure 2 shows the corona cases before lockdown 1.0. Figures 3 and 4 show by comparing with before lockdown statistics, we can say that the cured cases have been increased and deaths are also slowly increased. Figures 5 and 6 show during lockdown 2.0 the active area increased and cured cases are also grown increasing, whereas deaths are slowly decreased. Figure 7 shows in lockdown 3.0, the active cases are slowly increased and people are cured fastly as compared to lockdown 2.0. Death rate also has been decreased. Figure 8 shows in unlockdown 1.0 the cases have been increased slowly, and death rate is maintained constantly. Figures 9 and 10 show the lockdown 1.0 and 2.0 situation. Figure 11 shows that the number of confirmed cases is less than

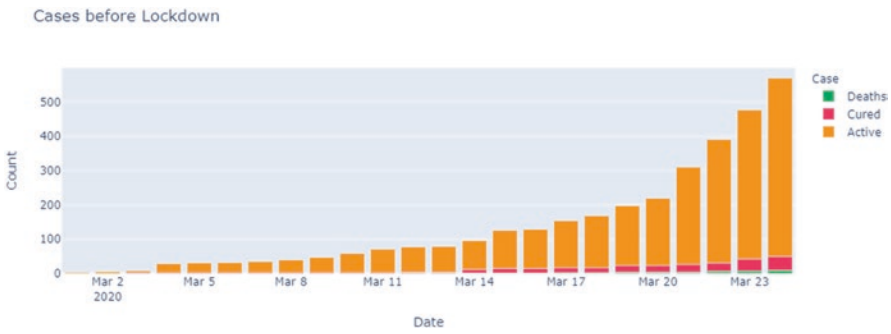

Fig. 1 Number of COVID cases before lockdown

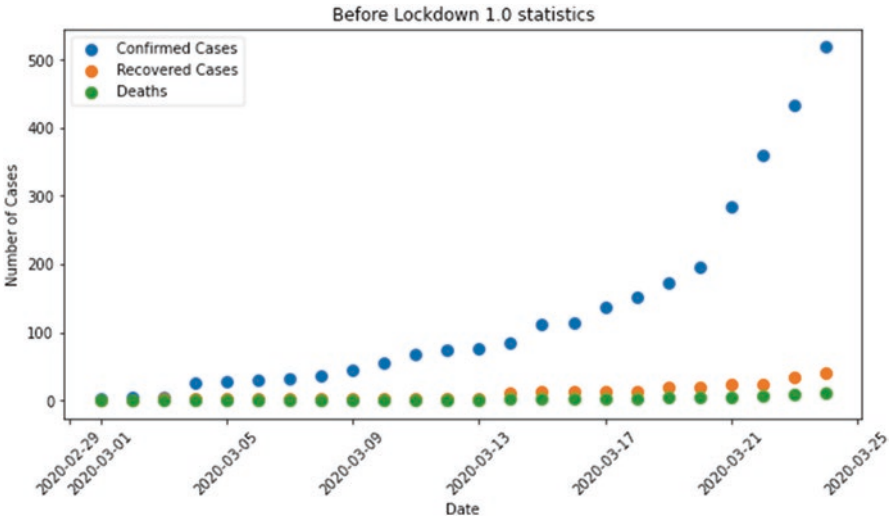

Fig. 2 Corona cases before lockdown 1.0

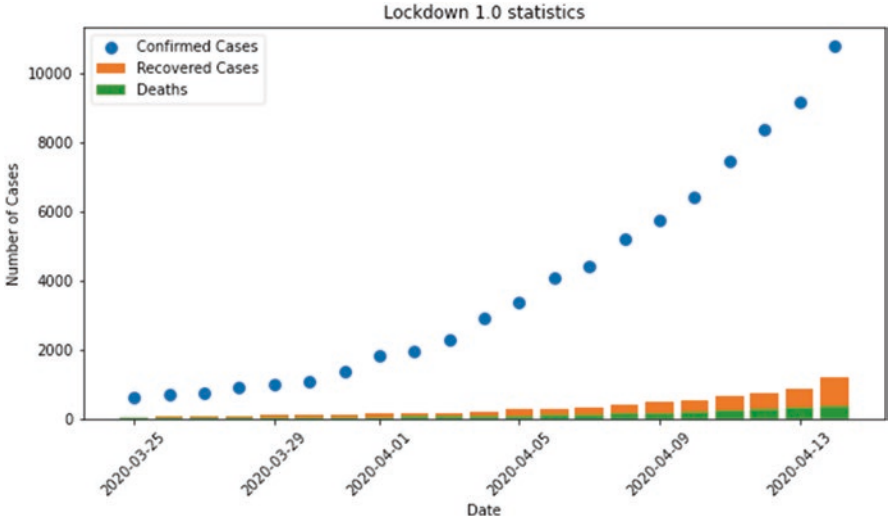

Fig. 3 COVID cases during lockdown 1.0

the actual confirmed cases. In Fig. 12 with the graph, we can conclude that actual recovered cases are more than the predicted recovered cases.

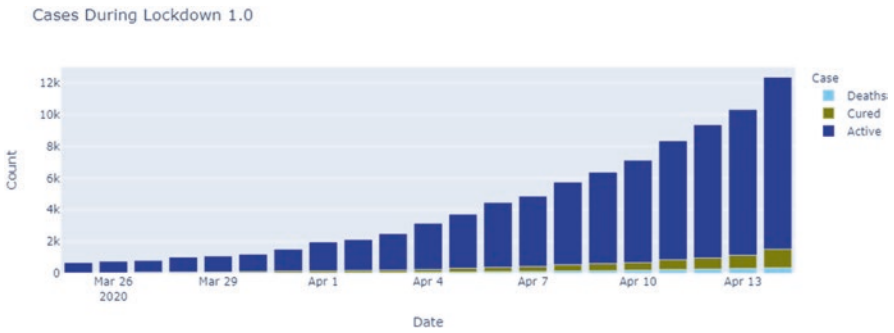

Fig. 4 Number of cases during lockdown 1.0

Fig. 5 Number of cases of lockdown 2.0

Fig. 6 Number of cases during lockdown 3.0

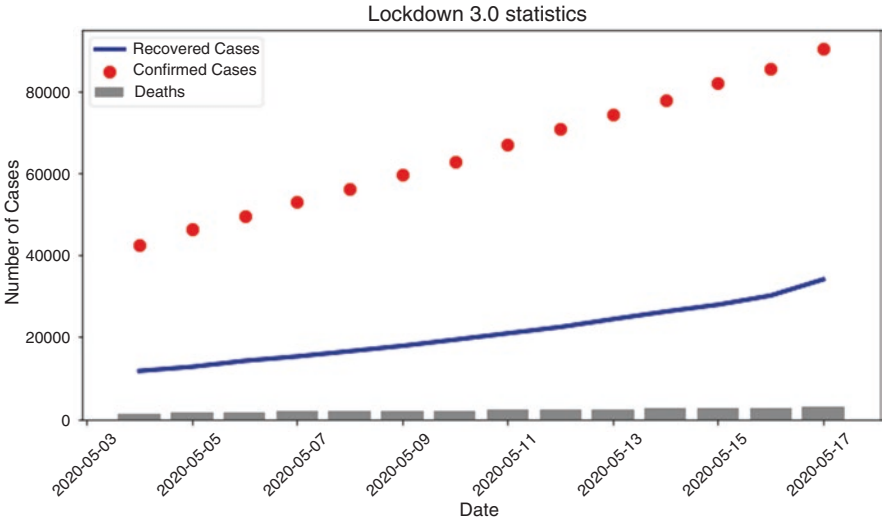

Fig. 7 COVID cases in lockdown 3.0

Fig. 8 Cases during unlock 1.0

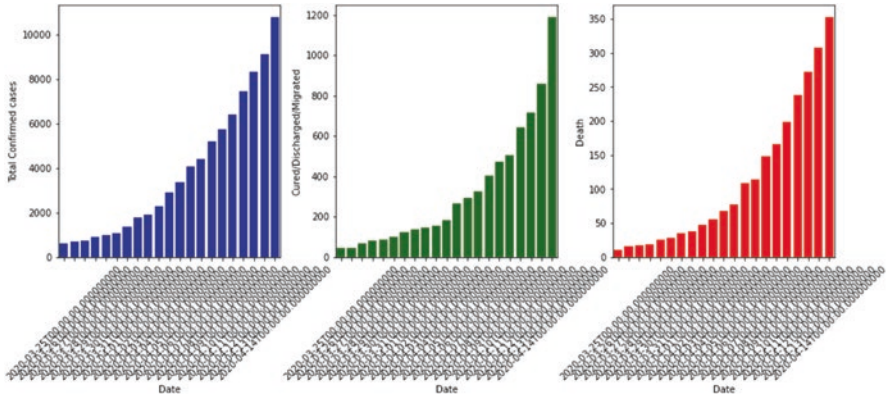

Fig. 9 Lockdown 1.0 situation

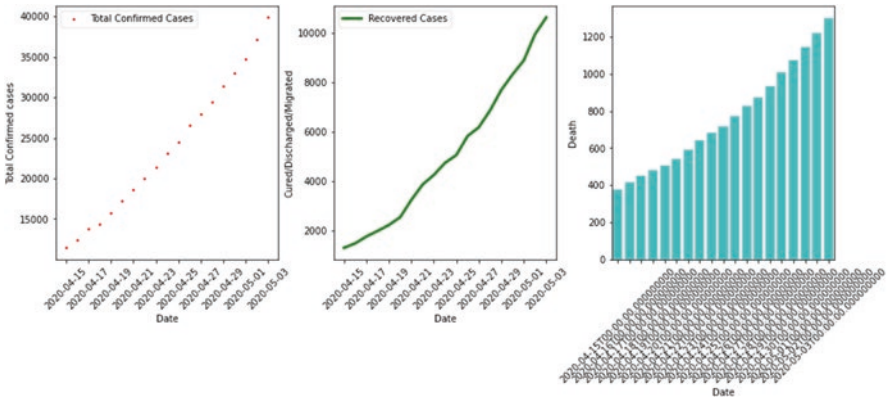

Fig. 10 Lockdown 2.0 situation

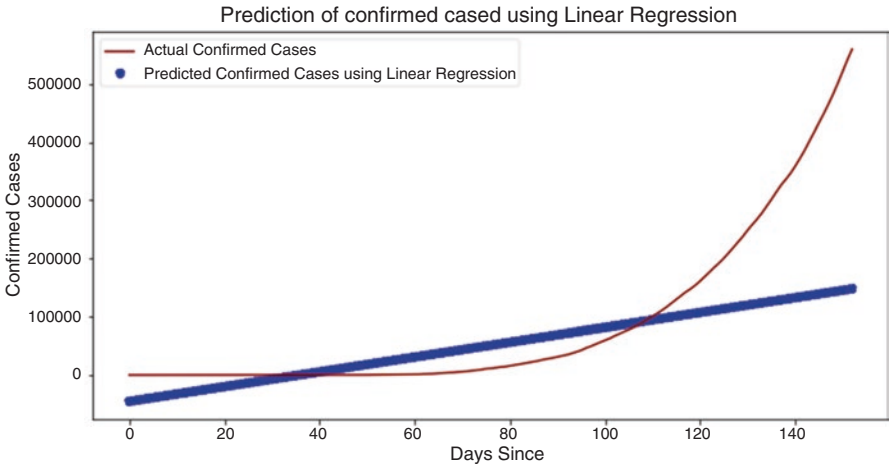

Fig. 11 Prediction using linear regression for confirmed cases

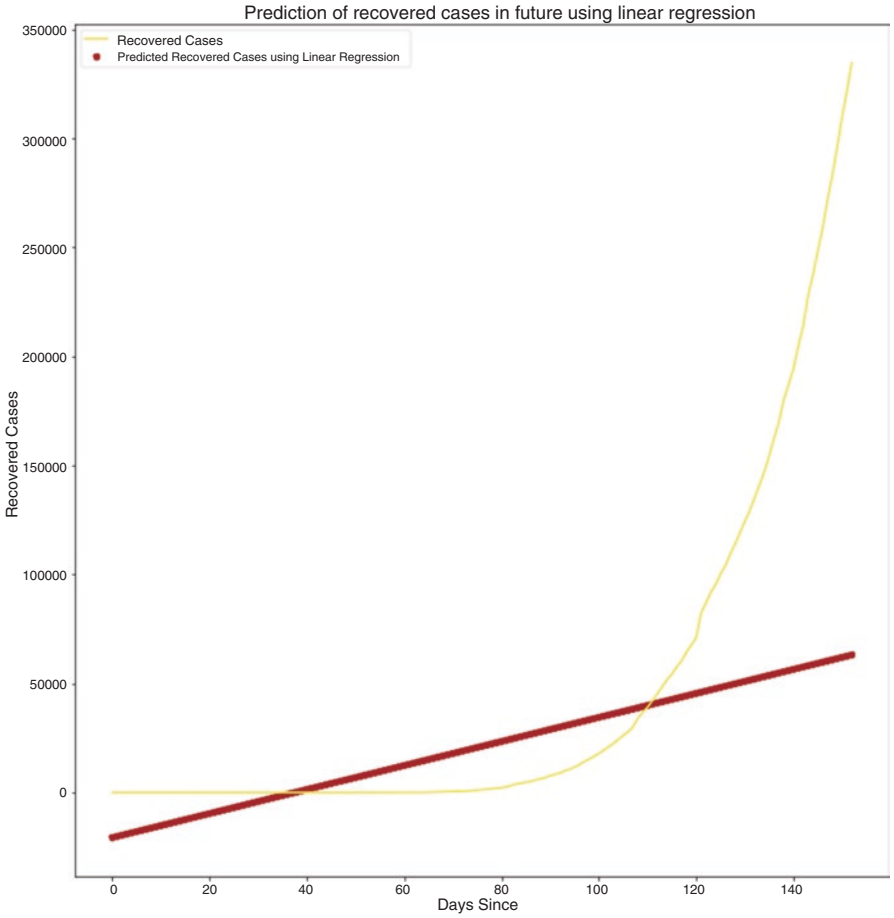

Fig. 12 Prediction using linear regression for recovered cases

5 Conclusion

In this paper we first did the analysis of the dataset taken by dividing the data as per lockdown dates. From the result, we can observe that confirmed cases are increasing abnormally and the cases have been doubled a lot from lockdown 4.0 due to relaxations given by government. And there is also a positive sign that the rate of recovered cases also increased which indicates that affected people are recovering. As like confirmed cases, death rate is not increased. We have used two machine learning algorithms, namely, linear regression and polynomial regression, which are useful for future predictions, whereas polynomial regression gave an excellent predictions with almost 100% accuracy for all the confirmed cases, deaths, and

recovered cases. The end of this pandemic will be decided by the people. It is dependent on how people follow rules strictly which are imposed by the government. It will take some time to get vaccine available. Till then the only way to reduce cases is to maintain social distance which is about 6 feet at public places and wearing masks and doing sanitization. In this paper, we have done prediction mainly using linear regression and polynomial regression.

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Food Detection and Nutritional Recognition System Using Neural Networks

Ranjana Ponraj and Meghana Kelam

Abstract The purpose of this research paper is to implement a user preference-based recommendation system that not only detects food items but also gives nutritional content of the food specially fruits, diet suggestions for the targeted calorie values, and special diet for diseased persons and also the combination of food that harms the digestive system. The proposed methodology incorporates a model for the food varieties specially fruits using deep learning and convolutional neural networks (CNN). The neural network model takes input as image and text data, analyzes it by using SoftMax activation function it provide multi classification and gives the nutritional values. The methodology uses stochastic gradient descent (SGD)which is a simplified optimization algorithm for large-scale datasets. The output values are displayed through a dedicated website designed to show the nutritional contents, user recommendation diet plan, disease-based diet plan, etc. In addition to this, the proposed paper focuses to help the people to improve their dietary habits and lead to the minimal health risks.

Keywords Deep learning · Machine learning · Neural networks

1 Introduction

The existence of food and dietary-related content on the Internet has become notable in recent days. In addition to the massive amount of images on social networking sites, the usage of online mediums as a source for eating habits and diet intakes is enlarging rapidly. With the enormous number of existing information, finding the

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proper intake for the diet becomes a hectic task. The nutritional food recommender systems, a subclass of food recommender systems, have been designed to give assistance in providing users with nutritional facts and dietary plans for targeted diet intakes and also disease-specific diet plans that helps the users to accommodate their preferences and also identifies the problems present in the existing food recommender systems [1]. Recently the food intakes and dietary plans are suggested mostly by online recommender systems that help to filter the data based upon user-given input or their concerned dietary requirements [2].

A food recommendation system can simply be defined as a software tool that takes a very large and complex amount of data such as images and user input data, analyzes it, and gives the output based on the selected choice by the user [3]. Recommender methodology is extensively used in various online platforms especially e-commerce websites.

In this paper it is implemented within the platform of health and nutrition. In the year 2016 the World Health Organization (WHO) evaluated that worldwide there were 39% of adults suffering with obesity and 13% were overweight [4]. Obesity will lead to many diseases including heart diseases, lung diseases, blood pressure, and gastric trouble and also many other cardiac problems. A nutritious and balanced dietary habit plays a crucial role in balancing and maintaining the overall well-being of a person [5].

Many studies have been carried out on the effectiveness of the dietary intake systems. It has been improvising by experimenting with various object detection, pattern detection, and image processing methodologies to spontaneously identify the food varieties. In this technique comprehensive food images dataset help to regular meal consumption report for each person depending on the detection and recognition of food images. The examination of food images is considered as a difficult work due to the various parameter.

2 Literature Survey

Food detection and recommendation system have implemented and advanced through various technology and diverse methodologies [6]. In this paper they utilize AHP Sort as multiple-criteria result investigation means for refining out meal, meat, and snack among these foodstuffs which are unhealthy for the user to intake, and it also covers an optimization-based level for creating an everyday diet forum whose ultimate aim is to recommend the foodstuff which is likely selected by user. This work presents a normal structure for every day diet strategy suggestions, absorbing as important aspect the parallel maintenance of nutritional aware and preference aware data, in variation of the previous effort which neglects this international angle.

But this work requires a heavy processor for processing data and requires more memory to save different datasets. The similar work has implemented using neural networks. This analysis groundwork is concentrated on developing machine and deep learning algorithms as logistic regression, naive Bayes, recurrent neural

network (RNN), multilayer perceptron (MLP), gated recurrent units (GRU), and long short-term memory (LSTM). This journal offers a deep learning quick fix for health infrastructure medicinal dataset that naturally find whatever food to be given to respective patients based on their illness and remaining lineaments like elderliness, gender-specific, weight, calories, etc., but if a person is not having any health problems or diseases, this system cannot give any recommendations for him/her [7].

Further implemented research mainly focuses on the detection process which implements the same kind of methodology as this research. In this paper, deep learning has been widely used as an efficient image recognition method, and CNN is the contemporary approach for deep learning to be implemented. It will just recognize the food image based on the datasets that they trained before, but it cannot tell you the nutritional values, and also, we cannot give our health issues/conditions in this system.

3 Neural Network Model

A neural network model consists of hidden layers, input layer of neurons, and also output neurons [8]. This research uses multilayered architecture that helps to give more accurate and efficient results.

Multilayered neural networks are suitable for real-world applications and complex situations. Implementation of multilayered architecture takes lot of efforts in real-world scenario [9]. The multilayered and artificial neural networks together demonstrated for the functionality of deep learning [10].

Deep learning follows unsupervised learning that has the capability to take unstructured and unlabeled data [11]. Initially it makes a decision by itself and sends the node information forward based on the previous node information. Figure 1 shows the neural network model [12].

The data in the network must be trained by providing a set of input images. These researches acquired images resources from Kaggle datasets and analyze the data using a model to get the output. Neural networks are showed with respect of layers used for implementing the input and outputs [13]. The convolution neural network (CNN) is expressed as a prominent methodology used for any kind deep learning and classification techniques. It comprises of many hidden layers, termed as convolution layers. This model uses the following layers such as conv_2d, maxpooling, dropout, and flatten.

Conv2d layers generate a convolution kernel that is convolute along with layer input to build a tensor of outputs. The layer1 conv2d_4 takes 416 parameters, and the output volume is $49 \times 49 \times 32$. The max pooling layer is essential to subsample the recognition of characteristics in maps. Layer 2 max_pooling2d_4(MaxPooling2) takes no parameters, and output volume is $24 \times 24 \times 32$. The third layer conv2d_5 takes 8256 parameters and the output shape.

Volume contains $23 \times 23 \times 64$. Layer4 maxpooling_2d_5 takes zero parameters; it has output volume as $11 \times 11 \times 64$. The fifth layer conv2d_6 accepts 32896

```
Model: "sequential_2"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_4 (Conv2D)            (None, 49, 49, 32)        416
_________________________________________________________________
max_pooling2d_4 (MaxPooling2 (None, 24, 24, 32)        0
_________________________________________________________________
conv2d_5 (Conv2D)            (None, 23, 23, 64)        8256
_________________________________________________________________
max_pooling2d_5 (MaxPooling2 (None, 11, 11, 64)        0
_________________________________________________________________
conv2d_6 (Conv2D)            (None, 10, 10, 128)       32896
_________________________________________________________________
max_pooling2d_6 (MaxPooling2 (None, 5, 5, 128)         0
_________________________________________________________________
dropout_2 (Dropout)          (None, 5, 5, 128)         0
_________________________________________________________________
flatten_2 (Flatten)          (None, 3200)              0
_________________________________________________________________
dense_4 (Dense)              (None, 64)                204864
_________________________________________________________________
dense_5 (Dense)              (None, 16)                1040
_________________________________________________________________
dense_6 (Dense)              (None, 4)                 68
=================================================================
Total params: 247,540
Trainable params: 247,540
Non-trainable params: 0
_________________________________________________________________
```

Fig. 1 Architecture of neural network

parameters and gives output volume as $10 \times 10 \times 128$. Sixth layer max_pooling_2d_6 takes 0 parameters that has output volume as $5 \times 5 \times 128$. Drop out is an important regulation method when we are providing large amounts of data that helps to minimize training of huge numbers of neural networks with various constructions in lateral form. It also gives support to the approximation of analyzing the image datasets. Flatten function helps to change the pooled feature map to a single column that moves to the wholly attached layer.

The seven layer takes zero parameters which has output volume as $5 \times 5 \times 128$. Layer8 takes 0 parameters and has output volume as 3200. Dense layer is a common fully connected neural network layer. It is the most frequent and routinely used neural network layer [14]. It follows a set of input and returns the output. Layer 9 has dense_4 that takes 204864 arguments and gives output shape as 64. Dense_5 is the tenth layer that takes 1040 parameters and gives output as 16. The last and final layer dense_6 has 68 parameters and gives output shape as 4. There are 247,540

total trainable parameters involved in this model. The images are collected from Kaggle datasets. 20 epochs are used to train images in the datasets. The following figure represents the flow of the model which mainly consists of six phases.

Data preparation can also be termed as data preparation in terms of neural networks. Data cannot be utilized directly. The initial data taken from the web is termed as raw data which is unusable for model preparation. Neural network model accepts only numbers that are stored in the form of matrices. The raw data converted into gray level in two dimensional and raw data converted into RGB levels in three dimensional. The movement of the neural network is described as follows

$$Q(\omega) = \sum_{i=1}^{n} Qi(\omega) = \sum_{i=1}^{n} \left(y_i - y_i \right)^2 = \sum_{i=1}^{n} \left(w_1 + w_2 x_i - y_i \right)^2 .$$

The proposed methodology selects convolution neural network models which have both 1d and 2d neural networks. This neural network model is created using stochastic gradient descent (SGD) algorithm. SGD irregularly collects data point through the entire set of data et at every cycle to minimize the computations immensely. Model training was carried out using Kaggle. There are almost 8000 images present in the dataset out of which 80% images are used for training and 20% of images are used for testing. Model validation has carried out through a set of tested images on a webpage. Finally the model has deployed through a dedicated website implemented mainly using web technologies such as html, CSS, java script, and also nodes in Fig. 2.

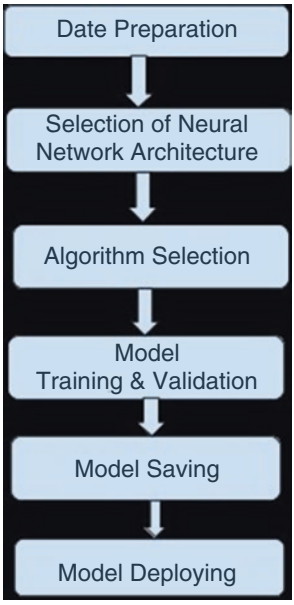

Fig. 2 Proposed model creation

4 Experimental Results

The experiments are performed on core-I3 system using anaconda-Spyder idea with 8 gb ram of computer 1.6 GHz processor is used for experimental setup. Data used in this experiment has taken from Kaggle community open source datasets. The dataset used in this project is named as fruit image for object detection. Figure 3 represents a graph that shows testing and training accuracy performance graph. The blue color represents the training accuracy, and orange color represents the value of accuracy. Figure 4 represents the accuracy loss of trained data. The blue line represents the training loss, and orange line represents the value loss. Figure 5 represents the detected model through neural network model. Here we detected apple as an object in Fig. 6; Figure 7 represents the model deployment in the website to get user preferences diet system.

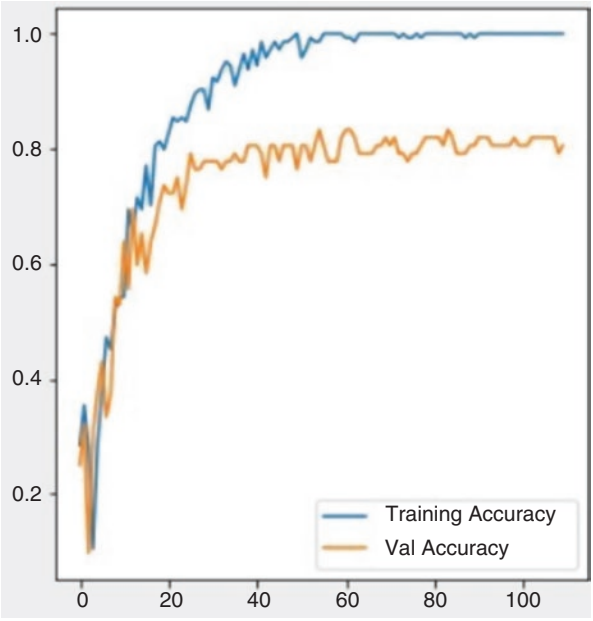

Fig. 3 Accuracy performance (test/train)

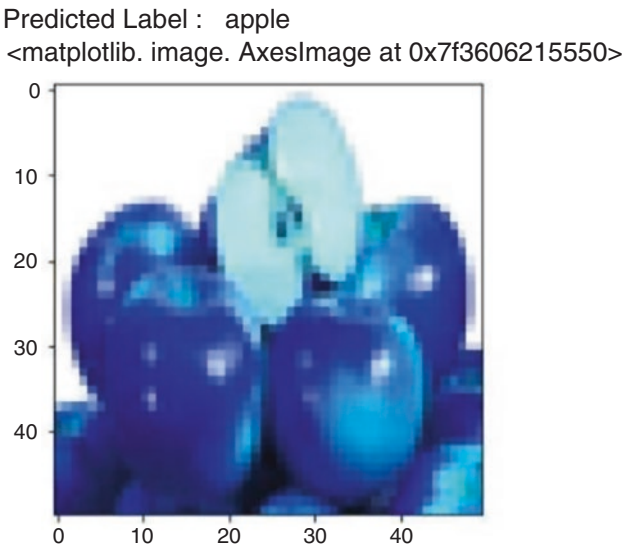

Fig. 4 Detected fruit through model

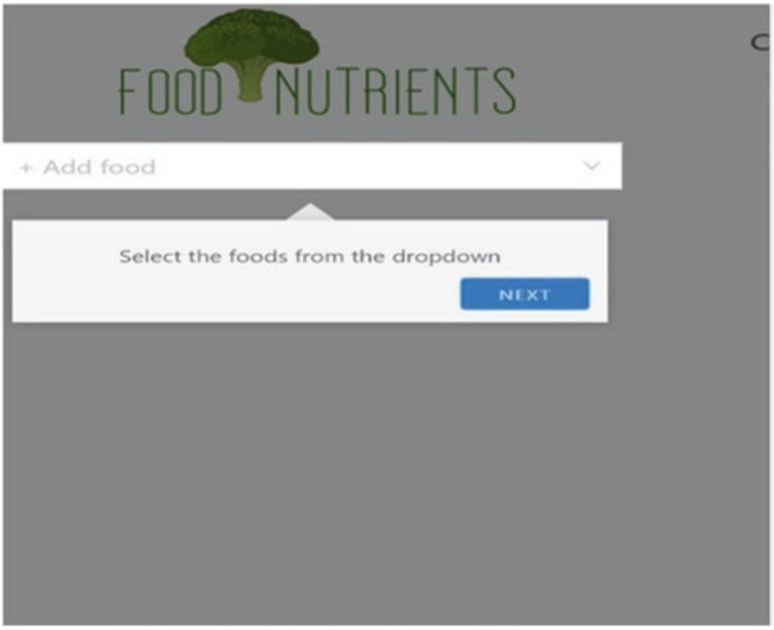

Fig. 5 Web interface for food selection

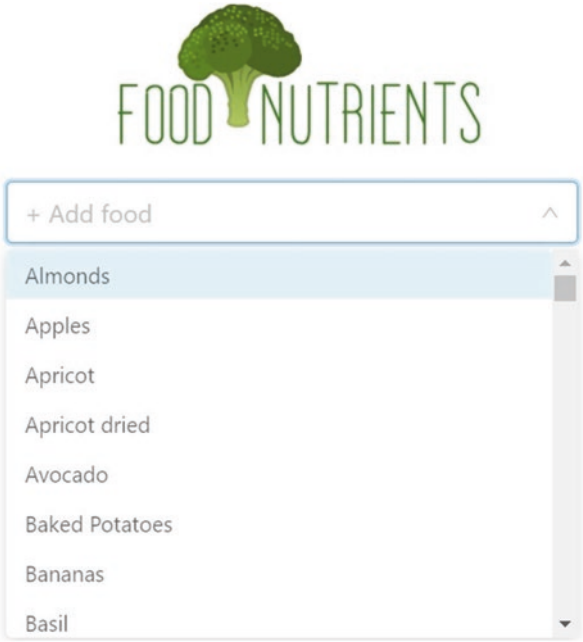

Fig. 6 Selection of food varieties

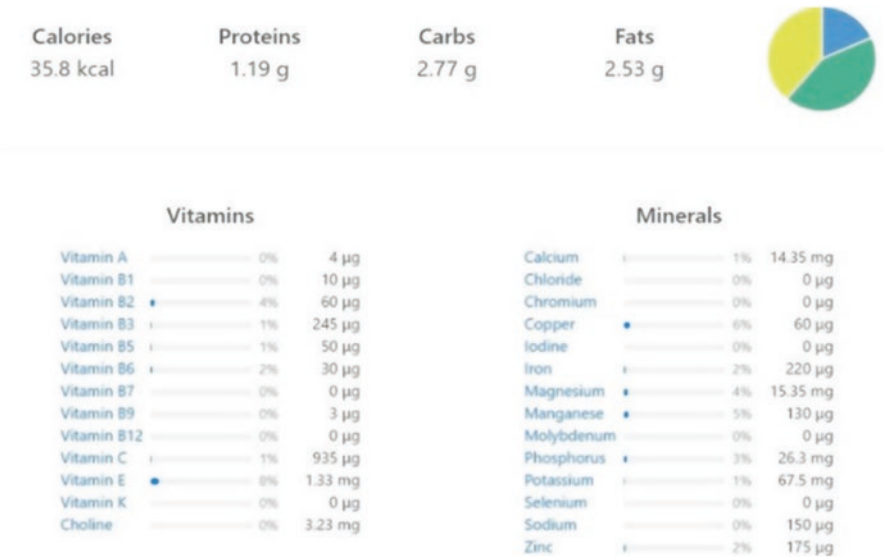

Fig. 7 Nutritional chart

5 Conclusion

In this paper, we implemented a CNN model using artificial neural networks and deep learning. Detection of images has converted into binary image using an 11-layered neural network model. Neural network model implemented through a set of images collected from Kaggle almost 8000 images were collected to test and train the data. The network mainly used 1d feed forward neural network and 2d neural networks.

The model takes SGD algorithm which gives accuracy rate as 83%. All the detection and nutritional facts displaying process have been implemented through a dedicated website.

To conclude this paper is a unique recommendation system that targets nutritional values of users. They can create their own diet plans according to their requirements. For further work, this model can be implemented with mixed food items.

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Online Shipping Management Firm with Route and Cost Optimization for Warehouses

K. Ramesh, V. Kirthika, C. J. Jyothsna Reddy, and K. Prithvi

Abstract Today's commercial industry is dominated by e-commerce ventures. The orders that general people place on different online sites get delayed in delivery due to the shipping problems that's present in the existing system Bowditch. The goods that we order are shipped from the respective vendor to different shipping agents for delivery to the required location. This paper comes up with the idea of shipping optimization that helps in fast and to increase the number of deliveries (Stodola 2018). Here we find the shortest route that can be used for shipping and also the different delivery agents available in the required location. The registered agents will have to register, and based on the performance and number of deliveries that are being assigned to the agent, new orders will be given to them to deliver the goods.

Keywords Shipping optimization · Shipment management · VRP (vehicle routing problem) · Heuristic approach

1 Introduction

The shipment industry has been one of the most important fields in many sector for the development and economic growth of India. For this reason, it is important that we implement various technologies in the process of transporting goods faster within the country and abroad. In addition, these new technologies should help in diminishing the most expensive processes for the companies of transport, the routing, and scheduling of auto-carriers [1].

In addition, it will also have a positive impact on the operational expenses for the transportation companies, decreasing the distance of the travelled in a route from each of the auto-carrier [2] which also represents a positive environmental impact.

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There are two solutions to this problem which is loading the vehicle with orders in last in, first out (LIFO) basis and providing the truck drivers with the optimal route possible. We use two-phase heuristic algorithm to solve this problem. In the first part, the algorithm will build us an optimal route along with the optimal insertion procedure. The second phase gives us the order in which the goods are to be arranged so that every time the orders are not disturbed while delivering [3].

The solution to the problem is the loading and optimal routing, without violating the capacity and time window constraints for each auto-carrier. A two-phase heuristic algorithm was implemented to solve the problem. In the first phase, the heuristic builds a route with an optimal insertion procedure and in the second phase the determination of a feasible loading. The experimental results show that the proposed algorithm can be used to tackle the transportation problem in terms of reducing the total traveling distance, loading/unloading operations, and transportation costs, facilitating better decision-making process for the logistics company.

Every good that is being shipped has a specific number or digit which is generally known as the receipt in Fig. 1.

The utilization of distributed computing administrations on shore started 10 years previous, and over the foremost recent quite long whereas came into utilization on board transports, delivering organizations and alternative ocean institutions like Gardline (sea life sciences organization).

A few ocean IT organizations, as an example, MESPAS noble metal, have perceived the benefits delivered by this innovation; what is more, they have consequently evolved and allotted individual or all distributed computing models on the boat and in delivery organizations. The advantages given by this innovation area unit mirrored within the decrease of operating expenses and therefore the price of IT parts (equipment, programming, databases, organizations), support of reckoning

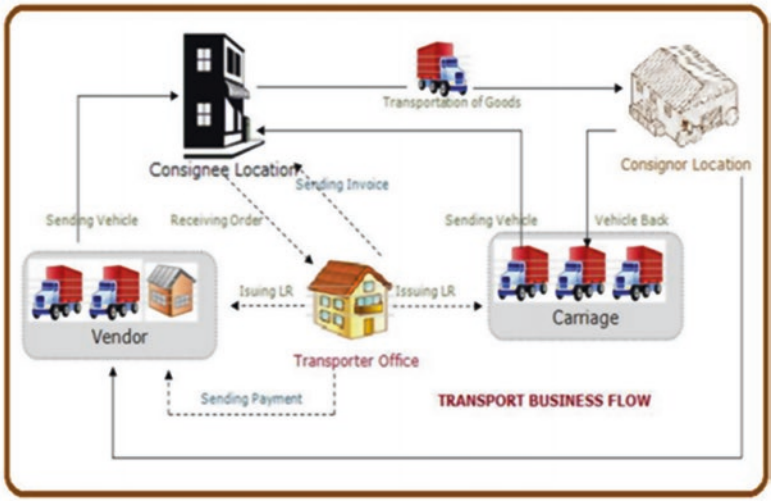

Fig. 1 Transport business flow

assets while not additional getting ready of latest workers also as acquisition of latest licenses for comes and applications. All of those edges allow dispatching organizations, particularly transports, to finish conjointly, improving oceanic cycles strained by PCs.

The use of distributed computing builds this conceivable outcome information of knowledge of information innovation in corporal punishment business measures as an example the possibility of utilizing data assets. The advances in knowledge and media transmission welcome higher opportunities for the move, handling, storage, assurance, and knowledge security.

There is a whole scope of meanings of what cloud registering is, nearly around the maximum amount as there are unit specialist co-ops.

The most acknowledged is that the one by the National Institute of Standards and Technology, USA, that peruses: [4] "Cloud reckoning may be a model for empowering pervasive, advantageous, on-request network admittance to a standard pool of configurable reckoning assets (e.g., networks, workers, storage, applications, and administrations) that may be quickly provisioned what is additional, delivered with negligible administration toil or administration provider connection."

Customary shoppers can characterize distributed computing as another what is additional, less costly approach to utilize programming arrangements that they'll lease on a case by case basis.

IT specialists can characterize it as another business model or new mechanical stage that empowers applications and records sent from any piece of the planet to be saved and place away on allotted employees. Sea subjects do not accept, but lease distributed computing, and obtain exactly the knowledge that they need hunted for. Hence, the expenses don't seem to be vast, and therefore the interest in instrumentality and programming is just about as low as nothing. In today's time of recession, this is often to be [5] only one of the numerous samples of however cloud computing can cut back money and material prices of ships and shipping firms. Reserves and initial misunderstanding of the terms "cloud computing" and "service" are found within the literature during this field and email interviews with maritime firms and ship officers [6]. The setup within distributed computing, applications, stages, and foundation area unit offered to shoppers as administrations implies that they're not sold out as things.

To be additionally clear, distributed computing is mentioned equally as once a ship [7] getting into a port needing administration like water, power, phone association, arrangement of food and/or potable, and so on. The sea subjects attract a reckoning administration by suggesting that of the Internet from distributed computing – equally like water or power through the general public water or power networks as opposition drawing it from their own wellsprings of water or electrical generator [8]. The results are the highlights of administration given by ocean subjects, expressly the transportation organizations, things is not if to utilize distributed computing administrations, but that models would be best cheap for up the productivity and security of the business cycles to be performed.

The upsides of utilizing distributed computing for oceanic subjects include:

- Lower costs of hardware and software system
- Likelihood of delivering administrations to all or any organization ships
- Plausibility of persistent observant of ocean measures upheld by computer
- Exaggerated worker potency

2 Similar Works

Logistic sector is considered to be one of the most important sectors for the growth and development of a country. The estimated worth of Indian logistic sector is about $215 billion, and it's worth keeps increasing over the time. There are various methods to optimize the logistic operations. The most important aspect of it is product delivery. Many researchers have put forth various algorithm and techniques for the development of this logistic sector.

One such algorithm proposed to solve the delivery problem is Two-Echelon Vehicle Routing Problem [9]. In this algorithm the goods are delivered to its nearest or intermediate depots, these intermediate depot is known as satellites, and then the goods are delivered to the customers.

"Multi-stage LTL transport systems in supply chain management" [10] paper showed the mathematical analysis of the algorithm where he say the cost of the arcs are asymmetric in symmetric capacitated VRP (ACVRP) problem [11] and also states the cost to travel from one customer i to another customer j is different from j to i. This problem has been solved in a different way by "Robust Branch-Cut-and-Price Algorithms for Vehicle Routing Problems" using branch and bound approach.

Other papers like "Recent advances in vehicle routing exact algorithms" used arc routing problem (ARP) which finds the shortest route through all the paths and returns to the starting position [12]. Advancement in this methodology is proposed by proposed large bounds for enormously large-scale scenarios.

Location routing problem (LRP) is another important aspect of logistics. This problem took care of the three most important things simultaneously like location of the depot, defining the route to the deport, and assigning the route to the opened depots. This problem also used granular search to assign the routes.

Some algorithms have been proposed inspired from natural physical phenomena [13]. Polar Bear Optimization Algorithm: Meta-Heuristic with Fast Population Movement and Dynamic Birth and Death Mechanism adopted multi-depot vehicle routing problem from ant colony optimization which is implemented by iterating the ant colony optimization with the deterministic optimization process. This paper adopted its technique from monarch butterflies and proposed butterfly [14] optimization problem using greedy search to solve dynamic routing problem. It adopted local and global search methodology from polar bear optimization techniques which imitates the best hunting and survival behaviors.

In this paper we are discussing about the vehicle routing problem aspect which comes after the shipping. Currently one of the most part of optimization technique is heuristic approach. On the Use of Learn Heuristics in Vehicle Routing Optimization

Problems with Dynamic Inputs discussed various vehicle routing methodologies using dynamic travel time, also considering the dynamic nature of the inputs and reevaluating travel time until it reaches the optimal solution [15–18]. They put forth a metaheuristic approach to solve the problem.

"A Heuristic Approach for a Real-World Electric Vehicle Routing Problem" proposes an adaptive large neighborhood search (ALNS) in which he proposes about the electric vehicle delivery system [19] and especially designed charging stations heuristic approach to reduce the operational costs and the delivery dispatch time. He also mentions about the emerging technology electric vehicle delivery.

VRP is globally studied in the areas of operations and research due it's computational power and its complexity. It has multiple real-world applications. This problem also has wide range of restrictions in terms of the population, the capacity of the goods, the delivery time, and much more. These restrictions make it much harder to find an optimal solution closer to the real-world scenarios [20]. Here, we have proposed a methodology to deliver the goods to and froth from a business to business or a business to consumer especially where the heavy goods are delivered. We have used two-phase heuristic approach to solve the loading, route selection, and problems related to delivery where phase one deals with the vehicle selection and phase two deals with the route selection.

Hereby, we aim to solve the problem by providing route and loading optimization technique, also reducing the operational and transportation cost for the logistic company.

3 Proposed Methodology

Heuristic algorithm is best suited to get optimal solutions in fastest and in efficient fashion rather than sacrificing the optimality, speed, and accuracy by using the traditional methods. Heuristic algorithms are used to solve NP-complete problems where the problem can be solved in polynomial time.

By using heuristic algorithm in logistics industry, we can avoid the empirical methodology which was being followed by logistics company where routes are chosen randomly by transport managers or by drivers, but heuristic algorithm eliminates the need to choose the route for the transport vehicles in the shortest and in the earliest time frame benefiting the company by reducing the transport and the fuel charges as well.

3.1 Heuristic Approach

This project has two phases, the first phase is to produce the route of the vehicle, and the next phase is the order in which the goods are to be transported which is the drop location. The first phase determines the optimal route through insertion heuristics so

that the orders are delivered at their drop location faster and with the optimal cost for delivery. It is also known that vehicle routing problem with time windows (VRPTW) is a NP-complete problem. The algorithm first creates a cluster and then determines the route which is grouped by the orders, and its delivery date first and then the route is determined, considering the allocation and capacity constraints.

The routing algorithm builds an optimal solution by generating one route at a time. At each iteration, the algorithm decides which new order and where the new order has to be inserted in the current solution decided.

When choosing the route, the algorithm takes into consideration both the cost increase associated and the delay in service time at delivery of other orders following the new order which is inserted on the route.

The algorithm has three steps:

(i) Step 0

This step is known as the allocation phase where the appropriate vehicle gets allocated for the dispatch. The vehicle allocation is decided based upon the number of order items, size of the order item, and the route which is involved for other orders so that it gets delivered in shortest and in earliest time window based on which a vehicle for transportation is picked.

(ii) Step 1

Choosing the best optimal route with the shortest and earliest time window. This phase also checks if there are any unrouted orders, that is, it checks if the orders which are placed in the vehicle are all routed and nothing is left behind.

(iii) Step 2

The orders are arranged in the vehicle in first in, last out (FILO) basis according to the route that is generated. The algorithm then checks if the vehicle has additional space. If the vehicle has additional space checks for the order in the particular area, it adds that order to the vehicle and then goes back to the Step1, and this process is continued until we get the optimal solution.

The feasible insertion takes care of the maximized benefits which is obtained from delivering the orders in the algorithm's generated path rather than choosing the individual path for each orders. The path which is generated by the algorithm gives us the path where the maximum order load is delivered in the shortest and cheapest manner. This helps the logistics industry to deliver their order on time and saves the industries cost by choosing optimal solutions one after the other which in turn saves the transportation and fuel charges for the company. This solution also overcomes the difficulty of arranging the orders in the truck in first in, last out (FILO) manner so that the orders are left undisturbed until the delivery location. This also ensures that the orders are not damaged which reduces the penalty costs for the company.

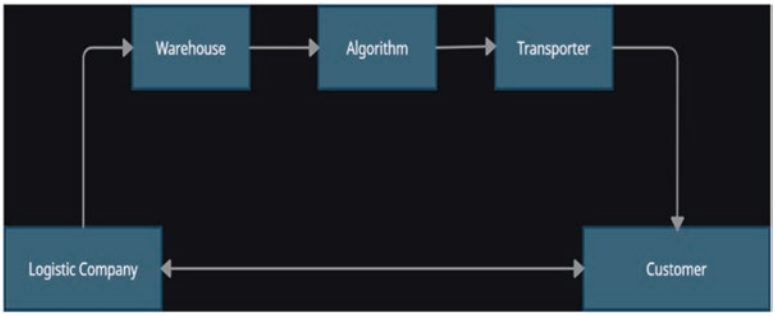

Fig. 2 Project design and modules

4 Implementation

The customer places the order from his/her application. The place order is then sent to a logistic company to ship the order.

As shown in the above picture of Fig. 2, the different modules that are involved can be explained as the following.

Admin
The admin can add all the consignments that has been given to his company and can also manipulate them. Admin also gives the count of the vehicles for the order delivery. He can mention which vehicle is currently available and the vehicles are engaged in delivery. He can control the movements of the vehicles and the orders as well.

Route
After all the orders has been entered in the system the algorithm generates the shortest and the optimal path.

Vehicle Allocation
The vehicle allocation is decided based upon the number of order items, size of the order item, and the route which is involved for other orders so that it gets delivered in shortest and in earliest time window based on which a vehicle for transportation is picked.

The orders are arranged in the vehicle in first in, last out (FILO) basis according to the route that is generated. The algorithm then checks if the vehicle has additional space. If the vehicle has additional space checks for the order in the particular area, it adds that order to the vehicle and then goes back to the Step1, and this process is continued until we get the optimal solution.

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Order Status Updating Module
With the help of this module, the admin can track if the order is being delivered in the right time. Once the order is delivered, the order status is updated, and the flow is maintained.

5 Result Analysis

The program helped us to insert shipment orders and helped us to track it. It also helps to generate a warehouse invoice which helped to modify and track the invoices status on the go.

With the application, we can also track the goods graphically. One can know how many orders are currently there under each status of delivery like shipped, delivered, picked, and more.

Under the list all category one can view all the orders which are placed to a logistic company, and once a particular order is clicked, the entire details of the order are viewed.

Once a click is made upon an order, this order invoice which is otherwise called warehouse invoice can be viewed. This invoice helps us to track the order with its unique reference number. The e-invoice helps us to change the status of the order on the go. The admin/delivery person can have access to change the status of the order to status which is currently in, and the same is shown in Fig. 3a–d.

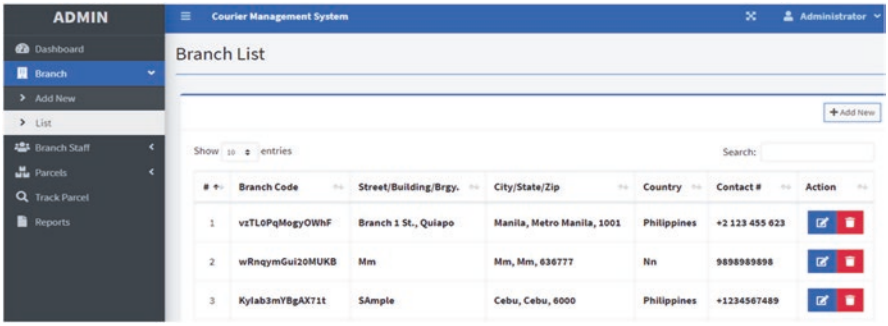

Fig. 3 (**a**) Sample screen shows adding and deleting new branches for a logistic company. (**b**) Sample screen shows the graphical representation of the status of the orders. (**c**) Sample screen shows the list of orders that are placed to the company. (**d**) Sample screen shows the warehouse invoice

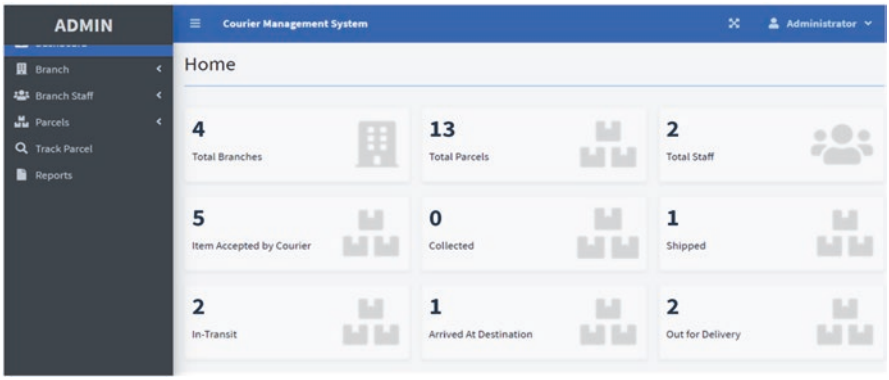

Fig. 3 (continued)

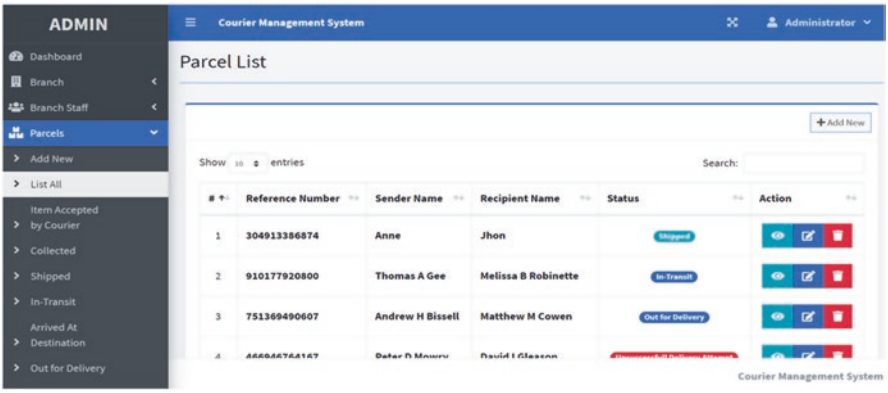

Fig. 3 (continued)

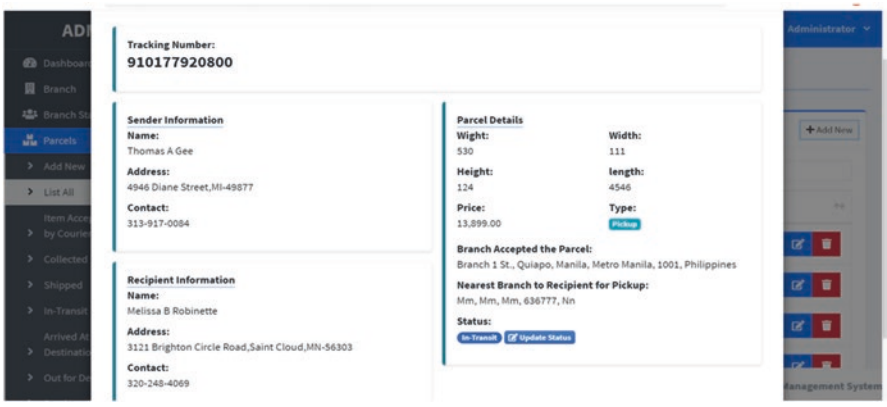

Fig. 36.3 (continued)

The warehouse invoice contains a unique 12-digit reference number to track the status of the order. Then these orders helped us to generate the shortest path.

6 Conclusion

The algorithm helped us to achieve the feasible loading of orders in the vehicles at a reasonable time and also helped to pick the most optimal route by saving the time of the logistics company and the fuel costs and also helps to safely deliver the orders without any damages. This work may be enhanced by implementing dynamic routing metaheuristic algorithm such as finding the blocked routes, rough roads, etc.

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Digital Certificate-Based User Authentication to Access Networks and Hosts

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Abstract When an unknown person comes in freely to talk to us, I believe that the first question that pops up within us will be with their identity. Incoming host detection requests are sometimes fishy but not in all cases; we may also have some peer friend of ours outside a network who wants to connect with us; we can't neither give complete trust on any incoming request nor decline it. How probable it is that the one who tries to connect us is a well-known entity of ours? All we need is the authenticity. Digital certificates are one of a kind that could help us with the authentication. The contents of the certificates disclose the identity of individual. Each messaging participant generates a matched pair of encryption keys—a private key, which is never revealed or transmitted, and a public key, which is freely available to other participants. These keys are stored in a local file or repository called a key store, and the public key is stored as part of a digital certificate. The certificate can be attached to a service operation to verify the sender's identity and to provide the recipient with the means to encode a response.

Keywords Authentication · Cryptography · Digital certificate · Hashing · Security

1 Introduction

Port scan is the first stage of reconnaissance. The goal behind scanning is to identify the details of hosts connected within the network. Port scan, one among the types of scanning, reverts back the details of most commonly used port which is considered as a standard for use of different services like file transfer protocol (ftp), telnet.

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These days, PCs and organization interchanges have an inescapable presence altogether in day by day exercises. Their right design regarding security is getting increasingly more mind boggling because of the developing number and assortment of network administrations offered to end-clients.

Security managers, hence, need to look with this difficult work, which requires quite certain abilities and an undeniable degree of skill. The determination of security designs requires the meaning of a few specialized subtleties among a few choices, for example, security legitimacy (privacy), security conventions, figure suites, and breaks [1]. At this point a question that arises in the mind is how, when, and where does the authentication and authorization of every user going to take place? "Higher the level of security, the lesser is the level of user-convenience." The other aspect that needs to be targeted is how to not compromise on the security level and also maintain user-friendly usage of the system. Addressing these main concerns, this paper proposes a new conventional method to maintain a balance of security level as well as adaptability [2–5].

Before entering into the technical proposal, the glance of topics that involve further in the paper will be gone through; if you are already familiar with the terms, you may feel free to skip the brush up part.

1.1 Role of Firewall in Network Security

Firewall is a system that protects internal network devices from un-legit network traffic directed into organization's network. The fundamental function of a firewall is to filter network data packets. Firewall stands as a gateway for an incoming request to get verified and been directed to the respective host computer.

Every organization would determine their security needs based on criteria: intra-network communication on a local area network (LAN) within the company spread areas, types of data their server handles the security configuration for a firewall has to be configured accordingly. Is it only for organizations? Not exactly, it can also be added to a home network, depending on awareness and willingness to adopt more secured system [6].

The firewall performs two major roles: provides defense against external threats by refusing unauthorized connections to the router from potential intruders [7].

1.2 Cryptography

Cryptography is an essential tool for protecting information in computer systems. It is more of how two parties who have a shared the secret key can communicate securely when a Herculean adversary eavesdrops and tampers with the traffic.

2 Related Works

In 1991, Phil Zimmermann built up Pretty Good Privacy (PGP) which simply provides privacy and authentication for the data being communicated. It has been implemented in various real-time scenarios today like digital signatures, encrypting and decrypting messages and files in turn increasing the security standard of communication [8].

A certification authority signs the records to the conjunct hash key of a document in the chain to recognize its name. Following this, the certificates are validated throughout the network using SSL/TLS [9–13]. It has been shown that the certificate authority is not at all dependable in late security episodes, contrary to popular belief. This infrastructure may also prevent dishonest authentications from being signed [14].

ITU developed the X.509 certification framework standards in 1988 in order to achieve remote network user authentication in the opening network. X.509 uses public key cryptography and digital signatures [15]. The following is the general format of digital certificates in X.509: The version number identifies the X.509 version that the certificate data format adhered to. Certificate serial number: the serial number of a CA-signed certificate must be unique [16]. The serial number is a long integer, and certificate users must be able to manage serial numbers of up to 20 octets. When signing a certificate, the signature algorithm identifier identifies the algorithm and the parameters that go with it [17]. Validity: A certificate's validity period is defined by its validity. During this time, the CA promises that it will keep track of the certificate's status. It contains the valid time's start and end times [18]. The information about the certificate issuer CA is defined by the issuer name. The name of the CA that issued the certificate 2 identifies the source of confidence for signing certificates.

3 Proposed Methodology

The main objective is to ensure authenticity of computer prompt to connect and communicate and establish encrypted channel for data transfers.

Cryptography would be a better choice to deal with secure transmission of data; with the help of superior cryptographic operations (encryption and decryption, hash functions), we could achieve a better platform to trust the communication [19].

A web application would play an intermediate role for getting the user input like requesting a digital certificate, download the same, to enter the details of the entity to connect after which is transformed to a network request for connection, and also the web application plays as an interface for the data transfer. Everything is encrypted over the communication channel [20]. To make a new connection with a computer, you may need to go through option to request for a certificate. If the owner of the device wants to allow you to communicate with them, then standard

process for issuing a digital certificate will be followed such as asking for user identity, validation proofs, photographs, etc. [21–23]; upon successful retrieval of all the details, the cryptographic key pairs will be generated to be sent via the same web application to download (two factor authentication might be included to download the digital certificate, in the future upgrades) and an ID corresponding to the entity to be shared so the user don't have to enter the IP address every time they want to connect.

List of accepted devices and the details of the digital certificate ID and personal identification details are to be stored in a database to create a match for authorization at the time of them connecting to the system/network. Certificate once issued can be used the same to connect unless the device you want to connect; it's owner removes you from their granted devices to access [24–25]. If changes are made to cryptographic key pairs for security reasons, then the existing devices that are granted access would be notified, and key pair sharing process is initiated and updated with the new key pairs.

4 Implementation

There is a user who sends a request over the web application to gain access to a certain set of data or a network or host along with their basic set of information. The issuer generates the certificate along with a private key for that specific user using the SHA256 algorithm.

Figure 1 demonstrates the issued certificate which is then sent to the verifier to confirm the user's identity. The verifier then begins to look upon authenticating the user with the provided details by verifying the degree number and verifying the enroll through other resources. If confirmed as a valid user, the private key is sent to the user's e-mail ID which the user will have to enter in order to download the digital certificate from our web application officially; else if found as a random third

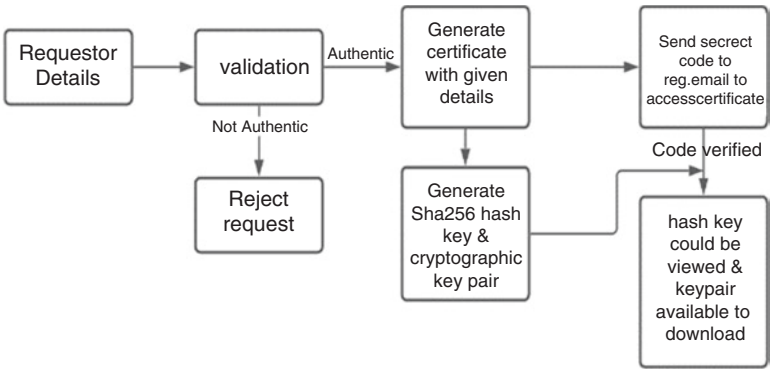

Fig. 1 Module diagram of the process

party trying to gain access through a fake profile, the process will be aborted then and there. This digital certificate is valid for 2 weeks upon generation. This method would help in denying access to unauthenticated users in just a few steps, hence increasing the security level to a greater extent.

5 Performance Analysis

Figure 2 depicts the collecting of the user's basic information; the issuer issues the certificate and passes it on to the verifier confidentially for the verification process. This data of the user lies only between the issuer and the verifier. The issued certificate of a specific user is shown above.

Figure 3 shows the verification process done by the verifier who begins to validate and check the user's authentication officially by checking the major defining parameters such as the degree number, enroll, and e-mail ID.

If the official validation has been successfully completed and the user is decided verified, the certificate is generated in the official website. Each certificate issued by the issuer contains a key value in it which is sent to the user's e-mail ID that is meant to be kept safe. To download the certificate from the website, only if the correct key is entered can the user access the certificate and then the data. In case the user is found as a random third party or somebody unauthorized, the verifier will discard the details and abort the certificate issuing process then and there.

Figure 4 portrays the abovementioned process of sharing the private key to the user secretly via mail which is then used for further authorization.

Figure 5 shows the various time analysis on RSA 2048 bit encryption and decryption, for different file sizes ranging from 1 MB to 5 MB have been observed and

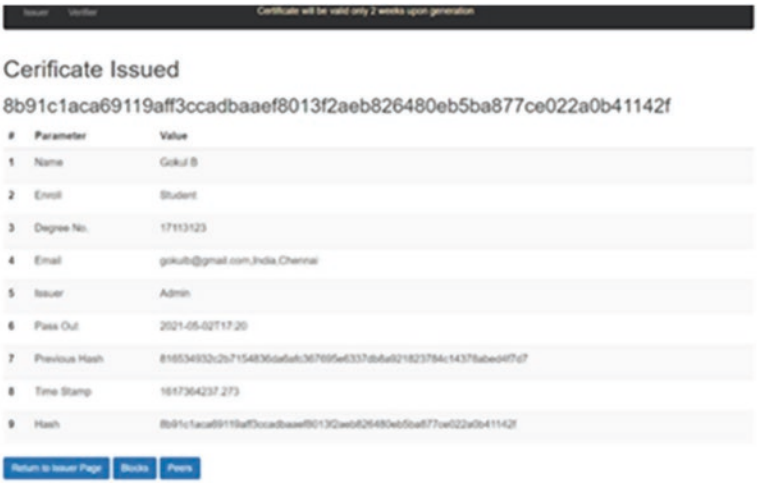

Fig. 2 Generated certificate

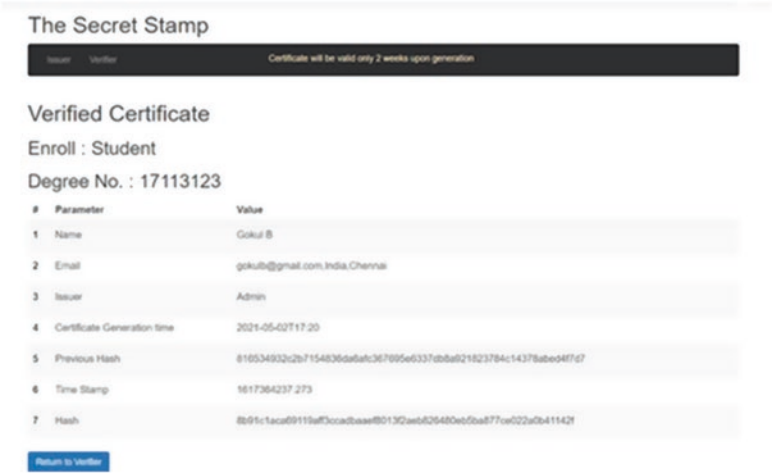

Fig. 3 Verified certificate

represented in the form of a plotted graph. The private key and public key pair generation for an asymmetric cryptography in use of the RSA 2048 bit key consumes a standard time of 872 ms.

Unlike organizational security measures and firewall configurations, home network devices either have some level of firewall security or sometimes no security at all. Considering a home network connected devices, it is not obvious that their network system security is always updated and has chosen the best type of security options. Business organization vs home networks, either of the case the common entity plays among them is the circulation of data, which needs to be kept safe anytime.

The network layer firewall protocol prompts for valid access grant digital certificate, to verify every single incoming communication request. The protocol would stand as a backbone to prevent malicious sniffing access. With the enhancement idea of this project on deploying a network layer firewall, we'd expect that port listener tools and network scanner tools would not be able to produce any output results on a scan or port sniff as it has to bypass the authentication firewall to retrieve information once it lands on target network. As long as it is managed to design with that objective, the improved functionality would enhance complete trust over the network connections inbound to a network.

The basic idea behind this paper is to authenticate and authorize users in order to grant them access to the data concerned. Hence encrypting and caching the digital certificate that has been initiated increases the security in a network.

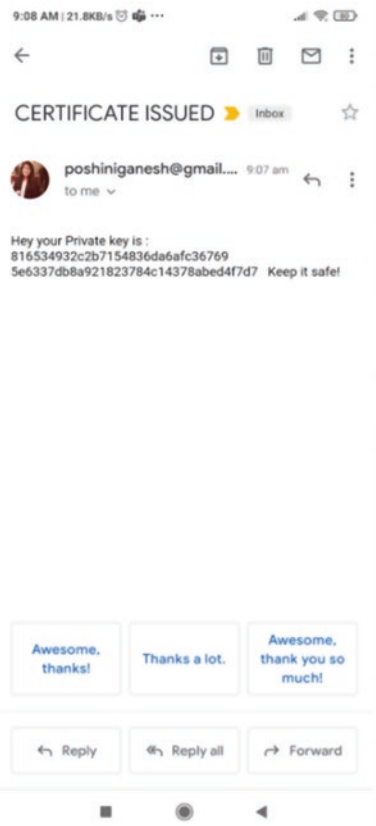

Fig. 4 Key shared to e-mail ID

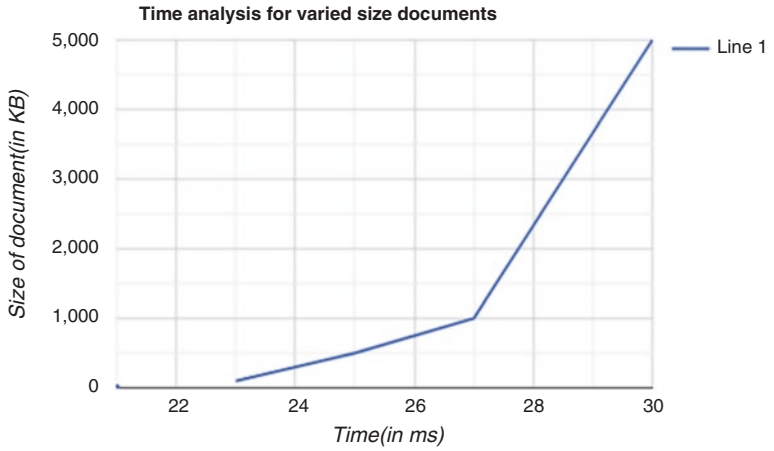

Fig. 5 Graphical representation of time complexity

6 Conclusion

Thus, the proposed methodology for the authentication mechanism and data transfer encryption for individual or a network or host for with the help of digital certificate is conceptualized, and the theoretical working methodology is elaborated above, making the system have a balance in maintaining the security level along with its easy usage. The utmost motive is to come up with robust and trust-worthy data security, since the vitality of doing so would be exceptionally outstanding in the emerging digital world.

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Wield NodeMCU IOT to Shelter Coal Mining

R. Suganya, N. Tamilarashan, A. Sharan, and K. Vishnu

Abstract Presently days a direct result of warming and environment changes there are troublesome things inside the field of a coal pit. This paper proposes a style of a remote finder organization (WSN) with the help of the NodeMCU esp8266 regulator that is in a situation to notice the temperature, dampness, gas, and remaining of smoke in partner degree underground mine. This technique also controls the ventilation interest to mine staff depending upon blessing environment conditions inside the land parcel. This strategy uses low force, effective NodeMCU esp8266, a temperature locator LM35, wetness finder SYSH220, smoke alarm, the gas identifier for detecting the mine environment boundaries, and Wi-Fi for far off work of data at a focal area the executives to direct to deal with the environment state with the help of engine and valve control electronic hardware. With the help of sensors if some irrelevant things happens in the coal mining, then mail will be sent to the required department. To determine the issues, we'll style a coal pit security watching framework upheld remote finder organization, which may improve the degree of watching creation well-being and scale back mishap inside the coal mineshafts.

Keywords IoT · Sensors · NodeMCU esp8266 · Arduino IDE · Wi-Fi · Mining

1 Introduction

Underground mining tasks end up being a dangerous endeavor to the extent that the security and well-being of laborers are concerned. These dangers are because of the various methods utilized for removing various minerals. The more profound the

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mine, the more noteworthy is the danger. These security issues are of grave concern particularly on account of coal businesses. Along these lines, the well-being of laborers ought to consistently be of significant thought in any type of mining, regardless of whether it is coal or some other mineral.

Underground coal mining includes the following danger than open pit mining on account of the issues of ventilation and potential for breakdown. In any case, the usage of large equipment and the techniques performed during unearthing bring about dangers on the whole kinds of mining. Present-day mines regularly actualize a few well-being systems, schooling, and preparing for laborers, well-being, and security norms, which lead to considerable changes and upgrades and security levels both in opencast and underground mining.

Headway in processing innovations, correspondence and wise innovations like sensors make the fantasy of brilliant climate conceivable. Well-being checking framework (HMS) is one such model. Because of its forefront highlights, they pull in impressive consideration in ongoing years. HMSs arise as urging answer for the decreased well-being circumstance of maturing populace. They have the capacity to guarantee e-well-being office to defeat the need of the quickly improving populace. HMS framework screens and analyses any well-being circumstance that the senior individual may have, incorporating checking how their day-by-day movement completes.

These frameworks not just make old resident's life free for a long time yet in addition make clinical consideration benefits more supportable by giving e-well-being administration at their entryway step. Staying away from continuous visit of matured individuals to medical clinic will lessen medical services cost and decrease tension on generally well-being framework. Coal is a vital regular asset to our country. The most huge employments of coal are in age of power, steel creation, and concrete assembling and as a fluid fuel and numerous modern applications.

It is said that coal can help in a lot of monetary development of any country. The future of India in the energy division and its prosperity are necessarily dependant after mining and utilizing coal, its most abundant, reasonable, and dependant energy supply. Be that as it may, there are numerous hazardous conditions like expansion in temperature and moistness and arrival of unsafe gases. These conditions create a risky climate for laborers to work in and pose a danger to their lives.

Because of this, specialists are either leaving their positions in coal mineshafts or not in the slightest degree willing to opt for such positions as mining. This is making loads of problems in accessibility of laborers for the coal mining industry. Thus safety of the specialist in a coal mineshaft has become a major issue to be tended to. It is very hard to screen all environment conditions persistently in a coal mineshaft by people.

2 Related Works

Information on technology products can be used to strengthen tested well-being and remote disaster management structures. These social viewing gadgets can range from a circulatory center and screen shots to cutting-edge jets suitable for specialized input tests, such as asystole, Fitbit electronic gadgets, or hearing aids [1].

Emergency clinics have already started using "smart beds" that can separate when they are involved and the patient is trying to get up. Security is a major concern in adopting the Internet of innovation, [2] by emphasizing that rapid development occurs without reasonable consideration of the major security challenges posed [3] and managing that changes may be significant [4].

A large part of the special security system is similar to that of traditional staff, cell phones, [5] and includes weak authentication, neglect to change certificates, cutoff messages between gadgets, SQL restrictions, and helpless treatment of security updates [6]. However, many IoT gadgets have significant barriers to computing power.

These key features often make it impossible for them to directly use key security measures, for example, to create fire issues or to use solid cryptographic to process their interaction with multiple devices, [7] and low cost and focus area for multiple gadgets create a powerful security protection. It can also be adjusted by ensuring proper pressure, and the support is used to tolerate without manual handwriting [8, 9]. In addition, the use of cell phones to assist clinics that followed promoted social production, which was used to reduce well-being [10].

Perhaps the best-known and most popular sensor is the temperature sensor. Heat sensors are used anywhere such as PCs, cell phones, cars, cooling systems, businesses, and more. Gas sensors (otherwise known as gas receivers) are electric gadgets that detect and differentiate between different types of donkeys. They are often used to detect toxic or dangerous explosions and to measure gas concentration. Gas elements use a sensor to measure the concentration of certain gases in a climate.

The sensor fills in as a type of viewing area and scale, delivering an unbalanced flow of electricity when a natural gas-induced reaction response occurs. Capture sensors vary in size and utility; some humidity sensors are found in portable gadgets (e.g., cell phones), while others are installed in large installed components (e.g., air quality monitoring units).

Mugginess sensors are frequently used in meteorology, clinical, car, HVAC, and business integration. The LM35 is an integrated circuit temperature sensor, which converts electrical energy, taking into account ambient temperature. Without a doubt it can be interrupted by any microcontroller with ADC function or any other segment of the Arduino system.

3 Proposed System

The arranged framework comprises the gadget modules that since all the data around the mine setting and logs the data onto the cloud controlled by worker page the IOT module.

The cutoff page is kept up IOT module. The logged data is handled into the regular qualities for each section on a partner stretch premise. These cost territory units are precisely handled utilizing predefined esteem kept up by the worker.

Once there's partner total alteration inside the estimations of the apparent data partner alert is delivered to the IOT MODULE and furthermore the elaborate specialists. The IOT module recognizes the alarm sign and sparkles the inborn gadget and ready messages to the specialists could play it safe advances.

The most benefit of this venture is that IoT identifies the vulnerability inside the setting already exploitation data investigation reports things to the elaborate position and furthermore the diggers. The framework conjointly considers the crisis things close by to caution the diggers as fast as feasible.

Figure 1 has a detailed view of wield NodeMCU IoT To Shelter Coal Mining. Each part within flowchart has different features where the sensor is used to get analog signal into digital signal.

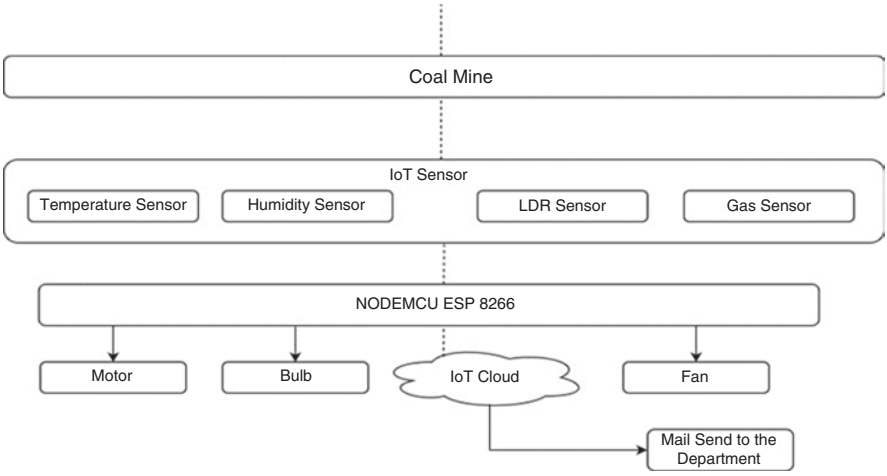

Fig. 1 Wield NodeMCU IoT To Shelter Coal Mining

4 NODEMCU esp8266

The NodeMCU esp8266 is a programming and hardware improvement environment that is worked around an efficient called ESP8266 System-on-a-Chip (SoC). The ESP8266, arranged and created by Express if Systems, contains all indispensable segments of the high-level PC: CPU, RAM, putting together (Wi-Fi), and even a bleeding edge working structure and SDK. When purchased at mass, the ESP8266 chip costs just $2 USD a piece. That makes it an awesome choice for IoT endeavors, all things considered. However, as a chip, the ESP8266 is additionally difficult to access and utilize.

The NodeMCU esp8266 movement board goes with the ESP-12E module containing ESP8266 chip having Tensilica Xtensa 32-cycle LX106 RISC CPU. This CPU looks after RTOS. Its high arranging power with in-made Wi-Fi/Bluetooth and deep sleep operating highlights make it ideal for IoT projects. NodeMCU can be filled using Micro USB jack and VIN pin (External Supply Pin). It cares for UART, SPI, and I2C interface. The NodeMCU Development Board can be adequately changed with Arduino IDE since it isn't hard to use.

Programming NodeMCU with the Arduino IDE will hardly require 5–10 min. All you require is the Arduino IDE, a USB interface and the NodeMCU board itself. You can check this Getting Started Tutorial for NodeMCU to set up your Arduino IDE for NodeMCU. You need to weld wires, with the suitable simple voltage, to its PINs for the easiest assignments, for example, controlling it on or sending a keystroke to the "PC" on the chip. Also, you need to program it in low-level machine directions that can be deciphered by the chip equipment. While this degree of combination isn't an issue when the ESP8266 is utilized as an inserted regulator chip in mass-created hardware, it is a tremendous weight for specialists, programmers, or understudies who need to explore different avenues regarding it in their own IoT projects as shown in Fig. 2.

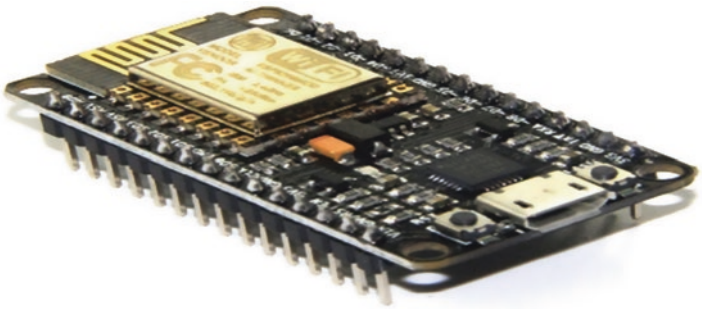

Fig. 2 NodeMCU esp8266

5 Sensors

Sensors are used for common causes, for example, critical sensitivity detection (product sensor) and flame that lowers or flames to the bottom, without unlimited monitoring when a certain number of individuals are frequently monitored. Advances in control and easy-to-use microcontroller components, self-adhesive modes reach by exceeding field temperature, partial compression or proportional distribution [11], for example, in the MARG sensors.

Applications fuse to collect equipment, aircraft and avionics, cars, prescription, advanced equipment, and various pieces of our daily life. There are a wide range of sensors, measurable objects, and real architectural properties. Several models include optical sensors for the refractive rundown test, vibratory sensors for liquid fluid sensors, and electro-sensitized sensor pH. Sensory sensitivity indicates the sensitivity of the sensor fluctuations as the amount of data being studied changes.

For example, if the mercury on a thermometer goes 1 cm while the temperature changes at 1 °C, the exposure is 1 cm/°C (basically the test dy/dx needs to be the name of a quick product). The nerves are surrounded by projections to have little effect on what is being tested; making the sensor not think continuously improves this and can bring various benefits. Technological advancement allows a growing number of sensors to be subjected to minimal expansion as microsensors using MEMS enhancements as shown in Fig. 3.

The time of much, a microsensor arrives at a fundamentally quicker estimation time and higher affectability contrasted with perceptible approaches [12]. Due to the expanding interest for fast, reasonable, and dependable data in this day and age, dispensable sensors ease and using easily the gadgets for short-term observing or one time shot estimations had as of late acquired developing significance [13]. Utilizing this class of sensors, basic logical data can be gotten by anybody,

Fig. 3 Sensors

anyplace, and whenever, without the requirement for recalibration and stressing over contamination [14].

6 Arduino Uno

Arduino is an extraordinary stage for prototyping ventures and creations however can be befuddling when picking the correct board. In case you're pristine to this, you may have consistently imagined that there was only one "Arduino" board and that is it. Truly, there are numerous varieties of the authority Arduino sheets, and afterward there are hundreds more from contenders who offer clones. Yet, don't stress; we're demonstrating which one to begin with later on in this instructional exercise.

The sheets with the name Arduino on them are the authority sheets; however there are additionally a ton of truly incredible clones available too. Perhaps the best motivation to purchase a clone is the reality they are more affordable than their authority partner. Adafruit and Sparkfun, for instance, sell varieties of the Arduino sheets which cost less yet at the same time have similar nature of the firsts. Single expression of alarm, be careful when buying sheets from associations you don't have even the remotest clue as shown in Fig. 4.

The Arduino Uno is a free software MCU board reliant on the Microchip ATmega328P microcontroller and made by Arduino.cc [15]. The ATmega328 is a solitary chip microcontroller made by Atmel in the megaAVR family (later Microchip Technology gained Atmel in 2016). It has an adjusted Harvard engineering 8-bit RISC processor center [16]. It tends to be capable by the Universal Serial Bus connect or by an outermost battery of 9-volt. It resembles the Arduino Nano and Leonardo. Configuration and creation records for specific interpretations of the hardware are similarly accessible.

Meaning of "uno" is "one" in Italian and was picked to check the basic appearance of Arduino Software. The Uno board is the earliest in a movement of Universal Serial Bus-based Arduino sheets and upon many Arduino version has been launched

Fig. 4 Arduino Uno

to execute the code for implementation, which have coming from the version of 1.0 to fresher deliveries. While the Arduino Uno conveys utilizing that STK500 of earliest protocol, it contrasts their all previous sheets, and it doesn't utilize the FTDI Universal Serial Bus-to-chronic chipset driver. All things being equal, it utilizes the Atmega16U2 modified as a Universal Serial Bus-to-sequential changer.

7 Conclusion

The assessment on ongoing checking of dangerous gases and various boundaries currently in underground coal mining has dissected using distant sensor associations. Continuous checking system is made to give all the more clear and more feature point perspective of the underground mine. This system is appearing the boundaries on the chronic screen at the coal mining where sensor located in the mining is introduced just as on to stop the loss in the mining or as to observe with the sensor. Caution is sent to the department through mail, when sensor exceeds pass the boundary point. This system likewise storing all the metadata in the IOT cloud.

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Pancreases Segmentation and Classification Based on RCNN and AlexNet

A. Sunitha Nandhini, R. Manoj Aiyer, V. Pramoth Kumar, and E. M. Rishi Nithin

Abstract Organ division is an essential for PC helped determination (CAD), quantitative imaging investigation, pathology location, and careful help. For organs with high anatomical changeability (e.g., the pancreas), past division approaches using support vector machine (SVM) to report low exactness can't discover the highlights for the pancreas diseases contrasted with all around considered organs, for example, the liver or heart. The main challenges for accurate CT pancreas division come from two directions: (1) a wide range of form in different patients and (2) poor distinction and obscuring around the pancreas limit. We propose two phase calculations which are regions with region-based convolutional neural networks (RCNNs) and AlexNet to take care of the difficult pancreas division issue in pictures. AlexNet is based on exceptionally dimensional element extraction, and RCNN is based on component determination and grouping. Utilizing datasets uncover that the proposed AlexNet-based pancreas displays a superior presentation with highlight determination, where it displays a pancreas order precision of 97.93% with highlights, while with RCNN, it shows 95.26% exactness. Relative investigation with highlights based on pancreases includes extraction and additionally affirms that AlexNet and RCNN based pancreases beats.

Keywords AlexNet · pancreas division · RCNN · Neural Network · MRI scans

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1 Introduction

The pancreas, as a vital organ of the human body, has both internal and external discharge functions and is immune to a number of diseases. Pancreatic cancer, one of the most common tumors on the planet, is a life-threatening disease with a median survival time of 3–6 months and a 5-year survival rate of less than 5%. Upgraded distinction CT is currently the most widely used imaging technique for assessing pancreatic illness, and it may be the best method for determining the decency of pancreatic malignant development. The pancreas division in CT images will support clinical work processes such as pancreas malignant growth detection, treatment preparation, and careful assistance in various spaces. In this way, an efficient, precise, and programmed pancreas division strategy is worth investigating. The ordinary pancreas comprises stomach-related protein discharging acinar cells, bicarbonate-emitting ductal cells, centroacinar cells that are the topographical change among acinar and ductal cells, chemical emitting endocrine islets, and moderately idle stellate cells. Most of threatening neoplasms of the pancreas are adenocarcinomas; uncommon pancreatic neoplasms incorporate neuroendocrine tumors (which can emit chemicals, e.g., insulin or glucagon) and acinar carcinomas (which can deliver stomach-related catalysts into the flow).

Indeed, even more uncommon neoplasms incorporate colloid carcinomas, pancreatoblastoma, and strong pseudopapillary neoplasms. Specifically, ductal adenocarcinoma is the most widely recognized threat of the pancreas; this tumor (regularly and here alluded to as pancreatic malignancy) presents a significant medical issue, with an expected 367,000 new cases analyzed worldwide in 2015 and a related 359,000 passing in the equivalent year1. Pancreatic malignancy is right now the fourth most elevated reason for malignancy demise in created nations, and if results are not improved, the sickness is anticipated to be the subsequent driving reason for disease-related mortality inside the following decade2. Danger factors, for example, tobacco smoking, type 2 diabetes mellitus, and ongoing pancreatitis, represent around one-quarter to 33% of cases.

Pancreatic malignant growth is related with an incredibly helpless visualization for a few. It is normally analyzed at cutting edge stages, which is regularly because of vague and at times no indications, an absence of delicate and explicit tumor markers and troubles in imaging beginning phase tumors. Pancreatic disease is forceful, with perineal and vascular neighborhood development and early inaccessible metastases that block remedial careful resection in many patients. Pancreatic malignancy is described by a surprising obstruction (or resistance) to most ordinary treatment alternatives, including chemotherapy and radiotherapy, and atomically focused on treatment. At long last, pancreatic disease harbors different hereditary and epigenetic adjustments and have mind boggling and thick tumor microenvironments. These components bring about a general 5-year endurance pace of the most recent information showing the rate proceeding to increase in the United Kingdom and in North America likely because of a maturing population 3, 8,9. Metropolitan populaces will in general have higher rates than rustic populaces, mirroring the

nature of conclusion, despite the fact that distinctions in danger elements may likewise be included. Studies propose that original travelers from okay zones who move to high-hazard regions experience rates like those of the nation of relocation after 15–20 years10, demonstrating the significance of natural variables on pancreatic disease etiology.

2 Literature Survey

Liu et al. [1] automatic and solid division of the pancreas is a significant yet troublesome undertaking for different clinical applications, like pancreatic malignant growth radiotherapy and PC supported finding (CAD). The main challenges for accurate CT pancreas division come from two directions: (1) a wide range of form in different patients and (2) poor distinction and obscuring around the pancreas limit [2]. The division of pancreas is significant for clinical picture examination, yet it faces extraordinary difficulties of class lopsidedness, foundation interruptions, and non-inflexible mathematical highlights. To resolve these issues, we present a deformable U-Net-driven profound Q organization (DQN) methodology for precisely portioning the pancreas by unequivocally collaborating with logical data and concentrating anisotropic highlights from the pancreas [3]. Robust organ division is an essential for PC helped conclusion, quantitative imaging investigation, pathology recognition, and careful help. For organs with high anatomical fluctuation (e.g., the pancreas), past division approaches report low exactnesses, contrasted, and all around contemplated organs, like the liver or heart. In stomach computed tomography (CT) scans, we present a computerized base up technique for pancreas division [4]. Automated pancreas division in stomach registered tomography (CT) examines is of high clinical importance (e.g., pancreas malignant growth conclusion and guess); however it is very troublesome in light of the fact that the pancreas is a delicate, little, and adaptable stomach organ with high anatomical fluctuation, which makes the past division techniques bring about low precision [5]. Automated pancreas division in stomach registered tomography (CT) examines is of high clinical significance (e.g., pancreas disease determination and anticipation), yet amazingly troublesome on the grounds that the pancreas is a delicate, little, and adaptable stomach organ with high anatomical fluctuation, which makes the past division techniques bring about low precision [6]. made significant progress in the field of mechatronic implantable counterfeit organs by demonstrating the feasibility of a mechatronic topping off module for use with implantable fake organs (and especially suitable for a fake pancreas), allowing for a completely non-intrusive topping off methodology without the need for devoted careful intercessions.

3 Related Work

The division of pancreas is significant for clinical picture examination, yet it faces incredible difficulties of class irregularity, foundation interruptions, and non-unbending mathematical highlights. To fix these issues, we present a deformable U-Net-driven profound Q organization (DQN) methodology for precisely sectioning the pancreas by unequivocally interacting with logical data and concentrating anisotropic highlights from the pancreas [7]. Robust organ division is an essential for PC supported finding, quantitative imaging examination, pathology recognition, and careful help. For organs with high anatomical changeability (e.g., the pancreas), past division approaches report low correctness, contrasted, and all around contemplated organs, like the liver or heart. In stomach computed tomography (CT) scans, we present a robotized base up methodology for pancreas division [8]. Automated pancreas division in stomach registered tomography (CT) checks is of high clinical significance (e.g., pancreas malignant growth conclusion and guess), yet amazingly troublesome in light of the fact that the pancreas is a delicate, little, and adaptable stomach organ with high anatomical fluctuation, which makes the past division techniques bring about low precision [9]. Automated pancreas division in stomach figured tomography (CT) checks is of high clinical pertinence (e.g., pancreas malignant growth conclusion and anticipation); however it is incredibly troublesome in light of the fact that the pancreas is a delicate, little, and adaptable stomach organ with high anatomical changeability, which makes the past division techniques bring about low precision [10]. advances the field of mechatronic implantable fake organs by demonstrating the feasibility of a mechatronic topping off module for use with implantable counterfeit organs (and especially appropriate for a fake pancreas), allowing for a completely non-intrusive topping off strategy without the need for dedicated careful mediations.

4 Proposed System

Our method combines five critical CNNs into a single predictive model. This approach will overcome the challenges of increasing the vigor of component portrayal on the pancreas' wide range of appearances. The proposed technique is limited by the fact that it has two stages for discovery and division, which could lead to sluggish preparation and testing [11]. It will zero in on RCNN and AlexNet technique to a learning system. The examination of extra assorted classifiers, for example, extraordinary engineering organizations and group procedures that take the power pictures during our investigations, we demonstrate that the gathering model remarkably improves the precision of division and acquires low fluctuation [12]. RCNN models initially select a few proposed districts from a picture and afterward name their classifications and jumping boxes. Then, they utilize a RCNN to perform forward calculation to extricate highlights from each proposed zone. Subsequently,

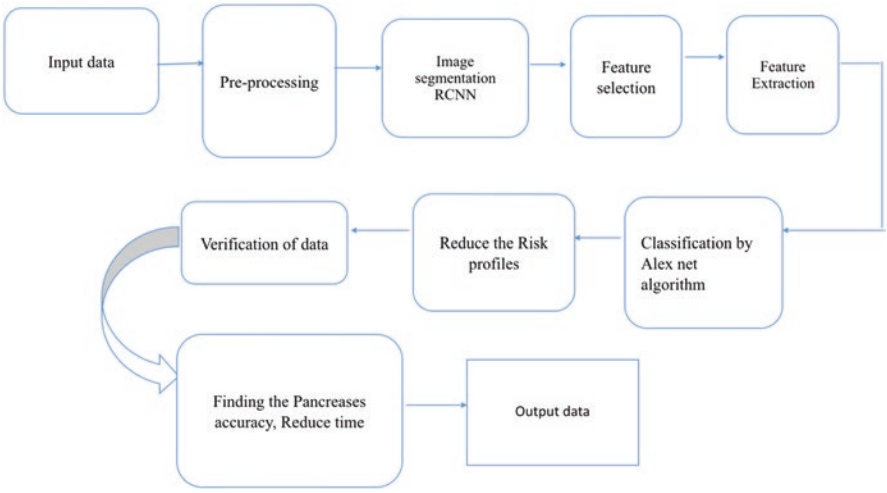

Fig. 1 Proposed system flow diagram

utilize the AlexNet utilizing fragmenting highlights of each proposed district to foresee their classes and jumping boxes. The exhibition and plausibility of preparing RCNNs on bigger, more sensible datasets are to be set up (Fig. 1)**.**

4.1 Processing of an Image

Pre-processing is the technique for incorporate smoothing, testing, and sifting. In this technique we will do lessen the clamors by utilizing channels. Separating is utilized to eliminate the undesirable clamors in a picture. A typical picture preparing task is to apply a picture handling calculation to a progression of records. This strategy can be tedious if the calculation is computationally concentrated, in the event that you are preparing an enormous number of documents, or if the records are exceptionally huge. This demo tells the best way to cluster measure a bunch of picture documents in equal (Fig. 2).

4.2 Feature Extraction

The element vectors for a typical retina will have relatively uniform values resulting in a minimized ordinary subspace. These feature vectors are utilized for learning the subspace corresponding to typical pictures (Fig. 3).

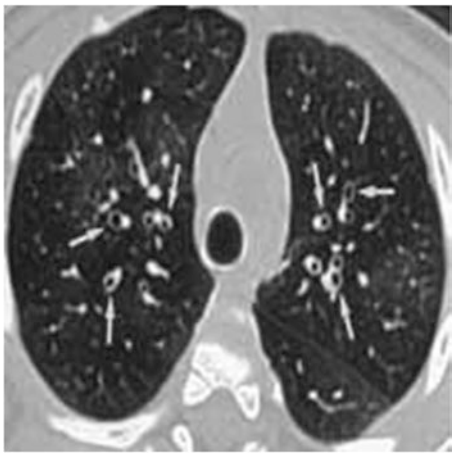

Fig. 2 Pancreatic tumor image

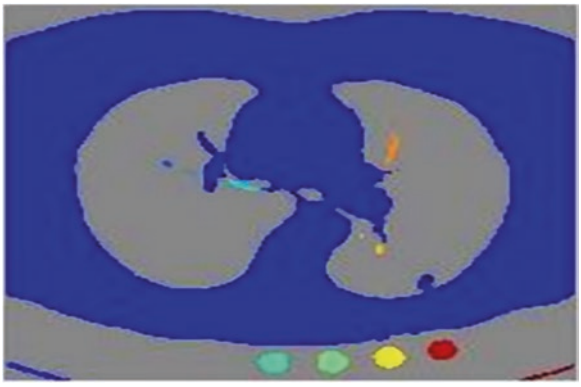

Fig. 3 Feature extraction

4.3 CNN Algorithm

Convolutional neural organization (CNN) to order the picture patches of the transformer into pancreatic and non-dangerous pancreatic tissue gatherings (Fig. 4). Specifically, there were those whose strange pictures were affirmed by tissue assessment or cytologically affirmed pancreatic disease in patients. A blend of pancreatic malignant growth, pancreatic neuroendocrine tumors, and intraductal mucinous neoplasms. The specific quantities of those various pathologies in this outside dataset and the clinical data of individual cases are not known.

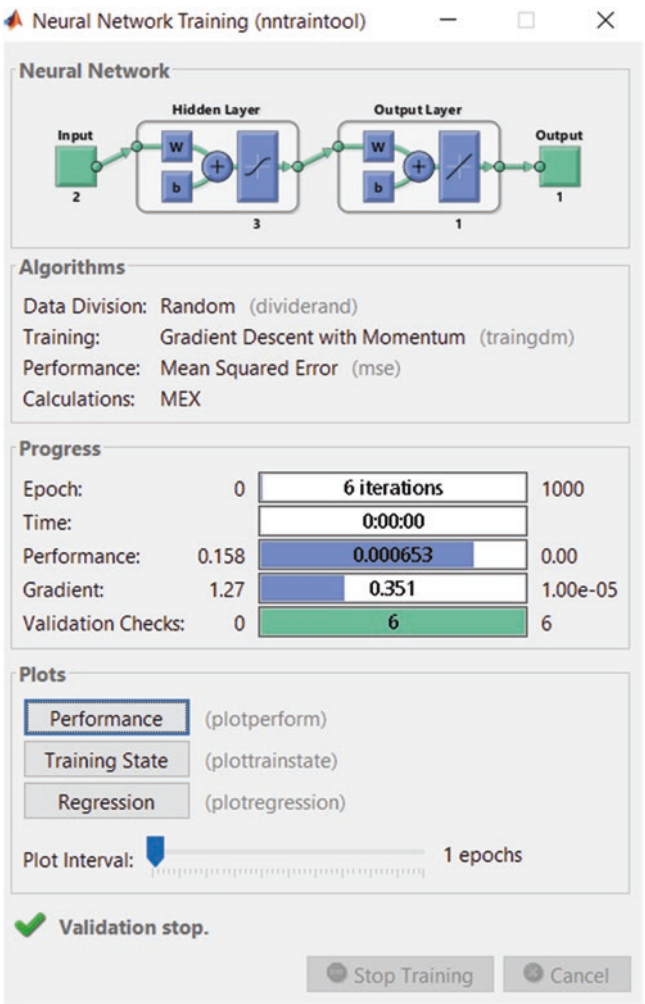

Fig. 4 Neural network

4.4 AlexNet Algorithm

The pre-prepared AlexNet profound convolution neural organization model was utilized for highlight extraction. Furthermore, the ghastly highlights, AlexNet element, are joined with multi-bit learning classifier; at long last the order results were thought about and analyzed. The results show that the profound convolution neural organization can separate more precise picture highlights and essentially improve the general exactness of grouping (Fig. 5).

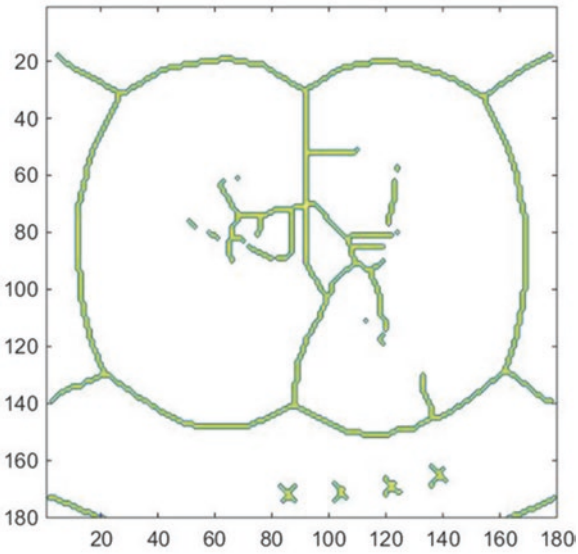

Fig. 5 AlexNet algorithm output

5 Experimental Setup

With discussion of the trial findings using a 1.5 T Siemens Avanto Scanner, we tested our technique with stomach MRI scans from 78 subjects. These MRI scans have an in-plane resolution of [152,232] 256 voxels, with voxel sizes ranging from [1.09,1.68 mm] and between 23 and 35 cuts, with dividing distances ranging from [6.90,7.20 mm] depending on the field of view and cut thickness. A board-certified radiologist reports on the pancreas manually for each sweep. To evaluate the proposed strategy, the dice similitude coefficient (DSC) is used. We define DSC =2|L1L2|/(|L1| + |L2|) to represent the manual comment and the mechanized division results, respectively. From pre-prepared VGG-16 [5, we fine-tune CNN models. The starting learning rate for the FCN model is set to 1.0102 and scaled by 0.1 every 5.0104 iterations. The greatest cycle is 1.5 × 105. The HED model is trained in the same way, with a learning rate of 1.0106 and weight rot equivalents of 0.1 for each iteration of 1.0104 to 4.0104 which is the highest period number. We define the yield for FCN or HED as a likelihood probability map with a position for the pancreas in each region. Figure 4a depicts the DSC of CNN models as a portion of yield likelihood limits. The level in the [0.2,0.6] range reveals that division execution is consistent within this range. To create a division norm for our MRI dataset, we delete Hog features from 64 pixel measured picture fixes and use a support vector machine to direct super pixel-wise prediction (SVM). We train an 11-layer neuronal layers segmentation network (NMSN) model in [1] to contrast with a CNN model that was prepared without any training. On 95×95 pixel calculated picture patches, the NMSN calculates pixel-wise expectation. We train an FCN model (FCNM) with three groups of pancreatic tissue, pancreatic boundary, and base in addition to

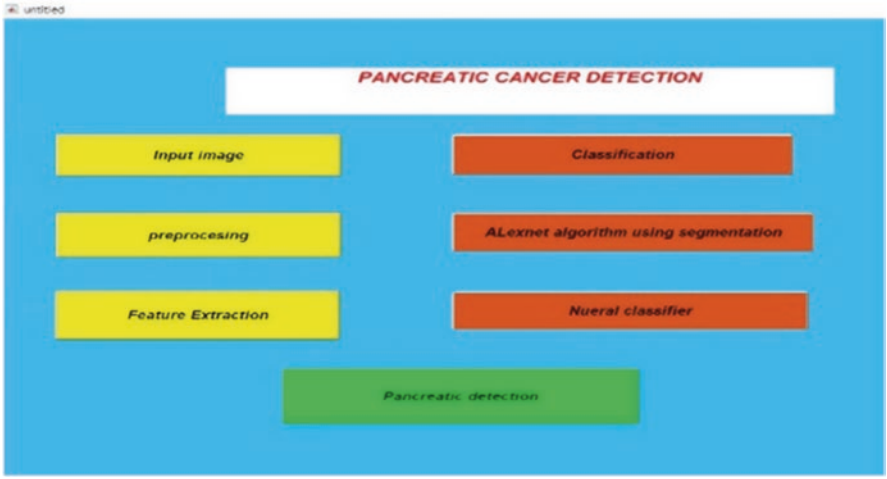

Fig. 6 Application screenshot

contrast and extremely profound CNN models. To create the graphical model for decision fusion, we mark chart hubs with more than half of the covers annotated by humans as sure and the rest as negative as shown in Fig. 6.

6 Conclusion

It acquainted the idea of quantum with RCNN improving it. Another smell focus assurance work was characterized in the improved RCNN. The improved RCNN was utilized to enhance the boundaries of RCNN, and AlexNet classifier is developed dependent on the advanced division. As an application, pancreatic malignant growth classifier was set up. The proposed strategy accomplished better order execution. The primary explanation is that RCNN and AlexNet activity expanded the variety of the populace and evaded intelligence. The subsequent explanation is that the reclassified smell fixation assurance work was more appropriate to the real determination necessities. The third explanation is the benefits of algorithms which are not difficult to set up, simple to execute, and quick to advance. Hence, the proposed technique can improve the order execution of pancreatic malignancy pictures and afterward help specialists in diagnosing sicknesses.

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A Compact Wideband Dielectric Resonator Antenna for 5G Applications

Udayamoorthy Venkateshkumar, S. K. Kalaimughil, V. Karthik Balaji, and B. Mukesh

Abstract An antenna with high gain which is used for 5G apps is described in this paper. The designed antenna is dielectric resonator antenna whose material has a relative permittivity of 10. The setback diversion is 0.02. The substrate used is Rogers RT/droid 5880 with relative permittivity of 2.2, width thickness of 0.25mm, and incident straying value of 9E-4. A move speed of 17.3 percent is achievable from the above-mentioned count. The percent variation was from 23.8 to 28.3 GHz which is 4.5GHz. The achieved gain was approximate 9 dbi at plan repeat of 26 GHz whose radiation capability is 96 percent. A microstrip transmission cable which contains a space opening is used to feed the DRA. For applications such as D2D (device to device) communication, this designed antenna can be used. It focuses mainly on 5G applications.

Keywords Antenna · 5G applications · Wideband · Repeater · Rogers · D2D

1 Introduction

The development of long-distance communication is an increasingly growing field in the telecommunication industry. 5G is currently regarded as a far-off future development. Dynamic evaluation has been pushed all over the world to force the gathering of people to come (5G) distant correspondence. The efficient transmission of 5G correspondence necessitates minimal effort, as well as a limited number of but effective gathering device. As a result, the gathering system testing neighbourhood demonstrated a significant advantage in the arrangement of such receiving wires. Microstrip receiving wires and the resonator which is dielectric in collecting contraptions were widely observed and understood over the past 2 or 3 years. Because of their small size, light weight, and ease of manufacture, microstrip

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radio wires are a viable competitor for gatherings of individuals yet to come correspondence. At higher frequencies, however, microstrip gathering apparatuses are subjected to the dreadful effects of genuine metallic adversity and surface wave excitation. Surprisingly, due to its potential core focuses such as low profile, delicate in weight, broad bandwidth, simplicity of elation plans, and high radiation capability without director mishaps even at higher frequencies, DRA has gotten an uncommon thought by researchers [1–4]. DRA is designed using a dielectric material and does not suffer from any transport problems [5]. In this way, dielectric resonator radio wire has the incredible potential to replace conventional low increment metallic gathering mechanical assemblies, such as microstrip fix receiving wires, and has been discovered to be a strong contender [6]. DRA comes in different forms, for instance, [7] round and empty, hemi- roundabout [8], rectangular [9–11], three-sided [12], and few extra shapes [13, 14]. The anterior part of DRA is movable excitation plans, and they are habituated to deal with control [12], opening hole [13, 14].Several new techniques have been put forth to renew the gain and transmission info of DRA. Also, to improve the transmission info and expansion, stacked DRA [7, 8] has been put forth. For the construction of gain and transmission info, small horns have been mounted at the surface around the DRA [11]. Lately, higher solicitation modes were used unmistakably to update the increment of DRA [14]; in any case this procedure has critical disadvantage of more modest bandwidth. The main goal of this paper is to use the possibility of a higher [15] solicitation mode at 26 GHz to achieve a faster large impedance move speed with high expansion. Show of even round and empty openings exhausted reliably in the DRA for information move limit improving dealing with the higher solicitation sending mode [16]. The DRA is energized by the higher solicitation mode, and the interest of this knowledge transmission enhancement technique alternates with the fundamental mode. Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 show the results.

2 Proposed Antenna Design

2.1 Details of the Dielectric Resonator Antenna's Design

Figure 1 depicts the proposed DRA's course of action, which shows even round and void openings when operating in higher requesting mode. A transmission line with a microstrip is used to animate the designed antenna through a rectangular space which is coupled and scratched on the ground plane. The DR ECCOCK HiK TEK material is proposed to operate at a resounding rehash of 26 GHz, with a dielectric consistency of 10, catastrophe wandering which is equal to 0.002, and dimensions of the designed antenna. As shown in Fig. 1, a resonator with a dielectric is built on a plane whose width (Wg) and length (Lg) = 11.5 mm. The substrate used is RT/Duroid 5880; 2.2 is kept as the relative permittivity, a difficulty wandering of

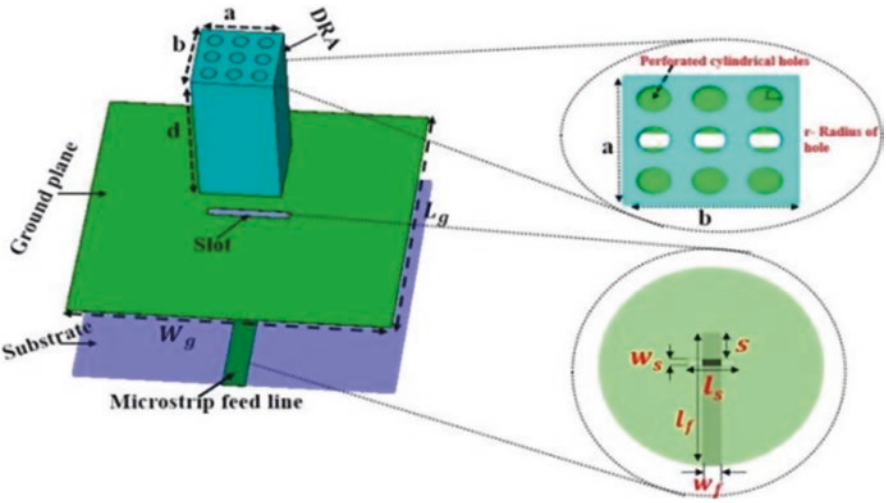

Fig. 1 Geometry of the designed DRA

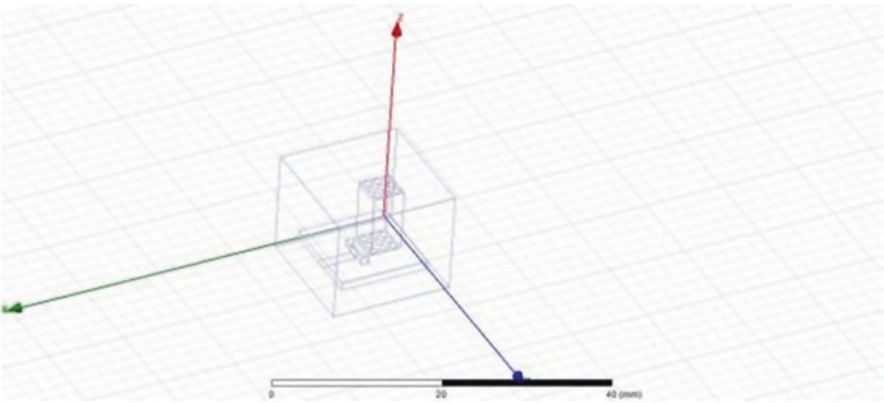

Fig. 2 The designed DRA

0.0009; and 0.254 mm is the thickness. Table 1 lists the parts of the designed antenna (Fig. 12).

2.2 Calculation of Antenna Design Parameters

Gain is an important parameterwhich is measured by the angle at which the directivity takes place. With low gain scattering takes place at longer region, while the high gain's power is scattered in a focused unidirectional area.

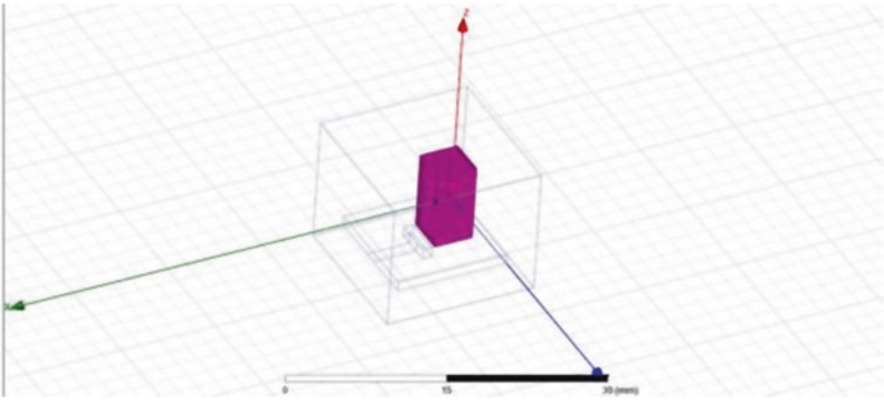

Fig. 3 Ceramic DRA

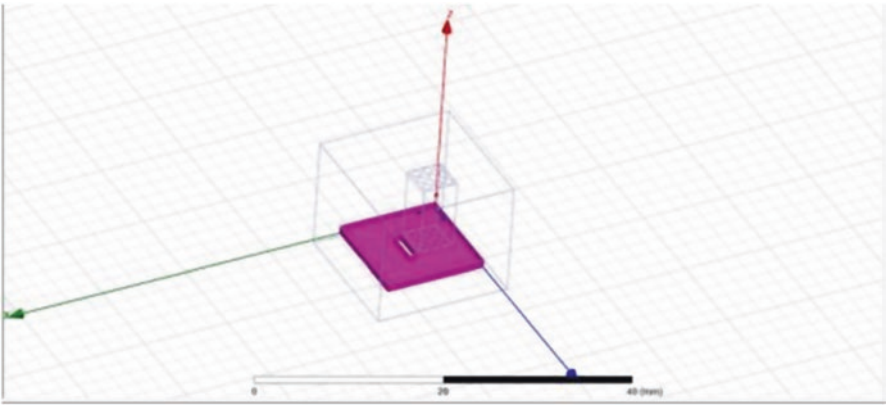

Fig. 4 Rogers RT/Duroid 5880(substrate)

$$Gdbi = 10\log I\left(Iiso\right)^{-1} \tag{1}$$

The power of the designed antenna is divided by the half wave dipole's power. This is also used to calculate gain.

$$Gdbi = 10\log I\left(\text{Idipole}\right)^{-1} \tag{2}$$

The gain of the half-wave dipole is 2.15 dbi, and since it's an additive log product gain in dBd is equal to the gain of half-wave dipole subtracted from gain in dBi.

$$Gdbi = \text{Gdbd} + 2.15 \tag{3}$$

The gain's effective area in a mentioned path is given by

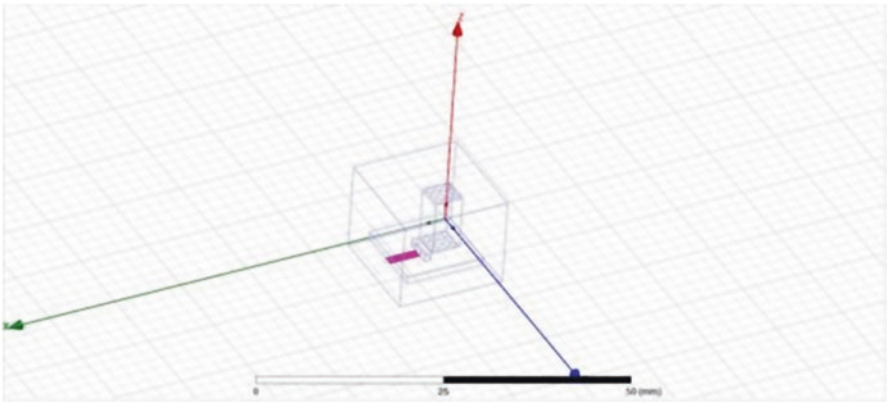

Fig. 5 Microstrip

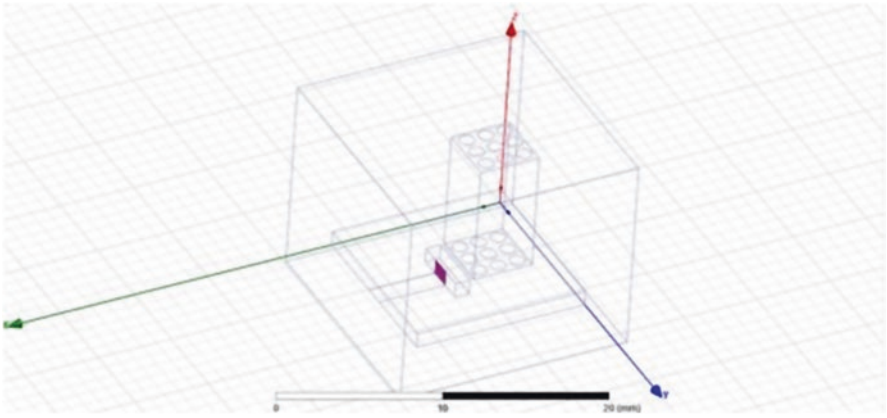

Fig. 6 Feed (lumped port)

$$A_{\text{eff}} = G^2 \left(4\pi\right)^{-1} \text{G} \tag{4}$$

3 Simulated Result

Ansoft HFSS is used to replicate the proposed DRA in higher solicitation mode. While it increases the expansion of a receiving wire, it has a feeble information transfer cap. It can be enhanced at the mode by minimizing the quality factor. The designed DRA gathers contraption transmission info. Cylindrical shaped openings are used to infiltrate the designed DRA so as to improve impedance bandwidth and reduce quality factor. The thickness of the cylindrical openings ranges from 0.27 to

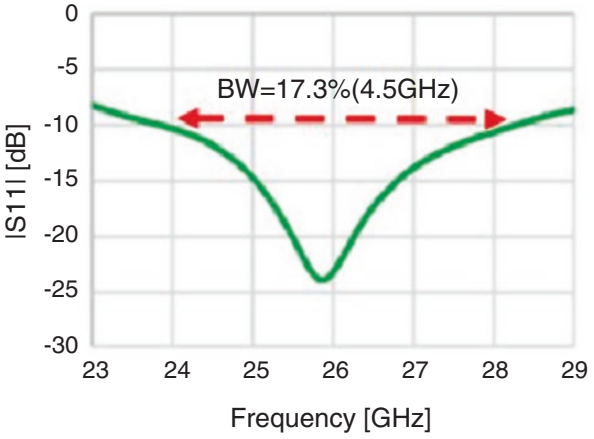

Fig. 7 |S11| of the designed antenna

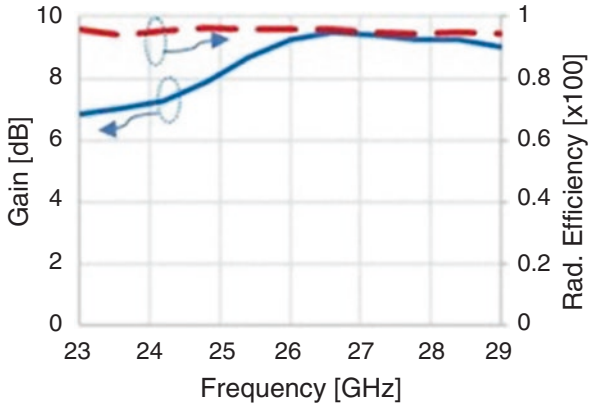

Fig. 8 Efficiency and gain vs radiation efficiency

0.34 mm. The designed DRA and the cylindrical holes share the same height as shown in Table 1. From Eqs. (1, 2, 3, 4, and 5), it is clear that bandwidth escalates with openings while the quality factor abates. The Q factor and BW, on the other hand, have a relationship.

$$Q = 2\omega\text{oStored energy}\left(\text{Radiated power}\right) - 1\alpha\, 2\omega\left(\varepsilon\text{eff}\right)\text{p}\left(\text{Volume}\left(\text{Surface}\right) - 1\right)\text{s}$$

$$\text{with } p > s >= 1(\left(1\right)\text{BW} = \text{VSWR} - 1\left(\text{Q}\left(\text{VSWR}\right)1/2\right)^{-1} \tag{5}$$

Figure 7 indicates that |S11| which is the conclusive result of the designed antenna. As shown in Fig. 7 that the designed dielectric resonator antenna has a large resistive bandwidth of 17.3% which is approx. 4.5GHz, the frequency is set from 23.8 GHz to 28.3 GHz. The gains and efficiency of the radiation as opposed to frequency is displayed in the next figure. The obtained most benefit of 9.28 dBi is finished with radio wave efficiency of 96%. This is obtained at a frequency 26 GHz.

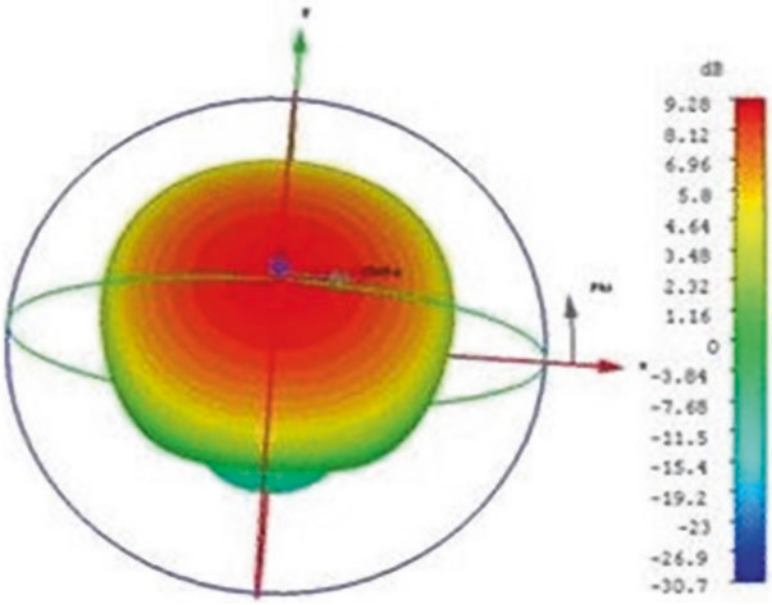

Fig. 9 Obtained 3D radiation pattern

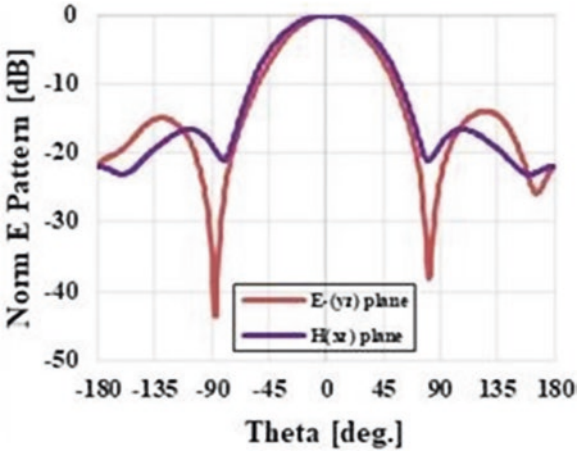

Fig. 10 Radiation pattern in both planes

Figure 10 shows the obtained 3D radiation pattern for the frequency which is set to 26 GHz. Figure 10 suggests the obtained normalized radiation styles of the designed antenna in both the planes which are E-and H-planes at an adjusted frequency of 26 GHz. As displayed in discern five, the obtained pattern suggests a broadside radiation feature over the complete BW. The outcomes of the designed DRA are depicted in Table 2.

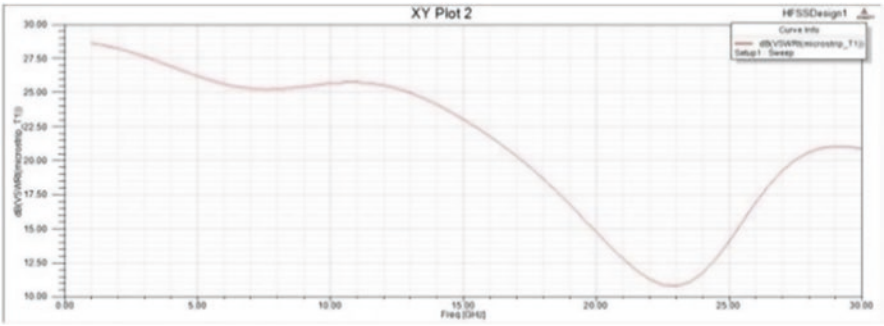

Fig. 11 VSWR measurement

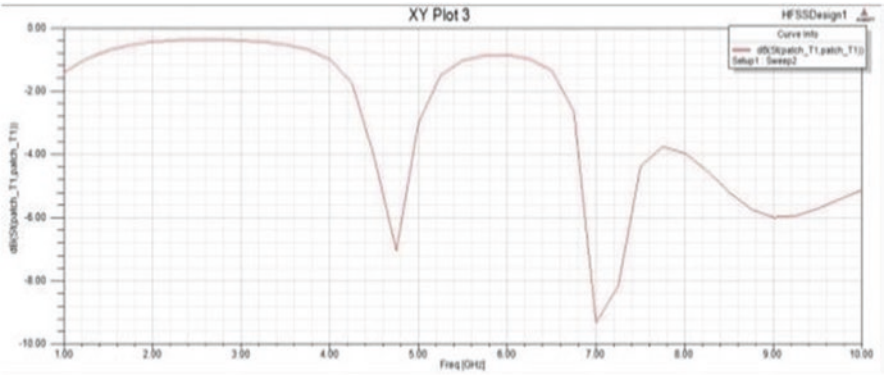

Fig. 12 Return loss

Table 1 Optimized parameters of the perforated DRA operating on TE^{x}115 mode

Resonant mode	*a*	*b*	*c*	ws	ls	*s*	*r*
$^{TE\delta}$15 mode	2.91	2.91	6.1	0.35	2.95	1.3	0.28

a, *b*, and *c* = length, width, and height of designed antenna; ^{l}s, ws = length and width of slot; *s* = Stub's length; *r* = cylindrical hole's radius

Table 2 The outcomes of the designed DRA

Mode	Frequency *(Ghz)*	BW (%) $^{(S}$*11 = –10dB*)	Gain in *(dBi)*	Efficiency (%)
$^{TE\delta}$15 mode	26	23.8–28.3 = 4.5	9.28	96

4 Conclusion

The DRA which contains perforated holes is designed to give high gain and made to include wideband; the designed DRA operates in high order mode. The frequency used is 26 GHz. After simulation the results obtained reveal that a much broader

impedance of 17.3 percent is used from 23.8 to 28.3 GHz. The overall gain is equal to 9.2 dbi, and the overall efficiency is equal to 96%. The DRA is used for D2D (device to device) communication and 5G applications.

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Development of FLC Based AC to AC Converter for Wind Energy

R. Senthil Kumar, K. Prabaakaran, Mohammed Ovaiz, R. Ramkumar, S. Mogan, and N. Praveen

Abstract Renewable energy has become more important backup power source for major power systems in order to provide clean, reliable electricity. To link the WECS with a grid by a distributed energy generation module, an alternating current-alternating current voltage controller is included. The alternating current-alternating current voltage controller is suggested in this study with two different modes of operation. The buck operation uses the first topology, while the boost operation uses the second. There seems to be no DC stage in each topology, and only three switches are used. The proposed converter doesn't have any snubber circuits and no commutation issues. The controller is realized employing a fuzzy logic controller (FLC), and therefore the performance is compared with a conventional proportional-integral (PI) controller. The proposed converter is simulated using MATLAB/SIMULINK environment, and the hardware prototype is implemented using DSP control panel. The converter is put through its paces under various operating conditions, and its results are analyzed and compared. This feasibility of suggested converter are tested and validated with the simulation outcomes.

Keywords AC to AC converter · Buck converter · Boost converter · Wind energy system · FLC controller · PI controller

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1 Introduction

It is to be noticed that variety of nations round the world is enchanting some stepladders for rushing the mixing of alternative perennial resources, mainly wind generation, as a reflection for the issues generated by environmental pollutions and therefore the reduction of traditional fuels. In recent times, the wind energy generation system gives everywhere the planet [1–3]. The renewable sources have some merits and demerits which require to be weighed so as to form an informed decision. When taking wind energy mainly as an alternate energy source, there are a couple of factors that ought to be kept in mind. Wind energy is pollution-free, which gives clean energy; therefore it doesn't pose any damage to our surroundings. Compared to other energy sources that are finite and can run call at time, wind generation is consistently being supplied to us by the world and can never be reflected. Additionally, wind generations are reliable and have very less cost [4, 5].

In the recent years, AC to AC voltage converters are more attracted toward the industrial applications. They are used in several applications like heating, voltage restorers and control, and soft starters for AC motors. A direct AC to AC voltage regulator transforming the constant alternating currents Vin to regulated alternating currents V0 at a fixed frequency won't demand necessity of the DC period. Consequently, it provides several merits like no need for the majority direct current storages elements, portable, less weights, and reduced expenses. Some of the direct AC to AC voltage regulators are added in the literature. Tap changing transformers are used for AC to AC voltage controllers in distribution power stations. Since the speed output during transient state is slow, then it is worth for only few applications. In the process of increasing the output speed, electronic tap changer electronic transformers are implemented in [6]. Along with it finest tunning of V0 will not be guaranteed in [7]. Implementation of high switching power devices such as IGBT, and initiation of PWM control technique, mitigates these demerits and enhances the AC to alternating current voltages convertor functionality in reducing harmonics, I/0 power factors enhancement, and high speed control [8, 9]. As similar to the DC to DC converters, the PWM alternating currents to alternating currents voltage convertors will be function in step down and step up modes of functions. However, the direct conversion needs an additional device such as inductors and capacitors; then it filters the harmonics developed owing to the switching process of PWM power convertors [10, 11]. The measurements of the filter component relay on switching's frequencies. By the way switching frequency rises, filter dimensions reduce, and then THD also decreases, and I/0 PF is enhanced.

Two topologies of direct conversion of AC to alternating currents voltage convertor for buck and boost function is suggested. Main goal of suggested topology for minimize no. of power switch. Then, both the converters use only three power switches such as IGBT and won't have direct current period. The cost of the overall system reduces since the number of switches is less, minimizing the total volume and portable control structure. Furthermore, without the use of traditional RC snubber circuits, the proposed converters offer the safe commutation. Fuzzy-LC was a

well-known nonlinear intelligent control technique that delivers reliable results even when parameters are unknown or when there are disturbances [12–16]. In case of current days, fuzzy-LC is becoming more widely utilized for a variety of power systems application. Article deals with fuzzy-LC intelligent control systems were structured according to system operating conditions. Simulation experiments were tried out using MATLAB/SIMULINK to verify efficiency of suggested convertor, and outcomes were related with existing controllers and other intelligent-based controller for various operating conditions [17, 18].

2 Proposed Topology

The proposed converter for the buck. Function and boost. Function is shown in Figs. 1 and 2, respectively. These converters consist of only active three power switches S1, S2, and S3 and without having any DC elements. The suggested topology has the advantage of being able to use any self-commutating power switch, such as a bipolar junction transistor, a metal oxide field effect transistor, or insulated gate bipolar transistors. These increases suggested topology's efficiency in industrial applications. Because of its self-commutation, high switching frequency, and high power, the IGBT is preferred as a power switch in the suggested setups. The two control circuits such as PI and FLC were suggested. The time field specifications and steady state parameters of voltage were analyzed using FLC regulator, and outcomes were related with conventional PI regulator.

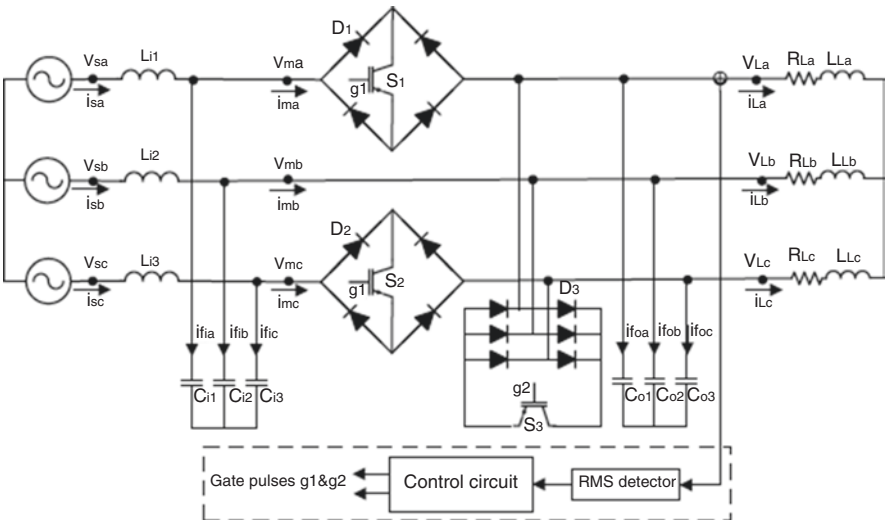

Fig. 1 Proposed AC to AC converter for buck operation

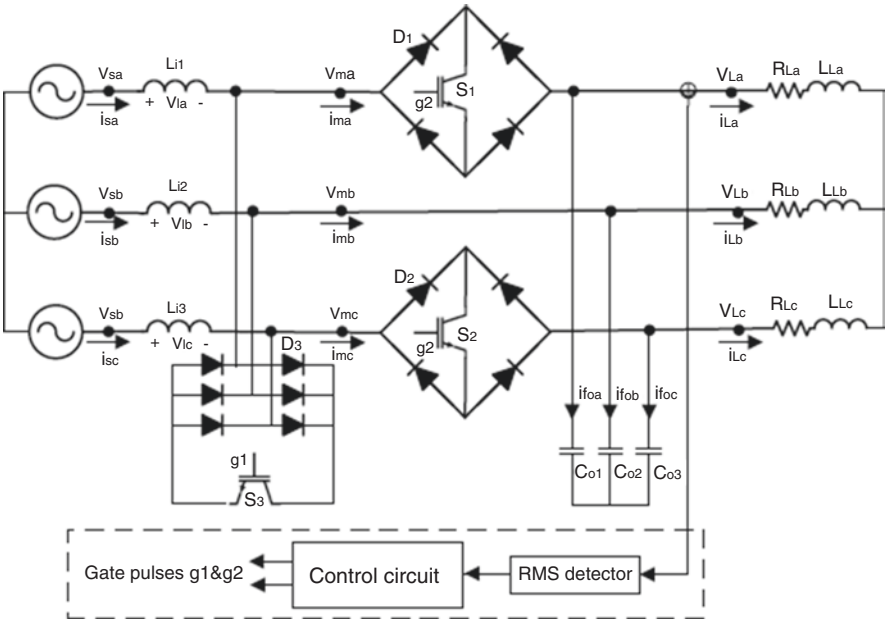

Fig. 2 Proposed AC to AC converter for boost operation

The wind generation system is used to power the proposed converter under buck operation. The harmonics present in the input current was attenuated using input LC filter. It consists of three inductors Li1, Li2, and Li3 and three capacitor Cin1, Cin2, and Cin3. The harmonics present in V0 was filtered via using 0/P capacitor filter which consists of very less components such as only capacitors Co1, Co2, and Co3. The unwanted spikes at the output voltage during switching are suppressed by employing the loss less snubber circuit. Hence, the conventional RC snubber circuit is not essential in the proposed converter. The power flow from source to load is controlled by the bidirectional power switches S1 and S2. During the freewheeling mode, the switch S3 is active, while other switches S1 and S2 are inactive.

The wind generation system is used to power the proposed converter under boost operation. In this, the three inductors Li1, Li2, and Li3 are utilized for boost up operation. The switch S3 is active and inactive periodically to connect and disconnect the three inductors Li1, Li2, and Li3 from the power supply. By adjusting the switch S3 duty ratio, the power to the inductors has been controlled. The power flows from sources toward loads is controlled by the bidirectional power switches S1 and S2. Harmonics present in V0 is filtered by using output capacitor filter which consists of the capacitors Co1, Co2, and Co3. As it differs from the other configurations, the proposed topology uses only single IGBT, as displayed in Figs. 1 and 2. Hence, it gives less cost, simple control, and driver circuits.

3 Modes of Operation

The proposed buck converter operation is classified into three modes such as active, freewheeling, and dead time mode. The equivalent circuits of modes of operation are shown in Fig. 3. The highlighted line indicates the direction of current. In active

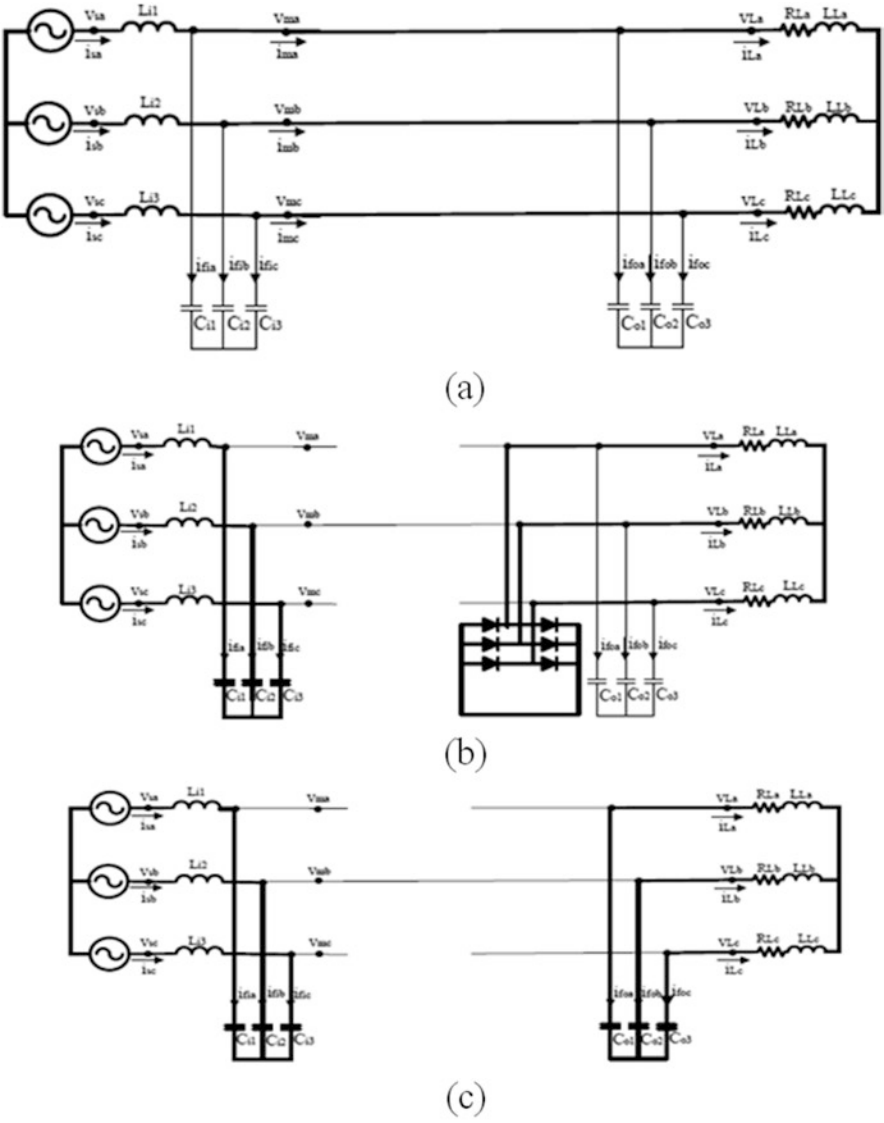

Fig. 3 Modes of operation for buck operation. (**a**) Active. mode. (**b**) Freewheeling. mode... (**c**) Dead time mode

modes, switches *S1* and *S2* are ON, and *S3* is OFF, and the corresponding circuit is depicted in Fig. 3a. During modes through switches *S1* and *S2,* the power transferred from source to load. The switch *S3* is ON, and *S1* and *S2* are OFF during the freewheeling interval, and it freewheels through the switch *S3* which is displayed in Fig. 3b. However power switches *S1*, *S2* and the switch *S3* are active during the deads times mode. It is needed while in the safer commutations. The deads times mode is displayed in Fig. 3c. During freewheeling operation, the power switches *S1* and *S2* and capacitors in output filter give the snubber operation. Hence, the safe stored energy discharging happens in the inductive load. Also, the spikes in the voltage during the switching can be mitigated. Since the absence of conventional snubbers circuit crossways power switch, functionality of suggested converter has been enhanced. As the load side current, the supply current was likewise unceasingly regulated from I/P. filter while in period of dead time. By employing the PWM and fuzzy control strategy, the buck converter output voltage is regulated.

There are two mode of process for suggested boost. Convertor: active and freewheeling. The equivalent circuits for both the modes are displayed in Fig. 4. In case of active modes, switches *SI* and *S2* are OFF and *S3* is ON and the corresponding circuit is depicted in Fig. 4a. During this mode the current flow via input inductors increases, and corresponding equivalent circuits were displayed in Fig. 4a. The switch *S3* is OFF and *S1* and *S2* are ON during the freewheeling interval, and the stored energy is fed to loads which are displayed in Fig. 4b. However, stepping up inductors. is used for saving energy and then transmits it to loads. PWM and FLC are utilized to regulate boost. Convertor Vo. In boost operation, the dead time mode is not required. Therefore, as compared to the buck operation, the harmonics are less in the boost operation which increases the efficiency of the converter and also offers high power factor.

4 Control Structure

The proposed converter output voltage is regulated by using conventional PI and FLC. The results are compared for both the controllers. The PWM control is initially used mutually for the buck. and boost. Actions, and control systems are shown in Fig. 5a, b. An error is produced when the Vo. is calculated and related to V_{ref}. Using PI controller, the gate pulses will be generated for the switches. S1. and S2. in the two converters. Measured output voltage is given below:

$$V_{\text{Lrms}}(k) = \sqrt{\frac{v_i^2}{N}} \tag{1}$$

The *N* denotes the how many of samples taken during a single cycle and *Vi* denotes the voltage. When the measured voltage was related to V_{ref}, an error. $e(t)$ was

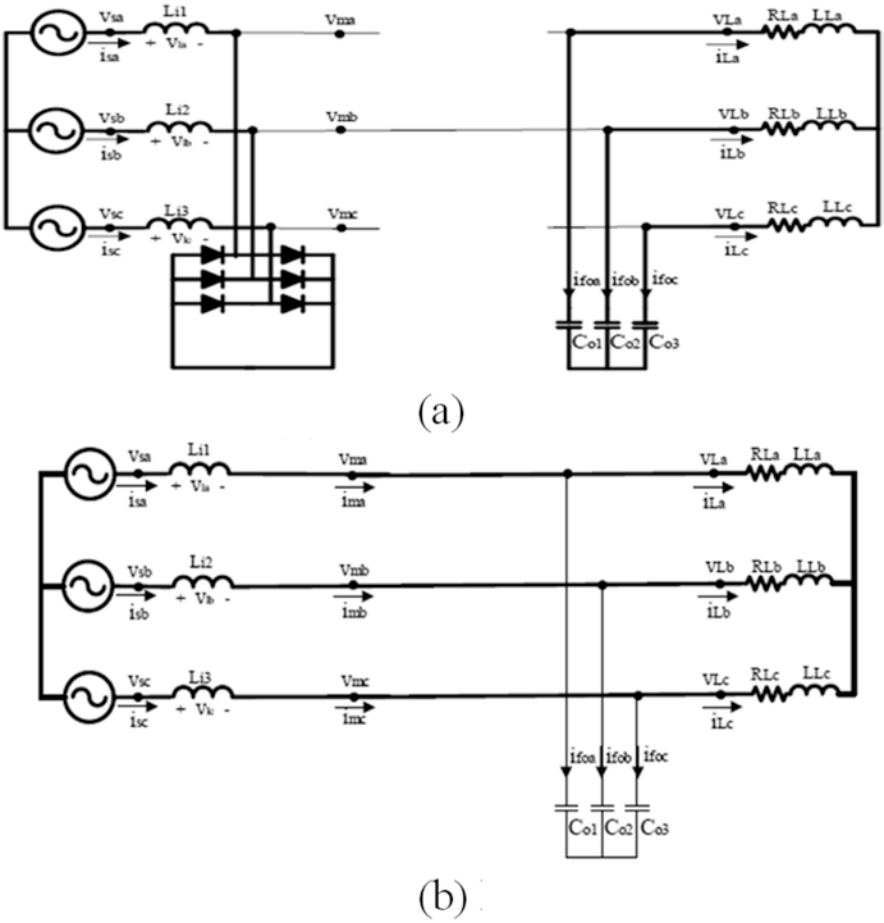

Fig. 4 Modes of operation for boost operation. (**a**) Active mode. (**b**) Freewheeling mode

produced, which is then passed on to proportional-integral controller. The following is the O/P. of the proportional-integral regulator $u(t)$:

$$u(t) : u(t) = K_P \mathrm{e}(t) + K_I \, ? \, e(t)\,dt \tag{2}$$

The gains of the proportional and integral controllers, respectively, are K_p and K_I.

The FLC control structure and the membership functions for I/P. and O/P. variables is displayed in Fig. 6. FLC comprises an I/P. layer for fuzzification, interpretation engine by the rules, and an output layer for defuzzification. The error and change of error inputs have been given with seven linguistic variables which are shown in Table 1. The FLC's primary goal is to create the rule base, which specifies the I/P. and O/P. variables.

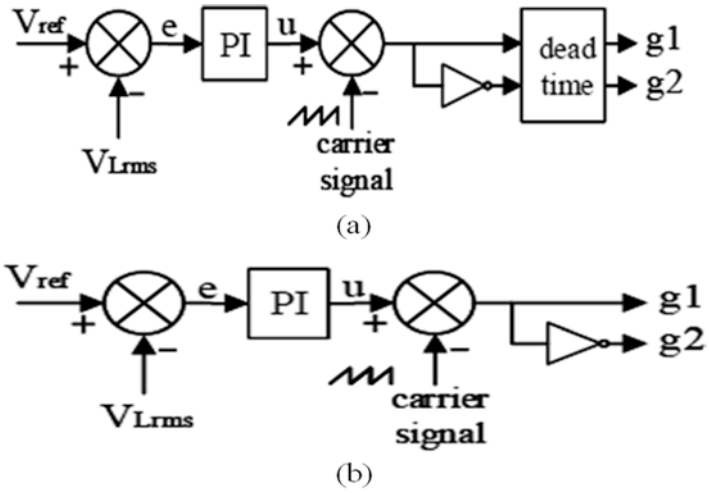

Fig. 5 PWM Control structure for buck operation. (**a**) Buck operation. (**b**) Boost operation

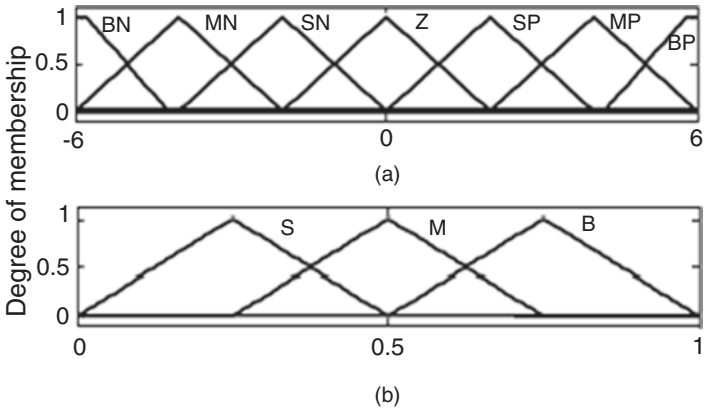

Fig. 6 Membership. functions. for I/P and O/P variables. (**a**) Input membership function e and de. (**b**) Output membership functions

5 Results and Discussion

The MATLAB/SIMULINK environment is utilized to analyze the performance of the suggested buck and boost converters under various conditions. Figure 7 shows the simulation diagram of proposed buck converter, and the internal circuit of the wind generation system is shown in Fig. 8. The parameters used to simulate the buck converter are given in Table 2.

Table 1 Rule base for FLC

	Change. in. error. (de.)						
Error (e)	BN..	MN..	SN..	Z..	SP..	MP..	BP..
BN.	B.	B.	B.	B.	B.	B.	B.
MN..	S.	B.	B.	B.	B.	B.	S.
SN	S.	S.	B.	B.	B.	S.	S..
Z...	S.	S.	S.	B.	S.	S.	S.
SP.	S.	S.	B.	B.	B.	S.	S.
MP.	S.	B.	B.	B.	B.	B.	S.
BP.	B.	B.	B.	B.	B.	B.	B.

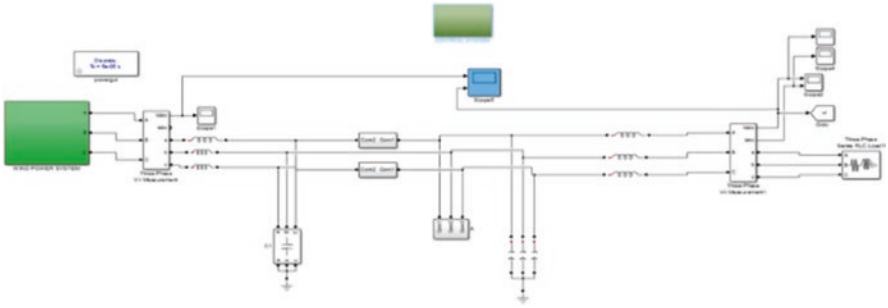

Fig. 7 Simulation diagram of the proposed buck converter

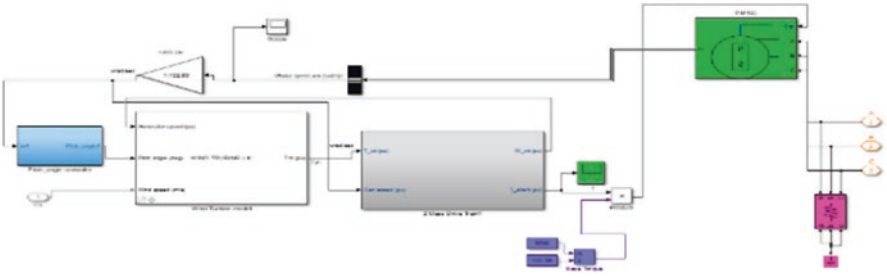

Fig. 8 Internal circuit of the wind generation system

In the proposed buck type system, the wind energy system is given as input, and the output obtained from the AC to AC converter will be 15 V. Figures 9, 10, and 11 show the input voltage, load voltage, and load current, accordingly.

Figure 12 displays simulation diagram for suggested boost convertor. The parameters used to simulate the boost convertor are given in Table 3..

In the proposed boost type system, the wind energy system is given as input, and the output obtained from the AC to AC converter will be 400 V. The $V_{L.}$ and $I_{L.}$ are displayed in Figs. 13 and 14 correspondingly.

Table 2 Design parameters of the buck converter

Parameter	Value
V_i	160 V/ph
Output voltage, V_o	15 V
Switching frequency, f_S	4.5 kHz
Capacitance C_{i1}, C_{i2}, C_{i3}	20e-6 μF
Capacitance C_{o1}, C_{o2}, C_{o3}	0.1e-6 μF
Inductance L_{i1}, L_{i2}, L_{i3}	1e-3H
Inductance L_{La}, L_{Lb}, L_{Lc}	1190e-3H
Output power P_O	1500 W

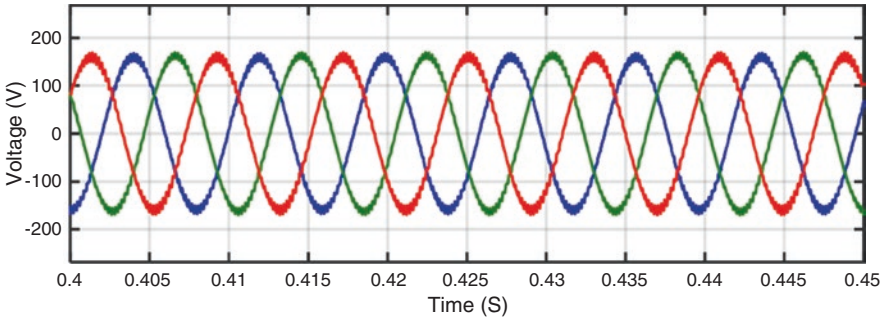

Fig. 9 Input voltage from the wind energy system

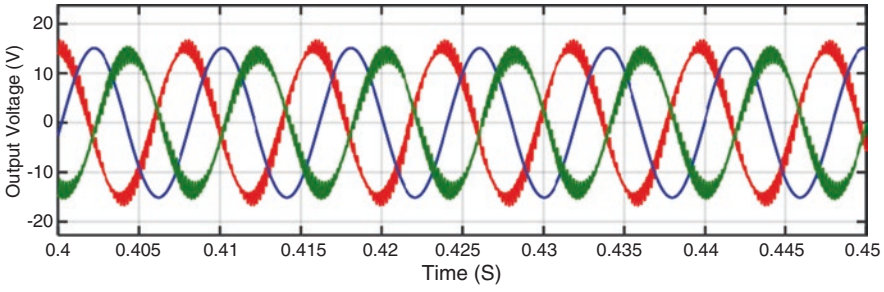

Fig. 10 Output voltage for the buck operation

The time domain specifications and the steady state parameters of the voltage were analyzed using FLC regulator, and outcomes were related with conventional PI regulator. The peak value of output RMS voltage is measured for both the conventional PI and FLC. The value of peak overshoot calculated for both the controllers and is shown in Fig. 15. It shows that the FLC has a less percentage of peak overshoot as compared to conventional PI controller.

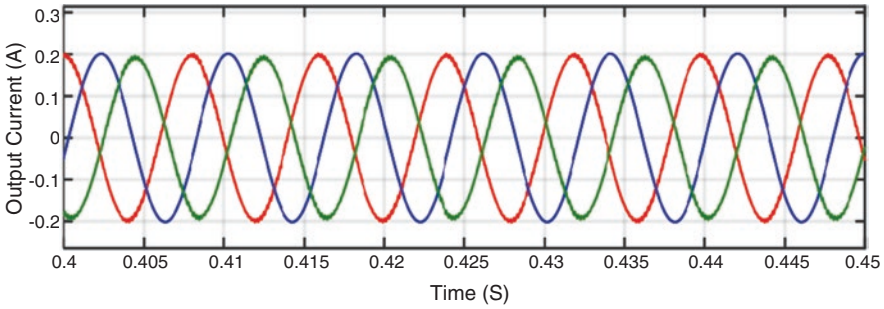

Fig. 11 Output current for the buck operation

Table 3 Design constraints of boost converter

Parameter	Value
Output voltage, V_o	400-500 V
Switching frequency, f_S	4.5 kHz
Capacitance C_{o1}, C_{o2}, C_{o3}	0.142e-6 μF
Inductance L_{i1}, L_{i2}, L_{i3}	0.05H
Resistance R_{La}, R_{Lb}, R_{Lc}	1 Ω
Inductance L_{La}, L_{Lb}, L_{Lc}	2000e-3H
Output power P_O	5000 W

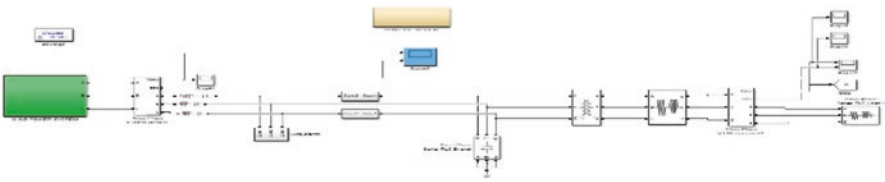

Fig. 12 Simulation diagram of the proposed boost converter

To check the feasibly of the simulation result, the experimental prototype for the buck and boost converters has been designed by using DS1104 control panel. The photo of an experimental prototype is displayed in Fig. 16. Gate pulses for power switches S1 and S2 are controlled by using the μc and are displayed in Fig. 17. The gate driver circuit consists of the three optocouplers. The gate signals to the gate emitter VGE1 and VGE2 are generated from the DSP control panel. The two power switches are operated simultaneously giving the converter output voltage. Because of the synchronization between the power switches the zero current between the two phases, both configurations have no DC and consist of only three switches; hence a number of power switches have been reduced. Also, the suggested topology has the advantage of being able to use any self-commutating power switch.

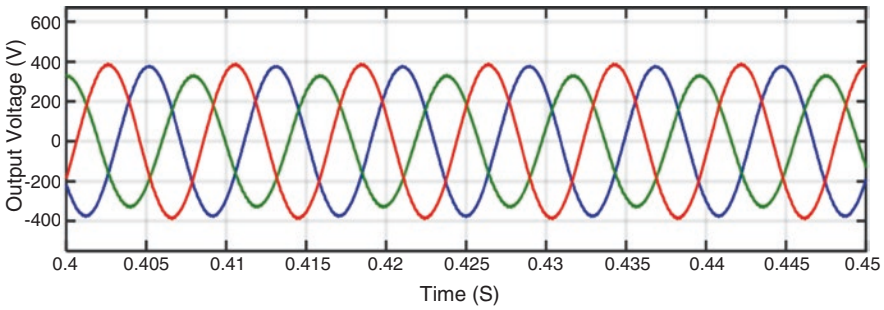

Fig. 13 Vo for the boost operation

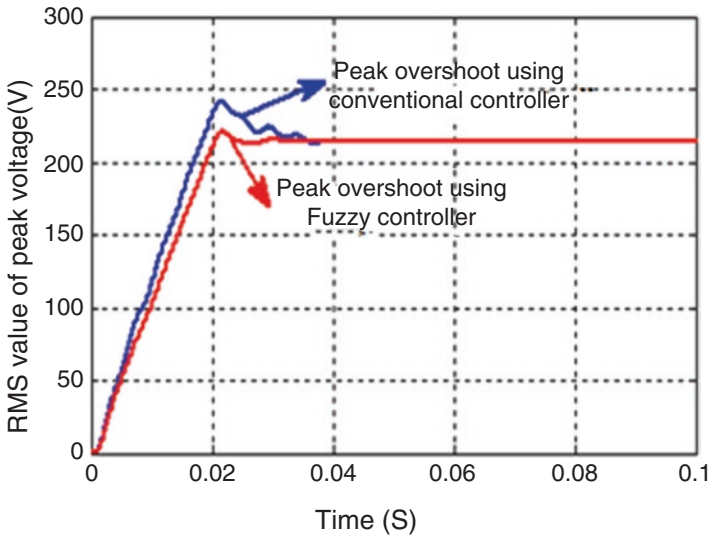

Fig. 15 RMS output voltage for PI and FLC controller

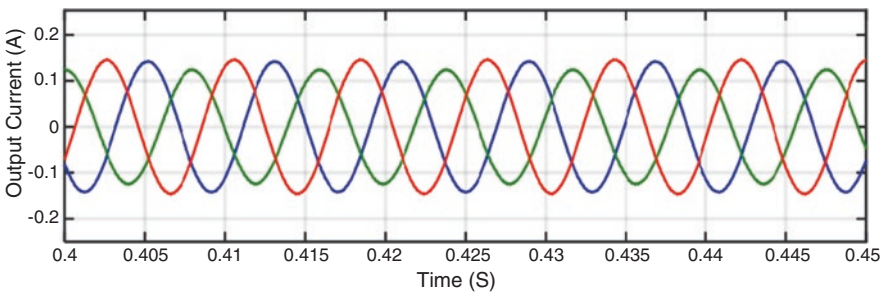

Fig. 14 Output current for the boost operation

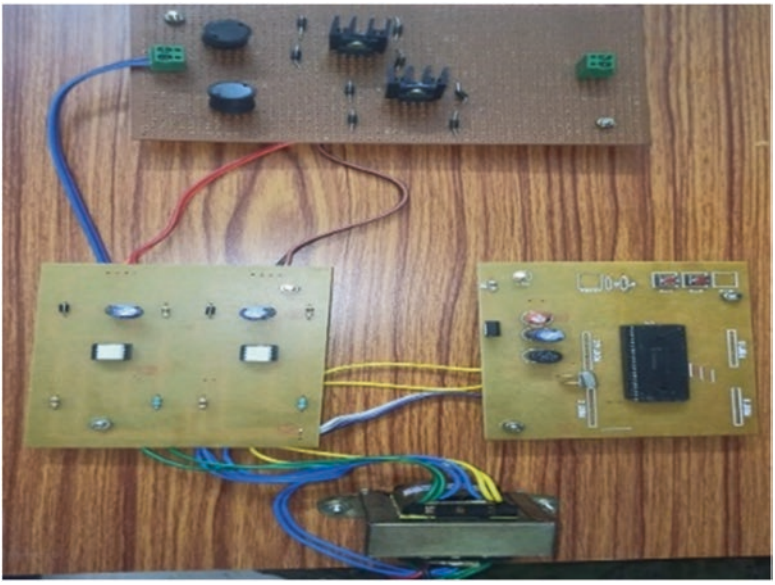

Fig. 16 Experimental prototype

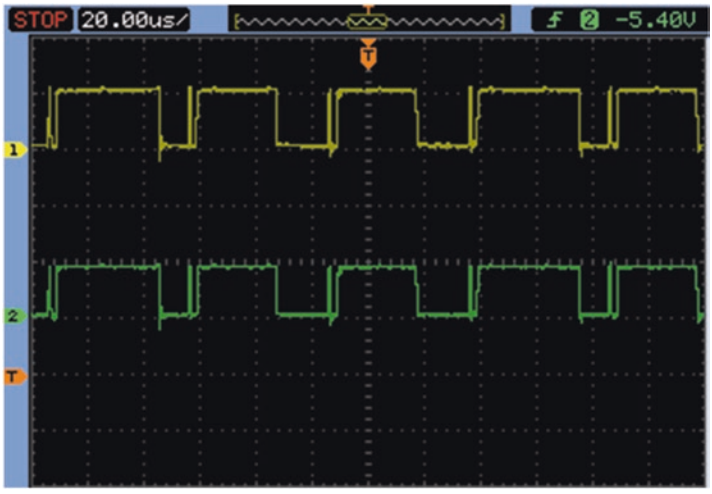

Fig. 17 Gate pulses for switches S_1 and S_2

The system with the traditional proportional-integral controller and the FLC were compared in terms of THD, in which the THD is obtained to be 5.45%, whereas for the system with conventional PI controller, it has been obtained to be 16.36% which is not closer to the IEEE standards. The measured result of the THD spectrum is also shown in Fig. 18.

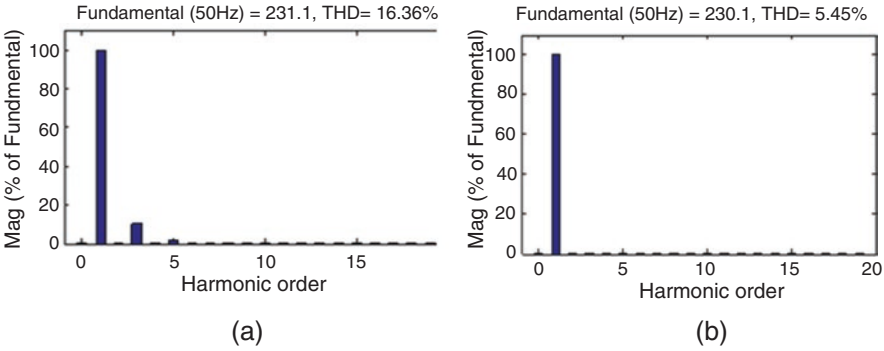

Fig. 18 THD spectrum. (**a**) PI controller. (**b**) FLC

6 Conclusion

The direct conversion of AC to AC voltage regulator was proposed with two converters, one for the buck operation and the other for the boost operation. Both the configuration has no DC and consists of only three switches; hence a number of power switches have been reduced. Also, the suggested topology has the advantage of being able to use any self-commutating power switch. The two control circuits such as PI and FLC were suggested. The time field specifications and steady state parameters of voltage were analyzed using FLC controller, and results will be equated with conventional PI regulator. FLC controller was found to be more efficient for different operating conditions. The steady state error was obtained in the output voltage using FLC and is less when checked with the results of proportional-integral controller. The effectiveness of the FLC controllers was also verified with different parameter variations. The THD of output current in the load side is also obtained around 5.45%. The test findings are more consistent with the simulation results, indicating that the proposed converter is conceivable.

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Energy Management System for Small-Scale Hybrid Wind Solar Battery-Based Microgrid

K. Prabaakaran, R. Srividhya, R. Senthil Kumar, D. Hemanth Kumar, D. Mohan Raj, and A. Sham Prabu

Abstract In this paper an effective energy the executives framework for a small-scale crossbreed wind-sun-oriented battery-based miniature matrix is proposed. Change frameworks for the breeze and sun-oriented energy and battery stockpiling framework are created alongside regulators to test the activity of mixture miniature lattice, power electronic converters, and control calculations. An energy the executives framework keeps up the force balance for the varieties of environmentally friendly power age and furthermore for the heap request varieties. This works in independent mode. Consequently, it gives a testing stage to various control calculations, energy the executives frameworks, and test conditions.

Keywords Energy management · Microgrid · Wind · PV system · Battery

1 Introduction

As of late, the focal organizations of all industrialized nations have inserted into their advancement programs a few strategies to bit by bit supplant carbon-based plants with ecological amicable inexhaustible sources [1]. The brilliant and productive combination of renewables into our force frameworks is the need of great importance, to facilitate the change of the world toward an ecological amicable and electrically autonomous future. Microgrid gives an able stage to the joining of renewables into our electrical environments. In any case, sustainable sources have a

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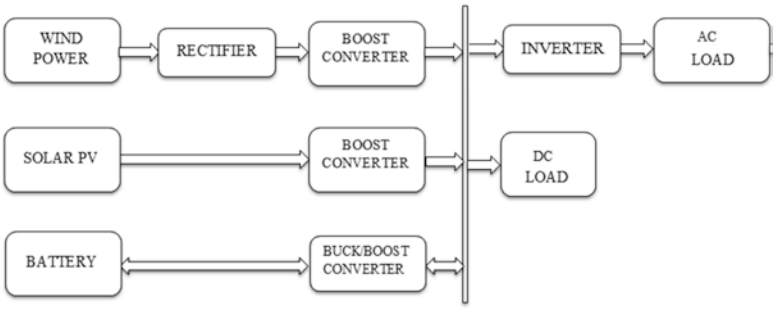

Fig. 1 Block diagram for proposed system

fluctuation that goes from day-night patterns of sun-oriented photovoltaic (SPV) frameworks to the moment patterns of wind-energy gathering frameworks to the hourly patterns of flowing energy generators [2]. Along these lines, mix of such sources into networks causes precariousness if their entrance surpasses a specific breaking point (30% by and large) without appropriate remuneration methods. Pay frameworks work on supplementing environmentally friendly power frameworks by providing deficiency power or putting away overflow power [3]. Absolutely incorporated control plans bring about overburdening of the focal regulator (CC) as the quantity of hubs in the microgrid increment, causing focal disappointment. Then again, absolutely decentralized plans work on unique agreement between adjoining hubs. This implies that, contingent upon the construction of the microgrid (i.e., ring or spiral or others), every hub should have the option to deal with the correspondence stress of sending/accepting information to/from every adjoining hub [4].

The requirement for a crossover control plot that intends to beat the downsides of both these regular plans is very obvious [5–13].

2 Proposed System

In proposed centralized schemes, a single central controller (CC) carries out system functions at all nodes simultaneously through a bidirectional communication bus. Figures 1, 2, 3, 4, 5, and 6 show the block diagram.

3 System Description

The proposed framework can be divided into three categories: (i) solar-powered power sources and air-based storage stored on a battery-saving frame next to its DC-carrying transformers, (ii) inverter side heap and single-stage load, and (iii) continuous controller using board frame power. The wind energy conversion

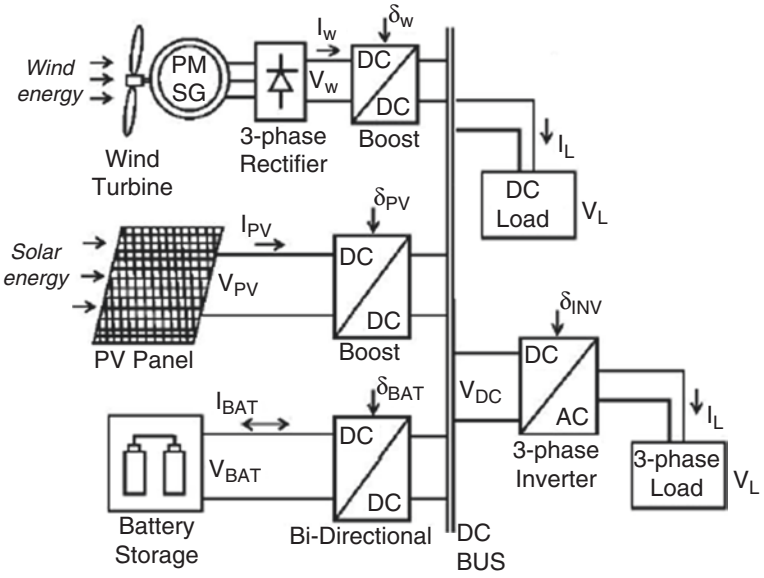

Fig. 2 Single line diagram of microgrid

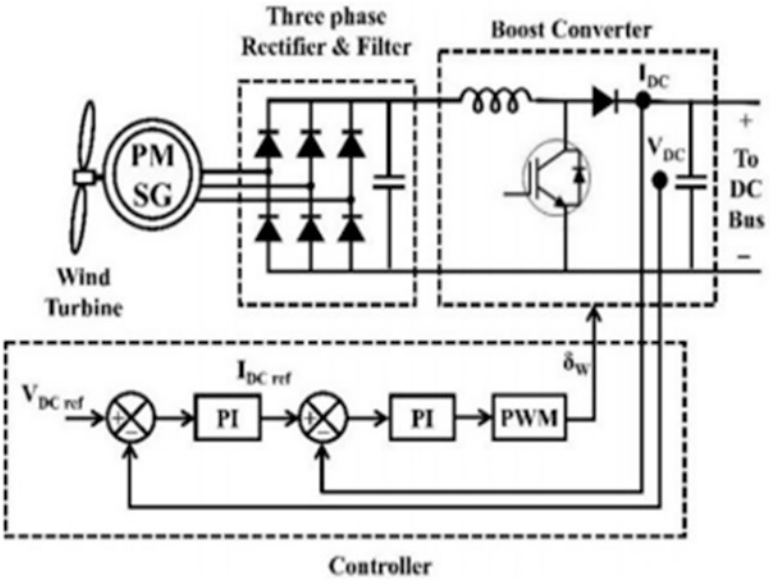

Fig. 3 Modeling of wind generation

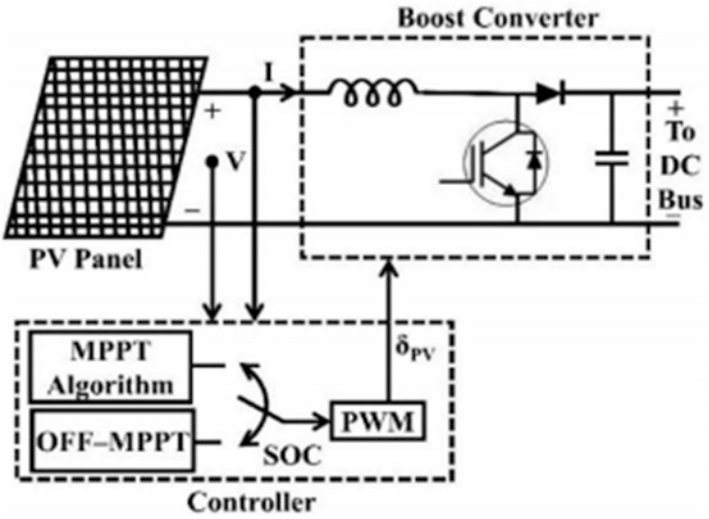

Fig. 4 Modeling of PV system

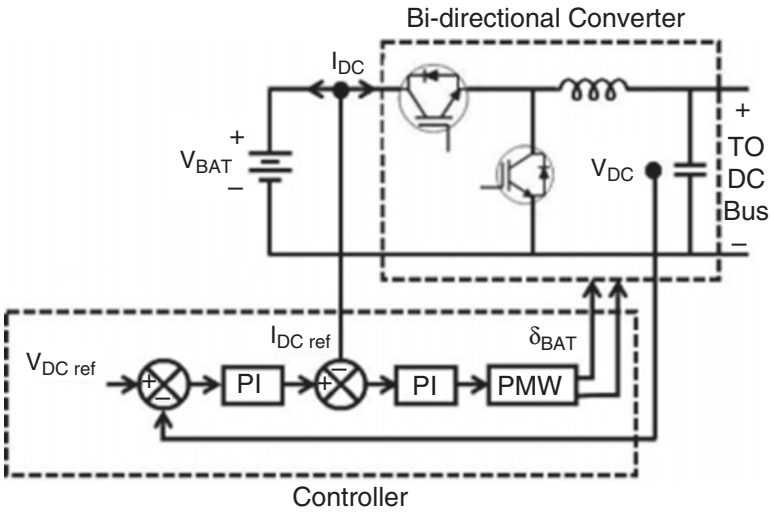

Fig. 5 Modeling of battery

framework consists of a magnetic respirator (PMSG) generator. A photovoltaic board (PV) that operates in the sun operates at high tensile strength (MPPT) where the energy produced by PV and air is not the direct interest of the bulk.

At the point when the wind force produced is more then there is addition in the attention of power generation, the abundance power is provided to the battery and when it is not, at this point for the battery to be charged, the MPPT is adopted. The battery stockpiling framework is utilized to keep up the energy balance in the

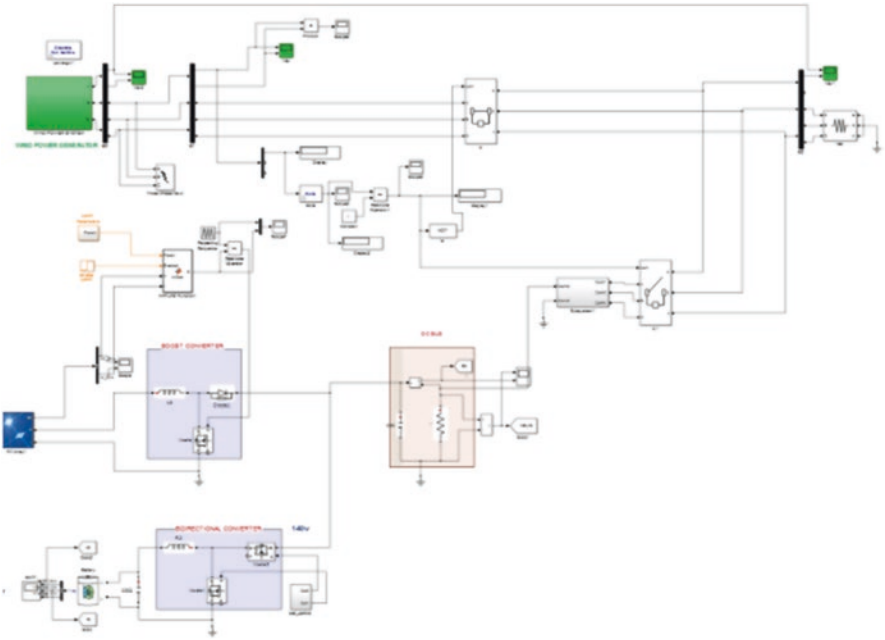

Fig. 6 Simulink diagram of microgrid

framework. Energy the executives framework is utilized to control the force stream under various conditions to supply to the heap through a solitary stage inverter.

3.1 Modeling of Wind Generator

The WECS comprises a breeze turbine, a PMSG, a DC-DC support converter, and regulator. The force generated from the breeze is given by Eq. (1)

$$P = 12\rho Av3\left(\lambda,\theta\right) \tag{1}$$

where is the maximum air thickness in kg / m^3, An is the area of the rotor edges of m2, and v wind speed in m / s. Cp is a power coefficient and is part of the tip speed (TSR, λ) and pitch point (θ). A flexible wind turbine is used in this framework. The characteristics of a wind turbine appear in Cp of different wind speeds at different altitudes.

3.2 Modeling of PV System

The solar energy conversion system (SECS) comprises a solar-oriented PV system with a DC-DC boost converter and a MPPT algorithm as demonstrated in Fig. 3. Contingent upon condition of charge of the battery stockpiling framework, the MPPT is worked under MPPT mode or under off-MPPT method of activity.

3.3 Modeling of Battery

The BSS consists of a destructive lead battery and a DC-DC buck-boost converter. This converter is reliable in maintaining DC power through the PI controller as shown in Fig. 6 Charging status (SOC) is provided by Eq. (2)

$$SoC = 100\left(1 + \frac{\int I_{\text{bat}}\, dt}{Q}\right) \tag{2}$$

4 Result and Discussion

The detailed modeling of microgrid is carried out in MATLAB platform. Microgrid is designed with multiple distributed generation (DG) like wind, PV system, and battery. The performance of grid system is made analysis using power sharing under different mode of operations. The performance of grid is made tested under various conditions.

The grid system consist of both AC and DC loads, respectively. Both are operated under various time ranges, and its system attains the robust in stability. AC load are activated during 0 to 3 sec with source from grid side, whereas DC loads are operated during the same duration with the PV system as a source. The PV system provides the irradiation ranging about 800 W/m^2 up to 3 sec. Then after the increase of load, the irradiation level is made decreased to 100 W/m^2; in order to compensate the adequate power, battery plays a supporting role to made proper power sharing between loads.

To evaluate the proposed design, fault is created between 3 and 4.5 sec, and the performance of grid is made evaluated. The simulation results show the enhancement in grid system. Figures 7, 8, 9, and 10 show the result.

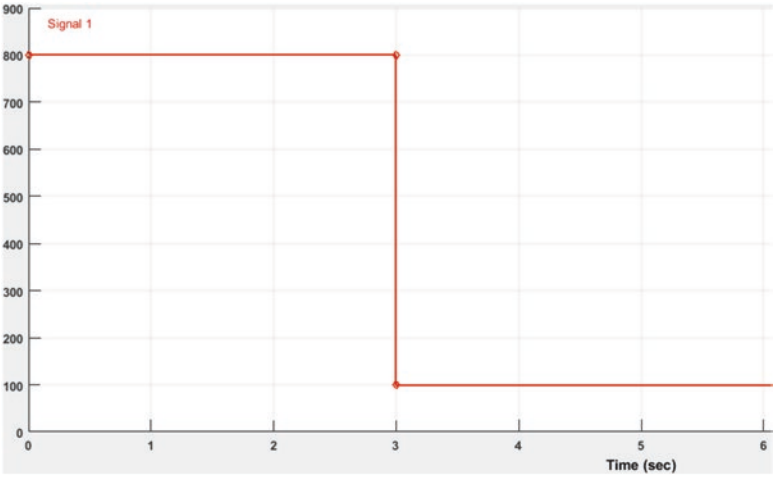

Fig. 7 Solar irradiance level

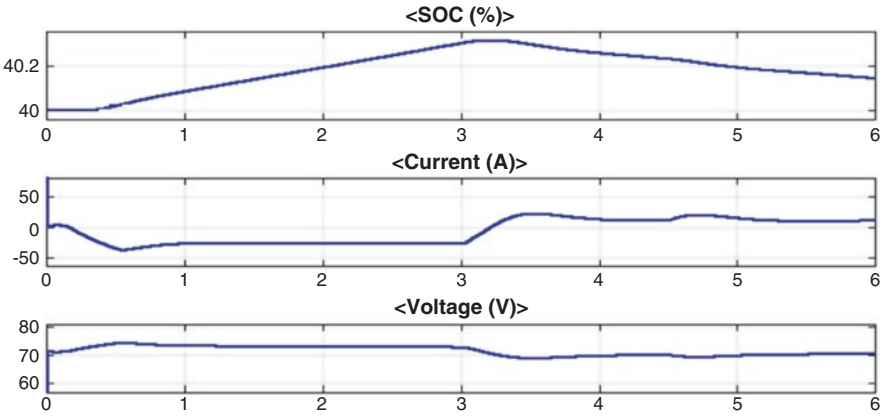

Fig. 8 Battery performance

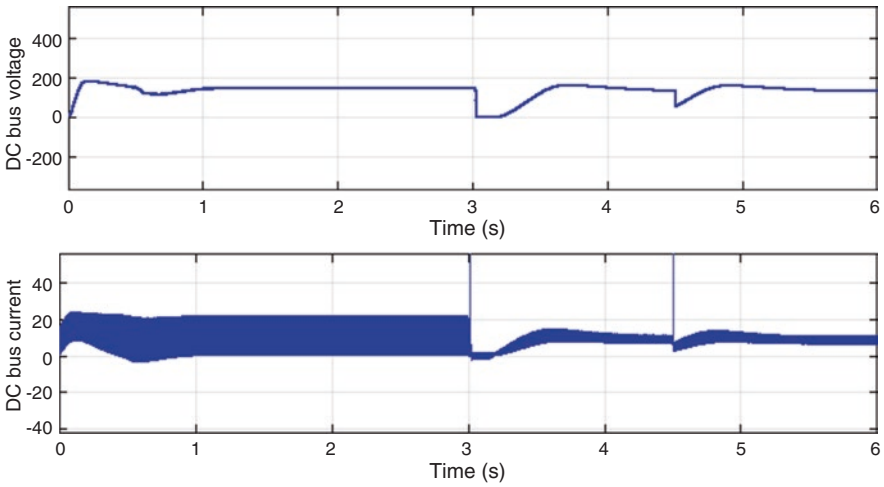

Fig. 9 DC Voltage and current waveform

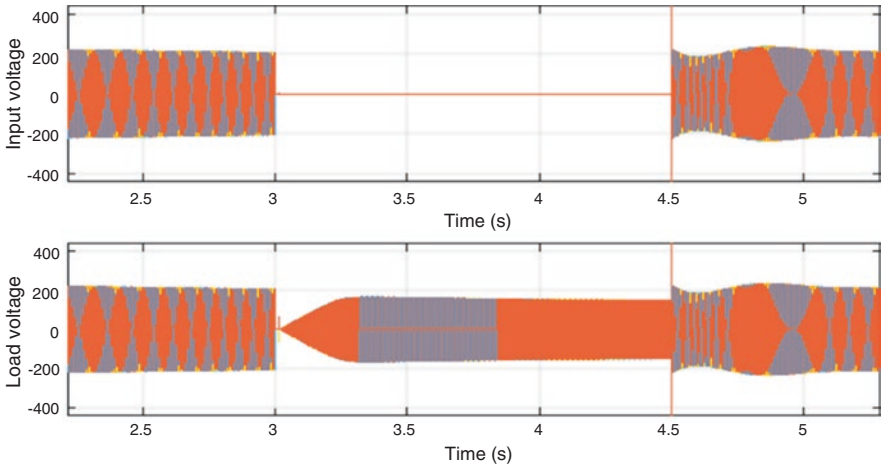

Fig. 10 AC Voltage and current waveform

5 Conclusion

A limited scale trial crossbreed sun-oriented breeze battery sustainable power-based microgrid with energy the executives framework is created and carried out. Examinations were directed to test the adequacy of the proposed energy the executive framework for various varieties in the sustainable power sources and various varieties in the heap interest. The energy the board framework and control calculations were executed utilizing fast control prototyping in DSPACE regulator. The exploratory outcomes show that the framework is adaptable and obliges the various

varieties in the sustainable power sources and in the heap. The regulator permits the viable execution of the energy the board framework. This test provides a stage where future tests can be performed on a variety of case cases and control of research statistics in the field of microgrid dynamic crossover frameworks.

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EYE-TM: An Automatic Teller Machine for the Visually Impaired

G. Lavanya, R. Rithika, P. S. Sanjana, and G. K. Shilpa Tharani

Abstract Digitalization of money has become the trend of the decade. Money plays a major role in our day today life. It is a difficult task for the visually impaired people to do their ATM transactions on their own without involving a third person or middleman. The current-day transactions involve the use of digital pins and smart cards which should be inserted into the slot for transaction. In this paper, we aim in providing a secured, efficient and a user-friendly system that can help them in activating bank transactions. There are three levels of security authentication which comes in handy for the visually impaired which can make them easily interact with the ATM and help them in secured transactions. The first level of authentication includes the single user detection where only the single user is allowed to enter into the system. The next process involves fingerprint authentication which acts a biometric identity and matches with the account. The final step involved is the facial recognition system which again matches with the current identity of the user. The prerequisites are obtained from the user during the time of account creation. Thus, our system aims in facilitating the visually impaired people in accessing their account without the help of any intruders and make their transactions more safe and secure.

Keywords Visually impaired · Automatic Teller Machine · OpenCV · Deep Neural Network · Fingerprint · Face Recognition

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1 Introduction

According to the world knowledge on disability report by the UN agency (2010), India has the second largest visually impaired individuals, i.e. 118 million. Also, it's an excellent matter of concern for countries across the world, for individuals with disabilities are the world's largest and fastest-growing minority cluster. India is claimed to possess the utmost range of blind individuals within the world. As per the media report, 37 million individuals across the world UN agency are blind and 15 million are in India. Under the global organization Convention on the Rights of Persons with Disabilities, Article 9 permits persons with disabilities to measure severally and participate absolutely altogether aspects of life and additionally provides them access to facilities and services open or provided to the general public, each in urban and rural areas.

The analysis of the accessibility and value of automatic teller machine (ATM) systems from the purpose of read of visually impaired persons is really challenging. It is suggested that there is a necessity for an additional precise application with helpful technologies so as to develop user-friendly ATMs. It might aid effective accessibility while not the need of help by standard people that may cash in of their visual challenges and project them to any or all odds of insecurity for his or her money. The paper suggests an ATM, against the counter services, area units widely of easing long queues within the banks and as a time-saving issue for the banking services to the customers. The associated accepted feature of the ATMs is to include helpful technologies that still remain a challenge even with the adolescence of ATM applications. It proposes attainable contexts which will profit the visually impaired from comprehensive exploration and incorporation of relevant helpful technologies. The paper ought to be of interest to monetary establishments whose passion is to render higher services to their customers during this era of technology considering that there are units of those customers who want to interact with them and even would like privacy with the ATMs however cannot access such advantages to their psychological feature challenges and specifically the visually impaired [1].

Security is of predominant importance during ATM transactions. The human mind opts for passwords which square measure straightforward to recollect, and simply foreseen, or they change all PINs to be constant. The concerning factor [2] which is currently found is the accessibility of the ATM by the visually impaired people. An ATM needs a user to pass the basic identity before any transaction may be granted. The present technique available for access management in ATMs relies on smartcards. Efforts were created to conduct necessary requirements with needed queries amongst the ATM users, and also the result treated that tons of issues were associated with ATM smartcards for access management. The arising problems may include the ability of another person knowing the pin which might not be legitimate; conjointly standard smartcard may be lost, duplicated, taken or impersonated with accuracy [3]. There is a considerable amount of illegal usage of ATM cases in recent years. A lot of criminals tamper with the ATM terminal and steal the user's Mastercard and word by extra-legal suggests [4]. Once a user's credit card is lost

and also the word is stolen, the criminal can draw all money from their account, which can bring monumental monetary losses to the client [5]. To hold on to the valid identity to the customer becomes the main focus in the current monetary circle.

Hence to smoothen the process of the authentication and thereby reduce the criminal records of the ATM transactions, the authentication procedures are modified according to the needs of the visually impaired with the three-level system. This can be developed as a prototype with the hardware and software components with additional features and embedded with the real-time user ATM for the transaction purpose.

2 Related Work

Devikanniga et al. [9] states that automated teller machine (ATM) provides transactions with additional security than alternative systems. It provides added security with secured information. This paper provides a system with features of double verification for blind individuals. In this paper, they tend to a specific area unit getting to focus on the face and speaker recognition algorithmic program. Hence it provides additional security and accessibility with the help of Raspberry. Matching of face and voice is at highest priority amongst all methods. When authentication is successful, all operations concerning transactions are allotted with the help of voice commands [10] infers that the implementation of ATM comes with the identity of being accessed by illegitimate users with valid authentication passwords and pins. This paper describes the service to the user only if the user is verified for authentication or the user is verified by the legitimate user of the ATM card. The users are verified by comparison the image taken before of the ATM to the pictures that are within the database. If the user is legitimate, the new image is employed to train the model for more accuracy. Just in case of associate degree illegitimate users, an Internet link is distributed to the registered mobile range United Nations agency owns the ATM card, to verify the access of the illegitimate user to his/her account solely then the user is taken into account as a legitimate user. Histogram algorithm and machine learning techniques area identify the personal victimization of the machine. This method uses OpenCV to method the image being obtained and Haar cascade classifier to notice the faces within the image. The face recognition is finished victimization native binary pattern. These processes area units wiped out AWS cloud for his or her architecture facilities.

Aneesh et al. [11] has proposed that ATM, called the automated teller machine, is an associate degree electronic telecommunication device that allows the shoppers of economic establishments to perform money transactions while not the requirement for cash development machines. Automated teller machines need a user to pass identity checks before any transactions. This methodology available for access management in ATMs is predicated on smartcard. It is difficult to forestall another person from attaining and employing a legitimate person's card; additionally a typical smartcard can be lost, duplicated, purloined or impersonated with accuracy. The

aim of the paper is to implement ATM for visually challenged individuals. Here we tend to implement automatic ATM processing exploitation voice command and fingerprint. In this, only a single person is strictly permissible at a time. The doors are going to be locked once the sensors discover human presence within the cabin. There'll be two modes – traditional mode and blind mode. Clients will choose their individual modes through voice command. When inserting the charge account credit, that already has the fingerprint example variety of the unsighted person encrypted on that, the user will use the fingerprint scanner which compares the one within the charge account credit with the contemporary one for authentication. In blind mode, there's a provision for exploitation which the blind individuals will even opt for whether or not to examine balance or to withdraw money by voice command. Traditional mode processing is the same as that of existing ATMs.

3 Proposed Solution

The system designed to aid the visually challenged to use the ATM with ease includes authentications to verify the user and to enable a safer transaction. The prototype contains a single user algorithm using OpenCV which enables only one user to enter the ATM booth. This represents the first level of authentication. If there is a chance of more than one person entering the cabin, a warning is displayed, thus allowing only one person to enter the ATM booth. The second level of authentication is done with the fingerprint scanning. The scanner is installed along the keypad, thereby reducing complication at the user's end. The fingerprint scanned is verified against data present in the database. Once the fingerprint is verified, the pinhole camera existing in the ATM is used to detect the face, by image processing techniques. The face is again verified against the data present in the database. Finally, the user proceeds to perform transactions, which are text to speech oriented. This system can provide a stress-free transaction to the visually impaired. Four phases of the proposed system are single user detection, biometric identification fingerprint scan, face recognition and transaction using text to speech module. The use case diagram in Fig. 1 illustrates the step-by-step connection between each distinguished module, including the front-end and the back-end of the system.

3.1 Single User Detection

The first level of authentication with the visually impaired happens with the single user detection which makes it easy for the communication between the ATM user and the machine. The user's identity is captured by a video, and the image is processed for verification using a single object detection algorithm and OpenCV. In order to build a real-time object detector, the video surveillance should stream in an effective manner, and object detection should be applied in each frame. First, the

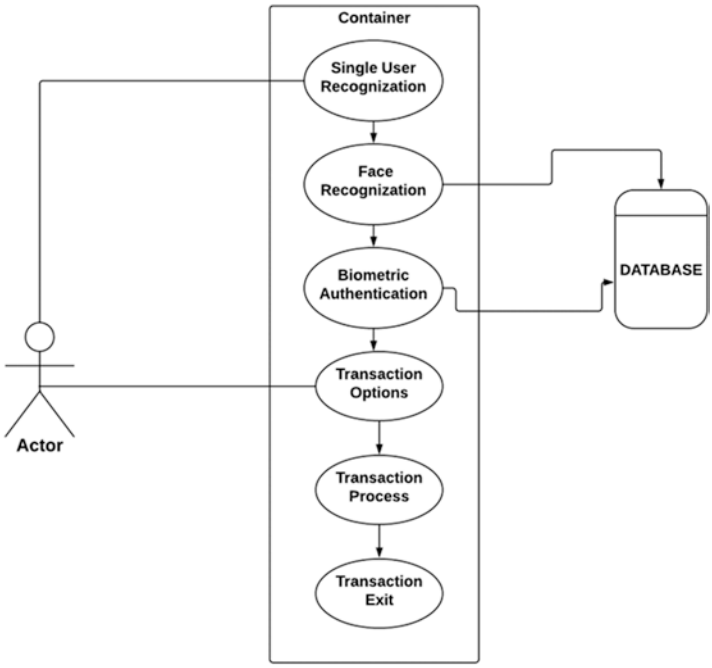


Fig. 1 Use case diagram of the proposed system

frame from the video is resized into a blob using the DNN [deep neural network] module. Then the blob is given as input to the neural network which in turn is fed as input through the nets which results in the detection. Thus, multiple objects can be detected in a single frame in a trained convolutional neural network. Using the image obtained from the module, the count of the person in the frame is kept tracked. If the count of the person is equal to one, then the user can proceed to the next level of authentication. This process occurs throughout the complete transaction ensuring safety by constantly monitoring the count of the person (Fig. 4). Figures 2, 3, 5, 6 and 7 represent the workflow.

3.2 Biometric Identification Using Fingerprint Sensor

Please ensure that affiliations are as full and complete as possible and include the country. The second level of authentication process for the verification of the user is given by the biometric identification using fingerprint sensor. An embedded fingerprint identification theme for automated teller machine (ATM) banking systems is projected. In this process, a fingerprint biometric technique is fused with the ATM for person authentication to enhance the security level [2]. Firstly, the user information is obtained from the user during the process of account creation. The fingerprint

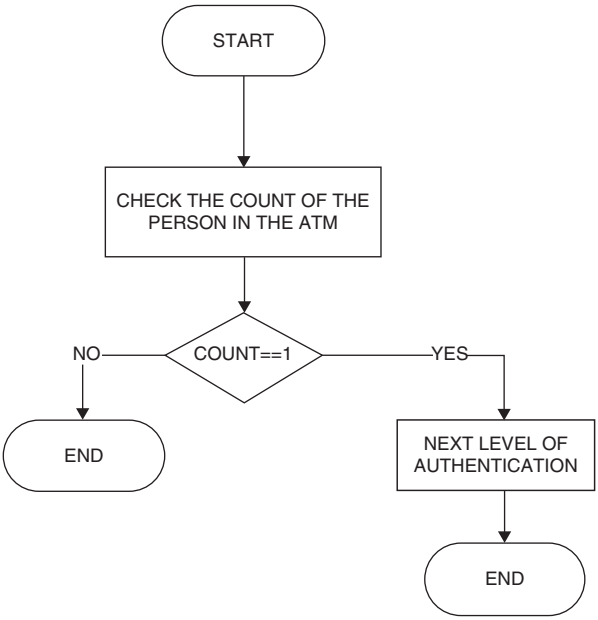


Fig. 2 Workflow of the single user detection module

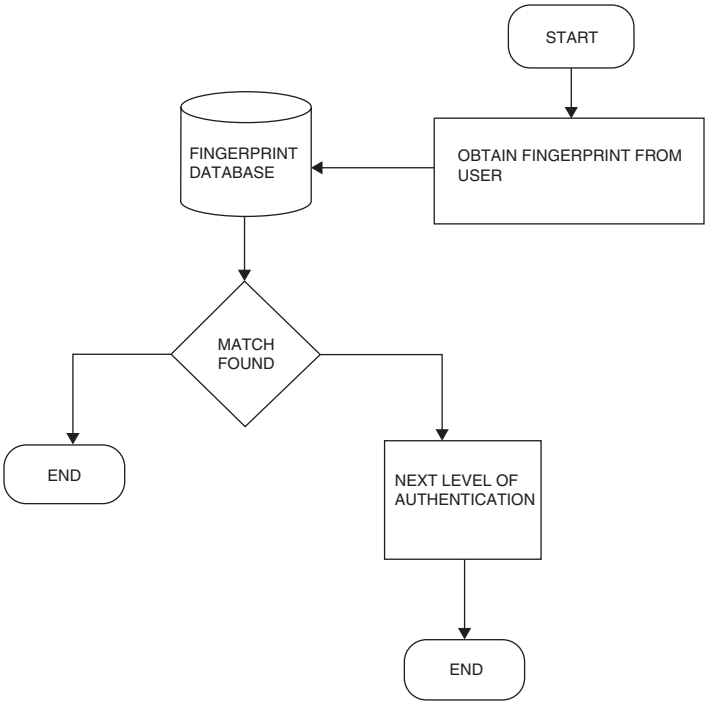


Fig. 3 Workflow of the fingerprint authentication

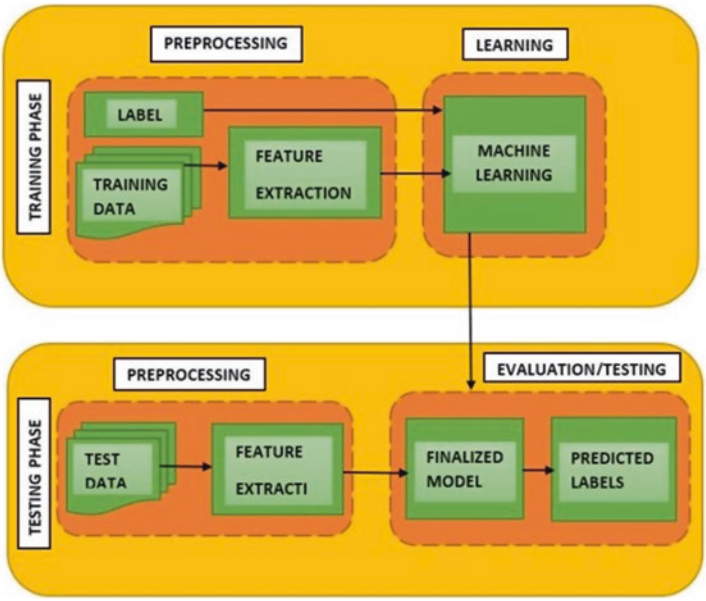
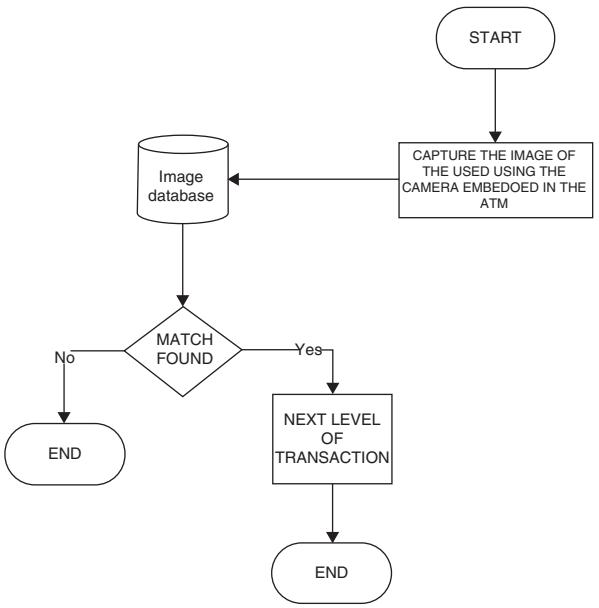


Fig. 4 Schematic representation of face recognition module

Fig. 5 Workflow of the face recognition module



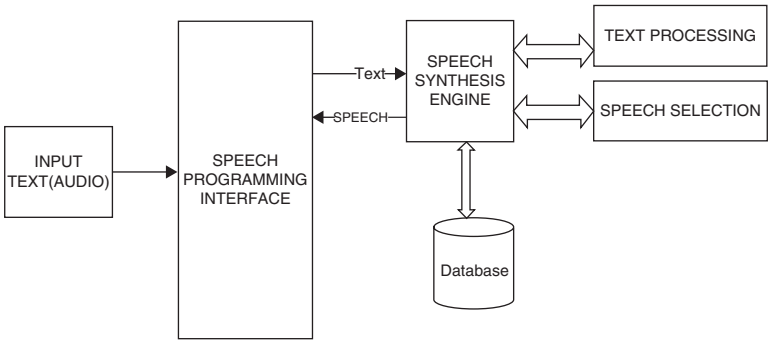


Fig. 6 Design of automated voice recognition system

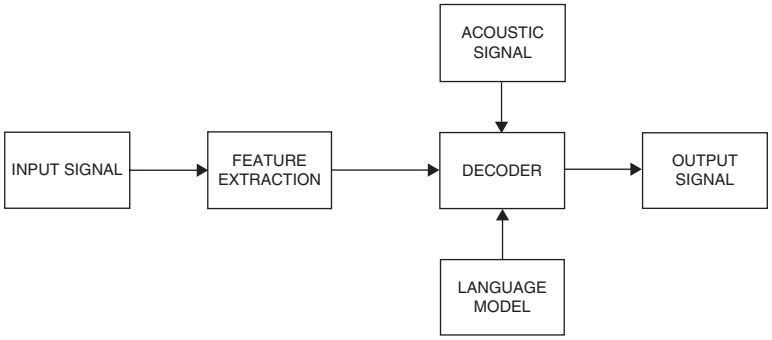


Fig. 7 Design of speech to text system

of the ATM user is stored in a database with a unique ID as an image for the verification process. When the user enters into the ATM, the fingerprint is obtained from the fingerprint sensor which is embedded and sent for the authentication. If the ID of the fingerprint matches with the user's fingerprint, then the user is proceeded for the next level of the transaction. The subsequent reasons to the wide use and acceptableness of fingerprints for implementing or dominant security are:

- Fingerprints are identical and hence no two persons have the same fingerprints.
- There is a high degree of consistency in fingerprints. Comparing it with the other biometric options, it has a rather wide scale of feature.
- Fingerprints are left each time the finger contacts a surface.
- Availability of small and inexpensive fingerprint capture devices.
- Availability of fast computing hardware.

3.3 Face Recognition

Processing images and recognizing digital images involve the use of digital image processing. Digital image processing is algorithm-friendly as various algorithms can be implemented to the data to avoid noise and other distortion. Digital images are used in multidimensional systems as they are processed in two dimensions [6]. Face recognition includes matching, feature extraction and much more. The test data or the existing model of the face of a user/candidate is stored in the database beforehand or at the time of the creation of the respective bank account. The user's face at the ATM is captured and is matched with the images stored in the database. The user proceeds to transact and/or to access his/her account. The system uses OpenCV to identify object points, recognize faces and track movements in camera. OpenCV, being a library package in python, converts its array structure to NumPy arrays and vice versa. It is extensively used to process images and load data from images and videos. With the photos captured, OpenCV performs feature extraction to recognize the object.

Contextually, machine learning defines the generation of mathematical models to process data. The machine model begins to "learn" when it arbitrarily customizes its internal parameters in accordance with the given data. The parameters are modified so as to make the model self-explanatory, that is, the data can be easily understood as an essence of model data.

Figure 4 represents the general framework of a machine learning algorithm (Figs. 5, 6, and 7).

Machine learning is distinctly branched into two phases:

- Training Phase: The training phase aims at training the machine learning model on data labelled as training data.
- Testing Phase: The testing phase is employed by testing the trained data against a new data set.

The data split into training and testing sets has a striking significance, to make the system learn from new data. The data to be tested is always on independent data sets, such that the machine learning model gets to analyse and predict new results. The next significant aspect in the machine learning model is the processing of data. The raw data goes through the extraction and recreation through the workflow diagram and tested with the training and testing data sets. When the data is broken down to pixels or data bits, it is not easy to infer clear, understandable information; this is when data processing comes into picture. Data processing is mainly subdivided into stages:

- Feature selection: As the name suggests, this is the process of identifying notable features of the data.
- Feature extraction: This is the process of converting the raw data into the desired feature.

Applying machine learning algorithms to the field of recognition and classification would unveil infinite findings and theories. The below is a workflow diagram of the proposed algorithm.

3.4 Transaction

The transactions in ATM may be performed victimization spoken voice messages. A customer enters the ATM cabin and performs the authentication method. Once the user is authenticated and then he/she should select the menu provided as follows by pressing a suitable number from the number keyboard:

1. Cash withdrawal.
2. Balance enquiry.
3. Mini statement.
4. Fund transfer.

If a client selects choice 1, money withdrawal through voice message, he/she is prompted to spell the number through the machine-controlled speech to text system. After entering the desired quantity, the client is requested to substantiate the number of it. If each of the amounts entered matches, money is formed out there. Otherwise, the client must redo the group action all over again. If client selects choice 2, balance enquiry, balance within the account is displayed. If the client selects choice 3, mini statement, last five transactions are provided as the voice message. If the client selects choice 4, funds transfer, he/she needs to tell the account number, account holder's name and amount to be transferred. Then it is reconfirmed by voice message, and by confirmation key pressed if found correct, funds are transferred. Once finishing the group action, a replacement group action will currently be initiated.

3.4.1 Text to Speech

Hybrid TTS in the financial domain is developed based on the concatenation approach for Talking ATM [7]. Text to speech takes input text messages and outputs speech signals. As TTS engines are going to be deployed in ATM, it ought to have low memory footprint and high reaction time. The development of the TTS has taken the automated user details by various data in terms of input. TTS output is measured by two parameters: naturalness and better understanding. Recording has been done by a voice creative person in a skilled studio. Text knowledge for recording is collected from varied banking domain sites, cleaned, applied improvement algorithms for negligible recording. Engine is developed in 'Python' language to port on any platform.

3.4.2 Speech to Text

The speech to text module in the EYE-TM has proven efficient for the actual conversion of data modules based on the conversion of the audio or input signals which is analysed based on the frequency of the voice module and then converted into the text for the ATM to understand. This module uses two components where in the first part the audio which is to be given as input is processed as a feed through the microphones which is integrated with the hardware of the EYE-TM. The second module is to convert the feed into the acoustic signals and interpret the processed signal based on the voice and mapping each letter from the signal obtained. The speech recognition involves the usage of two techniques, namely, MFCC and VQ [8]. The feature extraction process involves MFCC where the speech signal is framed and blocked based on the audio input. After the process, the signals are windowed for clarity based on time intervals. Applying FFT [fast Fourier transform], the mel scale is obtained. By further applying DCT [discrete cosine transform], the feature is extracted.

After feature extraction, the feature matching process is done. The feature extracted is now processed using the vector quantization technique, any two dimensions of the speech signal are chosen, and data points are plotted. Without any blockage of the audio signals and overlapping of each signal, the observation of the data region is done. Now the LGB algorithm will train the VQ codebook. The final extraction will again be taken into the MFCC algorithm and the models are created.

4 Implementation Results

The following are the results of the code implemented to carry out the checking in of the user and their transaction through the database. The process starts by feeding basic data into the database. MongoDB has been implemented for tackling smaller quantities of data. The below is a representation of initial log-in and deposition of money phase. Now consider the account number 27. The database contains the basic information, including the photograph captured at the time of creating the respected user's account. The image is stored in the binary format and used to verify users at the time of entry to the ATM booth. Considering the fact that there is an existing limit to the number of transactions/minimum amount to transact, the mini statement is stored in the form of an array, such that when it exceeds the arbitrary limit, a warning is imposed. Figure 8 displays the data, and Fig. 9 shows the face recognition module.

The actual process begins by face recognition as the verification step. The below is the result of how the system verifies an individual, given the details of the same are previously updated in the database. The system is trained with various angles of the same face, by holding the unique ID as the reference point. Hence, the face is recognized, and the transaction is processed further to withdraw or deposit money. This on the whole is completely text to speech (TTS) and speech to text (STT)

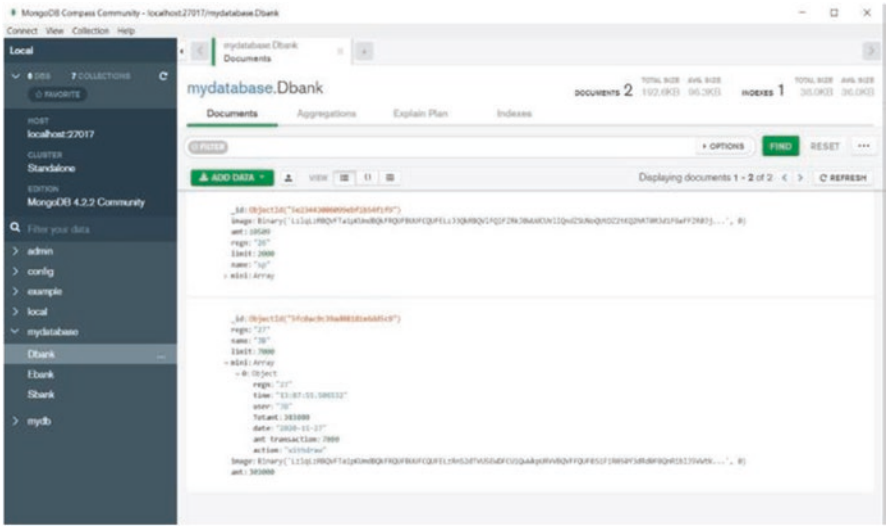


Fig. 8 Initial display of the stored data in the database

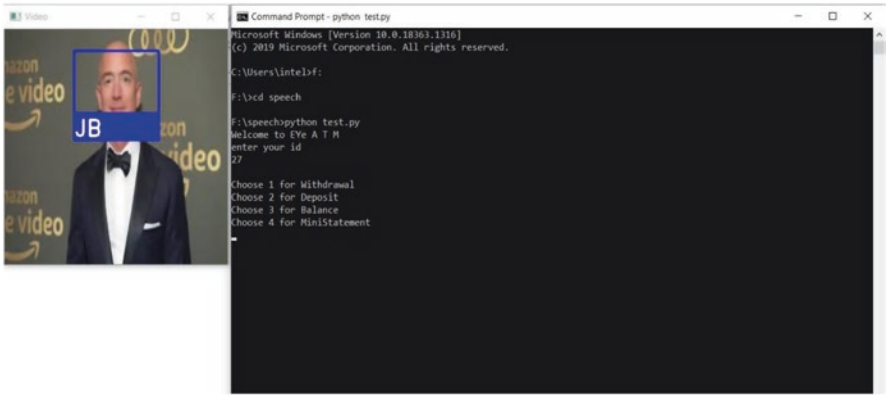


Fig. 9 Face recognition module and the commencing of the transaction process, once the image is verified

oriented, thus enabling the visually impaired to safely transact the correct amount of money to and fro.

The transaction is divided into four parts: withdrawal, deposit, balance and mini statement:

- Withdrawal: The conventional withdrawal system as in any banks, controlled by TTS (text to speech) and STT (speech-to-text).
- Deposit: The similar aspect of the deposition system, controlled by TTS and STT methods.
- Balance: The current balance of the account holder (TTS and STT).
- Mini statement: The record of the transaction that has been intimated (minimized to five transactions) (TTS and STT).

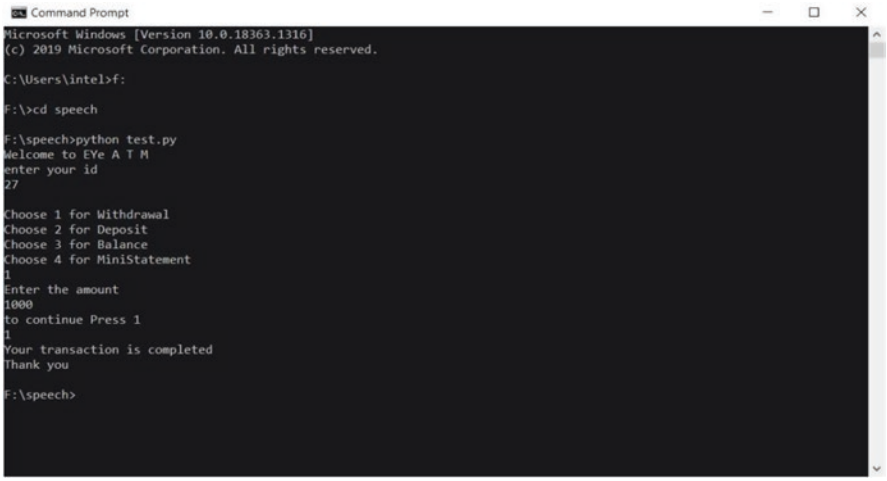


Fig. 10 Transaction process

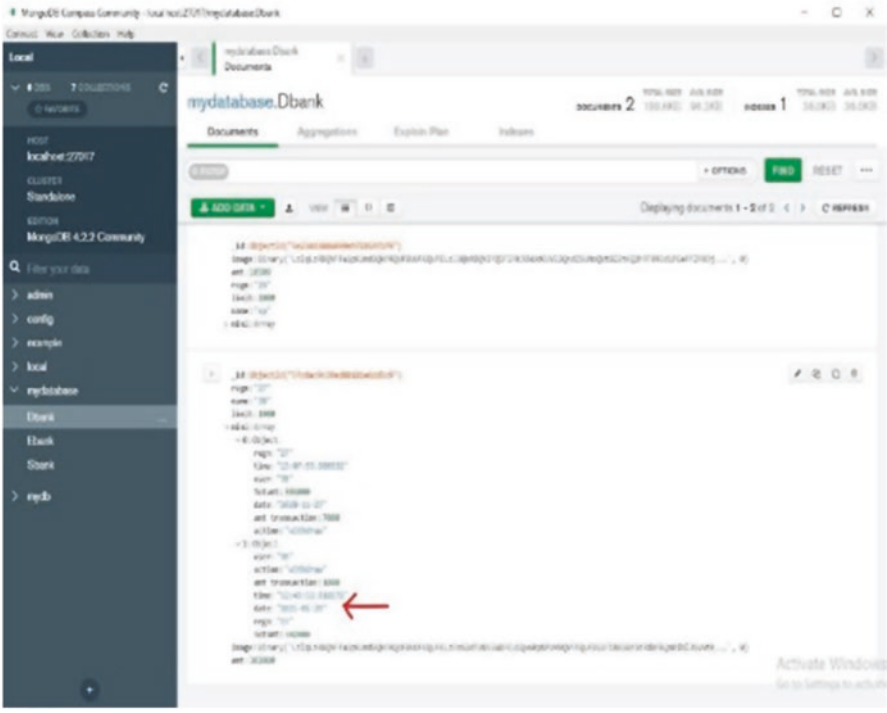


Fig. 11 Updating data in the database after the transaction

Figures 10 and 11 depict the transaction flow that is implied to each and every part of the selected option. Once the operation is confirmed successfully, the money is transferred and dynamically modified in the database, with the amount transacted,

the kind of operation performed and the date and time of transaction. The following images makes it clear that, compared to the previous data in the database, the mini statement includes another entry with the above-mentioned credentials.

5 Conclusions and Future Enhancement

The EYE-TM is evidently an effective use for the visually impaired that can help in easy and safe transactions without involving the third party or middleman. Though there are other security-related issues arising in the machine, this can be effectively enhanced by the usage of strongly encrypted servers and databases from the bank authority. The prototype created for the user authentication provides features which can help in user-friendly transactions. The future enhancement includes integrating of more language modules to the chat-bot mechanism making it more precise and comfortable to the native and rural users. Furthermore the model can be improvised by creating a chat-bot which involves NLP [natural language processing] algorithm that can be more effective and user friendly with enhanced features.

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High-Capacity Reversible Data Hiding Using Lossless LZW Compression

R. Leelavathi and M. N. Giri Prasad

Abstract Reversible data hiding is a form of steganography where the cover data is recovered completely after extracting the secret message. This paper presents a novel reversible data hiding scheme for compressed images. For the cover image to be recovered completely, the compression algorithm employed must be lossless. The proposed method processes the image to achieve higher compression efficiency using LZW lossless compression. LZW compression exploits the redundancy in the form of repetition present in the input data. Less redundancy increases the size of the coded output. The proposed pre-processing method increases the input data's redundancy, thereby compressing the input image with a very high compression ratio. The redundant bits present in the LZW output are used to store the secret information. After retrieving the hidden bits at the receiver after transmission, the cover image is recovered completely after decompression. The proposed method is compared with existing techniques in terms of compression ratio and data hiding capacity. The proposed data compression model increased the compression ratio to a great extent. The experimental results show that the proposed method showcased a very high compression ratio and good data hiding capacity.

Keywords Reversible data hiding · LZW compression · Hiding capacity · Compression ratio

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1 Introduction

Steganography is used to ensure the confidentiality of the existence of secret data during data transmission. Steganography is hiding the secret data in the cover media so that it is not apparent that secret messages were exchanged during data transmission. Figure 1 shows the basic structure of a stego-system. In steganography, the message to be kept secret is embedded in an envelope in such a way that:

1. The result (marked with Stego in the figure) the minimum changes are not to be seen.
2. The changes cannot be detected with measuring methods.

The idea is to take a message and modify it as discreetly as possible to hide the information to be transmitted. The original message is most often an image.

A lot of research has been done on image steganography techniques. A variant of steganography is reversible data hiding (RDH). RDH is used to hide secret information in cover media [1–4], and the cover media can be recovered fully after extracting the secret message. RDH is very useful in applications like telemedicine. In recent years, many methods have been designed in this area of research: lossless compression-based [5, 6], difference expansion-based [7–9] and histogram shifting based [10, 11] methods. These methods aim to ensure that the secret information cannot be detected and the cover image's change is not perceptible.

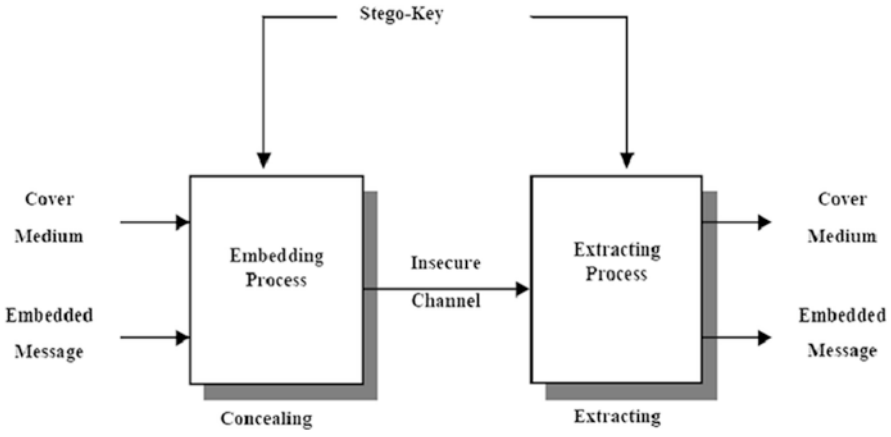

Fig. 1 The general steganography system

2 Data Compression

The role of data compression is to reduce the technical effort involved in the transmission or storage of information as small as possible. Data compression reduces the number of bits present in the information. Compression algorithms can be categorized into two types, namely, lossy and lossless. In lossy compression, the original information cannot be retrieved fully. In lossless compression, the original information can be reconstructed from the compressed data completely.

LZ77 was a compression method used by Jacob Ziv and Abraham Lempel in 1977 [12]. The LZ77 algorithm was the first table-controlled compression method presented. It compressed data by using previously read text as a table. Pointers in the table replace the input text phrases. This will compress the data by exploiting the redundancy. The degree of compression depends on the length of the phrases, Window size, and the original text's entropy (about LZ77). Close text sequences lying next to one another are compressed very quickly. New parts of the text are coded so that they have been coded as long as possible. Sections searched for in a continuously updated store, and new pigtails code words are used. Such a coding method is universal, i.e., of the type and independent of the text's language. Shown by Ziv in the 1970s, it was able to reach the ideal goal surprisingly quickly with uniform texts, namely, through the "entropy" given limit of error-free data compression with a minimum number of bits. Finally, the original text can be restored just as easily win back.

Two Israeli researchers, Jacob Ziv and Abraham Lempel, published a new algorithm for lossless data compression [13]. Jacob Ziv drew the idea and the theoretical foundations, whereas Abraham Lempel is responsible for the program structure. A few years later, in 1983, Terry Welch developed a faster variant of the Lempel-Ziv algorithm; the so-called LZW (Lempel-Ziv-Welch) compression was thus created [14].

The most important part of these models is the table and its management. The idea was to assign strings (phrases) that appear several times in the text once to save. If a phrase occurs a second time, only a pointer to this phrase is saved. If the token's memory requirement is less than that of the phrase, one data compression is achieved. Otherwise, the file is inflated. This can easily happen if you want to compress files that have already been compressed.

A table is generally used to reference phrases. In the procedure described in the first publication, the table was in the form of a text window that slides over the encoded data. Old phrases that come out of the window or the table are pushed, are forgotten, and can no longer be referenced. The simple run-length coding (RLC) can be understood as a table-based model [15]. The number of transfer characters is repetitions of the table. An offset is not necessary because the table contains only one character.

Wang et al. [16] implemented a high-performance RDH technique in LZW compressed data (HPDH-LZW). In this technique, the compressed data is divided into two parts based on the LZW dictionary created. The RDH is carried out by checking

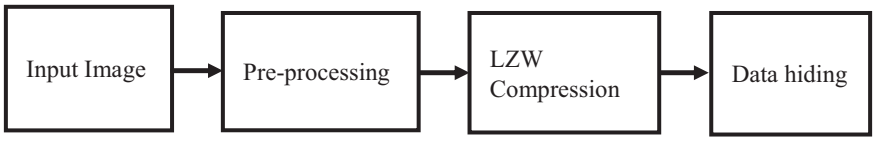

Fig. 2 Proposed RDH model using LZW compression

if the secret data bit is 0 or 1. If the bit is 0, the compressed code word is passed to the output directly. If the data bit to be hidden is 1, then the code word is added with the dictionary size before sending the data to the output. If the code word is larger than the dictionary size during the extraction phase, then the secret bit is identified as 1. In the other case, the secret data bit is considered as 0. The code words are then decompressed to get the original image.

Chang et al. [17] proposed a method where LZW output code words are modified to hide the secret data. All the symbols in the dictionary are used to embed the data [18].

3 Proposed Model

The proposed model consists of three phases. The first phase is pre-processing, where the image is processed to increase the compression ratio. The second stage is the lossless data compression using LZW compression. The third stage is data hiding. Figure 2 shows the block diagram of the proposed method [19–23].

The hidden secret data is extracted first at the receiver end. After LZW decompression, the inverse pre-processing is performed to get the original data.

3.1 Image Pre-processing

The image pixels, when given directly to LZW compression, cannot be compressed effectively [24, 25]. In many cases, the size of the compressed data is more than that of the original. To increase the redundancy in the data, the following steps are followed:

- **Step 1**: Subtract the consecutive pixels from one another.
- **Step 2**: Divide the pixels into the range of −50 to +50 and remaining the other values.
- **Step 3**: Add sign bit to numbers.
- **Step 4**: Send the signed data for LZW compression.

3.2 LZW Compression

LZW is very much based on the LZ78 method by Lempel and Ziv. The standard implementation is a "dictionary technique"with a dictionary of up to 4096 possible entries and a fixed code length of 12 bits. The dictionary will be like in all LZ procedures during the compression or decompression process built up. The first 256 entries, which contain all possible individual characters, are pre-assigned. This avoids the transmission of single characters since they do all already available as a phrase. At runtime, patterns are obtained from the input data, which are entered in the dictionary if they are not yet known. In the other case, not the pattern but its index is output in the dictionary.

Input	Recognized Pattern	New dictionary entry	
LZWLZ78LZ77LZCLZMWLZAP	L	LZ	(=256)
ZWLZ78LZ77LZCLZMWLZAP	Z	ZW	(=257)
WLZ78LZ77LZCLZMWLZAP	W	WL	(=258)
Z78LZ77LZCLZMWLZAP	LZ	LZ7	(=259)
78LZ77LZCLZMWLZAP	7	78	(=260)
8LZ77LZCLZMWLZAP	8	8L	(=261)
LZ77LZCLZMWLZAP	LZ7	LZ77	(=262)
7LZCLZMWLZAP	7	7L	(=263)
LZCLZMWLZAP	LZ	LZC	(=264)
CLZMWLZAP	C	CL	(=265)
LZMWLZAP	LZ	LZM	(=266)
MWLZAP	M	MW	(=267)
WLZAP	WL	WLZ	(=268)
ZAP	Z	ZA	(=269)
AP	A	AP	(=270)
P	P		
Output : L Z W < 256 > 78 < 259 > 7 < 256 > C < 256 > M < 258 > Z A P			

Each line in the example above shows the input string's content in each step of the coding. The longest character pattern found in the dictionary in this step and newly added dictionary entries with their index numbers.

In the first step, the longest found pattern will necessarily only be a single letter because, with the LZW procedure, the dictionary with all single characters with the code values is preset from 0 to 255 but does not contain any longer strings. In our example, the algorithm finds the "L."

Input viewed ("Z") and appended to the "L." The string created in this way is guaranteed not yet included in the dictionary, so it is re-entered under index 256. The next step is the longest character string found in the last step from the input stream (i.e., the "L") removed and output. The "Z" now becomes the first character of the new one.

Input strings. Here the same game starts over. “Z” is the longest known pattern. “ZW” is added to the dictionary under index 257. “Z” is taken from the input removed, issued, and a new run started. “W” is now the longest in the dictionary entered character string, “WL” is added with index number 258, and the “W” deleted from input and redirected to output. The next step finally happens something more interesting; the longest known pattern is now a string in the dictionary (“LZ” with index number 256). The following step does not output two single characters but the index of the dictionary pattern (256).

Decoding

Entry character C New dictionary entry P				
L.				L.
Z	Z	LZ	(=256)	Z
W.	W.	ZW	(=257)	W.
<256>	L.	WL	(=258)	LZ
7th	7th	LZ7	(=259)	7th
8th	8th	78	(=260)	8th
<259>	L.	8L	(=261)	LZ7
7th	7th	LZ77	(=262)	7th
<256>	L.	7L	(=263)	LZ
C.	C.	LZC	(=264)	C.
<256>	L.	CL	(=265)	LZ
M.	M.	LZM	(=266)	M.
<258>	W.	MW	(=267)	WL
Z	Z	WLZ	(=268)	Z
A.	A.	ZA	(=269)	A.
P	P	AP	(=270)	P
Output string : LZW LZ 7 8 LZ7 7 LZ C LZ M WL WAP				

Decoding also starts with a pre-initialized dictionary. Again, there are entries from 0 to 255. In an example, “L” is the longest known string. It is, therefore, also output and in the variable P (such as “Prefix”). The next entry is also a familiar character. This will initially store in variable C. In the following, P is concatenated with C and that result added to the dictionary under index number 256. Note that “LZ” in both the decompressor and the compressor in the same place in the dictionary occurs (256). The last entry is then copied into the variable P and P. issued. The following step (with “W”) works in the same way. In the next step, only the first character of the dictionary entry is transferred to C (“L”). Then it will be P and C are concatenated again, and a new dictionary entry is created (“WL” with index 258). Now P is assigned the index 256, and the corresponding dictionary entry is output.

3.3 LSB Data Hiding

The secret data is hidden in the LSB part of the compressed out. The maximum number in the output of compression is 4096. The 16-bit number has empty spaces in the LSB. These blank nits are used for data hiding.

The decompression part is also simple. The LSB bits are extracted to get the secret message. LZW decompression is applied after the secret data is removed. In the end, pre-processing is reversed to get the original data.

4 Experimental Results

To test the proposed algorithm, the existing algorithms are compared in two aspects:

(a) Data hiding capacity.
(b) Size of the LZW code after compression.

This section presents the experiments performed to analyze the proposed algorithm.

The standard texts used in the experiments are:

- Obama's speech.
- Lincoln's Gettysburg address.
- A medium-sized research paper.
- Mandela's speech.

New text samples with very large capacity have been created to test the proposed algorithm. The secret data that can be hidden can be digital, namely, text, audio, image, video, etc. The data needs to be converted into binary form to perform the reversible data hiding in Fig. 3.

The proposed method is applied to different images to obtain the number of compressed pixels and bits, compression ratio, and hiding capacity of each image. Table 1 shows the compressed pixel count, compressed number of bits, compression ratio, and hiding capacity for each test image. The images represented in Table 1 grayscale images of size 256 × 256.

Table 2 shows the compressed pixels, compressed number of bits, compression ratio, and hiding capacity for each test image of the size of 512 × 512.

Comparison Results

The proposed method is compared with HPDH-LZW and IDH-LWZ algorithms. Table 3 shows the compression ratio obtained by HPDH-LZW, IDH-LZW scheme, and proposed scheme for gray images of 256 × 256. The comparison results show how the proposed method produced better results than HPDH-LZW and IDH-LWZ. From baboon image, the HPDH-LZW and IDH-LZW produced a compression ratio of 0.82. In contrast, the proposed method produced a compression ratio of 6.50, which is 7.92 times greater than the other compared algorithms. For the images

Fig. 3 Cover images. (**a**) Baboon. (**b**) Boat. (**c**) Gold hill. (**d**) Jet (F-16). (**e**) Zelda. (**f**) Lena. (**g**) Liftingbody. (**h**) Tiffany. (**i**) Cameraman. (**j**) Woman

Table 1 Experimental results for input images of size 256 × 256

Image name	Number of pixels	Number of bits	Compressed pixel count	Compressed number of bits	Compression ratio	Hiding capacity
Baboon	65,536	524,288	5043	80,688	6.50	13,518
Boat	65,536	524,288	2661	42,576	12.31	7470
Gold hill	65,536	524,288	1671	26,736	9.50	4350
Jet	65,536	524,288	3448	55,168	19.01	11,148
Lena	65,536	524,288	1568	25,088	20.90	5244
Pepper	65,536	524,288	2405	38,480	13.62	6402
Tiffany	65,536	524,288	1611	25,776	20.34	5502
Zelda	65,536	524,288	712	11,392	46.02	2832
Cameraman	65,536	524,288	2624	41,984	12.49	8124
Woman	65,536	524,288	886	14,176	36.98	3408

boat, Lena and peppers, HPDH-LZW produced a correlation of 0.89, 0.86, and 0.85, respectively. For the images boat, Lena, and peppers, IDH-LWZ produced a

Table 2 Experimental results of input images size 512 × 512

Image name	Number of pixels	Number of bits	Compressed number of pixels	Compressed number of bits	Compression ratio	Hiding capacity
Baboon	262,144	4,194,304	8469	135,504	30.95	22,278
Boat	262,144	4,194,304	3105	49,680	84.42	9894
Gold hill	262,144	4,194,304	3867	61,872	67.79	9942
Jet	262,144	4,194,304	5482	87,712	47.82	17,652
Lena	262,144	4,194,304	2148	34,944	120.03	8820
Pepper	262,144	4,194,304	4989	79,824	52.54	13,434
Tiffany	262,144	4,194,304	5177	82,832	50.64	15,306
Zelda	262,144	4,194,304	1226	19,616	213.82	5280
Cameraman	262,144	4,194,304	3455	55,280	75.87	10,470
Woman	262,144	4,194,304	1342	16,896	248.24	6336

Table 3 Compression ratio comparison results for 256*256 gray images

Image name	Original file size	HPDH-LZW		IDH-LWZ		Proposed	
		C_size	Compression ratio	C_size	Compression ratio	C_ size	Compression ratio
Baboon	65,536	79,999	0.82	80,208	0.82	5043	6.50
Boat	65,536	73,238	0.89	69,698	0.94	2661	12.31
Lena	65,536	76,428	0.86	69,722	0.94	1568	20.90
Peppers	65,536	77,546	0.85	70,398	0.93	2405	13.62

compression ratio of 0.94, 0.94, and 0.93. The proposed method produced very high compression ratios of 12.31, 20.90, and 13.62 for the images boat, Lena, and peppers. The average compression ratios of HPDH-LZW, IDH-LZW, and the proposed method are 0.855, 0.9075, and 6.50. The proposed method produced much better results in terms of compression ratio than the existing techniques.

Hiding Capacity (Bit/Pix)

Table 4 shows the hiding capacity in terms of bits per pixel in grayscale images of the size of 256 × 256. The value indicates how many bits are being hidden per pixel by an RDH algorithm. HPDH-LZW average hiding capacity for all the test images is 0.7925. The IDH-LWZ average hiding capacity for the test images is 0.9225. The proposed method obtained an average hiding capacity for over images are 1.435.

Table 5 shows the compression ratio obtained by HPDH-LZW, IDH-LZW scheme, and proposed scheme for gray images of 512 × 512. The comparison results show how the proposed method produced better results than HPDH-LZW and IDH-LWZ. From baboon image, the HPDH-LZW and IDH-LZW produced a compression ratio of 0.81 and 0.87, respectively, whereas the proposed method produced a compression ratio of 30.95. For the images boat, Lena, peppers, Tiffany, and Zelda, HPDH-LZW produced a compression ratio of 0.94, 0.87, 0.86, 0.82, and 0.87. For the images boat, Lena, peppers, Tiffany, and Zelda, IDH-LWZ produced a compression ratio of 1.01, 1.03, 1.04, 1.13, and 1.06. The proposed method produced very

Table 4 Hiding capacity comparison for grayscale image (256*256)

Image name	HPDH-LZW	IDH-LWZ	Proposed
Baboon	0.79	0.88	1.34
Boat	0.79	0.94	1.40
Lena	0.79	0.94	1.67
Peppers	0.80	0.93	1.33

Table 5 Compression ratio comparison results for 512*512 gray images

Image name	Original file size	HPDH-LZW		IDH-LWZ		Proposed	
		C_size	Compression ratio	C_size	Compression ratio	C_ size	Compression ratio
Baboon	262,144	321,820	0.81	302,155	0.87	8469	30.95
Boat	262,144	279,783	0.94	260,908	1.01	3105	84.42
Lena	262,144	300,391	0.87	254,852	1.03	2148	120.03
Pepper	262,144	305,998	0.86	252,750	1.04	4989	52.54
Tiffany	262,144	286,201	0.82	232,441	1.13	5177	50.64
Zelda	262,144	301,776	0.87	248,214	1.06	1226	213.82

high compression ratios of 84.42, 120.03, 52.54, 50.64, and 213.82 for the images boat, Lena, peppers, Tiffany, and Zelda. The proposed method produced much better results in terms of compression ratio than the existing techniques.

Hiding Capacity (Bit/Pix)
Table 6 shows the hiding capacity in terms of bits per pixel in grayscale images of the size of 512 × 512. HPDH-LZW average hiding capacity for the test images is 0.7983. The average hiding capacity of IDH-LWZ for the test images is 1.3383. The proposed method produced an average hiding capacity of 1.6533, which is much higher than the existing techniques.

5 Conclusion

A lossless compression type of compression allows information to be much larger compressed than is possible with compression without loss. This, in general, however, only makes sense if either only one, reduction (or elimination) of redundancies or an abstraction of information, takes place. The proposed pre-processing method increases the input data's redundancy, thereby compressing the input image efficiently. The redundant bits present in the LZW output are used to store the secret information. The proposed method is compared with existing techniques in terms of compression ratio and data hiding capacity.

Table 6 Hiding capacity comparison for grayscale image (512*512)

Image name	HPDH-LZW	IDH-LWZ	Proposed
Baboon	0.80	1.26	1.31
Boat	0.79	1.33	1.59
Lena	0.80	1.34	2.05
Peppers	0.80	1.35	1.35
Tiffany	0.80	1.39	1.47
Zelda	0.80	1.36	2.15

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Tropical Cyclone Detection Using Optical Flow Estimation Deep Learning

Nagu Malothu, V. V. K. D. V. Prasad, and B. T. Krishna

Abstract Tropical cyclones (TC) are amongst the deadliest natural disasters that cause massive damage to property and lives. Meteorologists track these natural phenomena using satellite imagery. The spiral rain bands appear in a cyclic pattern with an eye as a centre in the satellite image. Automatic identification of the cyclic pattern is a challenging task due to the clouds present around the structure. Conventional approaches use only image data to detect the cyclic structure using deep learning algorithms. The training and testing data consist of positive and negative samples of TC. But the cyclic structure's texture pattern makes it difficult for the deep learning algorithms to extract useful features. This paper presents an automatic TC detection algorithm using optical flow estimation and deep learning algorithms to overcome this drawback. The optical flow vectors are estimated using the Horn-Schunck estimator, the Liu-Shen estimator, and the Lagrange multiplier. The deep learning algorithms take the optical flow vectors as input during the training stage and extract the features to identify the cyclone's circular pattern. The proposed method increases the accuracy of detecting the cyclone pattern through optical flow vectors compared to pixel intensity values.

Keywords Tropical cyclone · Conventional approaches · Deep learning algorithm · Horn-Schunck estimator · Liu-Shen estimator · Lagrange multiplier

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1 Introduction

Tropical cyclones (TC) are one of the deadliest natural disasters that harm human beings, society, transportation, and properties. After a cyclone has formed, meteorologists can make predictions about its trajectory, intensity, and current speed. The experts look into the future for up to 10 days. If a cyclone hits land, the threatened population is warned. The authorities often initiate large-scale evacuations. For predictions, meteorologists collect numerous data from all over the world [1]. Weather stations supply these predictions to the ground, ships, and aircraft with satellite data. Using physical laws and simulation calculations and computers, experts calculate how the cyclone will behave. Statistics from previous years and decades also play an important role. Tropical cyclones in the Atlantic and North Pacific are classified on the Saffir-Simpson hurricane scale [2]. It enables statements to be made on hurricanes' destructive potential – they are indispensable for civil protection in Table 1.

Like weather forecasts in general, hurricane forecasts have improved in recent years. However, the difficulty in the prediction has made the prediction process very challenging. It happens that a hurricane intensifies within a short time, or low-pressure areas develop a greater destructive force than assumed. For example, in 2007, the Felix gravure area developed into a magnitude five hurricane within 39 hours. Many scientists believe that the number and intensity of cyclones will increase due to human-made climate change. Research groups worldwide are working on ways to respond to the effects of climate change and improve protection against natural disasters such as hurricanes. Reinforced, higher dikes and drainage facilities are intended to protect low-lying coastal regions, and mangroves and mixed forests planted on the coast are slowing down the force of tidal waves. The dismantling of vulnerable settlements and cities is also being considered. Recently, cyclone "Amphan" has killed at least 22 people in India and Bangladesh. The cyclone had reached the mainland on Wednesday, May 13, 2020, with a lot of wind and rain [3]. According to the authorities, more than three million people had been taken to emergency shelters. According to the Indian Meteorological Service, "Amphan"is one of the worst storms in the region in the past 20 years. The wind had reached up to 185 km / h.

Various southeast US regions are affected by Hurricane Katrina, which occurred with an extreme wind speed of 280 km/hr. on August 23–31, 2005. Due to the hurricane, approximately 1245–1836 people were killed, and around $149 billion [4].

Table 1 Categories of the Saffir-Simpson hurricane scale

Categorization	Speed
Category 1	Between 119 and 154 km / h
Category 2	Between 155 and 177 km / h
Category 3	Between 178 and 210 km / h
Category 4	Between 211 and 249 km / h (corresponds to a super typhoon)
Category 5	Over 250 km / h

Hence, the cyclone was termed as the costliest hurricane in the history of the United States. The highest wind speed of 185 km/hr. has continued by Hurricane Sandy through October 22–November 2, 2012. Due to this, around 233 people died and caused damages of $75 billion. Harsh TCs accomplish heavy precipitation and intense wind speeds above 260 km/hr. Because of its sturdy wind with flash moving force, the maximum loss is occurred by TC. Intended for the Earth's study [5], the television infrared observation satellite (TIROS) was the earliest investigational mission on the satellite launch's feasibility on April 1, 1960, and is used to monitor and track TC. The significant factor in weather monitoring and forecasting of the United States is the geostationary operational environmental satellite (GOES). Climate forecasting and harsh squall tracking with the meteorological investigation are the intended applications of GEOS. The first image of GOES-1 on 1645 GMT on October 25, 1975, is shown in Fig. 1. The benefits of geostationary satellites (GEO) are observed repeatedly over an extensive area. Weather forecasting and monitoring are improved by their meteorological satellite programmes implemented in countries like China, Europe, South Korea, and Japan. Geostationary satellites like Japanese Himawari-8 with US imminent GOES-R have indefinite measurement capacity. The advanced onboard functioning sensors provide a maximum number of channels using higher spatial resolutions and additional noticing frequencies.

Fig. 1 The first image obtained from the GOES-1 satellite, October 25, 1975, at 1645 GMT. (Adapted from NOAA photo library http://www.photolib.noaa.gov/)

The observations on a location are provided by low Earth orbit (LEO) polar orbital satellites two times a day [6]. For analysing detection, intensity, structure, and monitoring of TC, a reliable spatial resolution is delivered by the pointed examine prototype of passive microwave (PMW) dimensions. The investigation of a typical TC from satellite images started soon after the first weather satellite observations [7]. Based on the visible channel's cloud organization, a practical example for diagnosing TC intensity was introduced by Dvorak. The degree of the brightness, temperatures, and banding or distortion curving of the cloud pattern are the various features that affect the storm's intensity calculated using the structural characteristics. The individual estimates of TC's intensity are produced regularly using the structural cues from the satellite images, and a flowchart of rules was proposed. Nowadays, the Dvorak method is continued as a critical element of working analysis. Using the additional efforts, the Dvorak method is still the utmost common technique for detecting the intensity of TC analysis that is deeply adopted for this work's legacy. By updating the wind-pressure relationship in defining the intensity, the method's precision can be enhanced.

Various methods are available for diagnosing the structure and intensity of TC using the infrared and visible channels [8]. In 2007, the correlations amongst the infrared TBs and operational storm size parameters such as radius of maximum winds can be introduced. Using the radius of 5-kt 850 h Pa wind, a comparable application of infrared imagery for solving the sizes of TC are described, which corresponds to the lifespan of TC. A great potential is always exhibited by a statistical investigation of temperature distribution regarding the TC axisymmetric in detecting the structure and supporting by centring TC, genesis, and intensity. With the differentiation in the GEO water vapour and infrared channels, the variations in between the intensity and structure of TC can be observed. Overshooting convective tops are the precise structural characteristics emphasized. The data in every medium is affected by this method since various altitudes and the weighting function represent chemical profiles.

2 Literature

Jessica et al. [9] showcased that many coastal areas are regularly affected by tropical cyclone disasters globally. To coastal people and the environment, tropical cyclones' destructive characteristics are significant threats resulting in the loss of more human lives than all other natural disasters. Each year across the world during 1968–2010, about 88 tropical storms formed on average. Out of these, 48 gained the quality of a violent tropical wind (classification 1 and 2), and 21 accomplished the force of a mighty tropical twister (class 3, 4, and 5). In the most recent two centuries, universally, around 1.9 million individuals have lost their lives by tornado fiascos. Tropical violent winds are additionally liable for enormous harms in nearby economy and condition. Under likely future climate change scenarios, the intensity of tropical

cyclones will probably increase, and thus coastal people and the environment will be more vulnerable to tropical storms [10].

A significant amount of work has already been conducted in different phases of tropical cyclone disaster management using satellite remote sensing, and spatial analysis was done [11]. In these studies, various kinds of processing techniques and datasets have been incorporated. For assessing tropical cyclone impacts and recovery, visual interpretation, field transects, data mining, and change detection incorporating moderate (5–30 m pixels) to high (<5 m pixels) spatial resolution satellite imagery are commonly used techniques. For tropical cyclone risk assessment, single criterion, multi-criteria, and various risk equations have been used [12–15].

Boyo et al. [16] constructed a benchmark dataset with the knowledge of TC wind profiles. The dataset is labelled to facilitate further research. The authors used CNN to analyse the structure of TC with several parameters on the dataset to validate it. The author's goal in creating the dataset is to attract more researchers towards TC identification using satellite images. Mozambique Channel in the African continent experiences two cyclones per year on average. These cyclones have a devastating impact on humans, plant, and animal lives [17]. described the Idai TC that hit land in Mozambique in 2019 as one of the deadliest storms in the region [18] proposed a method to identify the TC centre to estimate the trajectory and the intensity [19–23]. Due to the TC's morphology and structure, the centre's location becomes a challenging task. The authors used a deep convolutional network to locate the centre by exploiting the multilevel structural features present in the TC images [24, 25]. The proposed method is a two-step approach consisting of object detection and centre location. The object detection phase uses the global and local features present in the TC images maps through the upsampling and concatenation. Once the approximate object detection is achieved, image processing techniques are used to locate the centre accurately. The error of prediction in the latitude and longitude is approximately 0.237°.

3 Proposed Method

The proposed method consists of applying the optical flow method on the input video frame sequences. The resultant flow vectors are sent to deep learning algorithms for the detection of cyclone region. Figure 2 shows the overall block diagram of the proposed model.

3.1 Optical Flow Method

For particle image velocimetry (PIV) images, the optical flow equation in the image plane is written as

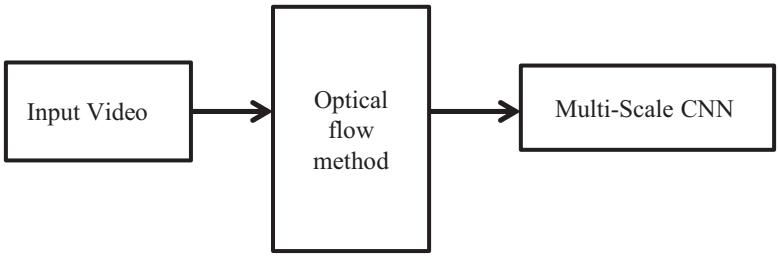

Fig. 2 Proposed method

$$\frac{\partial I}{\partial t} + \nabla.\left(Iu\right) = f\left(x_1, x_2\right), \tag{1}$$

Here,

The normalized intensity is I, and the optical flow is $u = (u_1, u_2)$, the gradient operator in the image plane(x_1, x_2) is $\Delta = \frac{\partial}{\partial x_i\left(i = 1,2\right)}$.

$f = w_{\text{ext}} C_{\text{ext}} n.\left(NU\right)\Big|_{r_1}^{r_2}$ is the boundary term which acts as a source/sink term and can be used to represent the effect of particles accumulated within the cloud layer confined by the two control planes Γ_1 and Γ_2. The particle velocity in the 3D object space is U, and the number of particles per unit total volume is *N*, in which the unit vector normal to *n* is the unit vector normal to $\Gamma_1$and Γ_2, C_{ext} is the extinction cross-section, and w_{ext} is the corresponding correlation coefficient. In Eq. (1), the optical flow is defined as $u = (u_1, u_2) = \gamma U_{12N}$, where U_{12N} is the light-path-averaged velocity of particles projected onto the image plane and γ is a factor of projection. A differential equation describing the projected motion of particles in the image plane is Eq. (1). This is assumed as the net flux of particles through the control surfaces is zero, i.e. $n.\left(NU\right)\Big|_{r_1}^{r_2} = 0.$

A variation formulation with a smoothness constraint is typically used to determine the optical flow as an inverse problem from Eq. (1). The fundamental equation has forgiven I and f is

$$J\left(u\right) = \int\left(\frac{\partial I}{\partial t} + \nabla.\left(Iu\right) - f\right)^2 dx_1 dx_2 + \alpha\int\left(\left|\nabla u_1\right|^2 + \left|\nabla u_2\right|^2\right) dx_1 dx_2, \tag{2}$$

The functional equation is the term of first integration. The second integral term is the first-order Tikhonov regularization functional, *D* is an image domain of interest, and $\propto$ is the Lagrange multiplier. Minimization of the functional *J* (*u*) leads to the Euler-Lagrange equation:

$$I\nabla\left[\frac{\partial I}{\partial t} + \nabla.\left(Iu\right) - f\right] + \alpha\nabla^2 u = 0, \tag{3}$$

The Laplace operator is $\nabla^2 = \frac{\partial^2}{\partial x_i \partial x_i}$ and the Lagrange multiplier is α which can control the smoothness of the field. The standard finite difference method is used when a pair of sequential images is given, and f is neglected in the first-order approximation to solve this partial differential equation with the Neumann condition $\frac{\partial u}{\partial n} = 0$ on the image domain boundary ∂D for the optical flow u; in theory, the optical flow method can extract a velocity field at the spatial resolution of one vector per pixel.

3.2 Multiscale CNN

The multiscale convolutional neural network (MCNN) framework in which the input is the time series to be predicted and the output is its label.

The MCNN framework has three sequential stages: transformation, local convolution, and full convolution.

1. The *transformation stage* applies various transformations to the input time series. We currently include identity mapping, downsampling transformations in the time domain, and spectral transformations in the frequency domain.
2. In the *local convolution stage*, we use several convolutional layers to extract each branch's features. In this stage, the convolutions for different branches are independent of each other.
3. In the *full convolution stage*, we concatenate all extracted features and apply several more convolutional layers (each followed by max-pooling), fully connected layers, and a SoftMax layer to generate the final output. This is an entirely end-to-end system, and all parameters are trained jointly through backpropagation.

Activation Functions

In the backpropagation algorithm, the first derivatives of the activation function are calculated. This assumes that this function can be continuously differentiated. S-shaped activation function is monotonously increasing and differentiating bare logistical function.

$$f(x) = \frac{1}{1 + \exp(-b.x)} \tag{4}$$

where b is a constant determining the curve's slope, as shown in Fig. 3. The value range of the function is between 0 and 1. The derivative has the form

$$f'(x) = b.f(x)(1 - f(x)) \tag{5}$$

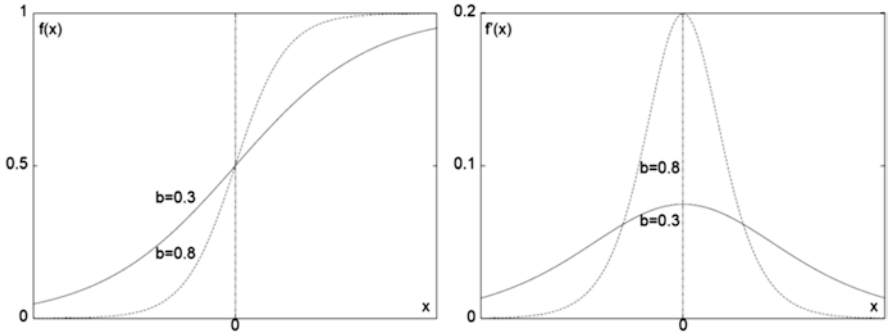

Fig. 3 Logistic function with derivation for two parameters *b*

On the one hand, the sigmoid activation function is differentiable; on the other hand, let's determine the first derivative very simply analytically because it is derived from the original function that can be calculated.

Another very popular activation function is the tangent hyperbolic, so

$$f(x) = \tanh(x) = \frac{2}{1+\exp(-2x)} - 1 \tag{6}$$

with the first derivative

$$f'(x) = 1 - \tan^2(x) \tag{7}$$

In 2000 Richard HR Hahnloser and colleagues developed a new type of activation introduced function that is biologically inspired:

$$f(x) = x^+ = \max(0,x) = \begin{cases} 0 & \text{falls} \quad x < 0 \\ x & \text{falls} \quad x \geq 0 \end{cases} \tag{8}$$

This function returns only the positive part of argument *x*. There are rectifiers for converting AC to DC voltage in electrical engineering with a very similar function. That is why this function is also called a rectifier. A neuron that uses this activation function is referred to as the rectified linear unit (ReLU). One problem, however, is that this function is not continuously differentiable for $x = 0$. For this reason, the function mostly approximated, and instead, the equation is used.

$$f(x) = \log(1+\exp(x)) \tag{9}$$

In the area of deep learning, ReLU activations are used very successfully. Figure 4 shows the course of the three activation functions presented so far.

The SoftMax function is a very special activation function:

$$f(x)_i = \frac{\exp(x_i)}{\sum_{k=1}^{K} \exp(x_k)} \quad for i = 1, \ldots, k \tag{10}$$

The SoftMax function can also be called a normalized exponential function. In classification tasks, this function often comes for the output layer units because the output than the respective class probability p_i of the K classes can be interpreted.

3.3 Cost Function

In the backpropagation algorithm, an energy or cost function is the target function defined to be minimized. The differences between the network output and the actual values (teaching input) of all output neurons squared and summed. The error function for a training data record is also called the loss function. With offline learning, the individual errors for all training are then summed up and then normalized, i.e. by the number of divided data records. This overall error function is very similar to the mean squared error (MSE), but with the MSE, a square root of the sum is still drawn in regression analysis; for example, the least-squares method is used as a standard method to estimate the parameters of a model that relationship between a dependent variable and independent variables is as good as possible mapped functionally. The advantage of squaring is that positive and negative deviations or errors cannot cancel each other out. The error function is the mean absolute error (MAE). Here the differences are not squared, but the absolute amount is used. Instead of absolute errors, the relative errors, i.e. the percentages, can also be considered an error. The corresponding error measure is called mean absolute percentage error (MAPE). In classification tasks, the records of the training set are already fixed classes allocated. One also speaks of nominally scaled characteristics or categorical ones variables. There are other cost and loss functions in these applications for use. The functions square loss, hinge loss, and logistic loss can be used as examples, and cross-entropy Loss is called. The latter function is particularly inter- essential because it is continuously differentiable and thus used in gradient descent methods. The cross-entropy loss function is the first choice in deep neural network works that are used for classification.

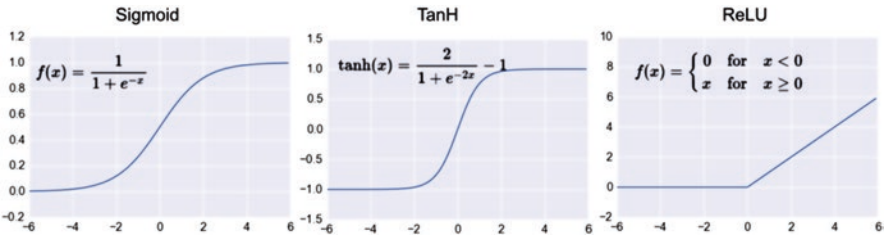

Fig. 4 Activation functions compared

3.4 Convolutional Neural Network

Critically, the convolutional neural network (CNN) got its name from the mathematical operation convolution. The folding or convolution of two functions, f and g, are given by the equation described.

$$(f * g) = \int_{\mathbb{R}^n} f(\tau)\, g(x - \tau)\, d\tau \tag{11}$$

The folding can be used, for example, to perform a given function smooth. To do this, it is folded using a special smoothing kernel. The kernel also acts as a filter. Application such a kernel or such a filter can be used for image processing, for example, to scan an area of an image to thereby edges or features to discover on the image section. Take a relatively small one, for example, an image with a size of 100 × 100 pixels. This already consists of 10,000 individual one's pixels. Each pixel is then described using a value, such as the colour or intensity (grayscale). With the help of the classic multilayer perceptron, it is difficult to process such images, for example, objects on them to recognize and classify, because such a network would already have 10,000 input neurons. Now the idea of folding comes into play. The CNN works like an MLP. However, only one image section is included scanned using a special filter or kernel and a feature map saved. The input layer of this KNN then consists of a stack of features maps. Therefore, CNN can also do very well in the field of image processing, in particular, be used in object recognition and object classification.

Structure and Layers
The last section found that different cells appear in the visual cortex. Certain functions in signal processing are specialized and in sequence stages of processing. In feature learning through deep learning, certain features are learned in stages. Like the multilayer perceptron, the convolutional neural network is a multilayered feedforward network. The combination of convolution is repeated layer and pooling layer multiple times. With this combination, features can be learned become. Figure 5 shows the schematic structure of a CNN. With subsampling, it is pooling meant. The convolutional layer has several filter kernels. Any filter kernel contains the weights to be trained, and each of these filter kernels has a feature map generated. This operation creates a stack of feature maps, all of which have the same get put, but due to the different kernels also different features extract.

Convolutional Layer This layer is the essential building block of a CNN. The neuro-nodes or units in this layer are specified according to the respective application arranges. In the field of image recognition, two-dimensional digital images are usually processed. In this application, the units are therefore 2D convolutional layer arranged, and only this is much smaller than the entire image. A discrete convolution calculates the activity of each unit. The convolution matrix, also called the filter kernel, is moved step by step over the input image. Such a step (English stride) can

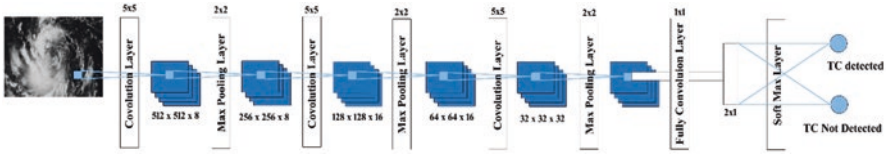

Fig. 5 Structure of a typical CNN

be one or more pixels. The inner pro product from the convolution matrix and the current image section gives just that input activity. If the convolution matrix is moved over the edge of the picture, it comes to a special technique called padding. Here must be defined how to deal with the non-existent pixels. For example, zero paddings are simply added with zero values. A speciality of the convolutional layers is that the weights of the filter kernel feature for all neurons map are the same, i.e. these parameters are shared, one speaks of so-called shared weights. That is why the use of convolutional layers is particularly efficient. Each unit in this convolutional layer only receives input signals from a local one image environment but shares the parameters (weights) with all other units. This leads to edges and features in the images being particularly well recognized. As activation function becomes the units in the convolutional layer, mostly the rectified linear unit (ReLU) is used.

Pooling Layer After each convolutional layer, there is usually a pooling layer. Pooling layer is needed to remove unnecessary information. E.g., is used in the object recognition does not require the exact position of an edge or feature, but approximate localization is sufficient. Frequently either the max-pooling or Avg pooling is used. With max pooling, only the most active activity is filtered neurons to a kernel (e.g. size 2×2). With Avg pooling, on the other hand, the mean of the activities is determined, and this mean activity is further turning. With the help of pooling, downsampling, or subsampling, it reduces the dimension and complexity. This will cause overfitting (English overfitting) prevented, the memory requirement decreased, and the calculation speed increased. Pooling is, therefore, a requirement when very deep CNNs are constructed to solve complex problems. Figure 6 shows an example of max pooling, in which a filter of size 2×2 using a step size (stride) of 2 on an input 4×4 size matrix is applied.

Fully Connected Layer The CNN is often with one or more fully networked layers completed, analogous to constructing a multilayer perceptron. There are just as many classification tasks in data mining in the last shift neurons as there are classes for a typical. So, the so-called one hot coding or dummy variables used by each class as its variable with the values 0 and 1 for false and true is mapped. This is based on nominally scaled paint, which means you don't have to make any implicit assumptions about class similarities. SoftMax is mostly used as an activation function since the sum is above all elements result in exactly one and this function then acts like a standardization.

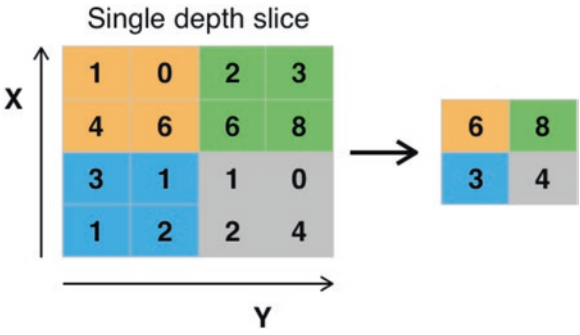

Fig. 6 Max pooling with 2×2 filter and stride = 2

Dropout Layer In addition to the pooling layer, a dropout layer can also be used to reduce the network's complexity and to overtrain or reduce the overfitting. In this layer, the activities of some neurons randomly set to zero. These units then fall in this training step dropout. This behaviour can be controlled via an adjustable failure rate in per cent being controlled.

Loss Layer Usually, the backpropagation algorithm or a gradient descent method controls the CNN parameters through supervised learning adapt. The loss layer defines how the training deals with the deviation between the predicted and actual output values. Thus, the loss layer to implement is the last layer of the CNN.

4 Experimental Results

The proposed algorithm uses satellite image pair to detect the cyclone. In Figs. 7, 8, and 9, images a, b represent the input image pair from which the optical flow vectors are extracted. Images c and d show the coarse-grained and refined velocity fields. The image shows the final velocity field. This data is given to the trained CNN to identify the TC pattern in the optical flow vectors. Images f and g show the final detected TC in the optical flow image and the original input image.

Figure 10 shows the image sequences where the proposed method accurately detected that there is no cyclone present. The images a, c, e, and g depict the input images which does not have an active cyclone formulation. The images b, d, f, and h show the output images where the cyclone was not detected successfully in Fig. 11.

Figure 12 shows the experiment results that proved that the proposed method could detect a TC at an early stage. The images a, c, e, g, and i depict the input images, and images b, d, f, h, and j show the resultant output images. The output images show that the cyclone is detected at a very early stage, and the algorithm performed the detection very precisely till the TC has reached its final form. The accuracy of the proposed system is evaluated as 98%.

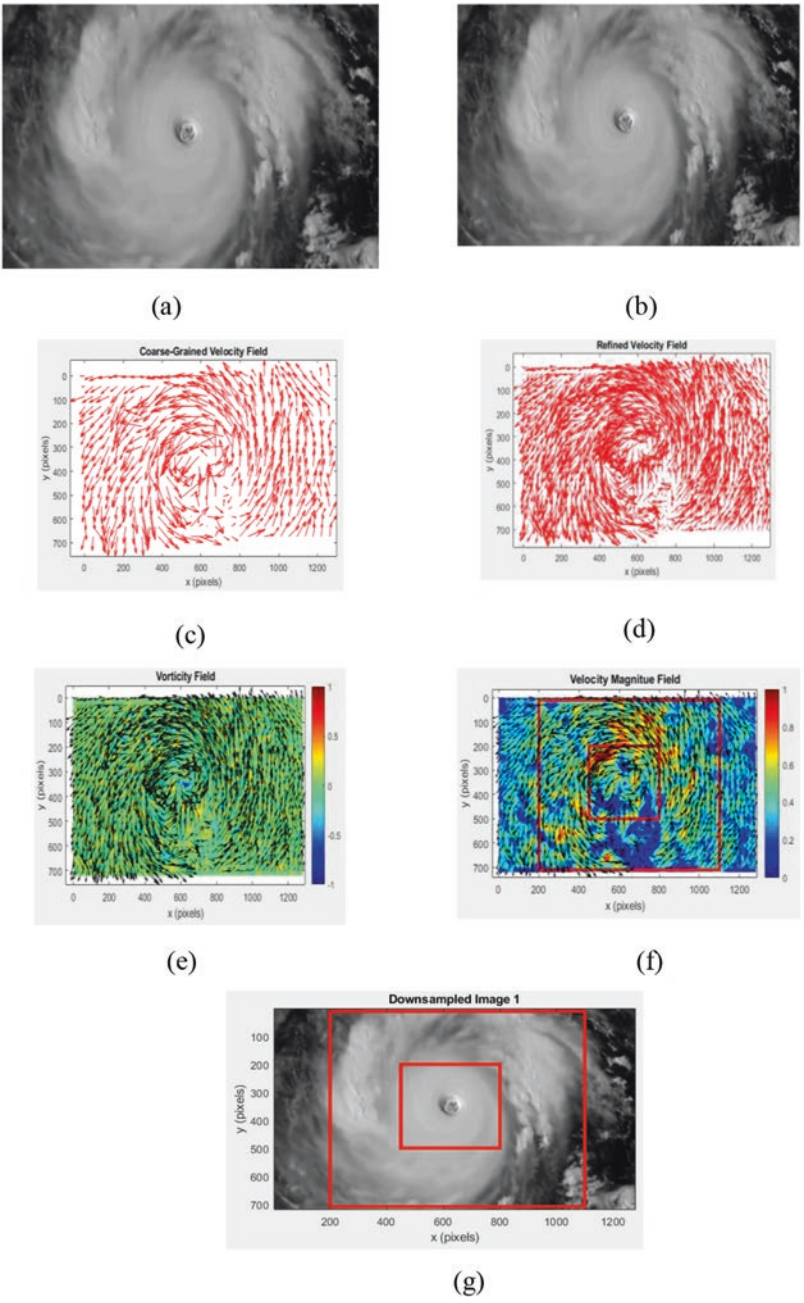

Fig. 7 TC Detection using the proposed method. (**a**) Input TC image 1. (**b**) Input TC image 2. (**c**) Coarse-Grained Velocity Field. (**d**) Refined Velocity Field. (**e**) Final Velocity field. (**f**) Detected TC. (**g**) Final TC detected

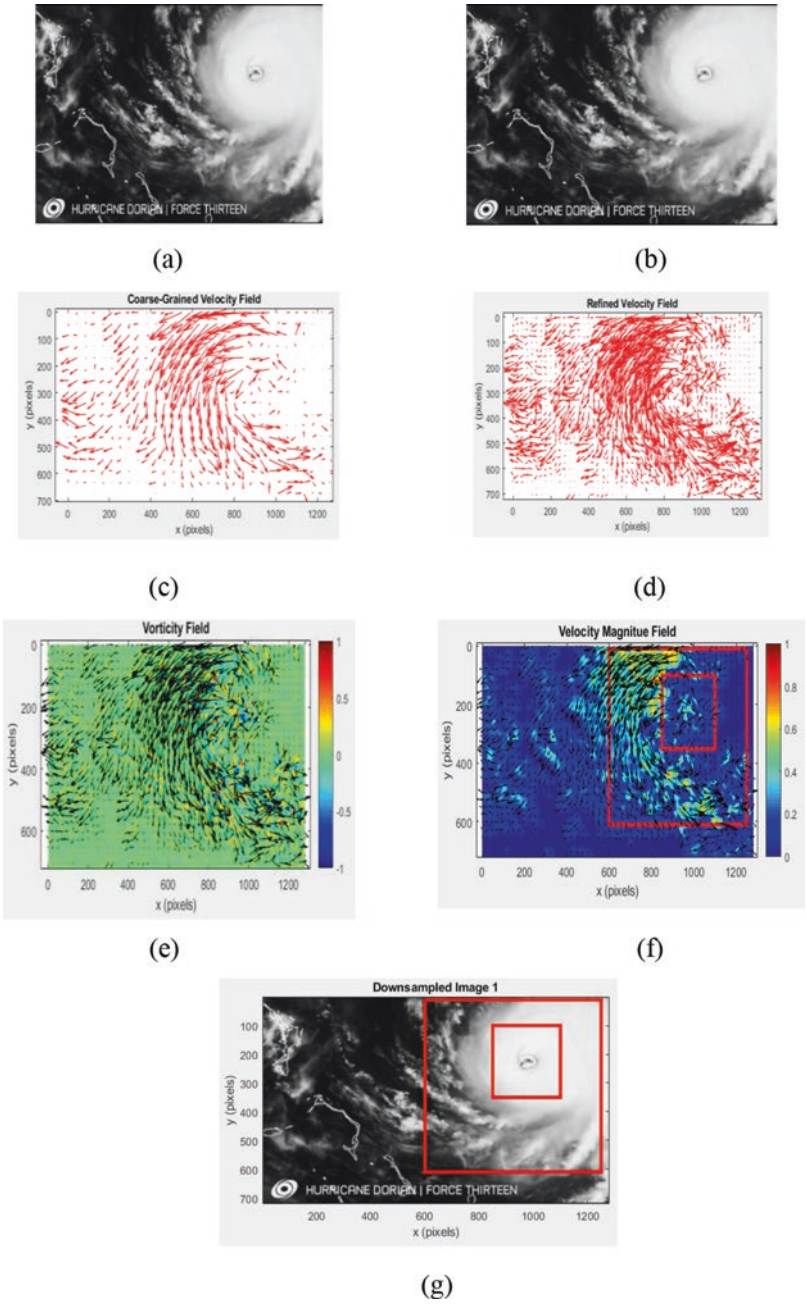

Fig. 8 Hurricane Dorian detection using the proposed method. (**a**) Input TC image 1. (**b**) Input TC image 2. (**c**) Coarse-Grained Velocity Field. (**d**) Refined Velocity Field. (**e**) Final Velocity field. (**f**) Detected TC. (**g**) Final TC detected

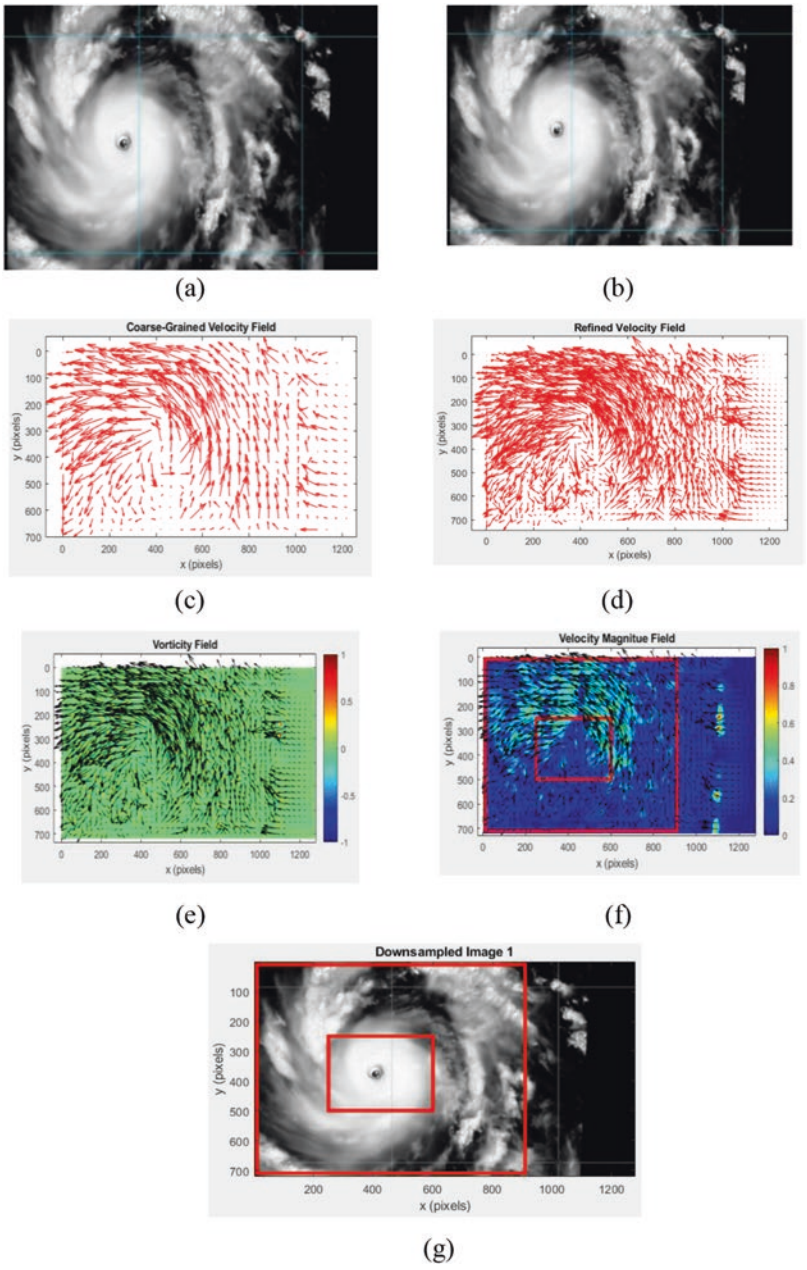

Fig. 9 TC detection using the proposed method. (**a**) Input TC image 1. (**b**) Input TC image 2. (**c**) Coarse-Grained Velocity Field. (**d**) Refined Velocity Field. (**e**) Final Velocity field. (**f**) Detected TC. (**g**) Final TC detected

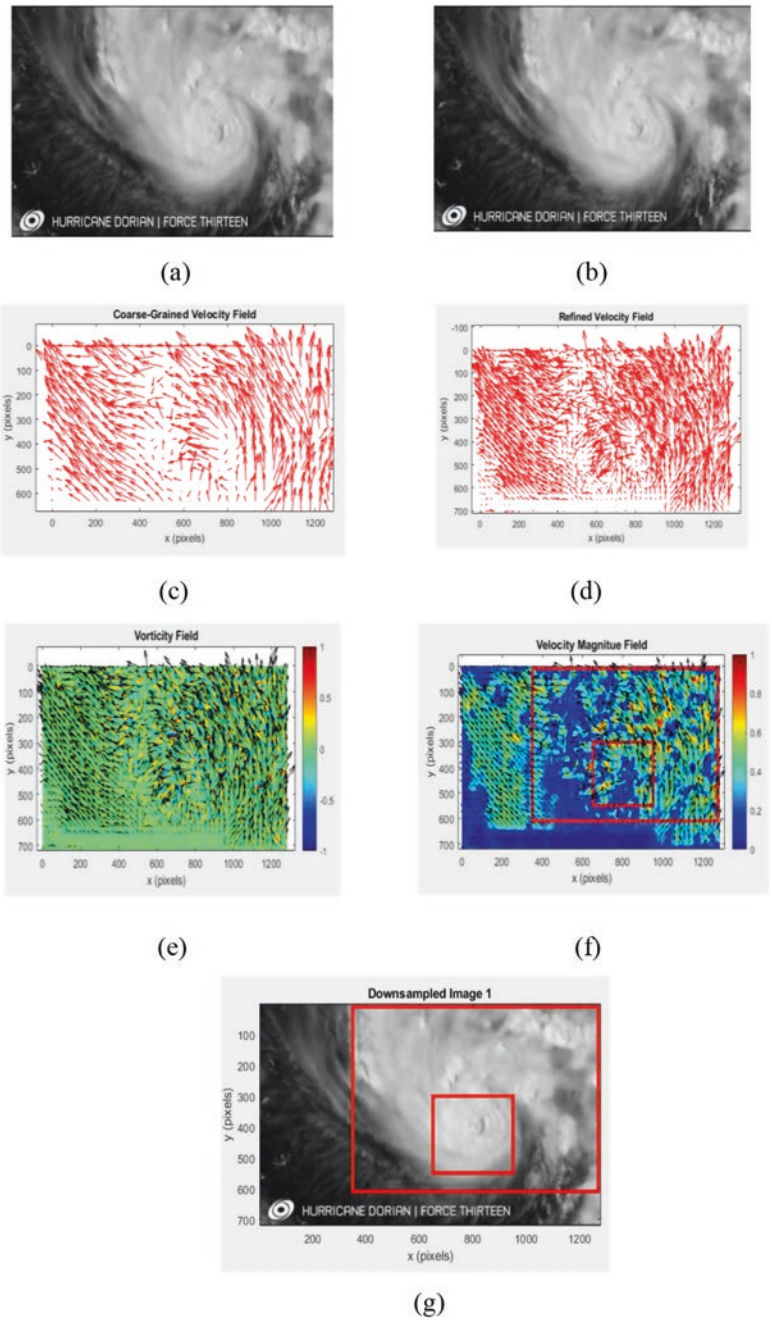

Fig. 10 TC detection using the proposed method. (**a**) Input TC image 1. (**b**) Input TC image 2. (**c**) Coarse-Grained Velocity Field. (**d**) Refined Velocity Field. (**e**) Final Velocity field. (**f**) Detected TC. (**g**) Final TC detected

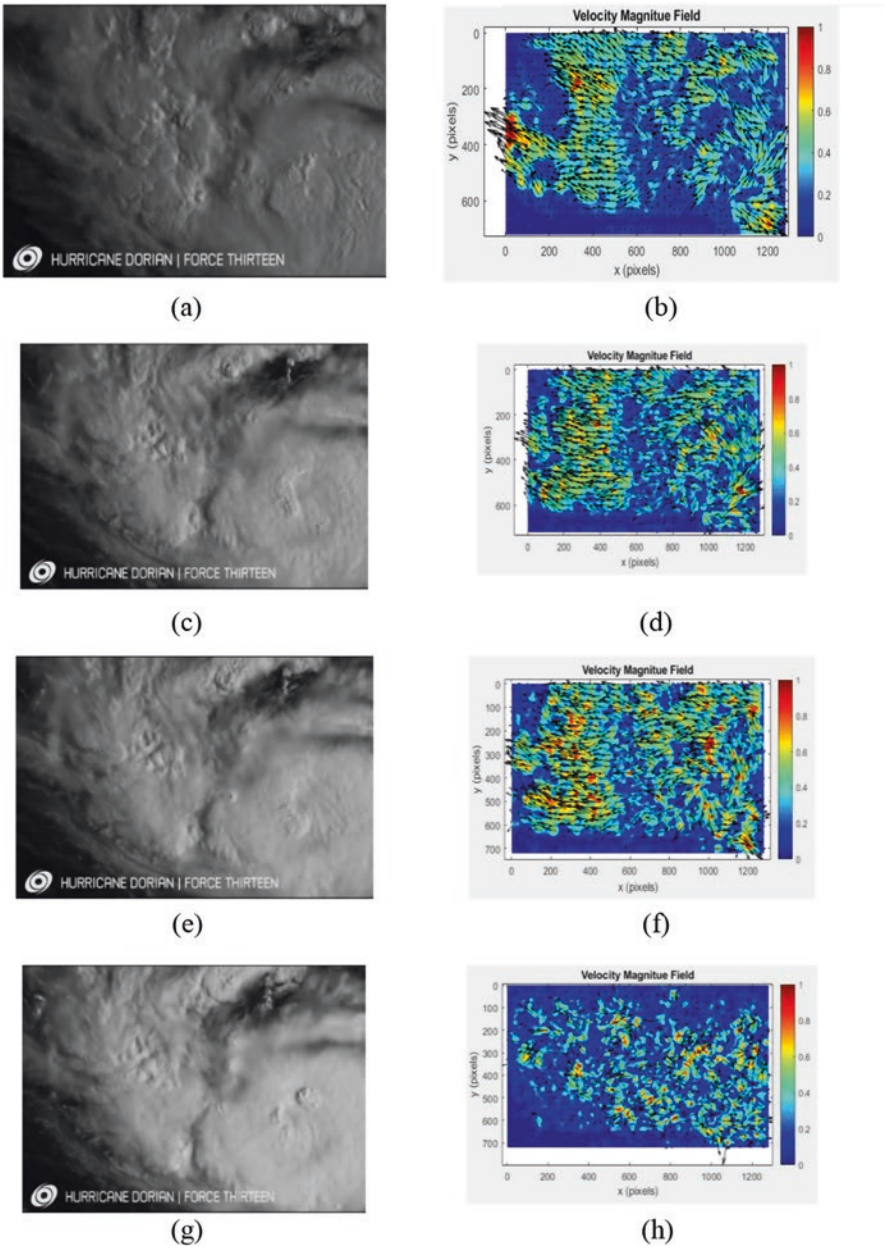

Fig. 11 TC negative samples. (**a**) Input TC image. (**b**) Output velocity Magnitude Field. (**c**) Input TC image. (**d**) Output velocity Magnitude. (**e**) Input TC image. (**f**) Output velocity Magnitude Field. (**g**) Input TC image. (**h**) Output velocity Magnitude Field

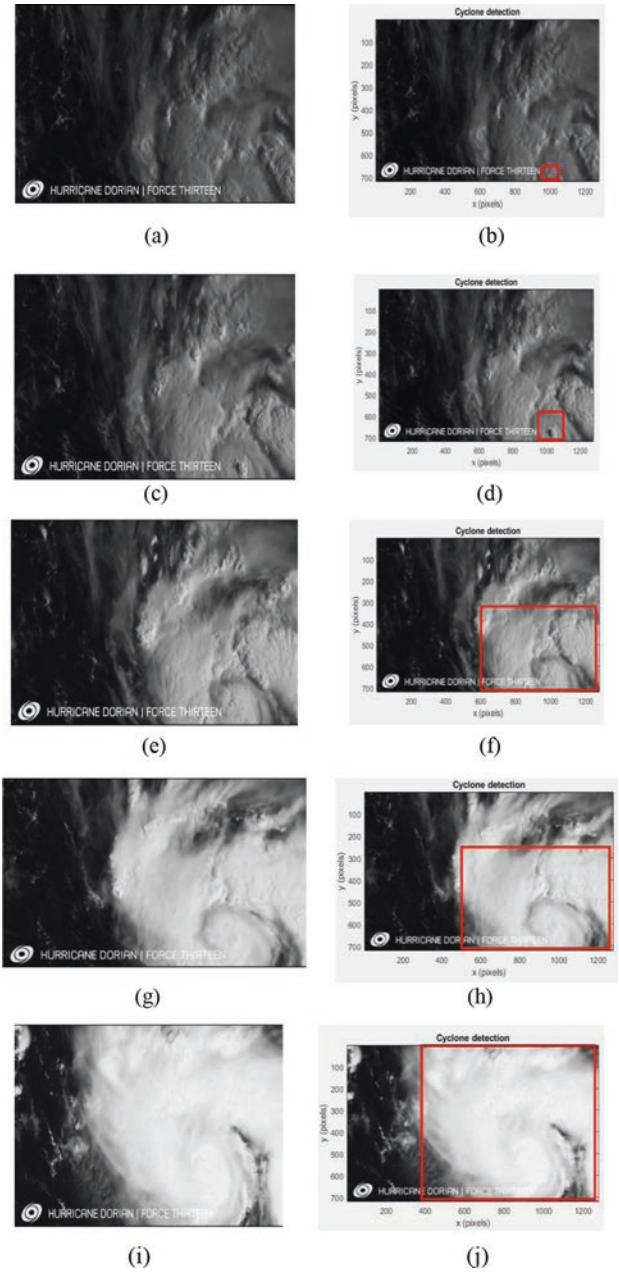

Fig. 12 Cyclone detection while the TC formation. (**a**) Input Image Sequence 1. (**b**) TC detected Output 1. (**c**) Input Image Sequence 2. (**d**) TC detected Output 2. (**e**) Input Image Sequence 3. (**f**) TC detected Output 3. (**g**) Input Image Sequence 4. (**h**) TC detected Output 4. (**i**) Input Image Sequence 5. (**j**) TC detected Output 5

5 Conclusion

This paper proposed a TC detection algorithm using satellite imagery. The proposed algorithm has been implemented on TC image sequences of multiple TCs. The combination of optical flow vector extraction and multiscale CNN in the proposed algorithm detects different sizes of cyclones. The system can therefore detect cyclones while in their initial stages of formation. Early detection can help meteorologists to assess the situation and take proper steps to safeguard humanity. The proposed method achieved an accuracy of 98%.

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Importance of Information and Communication Technology (ICT) in Higher Education Paper

Viney Dhiman, Anupama Bharti, and Vijai Sharma

Abstract The process of ICT becomes an integral part of the process of learning nowadays. The growth and the development of technology are playing an important role in higher education. It helps prepare different learning concepts to enhance the impact of teaching, learning, and research criteria. It highlights different impacts of information and communication technology for providing development to generate different methods. The use of the given technology has changed the procedures in terms of business and governance. The online learning methods provide an experience to adopt suitable factors of consideration used to access educational research to create a proper method of suitable learning based on different analyses. It represents the strategy of the curriculum to provide a demand to the educational practices. It is characterized by providing a descriptive study to link the use of ICT to educational practices.

Keywords Business · Development · Governance · Higher education · ICT · Online learning · Technology · Teaching

1 Introduction

The above article is based on studying the importance of information and communication technology in higher education. The aspects of different changes are based on ICT concepts. It is a process that refers to the different communication technology including different modes such as media applications and services related to the access of manipulation based on higher education. It plays an important role which

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allows students to learn different concepts. It provides different technology to support the process of communication which is beneficial for the students. The spheres of education have changed the practices of the suitable emergence to facilitate higher education growth. It brings many opportunities to explore the changes of education as the concept of ICT emerges practices to promote the criteria of enhancement in information technology. It is based on the approach related to different models for the requirement of the given technology.

2 Literature Review

2.1 Importance of Information and Communication Technology

The process of information and communication technology plays an important role in higher education practices. It deals with different technology to provide a suitable aspect used to interact with the given strategy. According to [1], it consists of different services that include telecommunications and data management to provide a suitable significance to access the information. The concept of communication integrates the experiences in terms of different methods of analysis. It is a useful technology that supports the mechanism of design to promote suitable roles. It helps to merge the devices to provide suitable concepts. In higher education, it includes different computer and Internet techniques, which acts as a powerful tool for educational change to expand education in terms of teaching and learning concepts. It is a diverse set used to manage the information to create different uses to exchange communication [2].

It supports the range of different activities related to learning analytics based on the given concepts' characteristics [3]. It focuses on computer-based technology's infrastructure to provide a suitable contribution such as manipulation and management analysis. The exchange of information provides an approach related to the practices of suitable methods. The organization provides a systematic function related to the factor of the learning process. It supports the process of education to enhance the functions of technology in educational research. In education, the role of education is used to estimate the process to access the factor of education. The definition of knowledge in higher education has achieved suitable functions for implementing communication and information technology. It is based on enthusiasm which mainly focuses on the practices of higher education functionality [4].

2.2 Theoretical Approach

The emergence of ICT has immersed in developing technology to provide a concept of approach related to different factors. For both the students and the teachers, the given technology has provided an outstanding effort. According to [5], it

supports different development concepts to enable the functions of suitable technology factors. It provides a platform to enhance the educational contexts which are related to the concept of learning. The paradigm of learning mainly helps generate the functions of technology to emerge various systems across different organization levels. It adopts the technology of innovation to create perspectives based on the given factor of consequences. The performance of different activities helps to develop the learning use of technology in the phase of communication. The concept of communication in the learning perspectives is mainly involved in the process of adaption.

It usually provides practice to the point of education which tries to connect the method based on different enhancement criteria. The concept of social network has brought a different method of functions related to learning. It is evaluated to develop a suitable method of resolution for the basic use of the development [6] stated that it provides a version of development extended to provide a factor of competence to develop a method of evaluation in the conceptualization of education and learning analysis. It is based on the alternative of the process regarding a suitable paradigm of teaching and online learning. It plays a role to develop different perspectives in the context of higher education. It is convenient to provide an approach based on the various paradigms of teaching and online learning criteria. It is based on stimulus learning response, which provides a factor of assessment to the ICT model.

The approaches are mainly useful to provide a factor of interaction in teaching and learning concepts based on the effectiveness of suitable technology. The concept of information and communication technology is described in the given table in terms of provision, enhancement, and the factor of prevention based on suitable characteristics [7].

The concept of ICT is used to construct the method to determine the process's functionality based on different educational research practices. It helps to represent the different roles that help build the ability to learn to generate the functions useful in higher education. According to [8], it represents the completion of the process based on certain factors used to provide complete in terms of suitable consequences to provide an approach related to the process's perspectives. It facilitates the parameters to describe the concept of education in the analysis of the given method, the information and communication technology.

It promotes the factor of estimation related to the paradigm of communication in higher education functionality. It describes the current development to enable the flexibility of the process related to teaching and learning contexts. It identifies the approach on the basis of different approaches which helps to reflect the phenomenon of education which are collected to modify. It helps to collaborate new technology to implement the method related to the different aspects that are useful to describe the given resource's proper function. It manipulates the skills to develop higher thinking to construct the knowledge related to learning aspects. It includes different aspects of information to better understand the mode of communication in the ICT analysis context [9].

2.3 The Model Used in Information and Communication Technology

Education Transformation Model In the concept of ICT, the education transformation model is used to increase effectiveness to improve the transformation factor's quality in higher education. According to [10], it consists of different factors that are generally used in professional development, research, evaluation, and assessment criteria. The ICT provides a systematic framework that is required to support and improve the quality of education. It increases the competitiveness strategy in terms of improving the process of cohesion. It plays a role in the development of educational approaches that measure education's functionality to produce different outcomes. In the given diagram, there are different terms used to analyze the process of evaluation. It acknowledges the transformation value which offers an opportunity to describe the role of transformation in the higher education context. It develops the factor related to the estimation which is used in information and communication technology in Fig. 1.

The transformation process provides an opportunity related to the practices of education to develop the factor of personality [11] stated that the ICT describes other technology's functionality that provides suitable information to recognize the process's analysis. The curriculum and assessment area involves the conceptual knowledge related to the process of different factors that determine the analysis related to the educational practices in the research context. This model describes research and evaluation functions to gather the collection based on the process's systematic analysis. In the education context, the personal development criteria require different skills related to the addition of the process used for communication

Table 1 The concept of information and communication technology

SI No.	Concept of provision	Enhancement approach	Prevention in ICT
1	Value-added quality	Use of the behavioral approach	Effectiveness of the communication
2	Information related to the development criteria	Providing suitable aspects of technology	Increases the factor of transparency
3	Building the cognitive ability	Promoting the work of estimation	Based on learning in the process
4	Virtual centralization of the learning	Generates knowledge functions	Encourages the creation of development
5	Helps to collect the process of interaction	Providing different experiences	Develop the method of communication
6	Reduces the factor of participation	Used to develop the process in higher education	Interacts with a different concept of knowledge
7	Learning stimulus response	Access the method of education	Preventing the paradigm of ICT in teaching and learning concepts.

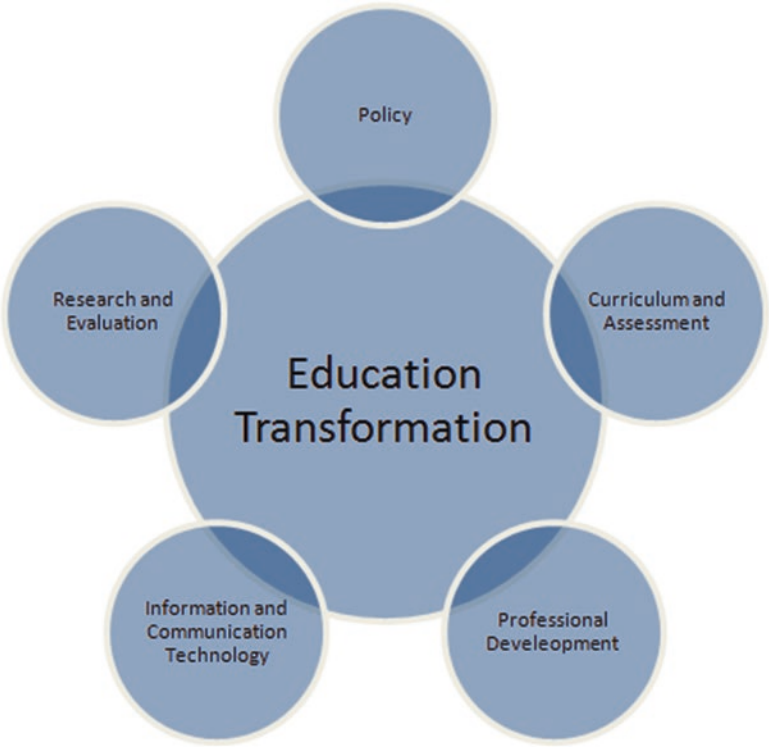

Fig. 1 Education transformation model

purposes. It describes an effective analysis of the process related to the approach of professional development functions. It is a fundamental right that helps create different policies used in the transformation of education.

Technology Acceptance Model This model is used to access the process of information and communication technology in suitable ways. It plays an important function in performing the concept of communication and technology based on perceived usefulness and behavioral intention. It claims certain characteristics based on the interaction of interfaces used in ICT analysis. It collects the different data used to estimate the process to accompany the factor of encouragement which aims to provide a suitable contribution in the research of ICT in higher education. The definition of perceived usefulness is used to establish the technology's perspectives to estimate external variables such as features of the system and criteria of training documentation. The particular system is used to the extent of perceived use to analyze the effort of estimation. It performs a specific function to enhance the concept of information and communication technology [11].

It is widely applied in the technology strategy related to suitable acceptance of the model, requiring the complete acceleration to improve the performance based

on different effects related to the use of suitable factors of evaluation. According to [12], the given model integrates the hypothesis to determine the influence of ICT which provides a proper significance. It is applicable in identifying the models to influence the model's strategy based on the factor of contribution. It defines the attributes which are established mainly to enhance the functionality of the model. The performance of the given models helps measure the strength of intention in actual use which is tested to influence the applications. The process of communication helps in identifying the development of technology for higher education purposes.

3 Materials and Methods

For finding the importance of information and communication technology in higher education paper, the survey was conducted. The questionnaire development took place by asking the students, faculties, and the staff regarding the importance of ICT, and their feedback was stored. According to [13], the participants were asked to rate the importance of information and communication technology on the five-point Likert scales. The questions were asked that meet the needs of ICT and the future needs of the ICT in the higher education paper. We have used the positivism research philosophy in this research, and the descriptive research design has been selected for conducting this study. For fulfilling the mandatory factors in this study, the deductive research design has been used. The participants rated the strong agreement, moderate agreement, moderate disagreement, and the strong disagreement on the five-point Likert scales.

3.1 Research Philosophy

Research philosophy is used in the study to increase the effectiveness of research which deals with the nature, source, and development of the knowledge. Various research philosophies are used to maintain the reliability and data collection needed in conducting the study. According to [14], the different research philosophies are positivism, pragmatism, interpretive, and realism, and among all these, we have used the positivism research philosophy for completing this study. Positivism philosophy is used in this study as it provides a large sample for analyzing the importance of ICT in higher education papers. This research philosophy is highly structured and provides both the analysis, qualitative and quantitative analysis of data. In this article, we have used qualitative data analysis for completing the study.

3.2 Research Design

The framework of the research methods is designed by the research design. It helps in enhancing the efficiency of the study. Research design is used for maintaining the structure of the study. In this study, we have used a descriptive research design. According to [15], descriptive research design helps the researchers find the importance of ICT in higher education papers by asking the participants questions and gathering their feedback. It provides information regarding the current phenomenon and provides the need according to conditions or situations. It is used in the study as it collects a large amount of data to complete the study. To complete this article, we have used a deductive approach to better explain the relationship between the importance of ICT and higher education paper. It follows the logical path to complete the study which makes it more interesting.

3.3 Research Approach

Research approach provides methods and plans for completing the study. The research approach provides various steps for completing the study. There are various types of research approaches used to complete the study, such as the inductive and deductive research approaches. For the completion of this article, we have used a deductive approach to better explain the relationship between the importance of ICT and higher education paper. According to [16], it follows the logical path to complete the article, making the study more interesting. In this research, we have used the qualitative data approach to finding the importance of ICT in higher education papers. The deductive research approach is used as it focuses on the method testing which provides convenience to the research in conducting the research.

3.4 Data Collection and Data Analysis

Data collection is the process of gathering the data about the thesis, and it is one of the important parts in the whole process of study. Research can be conducted based on the data gathered by the researchers. Secondary data collection is used in this article. The researchers gather data through various ways such as through online mode, face to face interviews, or SMS. According to [17], the researchers ask the questions about the study and record their feedback. Data analysis is the second step after gathering the data. The researchers analyze the data after collecting the data and eliminate the data that doesn't satisfy the thesis's needs and check the data redundancy. The authentic data is separated from the whole data. The researchers conducted a survey for knowing the importance of the ICT in higher education paper and the participants rate the level of importance on the scale of 0 to 10 ranges.

3.5 Ethical Consideration

Ethical consideration is an important part of conducting the study. It generates guidelines which must be followed during the whole period of study. According to [18], the researchers should perform the task according to the generated guidelines. The whole study should be completed in some limits, and the authentic way should be used by the researchers to complete the study. The participants in the survey should not harm, or they can't be forced to provide information. All the participants should be treated with full respect and dignity. The name and the information about the participants should not be disclosed; it should be confidential. The researchers should use only authentic data in the research, and they should not use unfair means for completing the thesis. The communication made between the researchers and the participants should be honest and transparent.

4 Result and Discussion

The information and communication technology (ICT) plays an important role in higher education paper. According to [19], ICT helps in the improvements in the social and economical sector and increase the standards of the person. The students can benefit from the ICT as it creates various opportunities for the colleges and universities to achieve diverse knowledge of contents effectively. In the higher education paper, the ICT will help by providing different learning styles and learning abilities in a diverse form. Involvement in the various online activities will develop collaborated skills among the students. The students in higher education who are struggling or disabled can easily get knowledge through information and communication technology. In the survey, 359 people participated to access the importance of information and communication technology for the higher education paper [20] The participants were teachers, students, faculty, and staff. Among all participants, 55 percent of participants strongly agree with the importance of ICT for higher education.

They agreed to learn ICT in the colleges as well as universities. They support the online learning management system. Majority of the people agreed that social media can provide more benefits in exploring the learning and academic skills. In the result, it is found the majority of the students have developed better knowledge retention.

It has been found the ICT helps in saving the time as the students can start their training from any place and also they can access the training system any time whenever they time which is more convenient and less time-consuming for them. According to [21], the students get opportunities to access their higher education through ICT in every situation. Majority of the participants agree that ICT reduces the anxiety among the students and increases the learning satisfaction among the students. In the table, it is found that the majority of the students (53.2% $n = 46$) are

agreed with the higher importance of the information and communication technology in the higher education paper. They support the currently available research capabilities of the higher education paper. They support the development of the currently available tools for the track progress and the research proposals. The questions were asked to the participants in the research about the importance of ICT in their higher education paper. Majority of the students (42% $n = 36$) were in the favor of ICT for developing their knowledge and enhancing their skills and interest.

Majority of the participants agreed with the benefits of ICT in the higher education paper. In the research, it is found that the majority of the students face various problems while using ICT such as the speed of their computer, problems in accessing the Internet, printer issues, as well as the computer backup procedures. These all were of high importance to the students, and these problems became a hindrance for the effective use of the ICT for the higher education paper. According to [22], ICT supports the technologies used in the higher education paper which was majorly supported by the participants. ICT support needs in the electronic testing environments and timely maintenance for enabling the teachers to perform their tasks.

Table 2 Importance of ICT for the higher education paper

Online survey assessments	38.9%($n = 32$)	39.4%($n = 29$)	15.9%($n = 13$)
View all the online active projects in the higher education paper	53.0.2% ($n = 46$)	23.6% ($n = 20$)	15.6% ($n = 13$)
Research capabilities like electronic data for capturing the research data	42% ($n = 36$)	28.2% ($n = 24$)	21.2% ($n = 18$)
Research capabilities for developing the research proposal for the higher education paper	43.2% ($n = 37$)	33.8% ($n = 29$)	15.6% ($n = 13$)

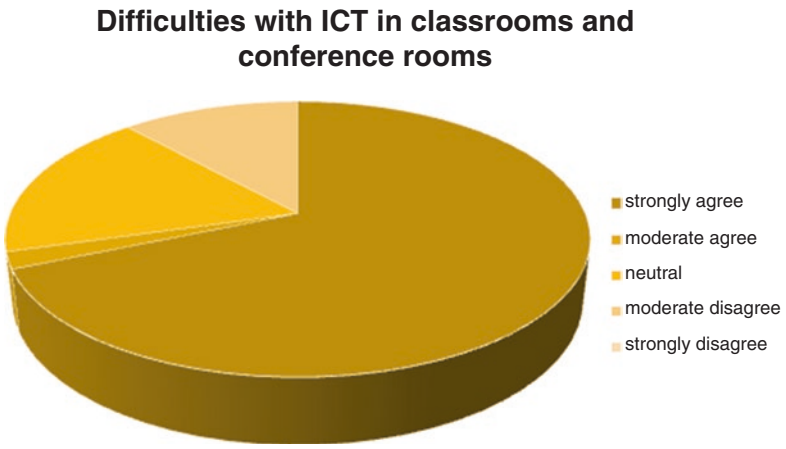

Fig. 2 Difficulties with ICT in classrooms and conference rooms

Figure 2 shows that ICT has major advantages in higher education paper. In the result, it is found that the ICT strategies should be examined in the consideration of the research capabilities of the higher education paper, and the available learning tools should be developed for the track progress and for developing the research proposals. According to [23], the students have supported the research activities through ICT and the faculty and staffs also agree with the benefits of ICT for the paper. The students were supporting ICT as it is less consuming time as well as they can start their training from anywhere and anytime they want. ICT creates interest among the students as it provides a diverse knowledge of the topics. Blackboard system was supported by the majority of the students which signifies that more training is needed for learning the system and Internet properly.

Digital audio and graphic design is not much used, and their importance is still not known by the students. In the result, various problems are found regarding the ICT such as the speed of the computer and the problem in accessing the Internet. ICT personnel give priorities to the maintenance of the conference room and the classrooms. Social media has a major impact on the learning skills of the students as it provides a larger explorer in the form of diverse courses in different learning styles which has highly influenced the students. ICT has the potential to increase access in the training of the students. This potential will include the challenges, needs, and the ICT limitation in the higher education paper. According to [24–27], the limitations of the ICT are they have poor data control as well as mechanism and incompatible software and the inappropriate design of the software creates problems in understanding the importance of ICT. Majority of the participants were in favor of blackboard study as they are more comfortable with the blackboard training which shows that there is a need to provide training for the proper use of the system. Students liked the ICT as a large volume of data they can store which would help them in learning the topics.

5 Conclusion

In this article, we have discussed the importance of information and communication technology in higher education papers. ICT plays an important role in higher education papers as it provides diverse knowledge about the topic as well as encourages the students to develop their skills by using the online platform for their training. Majority of the students like the ICT as it saves time and the students can start their training from anywhere any time. The struggling and disabled students take the ICT platform as a boon as this platform is motivating them a lot. The limitations of the ICT are the speed of personal computers, problems in accessing the Internet, and the issues of printer break. For understanding the proper benefits of ICT, it is important to provide proper training about operating the system. ICT is becoming a part of our lives as it satisfies the present needs with future concern.

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A Brief Analysis of Border Gateway Protocol for Internet Controlling and Malicious Attacks

Sunita Mala and Sujata V. Mallapur

Abstract A network security is an important term to cover Internet applications, devices and technologies. It is a combination of rules and settings used to design a confidential, secure network application. Network security consists of many terms and conditions, policies, unauthorized access control and denial services. A good network security system can help IT and banking applications and reduces theft from hackers. At heavy traffic in network conditions, many stability problems happen. Therefore, advanced network security techniques are necessary to overcome the above limitations. In this paper, a brief survey is performed on various network security issues and protocols. This paper proposes papers concerning network security research in Internet applications. Moreover, an advanced analysis is performed on metrics, and related network security techniques are also reviewed from earlier contribution. Finally, this survey concentrates on various research problems and weaknesses that may help investigators initiate modern network security methodologies on the Internet.

Keywords BGP · DBSCAN · Internet applications · Network security

1 Introduction

Internet routing protocols are more responsible for transmitting information between devices. The monitorization of the Internet routing protocols are more responsible for transmitting the information between devices. The monitorization of significant

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network task in Internet applications. To recognize the characteristics of heavy traffic in the network causes system performance degradation. The non-linear statistical analysis of this protocol estimation is synchronized with autonomous Internet systems [1]. The anomaly detection techniques give client security at server many BGP usages, and its disadvantages are mentioned [2]. The "Border Gateway Protocol (BGP)" is a generic external case diagram ability to generate on the network details on routing and accessibility between autonomous systems (AS). The protocol is sometimes categorized as a protocol for a route vector but is often also listed as a protocol for distance-vector navigation. By manual intervention between routers, BGP neighbours, called peers, are created to build a TCP session on port 179. To preserve the connection, a BGP speaker sends 19-byte keep-alive messages every 60 seconds. BGP is unusual amongst routing protocols in utilizing TCP as its transfer protocol. This method is being used to share Internet routing details and is the protocol used by separate ASes between ISPs. The procedure could use an arbitrary topology to communicate any independent information system around each other.

Figure 1 clearly explains the BGP clustering analysis. In this Internet, fog devices and clients are interconnected with various nodes. This mechanism is providing security to all devices connected to the network. Every cluster consists of clients, nodes and network elements. The BGP is the network security protocol, which is implemented through conventional methods. Without machine learning approaches, this application provides less accuracy of results, so that a machine learning-based BGP is required for future network security applications.

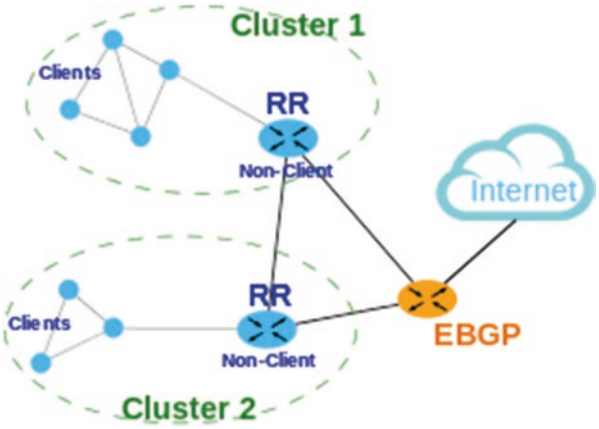

Fig. 1 BGP

2 Literature Review

This research would specifically concentrate on evaluating BGP upgrade messages because of available data. To sync port numbers, peers use data packet. If one peer router updates its routing table, an update message will alert the other peer router. The purpose of using this communication is to let other channels know about such system modifications. There has been a prolonged discussion as to whether the level of dissemination of the network at the AS level complies with the rule of power. The lack of a conclusive statistical test is partially due to this controversy. The spectrum is strongly distorted, and 98.9 percent is the correlation coefficient with a minimal square error fitting. However, numerous mathematical metrics could also be used, and one could protest about the precision of the approximation. Based on the source we consider more comprehensive and reliable intent or degree for statistical trust report, the report response may differ based on the BGP signals. We advocate a reconciliatory divide-and-conquer strategy to resolve the debate. We suggest modelling the mobility pattern separately according to the edge type: provider-customer and peer-to-peer. For model estimation, we assert that this will be a more reasonable approach.

Table 1 clearly explains a brief literature survey of many methods, which provide less accuracy and low functionality. An advanced modern protocol design is necessary for network security applications. Jianning Mai et al. implemented BAlet, a system for achieving temporal and spatial BGP anomaly localization. This first analysed BGP change count signals' self-similarity and concluded that total BGP traffic signals are self-similar with the parameter H about 0.8. Thanks to its strength in treating self-similar signs, we used wavelet analysis for temporal localization of the anomalies. The variance score and recurrent signal-based equations are used and proven useful in identifying volume anomalies at various periods. BAlet takes only a simple number of messages to upgrade BGP, so it is flexible and sufficient for online surveillance. In finding irregularities behaviourally but temporally, our two-dimensional clustering approach opens up more possibilities [15].

Dejing Dou et al. explain that this brings us a step forward into active interdisciplinary studies between network protection and data mining, such as analysing BGP incidents, in solving real-world problems. We would research irregular incidents on a smaller scale (which appear to be more challenging to detect). We could only impact particular networks in comparison to the global incidents we studied in this article.

The further review also warrants the derivation of rules that can develop over a prolonged period, the introduction of other data mining strategies (such as outlier analysis and graph mining) and our work's applicability to the BGP analysis phase as well as other BGP-based network security [16].

Figure 2 clearly explains BGP functional block diagram. In this DB scan, model selection and storage units are monitoring the front-end security information. In

Table 1 Literature survey

Ref	Technique	Key points	Limitations
[3]	TCP/IP protocol	The TCP/IP architecture is focused on networking on a six-layer model. There are the physical, data connexion, network, transport and device layers, from the bottom (the connexion) to the top (the user device). The model fully specifies not all layers, so external specifications and standards "fill in" certain layers	This communication and network security protocol mainly concentrate on transmission and reception
[4]	Session-seminar	In this meeting expert committee only discussed on routing mechanism but not the security	Network security issue not over crossed
[5]	Lecture on BGP	A path feature is a marketed BGP route aspect that is included in the update message. It contains destination data, such as the next-hop address. In BGP route estimation, path aspects are important	In this session, resource persons only concentrate on communication points only
[6]	BGP security scheme	To connect, GP is the default routing protocol introduced by routers, thereby facilitating data routing on the internet. To meet the right target, there are processes to obtain knowledge on the most suitable and quickest path for data to take	Economically high-end design
[7]	BGP anomalies wavelet	This work is inspired to apply the same methodology to BGP routing traffic by the power of wavelet analysis in managing signals with scaling property and earlier progress in applying it for network anomaly detection. BAlet is able to spot potential network-wide anomalous incidents later by clustering the abnormalities observed at various places	Design is more strength, but functionalities are less accurate
[8]	Abnormal BGP events	Rations or power shortages could have significant implications for the regular functioning of the border gateway protocol (BGP), which is responsible for delivering packets across various autonomous territories, a crucial activity for the Internet's functioning	Robustness is less
[9]	–	In the global routing system, BGP is the foundation. The GRS needs to be regularly tracked to maintain its stability	Explains general instructions of BGP
[10]	RIPE NNC	A non-profit membership group that funds communications technology in our service area by technological cooperation. The regional internet registry (RIR) offers global internet infrastructure and relevant services (IPv4, IPv6 and AS number infrastructure) as our most influential operation	Only providing the communication
[11]	RFC 6396 model	In recent years, details about a protection specification that will help protect the border gateway protocol (BGP) have been released by the US National Institute of Standards and Technology (NIST)	This model only deals with background applications
[12]	BGP model	Protocol implementation	–

(continued)

Table 1 (continued)

Ref	Technique	Key points	Limitations
[13]	Network security protocol	The border gateway protocol is an alternative gateway protocol used by autonomous systems (ASes) to submit modified data regarding network topology changes. Knowledge of network accessibility is found in BGP formulates	This model is useful for prototypes, not for real-time applications
[14]	BGP anomalies	Only a simple number of BGP update messages received over a certain time is needed. In BGP update traffic, we first examine the self-similarity and present a quantitative validation. We are inspired to apply the same methodology to BGP routing traffic by the power of wavelet analysis in managing signals with scaling property and earlier progress in applying it for network anomaly detection	It is not suitable for all types of applications
[7]	Detecting BGP	Our approach does not focus on any details inside the BGP emails and acts as a complementary tool for more comprehensive root cause analysis to minimize the candidate data collection. On actual BGP data sets that are considered to include irregularities, we test BAlet. Results suggest that it can detect network-wide incidents such as slammer worm assault communication volume spikes and distinguish impacted ASes from the rest	It is not working for cloud-based applications

real-time data flow row-wise data collection, the long-term storage is maintained through HDFS big data fundamental applications. On this hand, shaking and RFO-DB-BGP maintains clustering engine analysis.

The key role of BGP is to share information on network accessibility with other BGP frameworks. The Border Gateway Protocol establishes a graph of automated driving based on data exchanged amongst BGP routers. Table 2 clearly explains various network and communication protocols available in the current technology. In this TCP, TTL, router and IP application purpose is designed for network applications. The weights are allotted like medium, high and low. These techniques are useful for particular applications in different platforms [17–23].

Table 3 indicates different BGP event analysis and actions taken.

Analysis of Performance Measures

The performance measures obtained in the reviewed works are represented in Table 4 and indicate that performance is low.

Analysis of Protocols

The protocol analysis of the BGP obtained in the reviewed works is represented in Table 5. The IETF's IPsec Working Group specifies IPsec. It offers protection for any two IP entities, integrity and user protection. Using an IETF-defined key management protocol called Internet Key Exchange, cryptographic key and security review management can be performed manually or dynamically (IKE). The

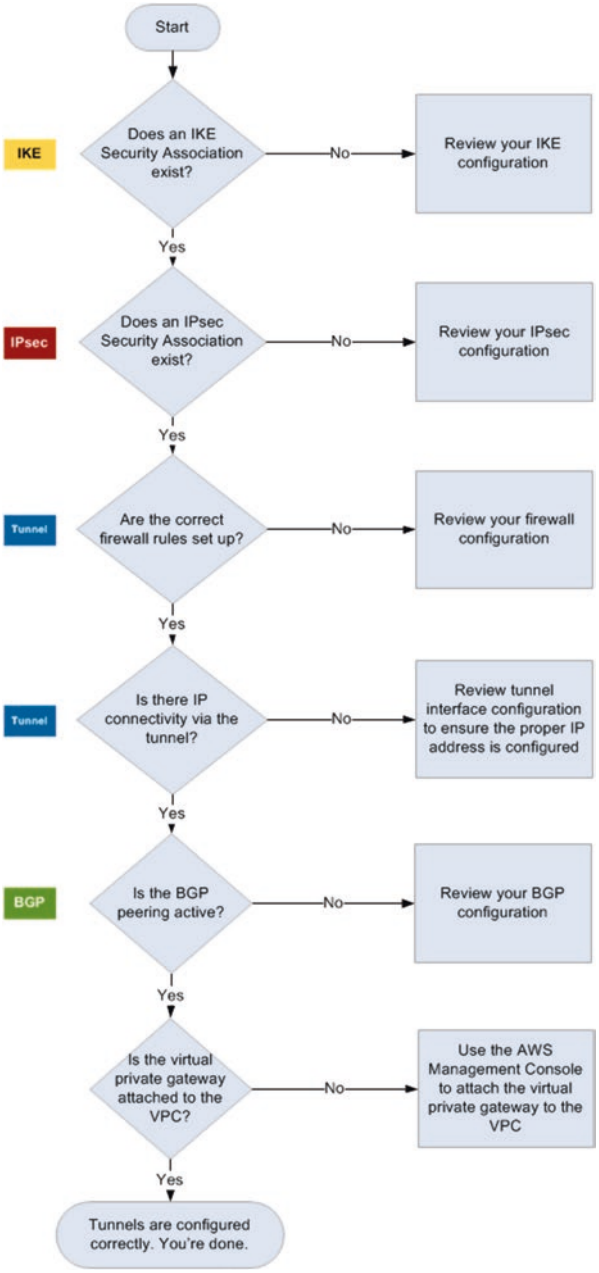

Fig. 2 Network protocol flow

Table 2 Various models' analysis

Model	Weightage	Cost	Technique
TCP sequence number checking	M	L	The advanced embedded framework differs. Linux, FreeBSD, OpenBSD, etc.
TTL hack	M	L	Easy setup option; one hop away, not successful against machines
Router access control	H	M	Type 3 ICMP block packets codes 2, 3 and 4. See also NISCC vulnerability advisory ICMP -5,329,677. See also NISCC security vulnerabilities advisory ICMP -5,329,677
IPsec authentication	H	M	Broadly accessible, substantial admin expenses may be available

performance measures like mean square error, NPM QOS, F1 score and SC parameters are analysed. Two variants of the IKE protocol exist: RFC 2409, the Internet Key Exchange (IKE) and similar RFCs describe IKE version 1.0 (IKEv1). This is the model that z/OS® Communications Database has been promoting for some time.

RFC 5996, Internet Key Exchange Protocol: IKEv2 and similar RFCs describe IKE version 2.0 (IKEv2). With z/OS V1R12, compatibility for IKEv2 has been added.

It can build Private Virtual Networks with IPsec (VPN). A VPN allows an enterprise, via a protected network called a security alliance, to expand its private network through a public network, such as the Internet. IPsec VPNs allow the safe sharing of data for same-business and business-to-business interactions over the public Internet and protect confidential data within the company's external network.

The Communications Server safeguards data and other tools on the device. Communications Server systems use RACF services to ensure users' identity and authentication seeking device access and secure data and other unauthorized users' machine resources. By defending against denial of service attacks from the network, the Telecommunications Server protects limited companies.

By supporting many cryptographic-based network security protocols such as IPsec and TLS/SSL, the Communications Server safeguards network data. The SSH protocol is also supported by z/OS. These protection protocols guarantee the identity of the contact partners (partner authentication) that the data sent comes from the requested source (verification of the origin of the data) that the information is unchanged in transit (the integrity of the signal). That sensitive data is hidden using cryptography (data privacy).

The Communications Server provides security incident monitoring to record possible security breaches. These services will help you detect potential sources of subsequent attacks, respond to network attacks more quickly and control wearable smart for major aspects throughout periods of high Internet traffic.

With cryptography, the cornerstone of good security procedures begins. Using encryption, authentication and data integrity, cryptography keeps the data and communications secure. Encryption systems prevent classified information from being accessed by a client other than the intended one. Cryptographic identification and

Table 3 BGP event analysis

State	Event	Actions	Message	Next state
Idle	BGP start	Start ConnectRetry timer. Start a transportation link tool	Not applicable	Connect
	Others	Not applicable	Not applicable	Idle
Connect	BGP start	Not applicable	Not applicable	Connect
	Open transport connexion	Full ConnectRetry timer initialization	OPEN	OpenSent
	The transportation link available failed	Restart ConnectRetry	Not applicable	Active
	ConnectRetry timer expired	Restart the ConnectRetry timer link	Not applicable	Connect
	Others	Not applicable	Not applicable	Idle
Active	BGP start	Not applicable	Not applicable	Active
	Transport connection open	Full ConnectRetry timer initialization	OPEN	OpenSent
	Transport connection open failed	ConnectClose ConnectRetry timer	Not applicable	Active
	ConnectRetry timer expired	Restart the ConnectRetry timer link	Not applicable	Connect
	Others	Not applicable	Not applicable	Idle
OpenSent	BGP start	Not applicable	Not applicable	OpenSent
	Transport connection open	Close transportation ConnectRetry timer		
	Transmission tragic mistake	Upgrade resources	Not applicable	Idle
	Receive a notification	Processes OK	Not applicable	OpenConfirm
		Failed procedure	NOTIFIQUES	Idle
	Others	Near transportation link release capital	NOTIFICATION	Idle
OpenConfirm	BGP start	Not applicable	Not applicable	OpenConfirm
	Transport connection open	Upgrade resources	Not applicable	Idle
	Transport fatal error	Upgrade resources	Not applicable	Idle
	KeepAlive timer expired	Restart KeepAlive	KEEPALIVE	OpenConfirm
	Receive KEEPALIVE.	Full initialization restart hold timer	Not applicable	Established
	Receive NOTIFICATION message	Near transportation link release capital	Not applicable	Idle
	Others	Near transport connexion release capital	NOTIFICATION	Idle

(continued)

Table 3 (continued)

State	Event	Actions	Message	Next state
Established	BGP start	No one else.	Not applicable	Established
	Transport connection open	Upgrade capital	Not applicable	Idle
	Transport fatal error	Upgrade capital	Not applicable	Idle
	KeepAlive expired	Restart KeepAlive timer	KEEPALIVE	Established
	Receive KEEPALIVE message	Restart hold timer	KEEPALIVE	Established
	Receive message UPDATE	System upgrade OK	UPDATE	Established
	Receive message UPDATE	Process upgrade fails	NOTIFICATION	Idle
	Receive message of notification	Near transport connexion release capital	None	Idle
	Others	Near transportation link release capital	NOTIFICATION	Idle

Table 4 Performance measures of earlier models

Method	Mean error	NPM	QOS	F_1	SC
GA	0.612 – High	0.812 – High	0.358 – Less	0.489 – Low	0.89 – Low
DT	0.258 – Low	0.612 – Moderate	0.284 – Less	0.387 – Moderate	0.91 – Low
NN	0.311 – Moderate	0.519 – Low	0.158 – Moderate	0.289 – Low	0.899 – Moderate
SVM	0.35 – Low	0.812 – High	0.156 – High	0.658 – Low	0.914 – Moderate
KNN	0.19 – Moderate	0.719 – High	0.184 – Low	0.71 – Moderate	0.915 – Moderate
BGP-DT-RFO	0.14 – Very low	0.659 – Low	0.139 – High	0.951 – High	0.9457 – Good

Table 5 Protocols analysis

Protocol	Delay	Overhead	Reliability	Support
BGP traffic	Low	High	Medium	Low
BGP anomaly	High	High	Low	High
Demystifying BGP	Low	High	Medium	Medium
BGP recommendation	High	High	High	High
TCP	Low	Low	Medium	Low
Ad hoc network	High	High	Low	High
Routing protocol	Low	Low	High	Low

data integrity systems make it easy to detect whether data is changed in transit by contacting hosts. Public key cryptography may identify hosts or users and authenticate them. In the stable development of symmetric session keys for all security endpoints, public-key cryptography can also be used. After a stable session is established, only if both hosts have the appropriate session's keys can effective fixed platform and encryption keys occur.

A part of the data path or end to end, whichever is suitable for the security strategy, may be added to cryptographic security solutions. Generally, as cryptographic techniques are used end to end, the greatest degree of security is given. However, where only aspects of the data path are deemed untrusted by an enterprise (such as the Internet), cryptography is necessary to encrypt only the untrusted component. Protection protocols that can be modified to cover parts of the data path or the whole data path are given by z/o.

3 Research Gaps and Challenges

Many network security controlling algorithms are available, but these are facing issues at the time of heavy traffic. The measures like count of the announcement, Interior Gateway Protocol (IGP), Exterior Gateway Protocol (EGP) and incomplete sources over time are conflicting incompatible issues. Along this observation time, individual states and hidden states are not controlled by this BGP. In superior knowledge, a machine learning-based network security model is essential for detecting intrusions, network anomaly and miscellaneous issues.

In this section, many conventional network security protocols are discussed with earlier methods. The existed methods with BGP cannot solve all type of network issues shown.

4 Conclusion and Future Work

A detailed analysis of numerous field network security models on the Internet has been presented in this article:

- This paper analysed 25 articles and subsequently carried out an important study of numerous methods, characteristics and difficulty.
- In this work, the success metrics and the corresponding maximum accomplishments were evaluated for each contribution.
- Finally, this paper identified the study concerns that could be valuable for researchers who have carried out more network security work in Internet applications.

In this research work, the network security analysis is verified with many conventional methods. The earlier methods cannot provide high-end security for

network applications. Existing network security models do not recognize the attacks like DoS attack, slammer attack, miss configuration and block out attacks. Therefore a robust network security protocol is required for advanced future generations, so that in this research work, BGP-DT-RFO-based network security protocol is proposed to implement and verified on python, java software. This work has outperformed the results and competes with earlier methods.

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Hybrid Blind Watermarking Using RDWT-DCT in Singular Value Decomposition Domain

D. Rajani and P. Rajesh Kumar

Abstract Image watermarking plays a major role in the field of communication. Applying the watermarking on the symbol provides higher imperceptibility and robustness properties with cover data help. Thus, various implementations are focused on non-blind watermarking (NBW) schemes combined with various transformations to perform this watermarking. The NBW methods do not have the accurate functionality to provide the maximum imperceptibility, embedding capacity standards, and the lack of robustness, respectively. Thus, to overcome these problems, this article focuses on implementing the proposed watermarking framework that utilizes the singular value decomposition (SVD), discrete cosine transform (DCT), and redundant discrete wavelet transform (RDWT) jointly, so the properties of the threes methods function together and give the higher performance. The proposed RDWT-DCT-SVD watermarking scheme simulated and compared for the various quality metrics such as normalized correlation coefficient (NCC), root means square error (RMSE), and peak signal to noise ratio (PSNR). Comparing the various existing methods shows that the proposed method gives higher imperceptibility and robustness properties.

Keywords Singular value decomposition · Discrete cosine transform · Redundant discrete wavelet transform · Blind watermarking

1 Introduction

In the simplest of terms, watermarking is concealing a message (image, audio, video, etc.) into the other media without substantial alterations in it. It is the undetectable message that can, later on, be extracted intact. The process involves a watermark

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embedding algorithm and an algorithm to extract the watermark using a key. The key here is what makes the watermark secure from third party users [1]. The invisibility of a watermark further secures the content, especially images which are highly prone to infringement. In [2], the basic classification of watermarking algorithms based on their characteristics and the domain being used for embedding, namely, the spatial domain and the transform domain, has been given. In the spatial domain, the watermark is directly embedded into the host image's pixels, and in the transform domain, the host image is transformed using discrete techniques. Then the watermark is mapped into the cover image. A little distortion or malicious manipulation may lead to incorrect findings [3, 4]. Therefore, the prime concern is the authenticity and ownership identification of the data [5]. One of the potential solutions [6] to better address the issue is digital watermarking. Besides authentication, most watermarking techniques can detect malicious tampering and locate the tampered area successfully [7]. Fragile watermarking techniques facilitate the detection of small changes in the image precisely [8]; hence these techniques are employed for authentication and tamper region identification. Robust watermarking techniques do not alter the watermark much, irrespective of the changes in the image. Therefore, these techniques are employed for the protection of copyright, ownership identification, and security. Dual watermarking techniques to cater to both requirements are emerging where robust and fragile watermarks are used in the same cover image [9–11].

These methods fail to provide the maximum imperceptibility properties, so the proposed work is contributed in the following manner to give the maximum robustness and imperceptibility.

- Implementation of a novel hybrid framework by combining the functionalities of RDWT-DCT in the SVD domain to overcome the drawbacks of existing BW frameworks like RDWT-PCA with IGWO, IWT-PSO, and Takore et al., W-PSO.
- The framework is tested with various cover images and quantitative analysis also performed.

The rest of the paper is contributed as follows: Section 2 deals with a detailed analysis of various existing methods with their drawbacks. Section 3 deals with implementing the proposed RDWT-DCT-SVD watermarking embedding and extraction procedure with detailed operation flow. Section 4 deals with the various simulations along with a comparison with the literature. Section 5 concludes the proposed method with possible future implementations.

2 Literature Survey

A blind watermarking technique is presented by authors in [12] in which dual watermarks are inserted into a host image. This method involves merging and embedding two binary watermarks into a cover image using coefficients of DWT-DCT of the cover image. It permits the multi-fold embedding of two watermarks in the cover image, making this technique more robust. Authors in [13] have presented a DWT-DCT-SVD-based

multilevel watermarking procedure intended for image authentication based on Weber's law. The image's preferred pixels' intensity quantization is performed to embed a watermark that can detect even little changes applied to the watermarked image and trace distorted portions. In [14], the authors presented that the host image is partitioned as a region of interest (ROI) where a watermark image is inserted for authentication along with the region of non-interest by using DWT-SVD, a scrambled or encrypted EPR as a text watermark is inserted for copyright protection and security.

In [15], the authors published a novel implementation of a robust dual watermarking technique for medical images. Arnold transform is used to scramble the pixel locations. RDWT is applied on the scrambled pixels to weaken correlation characteristics and produce many coefficients to accommodate the watermark [16]. offered a strong multi-watermarking technique using RDWT-DCT and Henon map encryption to provide better security to the watermark and proposed a digital image watermarking that is constituted by using RDWT and DCT. They watermarked various watermarks in image and text into different parts of the medical image differentiated by ROI and NROI parts. They used a special encryption method to secure patient identity by using the RSA technique before starting the watermarking process. The embedding is done by dividing the original/cover image into ROI and NROI divisions. They applied second-level RDWT on these two different parts to get sub-bands like LL2, LH2, HL2, and H2. Afterward, they applied third-level DWT transformation on the watermark image, followed by DCT transformation on the LL3 sub-band. Now the patient information file is watermarked and encrypted using the cryptography technique to generate the watermark image. Watermarked image is formed via applying reverse DCT and DWT. Afterward, ROI and NROI parts are merged to form the final result of the medical watermarked image. In [17], the authors presented hybrid watermarking with RDWT and SVD. They applied a binary algorithm to select the best place to embed a watermark logo on this LH and HL band. A watermarked image is formed by sorting binary watermarking bits into spaces selected by a binary algorithm. Finally, they embed the watermark into considerable wavelet coefficients inactive blocks with strong edges according to the binary algorithm.

These methods apply the embedding strength factor manually by the user-dependent [18]. But it is very difficult to identify the embedding strength factor. Thus the authors introduced bio-inspired algorithms for the calculation of embedding strength factor. Various types of bio-inspired algorithms are particle swarm optimization (PSO), ant colony [19], genetic algorithm [20] etc. In [21], the authors proposed watermarking embedding process by dividing the cover image into four sub-bands by applying DWT followed by SVD on the LL band. Then they modified the singular value coefficient with the watermark coefficient by using PSO-based scaling factor.

Finally, they reconstruct the image by updating singular values followed by applying inverse DWT to get the watermarked image. In [22], the authors discussed the watermarking embedding process by applying DWT on the cover image of size 512*512. They obtained four sub-bands out of that original image along with PSO optimization. Then they chose the LL band and applied DCT to collect the DC value from the coefficient matrix. Afterward, they applied SVD on the DC component, and they added singular value with the coefficient obtained earlier. The new singular value was adjusted

with the DCT coefficient matrix's DC value, trix, followed by inverse DCT and inverse DWT to obtain the watermarked image. In [23], the authors presented comparisons of various previously mentioned watermarking algorithms. The comparison reflected that different wavelet choices had different impacts on the extracted watermark quality. In our paper, we have made use of the iterative wavelet transform. In recent years it has attained considerable attention owing to its good stability. In [24], the authors presented the RDWT on the host image segmented into four sub-bands. DCT was applied to each one, and singular values were obtained and embedded into the watermark sub-bands with improved gray wolf optimization (IGWO). This hybrid method gave more promising results in terms of performance evaluation metrics [25]. Lai and Tsai introduced a DWT-SVD-based hybrid algorithm, wherein the watermark was embedded by varying the singular values of the high-frequency sub-component.

3 Proposed Method

Generally, a watermarking framework consisting of embedding and extraction procedures is exactly opposite to each other. Embedding phase consists of hiding the source image by the cover data and results in the output as the watermarked image. Similarly, the watermarked image extraction procedure is applied and results in the outcome as original cover data. During the extraction process, various kinds of applied attacks are removed, and system performance increases rapidly. To overcome the drawbacks of existing image watermarking procedures, the proposed watermarking scheme is developed with the DCT, RDWT, and SVD properties and formed the hybrid RDWT-DCT-SVD method. The major intention of the hybrid approach is that it can avoid the drawbacks of individual methods. The resultant watermark shows high imperceptibility properties and greater performance against both non-geometrical and geometrical attacks.

3.1 Watermark Embedding Algorithm

Consider the watermark image W and cover image C for watermark embedding process and results in the output as a watermarked image W_{out}. The detailed operation of the watermark embedding is presented in Fig. 1. The stepwise operation is described as follows:

Step 1: On both C and W image, apply the RDWT transformation, respectively. Applying RDWT on C will result from the outputs as HH_C,LH_C,HL_C, and LL_C. Similarly, applying RDWT on W will result in the outputs as HH_W,LH_W,HL_W, and LL_W. Among these bands LL_C and LL_W bands are considered for further operation as they contain maximum image information compared to the other bands.

Step 2: On LL_C and LL_W bands, apply the DCT transformation individually and result in the outcomes as LL_{Cd} and LL_{Wd} bands. The DCT transformation mainly

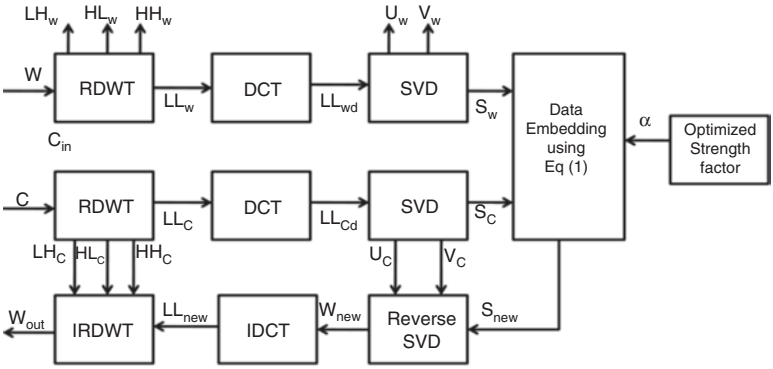

Fig. 1 Proposed watermark embedding framework

focused on reducing the attacks on every frequency bands using multiple frequencies. And DCT also used to synchronize the cover image pixel locations with watermark image pixel locations during the embedding procedure.

Step 3: On LL_{Cd} and LL_{Wd} bands, apply the SVD transformation individually and result in the outcomes as $\{S_C, U_C, V_C\}$ and $\{S_w, U_w, V_w\}$ bands. To provide the robustness and imperceptibility on the watermarked image, then the SVD play a major role by utilizing the singular matrixes. S_C and S_w are considered and applied to the next stages for embedding purpose, whereas the $\{U_w, V_w\}$ and $\{U_C, V_C\}$ matrices are used for extraction purpose.

Step 4: Finally, the S_C and S_w bands are embedded using the embedding strength factor(α). Data embedding is used to hide the cover image to the watermark image based on the α factor as dissipated in the following equation and results in the outcome as S_{new}:

$$S_{\text{new}} = S_C + (\alpha * S_w) \tag{1}$$

Step 5: Finally, to obtain the watermarked output image, it must convert the embedded data into image form. For this purpose, the exact inverse procedure such as reverse SVD, IDCT, and RDWT operations applied to the embedded data S_{new} to generate the highly imperceptible watermarked output image W_{out}, respectively.

3.2 Watermark Extraction Algorithm

The W_{out} watermarked image is applied as input to the watermark extraction framework. Performing the reverse operation to that embedding procedure will result in the output as the extracted watermark W_{ed}. The detailed operation of watermark extraction is presented in Fig. 2. The stepwise operation is described as follows:

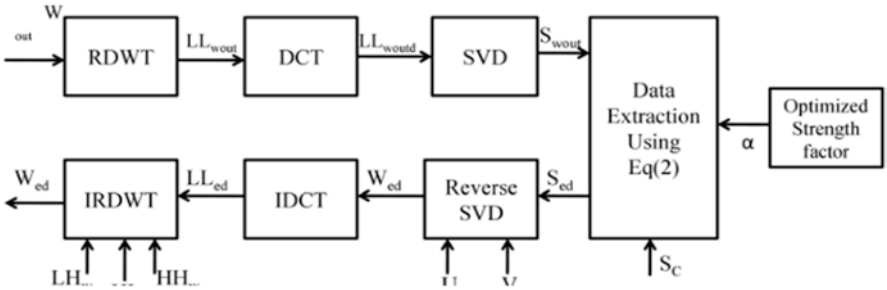

Fig. 2 Proposed watermark extraction framework

Step 1: On the watermarked output W_{out}, apply the RDWT transformation and results from the important output as LL_{wout} among four other high-frequency bands.

Step 2: On the LL_{wout} apply the DCT transformation operation and results from the outcome as LL_{woutd}.

Step 3: Then, on LL_{woutd} apply the SVD matrix decomposition operation and results from the important singular matrix as S_{wout}. Among other matrices, this matrix contains the maximum information.

Step 4: Finally, to recover the watermarked singular data, a data extraction procedure is applied concerning the same strength factor(α) used in the embedding procedure, respectively. Then on $\{S_{\text{wout}}, S_C\}$ data extraction operation performed is dissipated in the following equation and results in the output as S_{ed} singular matrix:

$$S_{ed} = \frac{S_C - S_{\text{wout}}}{\alpha} \tag{2}$$

Step 5: Finally, to recover the original data from the watermark data from the singular matrix**,** it is necessary to perform the reverse SVD, IDCT, and IRDWT operation and results in the operation as W_{ed}.

4 Results and Discussion

The watermarking operation mainly focused on two properties; they are imperceptibility and robustness. The viewer is unable to identify the watermark can be defined as imperceptibility. Thus, the performance of the watermarking framework is measured concerning these properties. This section deals with the MATLAB implementation of the proposed BW with the RDWT-DCT-SVD transformations. To measure the visible performance, various attacks are applied manually on the BW watermarked image. If the resultant outcome is the same as the original watermark image, then the system provides good imperceptibility and robustness performance. Again, the proposed method compared with several art approaches shows the proposed method's dominance using various quality metrics. The qualitative evaluation shows the proposed method gives superior performance compared to the

Fig. 3 Cover images used for embedding

Fig. 4 Test watermark image

state of art approaches. To perform all these operations, the proposed framework utilizes the various cover images, as shown in Fig. 3 and the watermark image, as shown in Fig. 4, respectively.

4.1 Watermarking Performance

To measure the watermarking performance, various quality metrics are considered in the below equations. These metrics are compared to the various existing dual watermarking frameworks based on the RDWT, SVD, and DCT methods:

$$MSE = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\left(C(i,j) - W_{\text{out}}(i,j)\right)^2 \tag{3}$$

Here, MSE is the mean square error used to identify the differences (errors) between the cover image and the extracted watermark image. By using the MSE, the image quality metric PSNR is calculated as follows:

$$\text{PSNR} = 10\log\left(\frac{\left(255^2\right)}{MSE}\right) \tag{4}$$

The PSNR is the peak signal to noise ratio, and here it represents the quality of extracted watermark. The PSNR, MSE, is used to measure imperceptibility. To measure the robustness of the proposed method, NCC coefficient is useful. And it is calculated as follows:

$$NCC = \frac{\sum i \sum j W(i,j).W_{ed}(i,j)}{\sum i \sum j W^2(i,j)} \tag{5}$$

Here, NCC is a normalized correlation coefficient, and it represents the similarity between extracted watermark W_{ed} and watermark image W, respectively.

The existing watermarking procedure outcomes are dissipated in Fig. 5a, b, respectively. The original watermark image is visible to human eyes; it means it

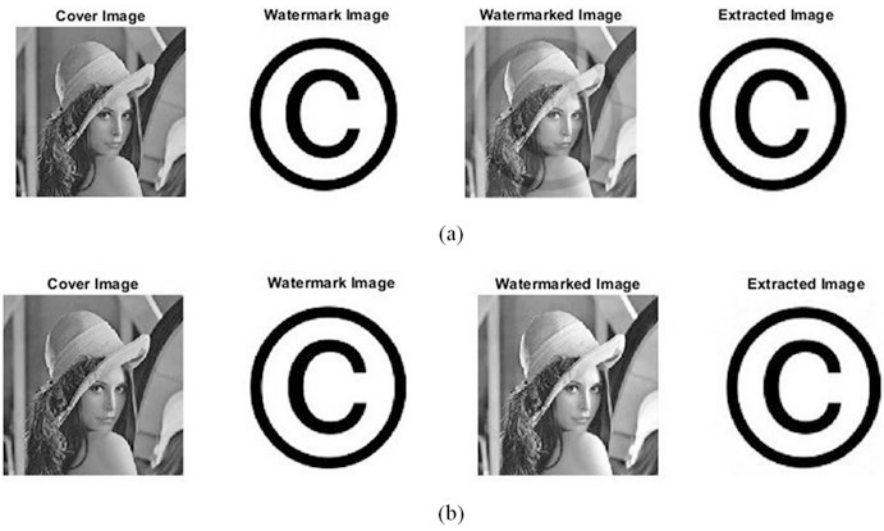

Fig. 5 Output results obtained utilizing existing BW approaches. (**a**) DWT. (**b**) RDWT

does not have the best imperceptibility properties. In the extracted watermark, there are also some minor losses.

The proposed watermarking procedure outcomes are presented in Fig. 6, respectively. By comparing the proposed watermarking visible results with the existing approaches, it is observed that the proposed method gives good imperceptibility properties. The performance comparison of various quality metrics has been presented in Table 1 for the multiple embedding strength factor values. Table 1 demonstrates the scenario only for the proposed method, whereas Table 2 demonstrate the comparison of various metrics with state-of-the-art existing approaches. From both

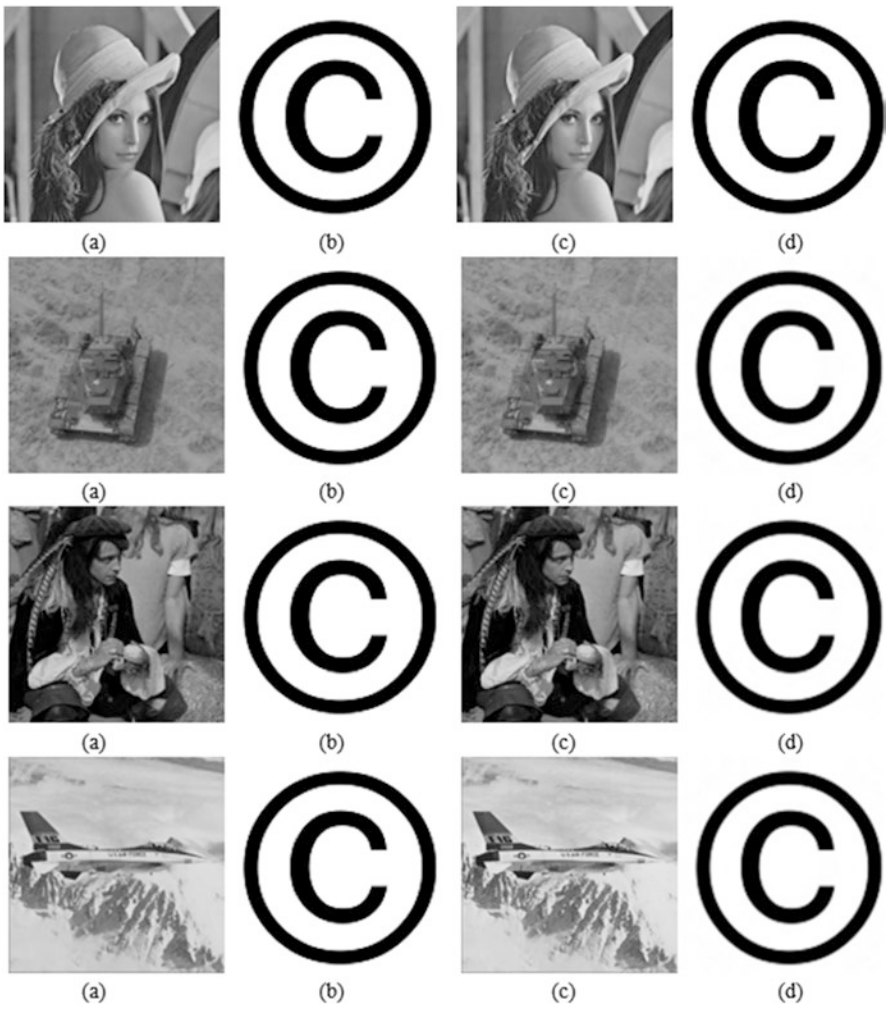

Fig. 6 Watermark embedding and extraction using proposed RDWT-DCT in SVD domain. (**a**) Cover image. (**b**) Watermark image. (**c**) Watermarked image. (**d**) Extracted watermark

Table 1 Performance comparison of quality metrics using proposed RDWT-DCT in SVD domain for various α values

	Value of α		
Metrics	0.01	0.02	0.1
NCC	0.99985	0.99996	0.99994
SSIM index	0.96153	0.96891	0.95486
PSNR	66.3406	70.5306	67.043
MSE	5.9222e-05	2.2568e-05	5.0378e-05

Table 2 Performance comparison of the proposed method with various existing methods

	Quality metrics			
Methodology	MSE	PSNR in dB	NCC	SSIM index
RDWT-DCT in SVD domain ($\alpha = 0.02$)	2.258e-05	70.53	0.99985	0.96891
RDWT-PCA with IGWO	0.0106	67.87	0.995	0.99
IWT-PSO	0.838	48.898	0.9812	0.9842
W-PSO	1.2910	47.02	0.9788	0.9829
Takore et al.	1.4545	46.50	0.976	0.9801
R-DW	3.6345	35.06	0.729	0.819

tables, it is observed that the proposed method gives the best robustness and imperceptibility performance compared to other BW frameworks such as RDWT-PCA with IGWO algorithm, IWT-PSO, W-PSO, Takore et al., and R-DW respectively. The best values are highlighted in bold for easy analysis.

5 Conclusion

This paper presents the new BW watermarking scheme method using the RDWT-DCT-SVD domain for both embedding and extraction of watermark data, respectively. As the proposed work is developed with multiple transformations, it can overcome the drawbacks of individual approaches and provide higher robustness and better imperceptibility properties. The proposed method shows better performance for qualitative evolution and visual analysis than the existing standard methods discussed in related work. This work can be extended to implement advanced artificial intelligence framework-based meta-heuristic optimization algorithms to perfectly identify the embedding strength factor. So, the embedding strength factor calculated perfectly. It will result in a more robust scheme, which can be useful for enhanced BW applications.

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A Real and Accurate Data Traffic Control in Wireless Sensor Networks Using CSMA Model

Pattem Sampath Kumar

Abstract The sensor nodes take routine physical parameters measurements and submit the data to the monitoring node through the established connection. The functional use of a WSN node in an industrial environment is illustrated as an introduction to this study. This project aims to build design architecture for a WSN node that can control congestion, develop connections, and have a long node life cycle. The data gathered at the downlink is analysed for end-user tracking. To reduce transmission overhead and energy usage, the data is packetized. Aggregating the calculated data is an easy way to reduce packet size. Data speeds of 9.6 Kbps to 40 Kbps are typically used for a standard sensor node. The CSMA data fusion process, which incorporates several reliable signals to generate a more precise signal in measurements, is the working and scalable system.

Keywords WSN · CSMA-Ml · Data rate · Congestion control

1 Introduction

The application's specifications define the architecture of a WSN node. Environmental monitoring is a method that involves a large number of sensor nodes and a station's centre, referred to as a drain. Sensor nodes for these devices are typically built to work in circumstances where the nodes' batteries could be refuelled or replaced [1]. As a consequence, reducing information sharing in sensor nodes is a very useful source of energy savings. The amount of power available in these devices is small. Hundreds or thousands of sensor nodes are interconnected to collect data for a specific monitoring location [2].

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1.1 Network on Wireless Sensors

Sensors are positioned at observation units in WSN, and data is collected, coded, and transmitted to the nearest neighbour. While this type of supporting connectivity aids in range extension by maintaining knowledge pieces, it often exposes data to the wireless medium, exposing it to high channel interruption and traffic congestion. The allotted power level for transmission is the cause of interference in WSN. Optimizing power usage for long life, lower disturbance, and topology control is a top priority in WSN.

Figure 1 model consists of hundreds or thousands of nodes, each of which is interconnected to one or more sensor nodes for data collection and transmission. These devices provide a microcontroller-connected antenna or radio transmitter and an electrical device and a battery-powered power supply for communicating with sensors. A sensor node ranging in scale from a small shoebox to a tiny grain is used [3, 4]. The goal of miniaturization of WSN nodes is established by power consumption and traffic flow constraints.

The below are the key characteristics of a WSN node:

- Node battery or energy storage consumes so much power.
- Possibility of resolving the node failure issue.
- A node's position changes over time.
- Errors in data transmission.
- Network heterogeneity.
- Deployment scalability.
- The opportunity to function in a range of settings.
- It's easy to use and can be used for tracking.

These characteristics make it ideal for industrial applications and real-time data monitoring. WSN's viability, on the other side, is reliant on the device's installation

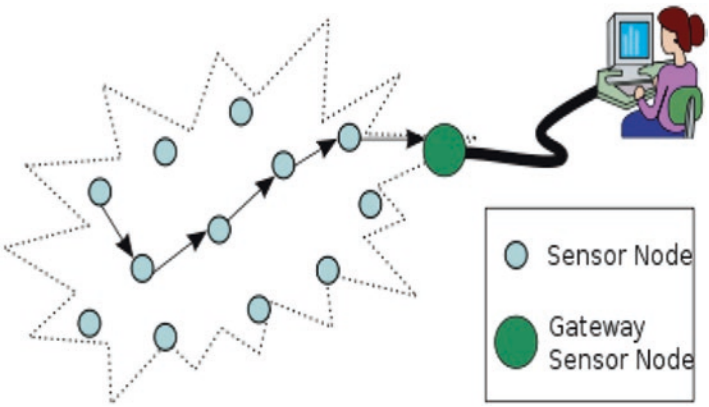

Fig. 1 Example of WSN model

and power supply. As a result, WSN node architecture must cope with high power consumption and increase throughput [5, 6].

1.2 CSMA/CA Approaches to Node Design

A CSMA/CA model was presented in the configuration of a WSN node. This strategy has demonstrated a traffic flow that is focused on managing the congestion at the node. A random packet delay is used to track traffic in this situation. The WSN node's interface architecture is depicted [7, 8].

The CSMA/CA device monitors the wait depending on queue status and decreases congestion overhead [9, 10]. This method, on the other side, utilizes a monitor activity towards the end of the blockage phase, resulting in enhanced buffer blockage [11, 12]. The random control method creates a global synchronization issue in WSN operations because the transmitting system interacts with a FIFO device, which buffers all incoming data in a linear order [13, 14].

1.3 Approach to Design

The data traffic flow was managed by random monitoring in WSN nodes' configuration utilizing the standard CSMA/CA architecture [15]. During a high-traffic scenario, this control operation is constrained by large congestion [16, 17]. The architecture does not regulate power dissipation, and data precision is not addressed [18, 19]. Consequently, assume WSN node architecture with higher traffic flow, lower data error, and low power dissipation. This work presents a modern WSN node architecture with these goals in mind [20, 21]. In WSN interfacing, this design offers higher synchronization, multilevel congestion management, and an energy-saving protocol [22–24]. The suggested architecture for WSN node design incorporates the specified objectives. The data traffic flow was managed by random monitoring in WSN nodes' configuration utilizing the standard CSMA/CA architecture. During a high-traffic scenario, this control operation is constrained by large congestion [25, 26]. The architecture does not regulate power dissipation, and data precision is not addressed [27, 28]. This work presents a modern WSN node architecture with these goals in mind. In WSN interfacing, this design offers higher synchronization, multilevel congestion management, and an energy-saving protocol. The suggested architecture for WSN node design incorporates the specified objectives [29, 30].

The traditional CSMA/CA model includes a multilevel traffic control monitoring and controller unit to control rate allocation and clock production. The encircled regions are the standard CSMA/CA model's integrated components [31, 32]. The ML CSMA/CA device works on the risk factor of congestion and provides traffic movement dependent on rate allocation with a 2 limit threshold for blockage. The

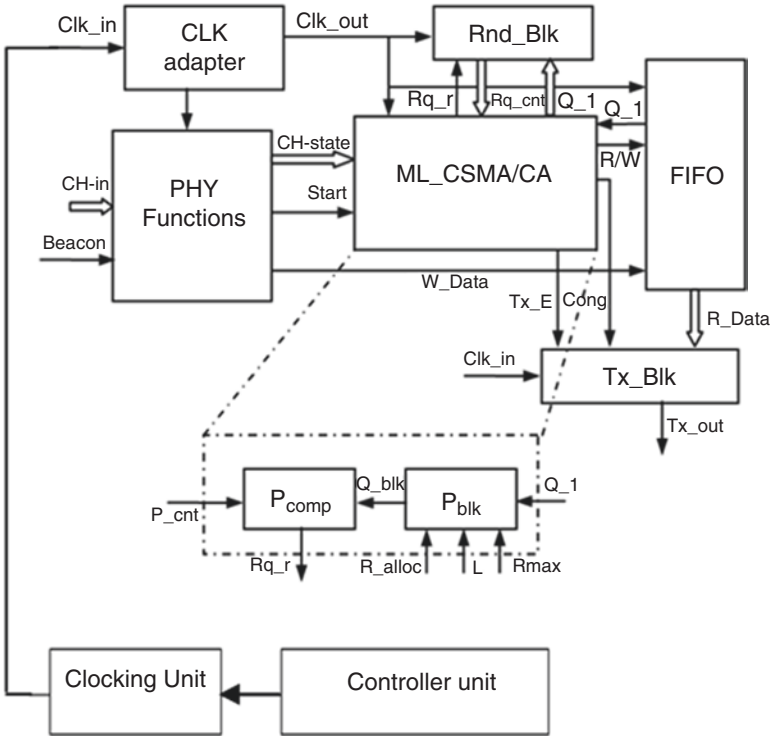

Fig. 2 WSN node architecture that has been proposed

clocking device is responsible for data access synchronization among the nodes. A schedule-based coordination protocol with complex listening and sleep periods is established to monitor power dissipation [33, 34]. The activity is carried out by interfacing a controller unit, and the specifics of each integrated unit are illustrated in the chapters that follow shown in Fig. 2.

1.4 Model of Communication

Data is shared through intermediate supportive nodes in a wireless sensor network's communication model to share information from source to sink. Bits of data are streamed over a channel from one node to the next throughout the data forwarding phase. These nodes serve as routers, routing data according to the details given. Each node buffers the data obtained and forwards it at the transmission pace throughout the data exchange process. However, during the data streaming phase, a significant volume of data is buffered at each node, creating congestion and lowering transfer performance [35]. A congestion management system for WSN nodes is

suggested to increase streaming efficiency. The suggested method is a probabilistic coding solution to the current queuing process that produces high throughput.

1.5 WSN Computer Traffic Simulation

To solve the channel congestion issue in the WSN node, a data traffic model is used. An early congestion prediction and avoidance framework are being built to achieve the node device's functionality for variable data traffic patterns. The most notable benefit of this encryption is that no packets were damaged or killed and all sent packets were sent to the sink node.

However, previous monitoring systems have shown to be much more successful than conventional methods. Throughout the communication process, each node functions as a router, and each node's congestion control is confined to a single restriction value. Congestion control is implemented using a queue management strategy where a node is used as a router. The buffer tracking approach achieves NODE-based traffic control rather than the average communication-level congestion model. The congestion control, traffic adjustment and MAC observation are performed through CSMA/CA architecture. The number of nodes calculates the queue's size, and latency is regulated by a backoff exponent (BE) determined by network traffic flow.

2 Constraint of Traffic Blockage in WSN

An upgraded MAC with a CSMA/CA mechanism has been added to meet the high-throughput target. To boost the efficiency of WSNs utilizing 802.15.4, a slotted CSMA/CA device has been proposed for a beacon powered mode. Using CSMA/adaptive CA's backoff exponent (BE) power, the BE is assigned to various node units, resulting in similar BE types on separate nodes. Consequently, when a node's queue size exceeds a predetermined amount, the backoff cycle (the duration it takes for a packet to be forwarded) decreases. Before each transmission, the queue size is tested and modified depending on the existing buffer value. Consequently, the backoff latency is decreased, as well as the chance of packet collision due to numerous traffics. However, the assigned traffic volume, which is comparatively dynamic in realistic implementations, is not considered in this proposed traditional method.

A traffic rate control mechanism is proposed to obtain dynamic rate management, which involves multipath routing and a cross-layer architecture control mechanism. The whole procedure is divided into two sections in this method: path exploration and route maintenance. The path exploration step is where the cross-layer solution is processed. Route request (RREQ) packets are transmitted from the source to the whole network to find all possible routes to the destination. The source node will search for buffer occupancy at each node after obtaining the

acknowledgement (ACK) to detect the channel load state. The total number of queued messages stored is needed for buffer occupancy detection.

It compares the actual buffer amount increment from the control level to the current queue level variance when calculating the buffer queue. The resource management system and the rate control method are used to control traffic here. If no active activity is present, the device will reach an optimal energy conservation state utilizing the rate control process. A temporary backoff warning alarm called 'BE' is used in this case. When the observed traffic is congested, the BE value is set to 1; when the traffic is not congested, the BE value is set to 0. BE's tracking will decide if the data rate will be fully blocked or transmitted at full capacity (Rmax). When busy situations (BE = 1) are observed, the upstream rate is limited to half of the allotted rate, or the upstream is fully closed in full congestion.

2.1 WSN Probabilistic Rate Governance

The proposed method alters the defined rate allocation operation and adds a chance dimension to congestion management. The data rate allocation is the phase of congestion control in this all back off nodes are protected by BE signal.

The rate allocation is based on two forms of blockage situations. The rate is set at either a high or a minimum, but no observation is made in the centre. If the control operation approaches its maximum, this results in a high blockage and packet loss level. If congestion is detected, the BE parameter is set to '1' in this process. When the buffer duration exceeds the congestion value's upper limit, this is set, i.e. $L_{\text{current}} \cong L_{\max}$.

The BE is set in line with the current buffer duration when the stated requirement is met. A two-level control operation is proposed in WSN node architecture to prevent heavy congestion. By establishing a lower and upper tolerance value as $L_{\min}$ and $L_{\max}$. This method defines two potential congestion management limits. It is shown how to label the two tolerances on a buffer in a WSN node.

At the lower tolerance level, the existing two-limit tolerance minimizes the risk of congestion, thus managing congestion at an initial blockage overhead. The traffic flows throughout the network to manage congestion for a Ru overall permissible data rate. This strategy is successful. Buffer the data before the buffering cap is reached. The data rate and the probability of buffer loading for the next incoming data are regulated until the lower minimum limit l-min is reached, shown in Fig.3.

In this case, the buffer level's congestion likelihood is determined by

$$P_{\text{cong}} = \frac{P_{\text{Blk}}}{1 - P_{\text{pkt}}} \tag{3}$$

where

$$P_{\text{pkt}} - \text{no.ofpackets and} P_{\text{Blk}} - \text{blockage}$$

Fig. 3 Two buffer limits are marked in the WSN node

The blockage at a node's buffer is specified as

$$P_{\text{Blk}} = B_{\text{current}} - \left(\frac{R_{\text{alloc}}}{R_{\max} - R_{\text{alloc}}} \right) \tag{4}$$

$$B_{\text{current}} - \text{current blockage and} R_{\text{alloc}} - \text{allocated rate}$$

2.2 Design Approach

Any node in the WSN conducts congestion detection operations depending on the weighting stage element, while the CSMA module manages the communication booster. The BE is traded as congestion management frames or communication frames. When the CSMA device senses a higher queue value that reaches the maximum defined limits, it sets the BE value to 0 or 1, as seen in the previous segment. A multilevel buffer system is suggested in the previous segment to achieve improved congestion management.

A complex probabilistic buffering logic is built to manage congestion at each node. The CSMA/CA device method is updated to achieve multilevel controlling by adding a statistical traffic computing module and identify the control technique depending on the derived random count. The proposed model depicted is an improvement to WSN's current architecture focused on the CSMA/CA model. The multilevel congestion management scheme implementation has been suggested.

The proposed multilevel CSMA devices measure the size of queues according to a threshold level. The package of FIFO continually buffers the Q1 and reduces the clock adapter ratio. When the average queue capacity reaches the top cap, packets will be discarded. The packets are labelled with the packet drop likelihood 'Pcong', while the average queue is between the lower and upper limits. Since this chance is proportional to the average queue capacity, the likelihood of a packet being identified is determined by the relation and the data rate.

If the minimum cap is set too low, packets are discarded too fast, and transmission connectivity is not completely used. There is enough of a gap between the highest and lowest limits to prevent global synchronization. If the gap is too tiny, several packets are discarded all at once, resulting in an unequal traffic flow as many

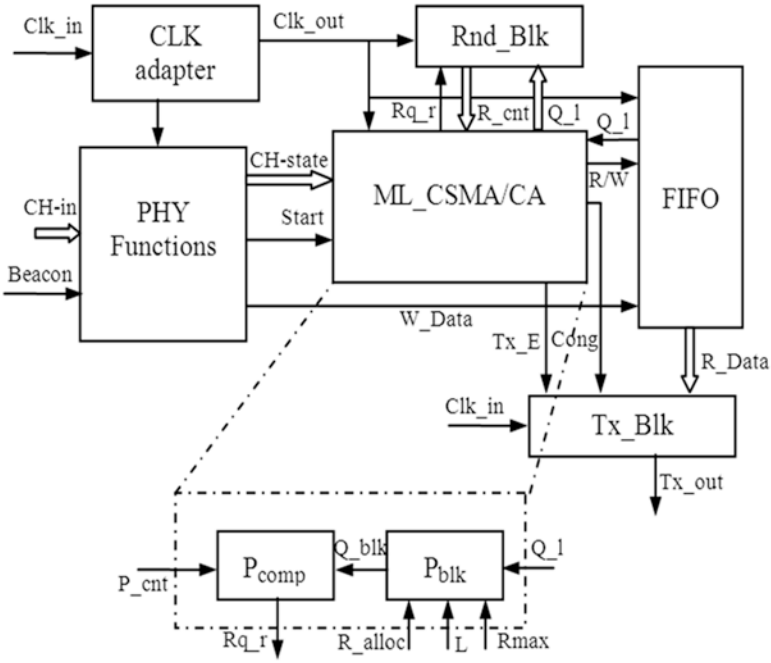

Fig. 4 Device designs for multilevel congestion management have been proposed

simultaneous communications are used. This proposed framework integrates an ML CSMA/CA device into the WSN node architecture to achieve faster data sharing shown in Fig.4.

Linear buffering causes memory to fill quickly, causing the node to become blocked early. Here, the random number produces a random count of buffered data, resulting in nonlinear buffering and a longer traffic period to pass through it. If the blockage rate declines, traffic volume improves, increasing the node's throughput and, in exchange, the network's throughput. The random count buffering gives all traffics the same weight, which eliminates the problem of global synchronization.

3 Experimental Outcomes

The suggested framework for the ML CSMA module is built squarely with Verilog description. To confirm the established method's practical verification, the timing effect for the developed approach is observed. The established VHDL units were simulated using an active HDL tool and synthesized with Xilinx ISE, with the Xilinx xc2vp1112tb-6 FPGA computer as the aim. The simulation effects are depicted in the following graphs.

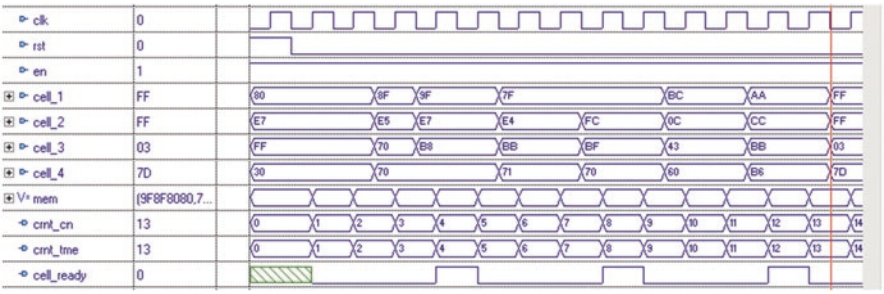

Fig. 5 Timing result for data input with control signals

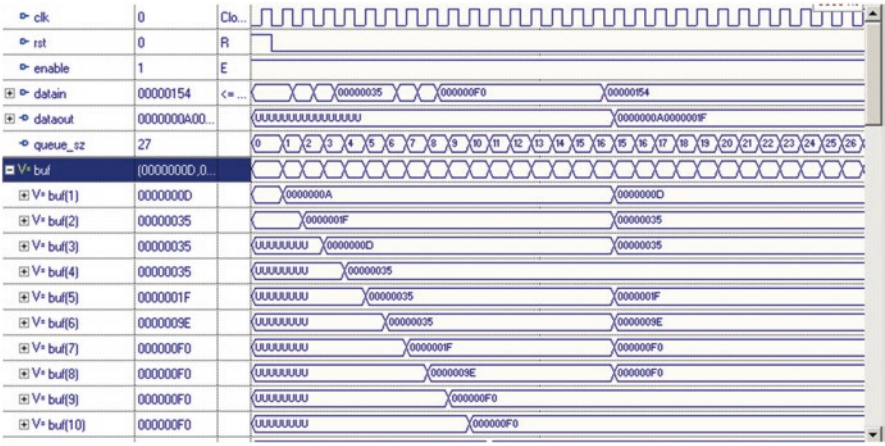

Fig. 6 Buffering operation's simulation outcome

The developed system's timing outcome for data input and relevant control signals is displayed. Cell 1, 2, 3, and 4 are the names of the data lines passed to the input data lines. These inputs are then sent to the FIFO device, buffered using the control signals produced. A cell ready signal is set to mean when new cell data is accessible. These details are stored in a FIFO queue for later processing, shown in Fig. 5.

The buffer machine reads a series of data packets and sends them to the transmitting interface panel.

During data analysis, frames are stored or neglected depending on the actual queue duration and the conceptual Q-length control criteria. Figures 6 and 7 show how data buffering works when the current queue duration is less than the minimum fixed Th value. In this situation, all frames are analysed through buffering because data buffering congestion is smaller.

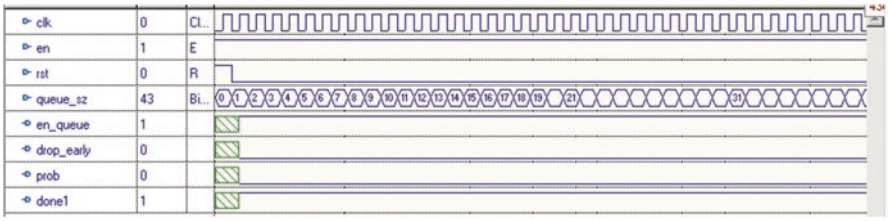

Fig. 7 Power analysis of Q-length

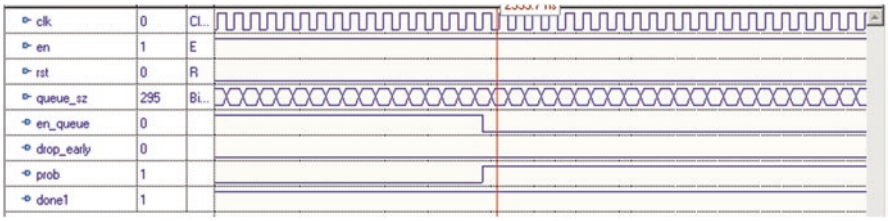

Fig. 8 Outcomes of minimum and maximum Q-length

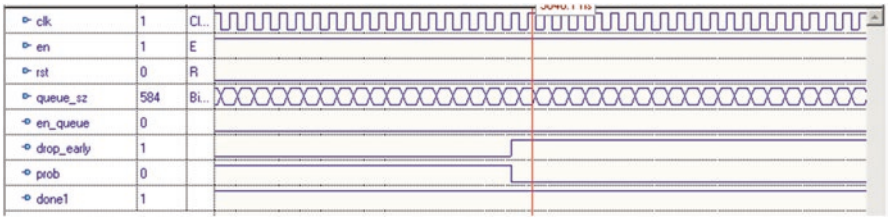

Fig. 9 Simulation result for Pcomp at Qlength>Maxth

If the Q-length approaches the set minimum Th value, packets will be dropped. Figure 8 shows how data buffering works in the case of an existing queue length below the lower and upper fixed limits. The control activates drop signal, and the enqueue signal goes down as the lower defined limit is crossed, signalling packet falling under average congestion shown in Fig. 8.

To prevent a deadlock state, maximum packets are discarded if the average queue duration approaches the higher defined cap. Dropped packets are routed across nodes with less traffic before they hit their target, shown in Fig.9.

Figure 10 illustrates the random block unit's timing simulation. This system is activated when the current queue length reaches the buffering lower threshold limit. The pseudo-random operation is used to create a Gaussian measure, and a random count is created depending on the input frame values in this coding. These multiple count values are utilized for buffering packets and their generation. The buffering system is allowed three packets for a count of three, during which the remaining packets are lowered to the square over another interface module.

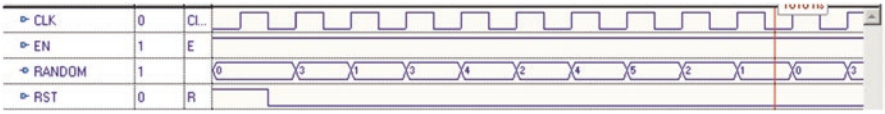

Fig. 10 Simulation result for random block unit

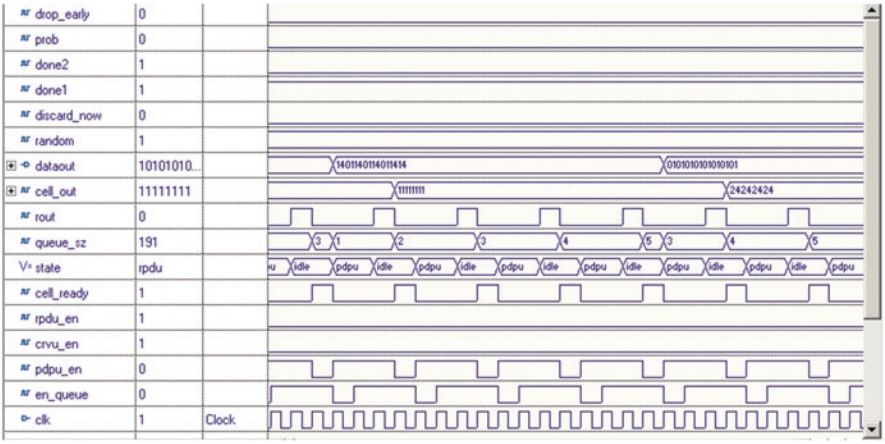

Fig. 11 CSMA analysis

Figure 11 demonstrates that buffering nature from lower set limit to higher bound limit. The signal dropping and control operations are monitors with an FSM controller. The master clock and clock pulse continuously synchronous with the transmitter codes.

The random dumping of incoming packets is initiated until the queue size reaches the specified fixed cap. The allowing of random packet falling and random value calculation is found to be initialized. The random count value created then dynamically toggles the enqueuing packet shown in Fig. 12.

The established system's connectivity is tested using a test packet with 128-bit data packets distributed in four slots simultaneously. A contrast of the proposed multilevel queueing method to the traditional backoff modelling and the IEEE-802.15.4 specification is made. For packet exchange simulation, a data rate of 64 kilobits per second is used shown in Fig. 13.

The queue's overhead is calculated, such as the established logic computes the complex buffering of data packs under low and large queue lengths. The extra storage per node affects the total computing overhead due to the queue overhead per node. This additional overhead intern necessitates more memory elements to buffer the data, requiring more power in the process. The simulation result for the proposed architecture is evaluated for average traffic flow, queue overhead, throughput, and data exchange accuracy. The QoS is defined by the throughput and the timing

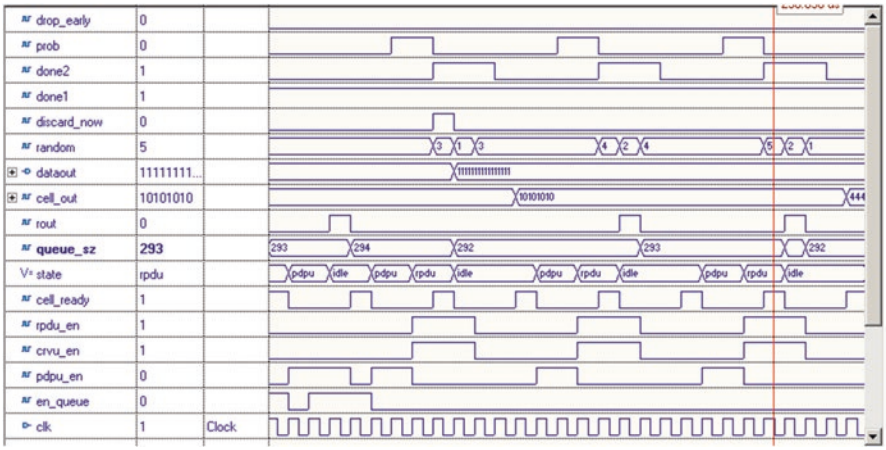

Fig. 12 Result for random count in ML_CSMA/CA unit

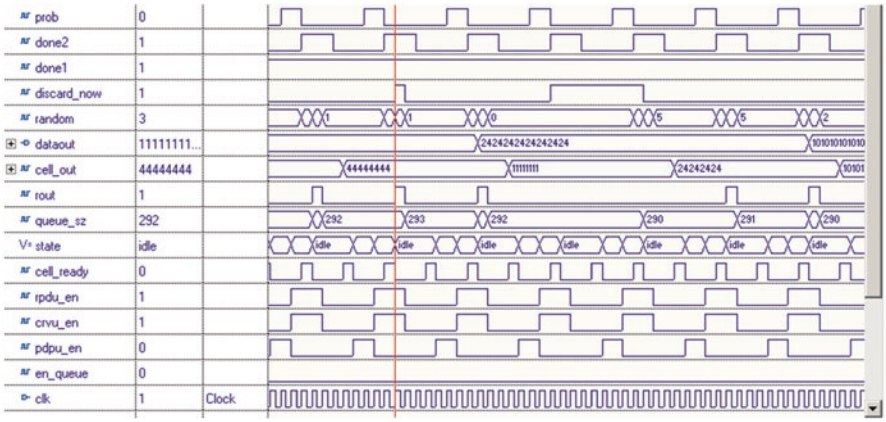

Fig. 13 Simulation result for integrated ML_CSMA/CA unit

result of the designed architecture using HDL simulation. The node throughput gets improved, queue overhead gets reduced, and the proposed ML_CSMA architecture improves traffic flow. This is how QoS is altered when we move from CSMA to ML_CSMA, shown in Fig. 14.

Under multiple unit interfaces, rate governance delivers a higher throughput to the design framework, resulting in fewer blockage and quicker data transfer.

Figure 15 clearly explains about traffic flow control analysis of the CSMA ML model. In this stage, it is identified that at all types of attacks on the protocol, traffic, congestion, and the data transfer rate is improved compared to earlier models.

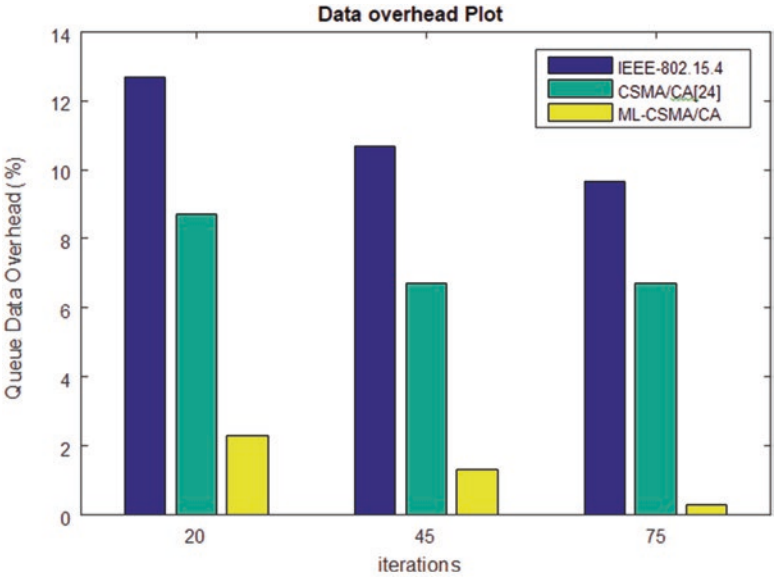

Fig. 14 Iteration for the established method; a packet overhead plot is seen

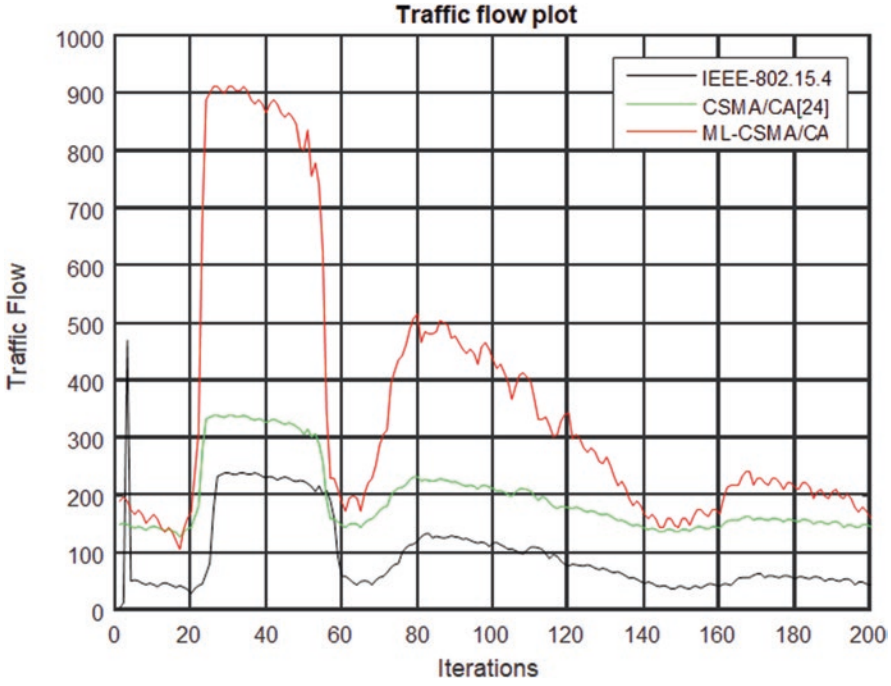

Fig. 15 Traffic flow control analysis

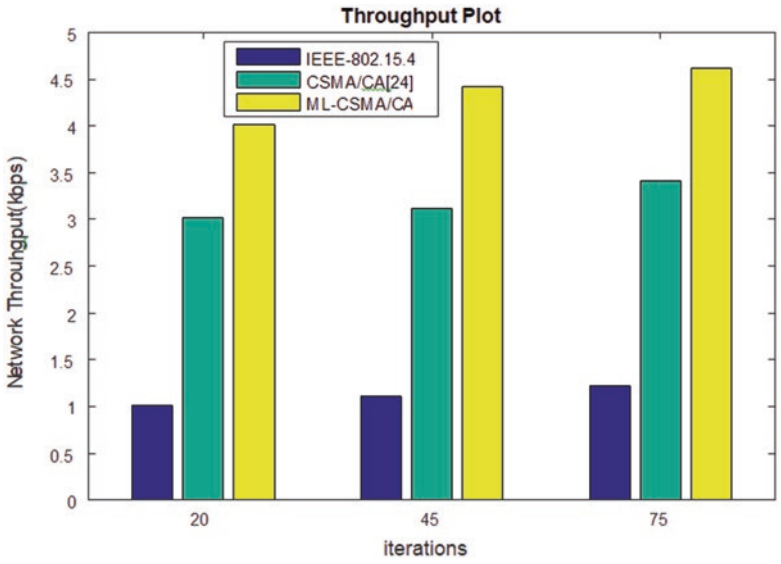

Fig. 16 Throughput vs iterations

Figure 16 demonstrates the throughput as well as no iterations analysis of the proposed CSMA model. This CSMA model attains more throughput compared to earlier methods which are clearly shown in the above figure.

4 Conclusion

The proposed architecture for WSN node design was illustrated in this portion. The node architecture strategy is focused on various levels of congestion monitoring and blockage probability. The architecture is enhanced by a clock synchronization operation in which time stamp simulation is used as a synchronizing protocol in WSN operation. A coordination protocol that controls the sleep cycle is recommended for power conservation. WSN nodes' usage for traffic sharing is employed; however, the complex traffic per node generated a substantial overhead in the form of buffered data, resulting in congestion. A multilevel congestion management solution is recommended to prevent such a likelihood of congestion. In contrast to the backoff exponent-dependent controlling method, multilevel control was more efficient in traffic control and node efficiency. The device throughput is degraded by the latency introduced by congestion or backoff. The implementation of multilevel congestion management strengthens this aspect. In contrast to standard methods, the network traffic flow and intern throughput are increased in this situation.

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A Novel Approach for File Security in Cloud

M. Priyadharsini, I. Mettildha Mary, K. Karuppasamy, and F. Margret Sharmila

Abstract Cloud computing is the data storage without direct active management by the user. Security is considered critical because of the meaning of the data put away in the cloud. Henceforth, the administration of information and security ought to be solid. The paper proposes an approach to store data safely in the cloud by parting information into a few lumps and store it on the cloud in a way that jam information privacy and uprightness guarantee accessibility. At the point when the client transfers a document to the worker, the record parts into four distinctive worker occasions in scrambled structure. The encryption is done using the Advanced Encryption Standard (AES) algorithm and storing the files in the cloud. The four encrypted files in the server instances combine into a single encrypted file, and by using the proxy re-encryption technique, the file re-encrypted by using a key. While downloading the file, the service asks for a key sent to the user's mail ID by using Message Digest (MD5) algorithm. Using the Advanced Encryption Standard (AES) algorithm, the file is converted into a single decrypted file and downloaded by the user. This approach ensures client-sensitive information security and privacy by storing data across a single cloud, using AES algorithm, MD5 algorithm, and proxy re-encryption techniques.

Keywords MD5 algorithm · Proxy re-encryption · AES algorithm · Cloud security · Encryption · Decryption

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1 Introduction

Cloud computing is the most requested and cutting edge innovation all through the world. It is quite possibly the main themes whose application is being investigated in the present time. The better assets given by distributed computing is distributed storage. Data is hung on various outsider workers with distributed storage rather than on the committed worker utilized in conventional organized data stockpiling. The information of the clients are put away on any at least one PC. The genuine stockpiling area may even take issue from one day to another or moment to minute in light of the fact that the cloud progressively oversees offered accessible extra room.

Notwithstanding, regardless of the reality, the area is a virtual one, the client sees a static area for the data and may genuinely deal with the space for putting away as though it were associated with the PC. A distributed storage framework wants just a single data worker associated with the Internet at its most basic level. A customer sends duplicates of documents over the Internet to the information worker, which at that point records the data.

Information stockpiling and registering power are significant highlights in the cloud. The depiction of the server farms is offered to numerous clients. The large clouds will circulate the capacities over different areas. Assuming the association gets intruded on, the edge worker can be chosen.

Distributed computing assists the customers with utilizing the applications with no establishment of individual documents. This innovation allows considerably more prudent registering by combining stockpiling, memory, preparing, and data transmission. Security investigators and experts normally say continue, notwithstanding, continue with alert. Every one of the dangers to touchy organization information identified with rethinking applies to distributed computing, to say the least.

Because of the importance of data saved on the cloud and the various services given to users, security is seen as a critical feature in the cloud computing environment. As a result, the information board and security must be completely reliable. The data in the cloud should be protected against malicious attacks. The information in the cloud should be shielded from noxious assaults. At the point when you manage outsiders, the security arrangements should be forced and the consistence is intense, including the known or obscure subcontractors around the world.

With the improvement of the various sorts of organization, advanced pictures are traded ludicrous. The essential need of each developing region in this day and age is correspondence. Everybody needs the data of work to be mystery and safe. The upgrade in innovation and the Internet has been the security of the data. At the point when we attempt to share data, we now and again have confronted uncertainty in moving the data over the Internet. Cryptography is a set of techniques for encrypting data in order to ensure secure communication. These days, to encode and decode information to ensure the message mysterious, diverse cryptographic strategies have been created. The information security issues of the cloud are settled utilizing the cryptographic strategy.

Subsequently, this paper proposes a strategy that permits client to store and access the information safely from distributed storage. It guarantees that the

distributed storage supplier and the confirmed client access the data. This approach guarantees the security and protection of the data put away on the cloud. An extra benefit of this philosophy is that if there's a security break at the cloud provider, the client's information can be secure since all data is scrambled. Clients likewise needn't stress over cloud providers accessing their information wildly. A strategy is proposed to fabricate a believed registering climate for a distributed computing framework. The strategy encodes the information at the customer side utilizing the mysterious key and unscrambles the information prior to sending it to distributed storage utilizing a similar key. These are done at the customer side with the utilization of a mysterious key. Along these lines, the mysterious key never leaves the customer PC. The client is guaranteed about security of information put away in the cloud. Information security is accomplished utilizing Advanced Encryption Standard (AES) calculation. The framework can naturally create the key by utilizing Message Digest (MD5) calculation.

2 Related Work

This section summarized some recent studies on secure file storage in cloud that use encryption and decryption algorithms. We also cover the recent studies on the Advanced Encryption Standard (AES) algorithm and proxy re-encryption technique.

2.1 Dual Server Encryption and Decryption Techniques

[1] proposed a novel approach to storing files in the cloud using Data Encryption Standard (DES) algorithm. Utilizing the randomization cycle, the public key is shipped off the collector. Utilizing this public key, the beneficiary hunts the record and demands the twofold workers to get to the necessary document. At that point the two workers send the distinctive randomized private keys to the beneficiary's mail. The Simple Mail Transfer Protocol (SMTP) is utilized to send messages that contain two mystery keys and verified utilizing Secure Socket Layer (SSL), which gives firewall insurance to send keys. Utilizing these private keys got to the beneficiary's mail, the collector can download the record if these two diverse private keys are coordinated.

2.2 Cryptography

[2] proposed an approach to store files in the cloud by splitting data into several chunks and storing parts of it on the cloud in a manner that preserves data confidentiality and integrity and ensures availability. The quickly expanded utilization of

distributed computing in numerous associations and IT ventures gives new programming effortlessly. Distributed computing is useful as far as ease and availability of data. It furnishes a great deal of advantages with minimal effort and information openness through the Internet. Ensuring distributed computing security is a central point in distributed computing now and again, the suppliers might be untrusted. So safely communicating the information is as yet a difficult issue while protecting it in an untrusted climate. Our methodology guarantees the security and protection of customer's touchy data by putting away information across a solitary cloud, utilizing Advanced Encryption Standard (AES), Data Encryption Standard (DES), and Rivest Cipher (RC2) calculations. The significant issue is to safely store and access information in a cloud that the information proprietor doesn't control.

2.3 Multi-cloud Computing Environment

[3] surveyed many existing research-related papers on single and multi-cloud security using Shamir's Secret Sharing algorithm and given a possible solution and methodology. The fundamental point is to utilize multi-cloud and information security and decreases the danger in the security. It's a strange sharing, where a mystery is broken down into parts and assigned to each person, and where some or all of the parts are required to reassemble the puzzle. To change the mysterious key, the limit plot is used.

2.4 AES Data Encryption and Decryption

[4], using Advanced Encryption Standard, implemented the encryption and decryption. It is a norm for the encryption of electronic information. The AES 192-bits calculation incorporates the capacity 192-piece key size, Automatic Round key estimation and encryption capacities. In this paper, the 192 piece AES calculation is planned, for encryption and unscrambling measure. In 2001 the AES was acknowledged by the National Institute of Standards and Technology (NIST), and it has been utilized in an assortment of safety compelled applications.

2.5 Encryption in a Cloud Environment

[5] enforced secret data storage in the cloud environment. Cipher is an algorithm used for performing encryption and decryption of information. The programmer thinks that it's intense and the encoded information are pointless except if the individual decodes it utilizing the right technique. Organizations with basic informational collections encode the information documents or restricted intel utilizing a

legitimate code calculation prior to sending it to the worker. This technique is the most secure strategy for the security of information in mists. The thoughts of distributed computing might be plainly perceived by different cloud arrangement and administration models.

2.6 Proxy Re-encryption

[6] proposed storing files in the cloud using proxy re-encryption. A proxy re-encryption scheme is suggested and blended with a disbursed erasure code such that a secure and sturdy facts garage and retrieval. Additionally, a consumer can proportion his statistics on the cloud with a special person within the encrypted formats themselves. The paper empowers utilizing encoding the scrambled records and sharing archives in the scrambled design itself. The paper utilizes the methods of both encoding and sharing the data. Eradication encoding assists with sharing scrambled documents and is legitimate in the decentralized allocated contraption. An apportioned eradication code is utilized to approve the security of the record inside the scattered cloud carport.

2.7 Encryption in the Cloud Using the USB Device

[7] proposed a system that will employ Rivest-Shamir-Adleman (RSA) and Advanced Encryption Standard (AES) using the USB device. All the files would remain encrypted till the USB device is plugged into the computer. The files could also be accessed within the cloud. The motivation behind applying such a method is to totally get the records and try not to utilize one single secret word. The haphazardly produced passkeys have exceptionally muddled mixes. Along these lines the client won't totally remember them. This proposed framework can recognize the USB that contains the private key utilized for the records to be downloaded from the cloud.

3 Proposed System

The proposed framework comprises a technique is proposed to assemble a believed registering climate for the distributed computing framework by giving the strategy that scrambles the information at the customer side [8]. It decodes the information utilizing a similar mystery key utilized for the encryption interaction. These are done at the customer side. Along these lines, the mysterious key never leaves the customer PC. The client is guaranteed about security of information put away in the cloud. This framework likewise proposes separating the document into four and

store into four workers cases prior to encoding the record. For sometime in the future, the encoded records are put away in the cloud. The four encoded documents are changed over into one single scrambled record [9]. This document can be unscrambled to get the first record.

3.1 Key Generation

In this module, the user can upload and download data from the server. Data like username, password, gender, email ID, and phone number are requested from the user. Once the user has registered successfully, a 16-digit (alpha numeric) secret key is generated using the MD5 algorithm and sent to the registered mail ID in Figs. 1 and 2.

3.2 Data Division

The cryptosystems allow third parties (proxies) to alter a ciphertext that has been encrypted for one user to decrypt it. The encrypted data is again altered by the user while uploading it to the server. The encrypted file's decision uploaded to the server

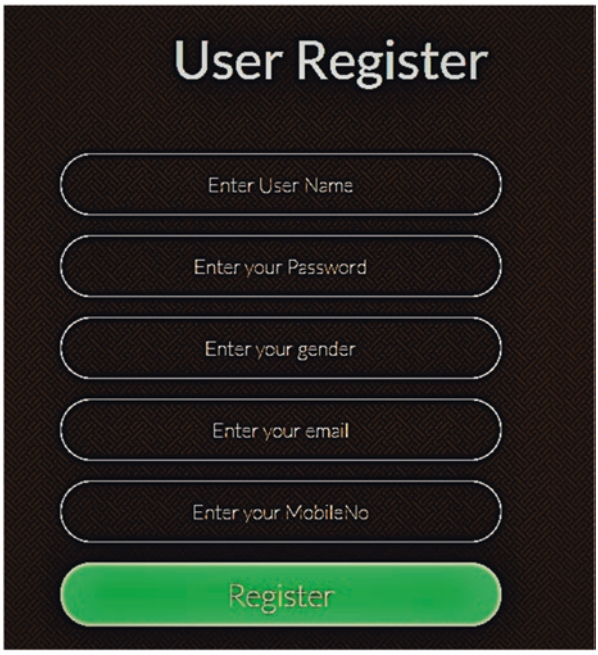

Fig. 1 User registration

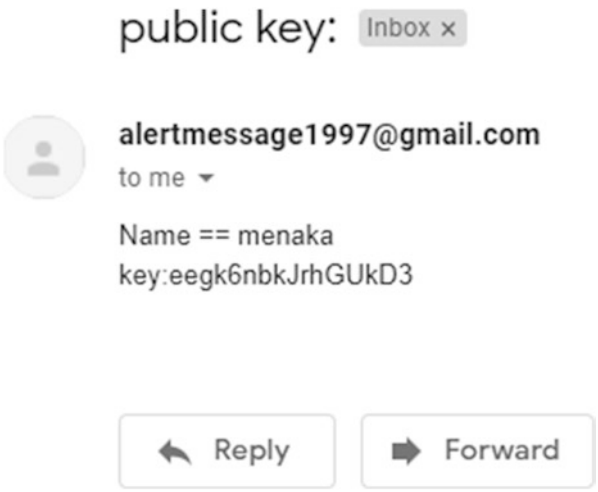

Fig. 2 Key generation

splits into four different encrypted files in the server. The original combined file is impossible to download and decrypt by the intruders in Figs. 3 and 4.

3.3 Encryption

Encryption is the process of encoding a secret message or data so that only authorized persons can access the information. Here, the plaintext is encrypted using an encryption algorithm that can be read only if decrypted [10]. The intruder cannot get the user's full information as the files are divided and stored in the cloud [11]. An authorized party [12] can easily decrypt the message with the admin's key to recipients, not unauthorized parties in Fig. 5.

3.4 Proxy Re-encryption

To retrieve the data from the server, the user should validate the Username and password. If the login credentials are validated, the server fetches the file from the cloud, uploads it previously, and uses the AES algorithm to decrypt the single file (encrypted file). Then, the secret key generated previously using the MD5 algorithm must be entered. If the key matches, the single decrypted original file can be downloaded. Thus, proxy re-encryption ensures data security and ensures that the intruder can't get the file in Figs. 6 and 7.

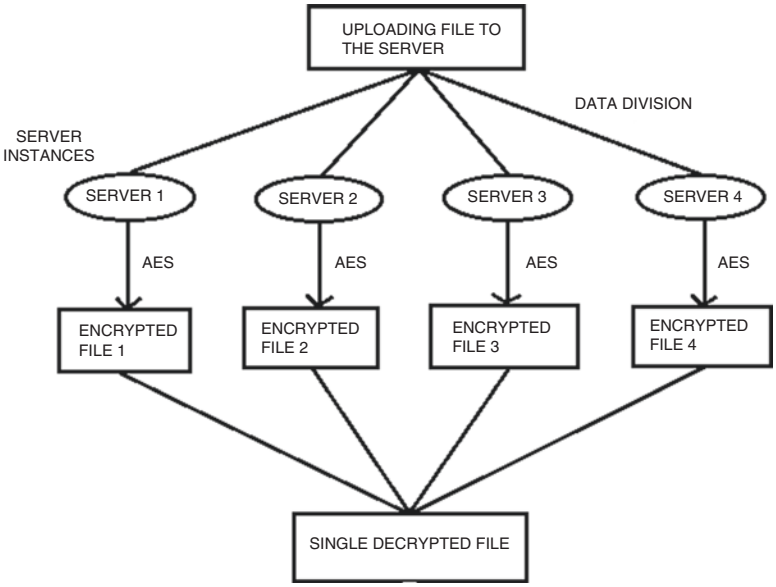

Fig. 3 Data division

Fig. 4 Divided encrypted files in four server instances

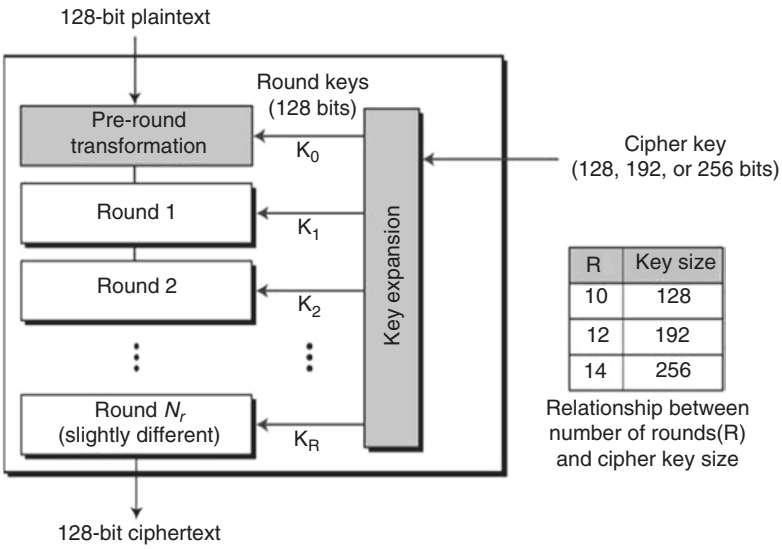

Fig. 5 Working of AES algorithm

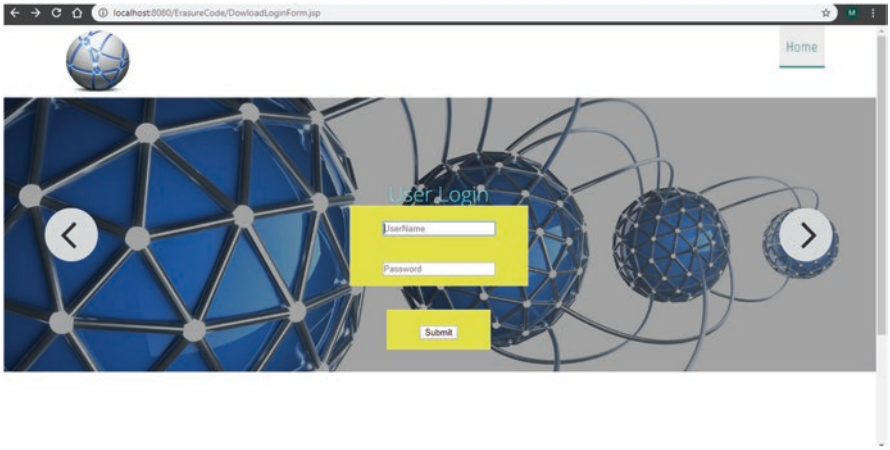

Fig. 6 Login page

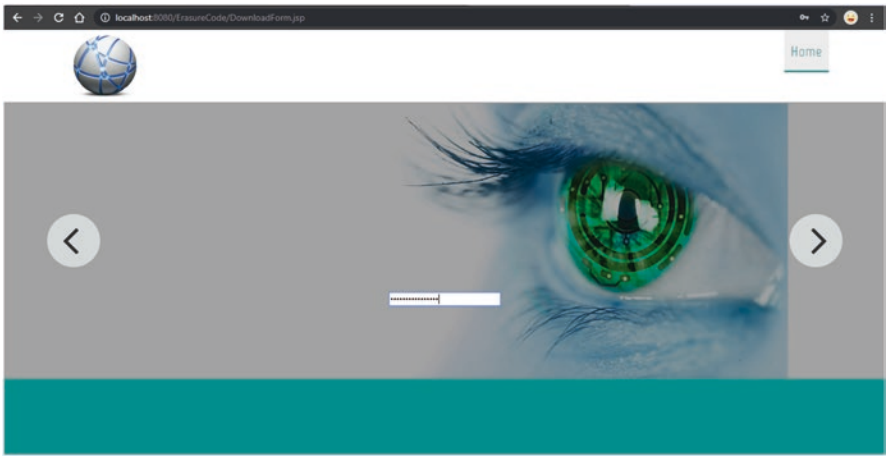

Fig. 7 Verifying private key

Fig. 8 Uploading the file

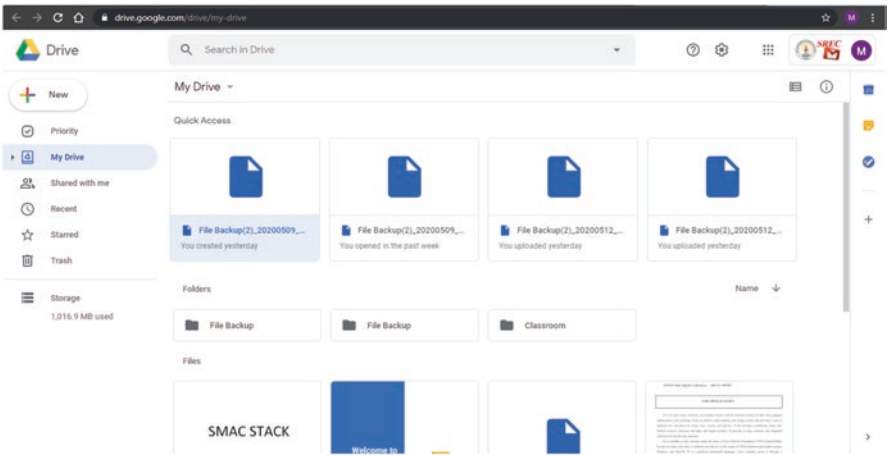

Fig. 9 Storing the file in the cloud (Google Drive)

4 Result and Discussion

This section shows the results and discussion of the proposed method.

4.1 Experimental Setup

The proposed system is done in the system with 8 GB RAM, Intel processor, and Windows 10 Operating System. This technique is implemented using NetBeans and uses SQLyog as a database and the software tool Easeus Todo Backup.

Fig. 10 Encrypted file

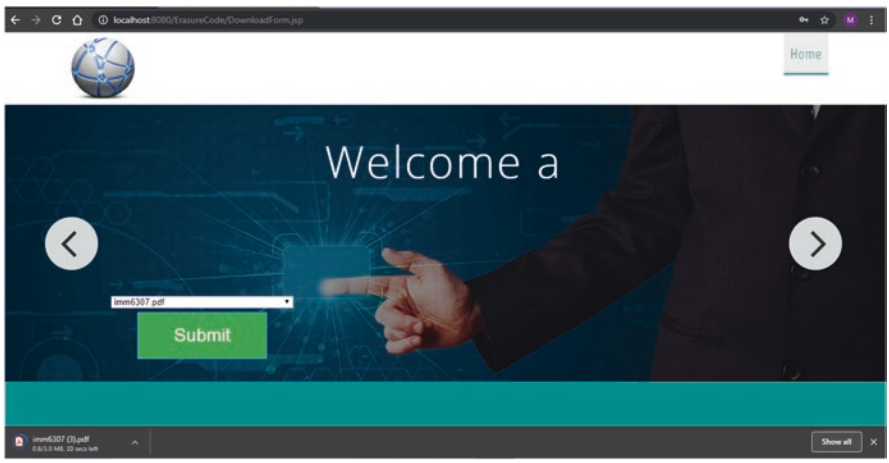

Fig. 11 Downloading the file

4.2 Experimental Results

This section shows the sample results of the proposed method. The uploading files are in Fig. 8. The file can be uploaded to the server, and it will be divided, encrypted, and stored in the four server instances.

The files stored in the cloud in Fig. 9. The files can be stored in Google Drive using Easeus Todo Backup software. The file stored in the cloud can be used for later use. The files are more secured as it is encrypted and re-encrypted using proxy re-encryption.

The files will be decrypted while downloading, as in Figs. 10 and 11. While downloading the file, it is needed to provide the private key provided to the user.

5 Conclusion and Future Scope

The technique of hybrid cryptography is used to protect data files in the cloud. A 16 digit (alpha-numeric) secret key is generated using the MD5 algorithm. While uploading the file to the server, the file splits into four. The data stored in the cloud can be encrypted using AES encryption. The data can be in any form like text, images, videos, pdf, word, etc. AES is an asymmetric cryptographic algorithm that takes ten rounds for one encryption method. Each file is encrypted separately using the cryptography technique. The encrypted data is then uploaded to the public cloud. The four encrypted files are converted into a single encrypted file. Then, the secret key generated using the MD5 algorithm is used to download the single original file, and this is done using the proxy re-encryption technique. The data stored cannot be hacked by hackers or any online intruders since the random secret key is known only to the owners. The AES encryption also makes it difficult to decrypt, although the original file is split into four different encrypted files. The method ensures client information security and privacy by storing data across a single cloud, using algorithms. In the future, the encrypted files of AES, which is four in number, can be stored in the cloud at different locations. So, it becomes more difficult for the intruder to understand the data.

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Malicious Firmware Injection Detection on Wireless Networks Using Deep Learning TF-IDF Normalization (MFI-IDF)

T. N. Prabhu, K. Karuppasamy, E. P. Prakash, and K. Karthikeyan

Abstract Mobile malware, as the quote says, is a harmful code that attacks smartphone devices in particular. These are several other forms and various delivery and intrusion strategies of smartphone malware. The challenge is quite significant and should be discussed for organizations based on smartphones to operate but require their workforce and guests to provide their smartphones when something of a new system. That huge percentage of malicious software is intended to access the files, including such financial records, a list of friends or other sensitive data. Other fraudulent applications view negative population on the handset or the web and send users to inappropriate pages. It is important for security and software builders to construct and adjust a broad variety of possible functionalities across the globe. The use of the advanced unexpected Tree (CA-IDF) as a network node firmware threat was reflected. A related output system is labelled hazardous or harmless through learning a particular CA-IDF model grouped through a standard or anomalous API. The result showed a really good meaning of 94.78 per cent and a low adware assault of 0.05 per cent. Thus, it is outfitted to identify a suspect pattern in unknown system software of cyberattacks Deep TFI-DF.

Keywords IoT · Backdoors · Malware · API calls · Deep learning · Random forest · Firmware

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1 Introduction

Malware is traditionally picked away from the previous computer environment and repeated from adding it to another system. Attackers have been using this approach mostly to disseminate their harmful research, and viruses had become a common term for all types of encryption on their machines [1]. We haven't seen any malware that propagates like a PC hacker too far for electronics, so this doesn't occur, particularly in Android, because theoretically, app hackers don't occur. Even so, several other forms of malware are usable in Android [2]. While technical inaccuracy, most folks assume infected computers as a worm. Made in the absence of smartphone adware, the action shall typically make its way into a cell phone via template or strong normative and sometimes without the individual's permission. Many types of malware are selected to obtain files and data so that advertisers can spare you [3]. Most of the malware variants typically provide a malicious software component, which captures the message and transmits it to a private entity regarding your Internet use. Information of their place, credentials and emails will contain this info. This makes things more or less concern for them and everyone in your contact list.

They may still target an android malware type called a people driving-by install when you access an incorrect email and access a suspicious blog. Those latter combinations are preinstalled on their system. Therefore, they can wreak various attacks, including certain spyware, malware, keyloggers or even a bot which is a bigger problem, for example, using your smartphone to carry out unpleasant tasks, along with virus transmission-relevant legislation. Just a reasonable framework could perhaps appear to include an infection or a computer virus that is prepared to strike your cell device. Such viruses can be very harmless, for example, by modifying the wallpaper or adjusting your computer's language. It has, though, in view anything more sinister, such as code extraction and card knowledge. Cyber scams would be nothing recent, but malicious hackers see their spyware strategies evolve with smartphones' advent to target mobile cell apps. Successful phishing methods involve the delivery of communications to clients from either a known source. iPhone phishing moves a stage better and utilizes desktop malware software. Often unable to differentiate between a genuine application and a fraudulent request, it is not the wiser user to gather bank details, credentials and the false implementation [4].

Everyone's smartphone is not necessarily ideal whenever it gets to encryption [5]. Of the whole purpose, a range of crazy web hacks will benefit completely from the web, and certain software-based programmes, including reading comprehension's two safest ways to secure oneself, are using smartphone protection software through prowl to detect the irritating "computer bugs" and be smart to uninstall applications only [6]. Verge can search your computer and phone and review any new application you launch to make sure it's free. However, before you can search the freshly updated device, you only need to test applications from reputable sources, check scores and read comments to validate that they are utilized and accepted by others [7]. Keep apps up to date: It will guarantee whether it must be

updating the software with both the best security fixes and improvements by installing the latest release of each programme on their smart devices [8]. Tech companies also publish a new upgrade or iteration when their product is impacted. Enable mobile protection programme: Through virus apps, a mobile security device prevents a machine from spreading malicious software. Take a proxy server into account. Many cell telephones have few firewall rules [9]. In addition to preserving your activity while navigating, routers could be used to enable approved apps to surf the network only via a series of configuration files. Using lock security on the monitor: If they are misplaced and robbed, often handheld devices become damaged. To ensure that the machine is at least password-protected. They are using based biometric or signature technologies much more efficiently.

2 Related Work

[10] The number of communication technologies, including network access apps, has risen dramatically, which has rendered ransomware more dangerous than past. Thus, the most significant information protection issues have been to find malware that was previously unseen to deter epids and malicious activity throughout the smallest practicable period. Spam filters utilizing long-accepted malicious fingerprint repositories can recognize current threats effectively, but they're hardly producing the very same efficiency as modern malware identification [11]. Neural network strategies for the detection and classification of vulnerabilities were also used. Nevertheless, that reality contributed to developing specific anti-analytic strategies by vulnerability writers to deceive the deep learning research by detecting the simulator setting and modifying their fraudulent activities to regular action. Hence we propose a new paradigm in this report, focused on profound awareness regarding malicious apps, which does not have to be carried out in such a debugger. Authorization to submit was used as a standard. These were rated with a precision of 93.67 per cent with a multi-player sensor after optimization of their masses by automated codec [12].

[13] Even before the reawakening of cellphones and touch screen devices, malicious mobile code has become substantial. TrendLabs approximated that throughout the second half of 2013, android devices were malevolent and potentially risky 718,000. Harmful smartphone botnet infections occur from many methods, including downloading relabelled legal malware software, modifying existing applications that cause harmful versions, and even uploading drive-by. At least one or more of the systems mentioned earlier, authority rises, central control, economic pressure, processing of knowledge, etc. should be used for infections themselves. This post discusses risks and assaults from malicious apps, various cybercrime reasons motivating malicious code, current approaches and security shortcomings. The study will propose a cloud-based threat identification system. The system suggestion includes a co-operation between smartphone users, subscription services and

IT, protection experts. A contract worth mobile protection is cloud-based threat identification.

[14] Many studies in the field of literature tackle malicious mobile identification by classification and the use of possibly the best-known machine learning techniques. Many authors' analytical reviews have been conducted to determine the consistency of apps [15]. Throughout this document, they provide Behave Yourself, a dependable Android framework that extracts remove-based characteristics using a faulty application. Our software is accessible and adaptable; as a reference point, an updated version can be specified and experimented with [16].

[17] The whole study describes a Localized Fast Technique for Problem Understood Convolutionary Structure (Simple R-CNN) [18]. Fast R-ML extends previous research, such that the predictions provided by deep coevolutionary systems are easily defined. Fast R-CNN uses a few technologies to improve planning and research efficiency while still increasing detection quality relative to previous ventures. Quick ML trains the deep VGG16 9 faster than R-ML, has a speed of 213 during test time and complies with PASCAL VOC 2012 guidance [19]. Quick R-ML transports poor communities 3 faster, 10 more accurately, and is more reliable than SPPNet. In Python as well as C++ (use Caffe), Fast R-CNN is modified [20].

3 Theoretical Background

Delineation of Social Media Malicious Post Identification Using Deep Learning Bag-of-Words (SM-DLB). It is a method for quantifying a phrase; typically, each phrase's weight was calculated, which highlighted the term's impact in the text and repository. The system is commonly utilized in the collection and processing of knowledge. The expression "value-inverse message size", as well recognized as tf-idf for identity diffusion or knowledge discovery, is a widely known way to determine how relevant the word is. Tf-idf is also a perfect way to transform details consolidating multiple into a latent space (VSM). TF*IDF is a methodology to collect knowledge that weights the occurrence of the word (TF) and reverse (IDF) paper. For any word or phrase, the associated TF and IDF grade. The TF and IDF outcomes of a word are referred to as the whole phrase's information exchange and communication value. A term in any text is weighted using the information exchange and communication formula. The value of that vocabulary is assigned according to the various occasions it is seen throughout the report. Most specifically, it explores the value of the web-wide term known as repository.

$$N_{k,l} = pL_{n,m} * \log\left(R / eL_i\right) \tag{1}$$

We would have seen that not so common terms such as I upload are reimbursed for the same meaning as certain terms currently used for the click and transfer of two

items. The tf-idf, a mathematical-statistical measure that weights down the results of the less significant terms, is one tool to tackle this conduct in Table 1.

$$\text{Tf} \quad \text{IDF}(p,L) = \text{TF}(p,l) * \text{IDF}(p,L) \tag{2}$$

Here $L = \{l_1, l_2, l_3 \ldots . l_m\}$

Tf-idf is the expression intensity as well as the opposite rate of data, the two variance variables. The incidence of a given text is essentially the number of iterations of a phrase. The word love level will be twice if our report is "update with pricing and free mobile applications". This meaning is generally weighted so that it is separated by the lowest level of terms in the text, resulting in level terms values of 0 (for words not used in the text) and 1 (with the language being the most prevalent phrase). Francs by term and text are measured.

$$Tf(p,L) = \begin{pmatrix} \text{Malicious instruction } l1 \text{ of} \\ \text{the existence of stint } p \text{ in file } L \end{pmatrix} / \begin{pmatrix} \text{Maximum of} \\ \text{Benign keywords existence in file } L \end{pmatrix} \tag{3}$$

On another side, only a term is measured for the reverse text size. This demonstrates how much a phrase occurs in the training collection. By making the log transformation of it, this meaning is inverted. Notice the omnipresent and destructive term of tried to rid ourselves. But one's numerator is zero, and it destroys its impact using Fig. 1.

$$\text{idf}(p,L) = (\text{Malicious instruction file } L) / (\text{Maximum of Benign Keywords existence in file } L) \tag{4}$$

It tests the significance of the report in an entire file and is just like TF. Perf seems to be the only variation in terms t in sourced, where DF is the number of instances t in recordset L. In other terms, DF is the number of reports that include the term.

Table 1 Wide CA-IDF vs potential malware scripts sample presented

S.No	Benign/malicious keywords	L1	L2
1	Click	3	5
2	Lucky	4	2
3	Download	4	2
4	Price	3	1
5	Offer	2	3
6	Book	1	1
7	Send	4	3
8	Love	1	6
9	Benefit	5	0

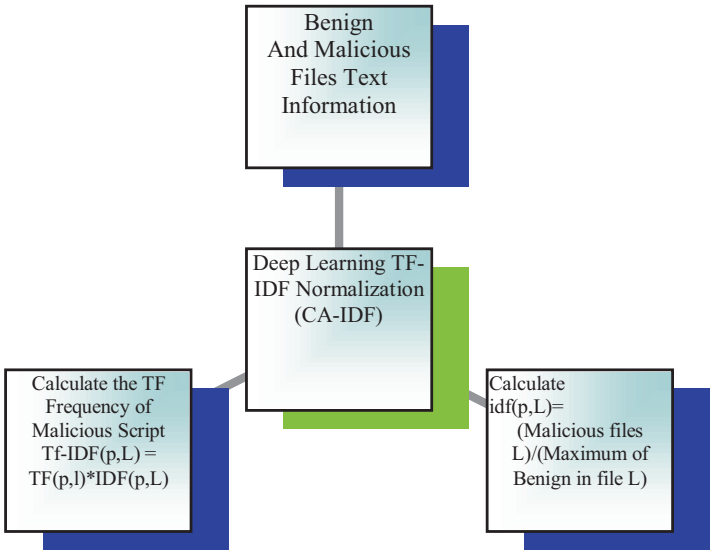

Fig. 1 Depicts the flow of CA-IDF malicious identification

They may not have to ask the number of occasions the word is used unless the phrase is included in the text at a minimum once. They stabilize this by splitting the overall amount of records to hold things in a set. Our key objective and DF was its absolute reverse, which is to understand a word's efficacy. Now we are restoring the DF. An IDF is the opposite of the intensity of the report that calculates the t detail. Unless we quantify IDF, the far more frequent terms collocations including such "click" are used in virtually all reports, and *p*/*nL* gives this term a very reasonable rate that would have been very small. This provides a's characterized everything eventually. Review of the evidence is just the next phase of every deep learning mission. When gazing through the list, we refer to all the records with deceptive terms at the first level in Table 1. These are two files for each text. Some of the key challenges today are locating the title somewhere in the structure, so there are various strategies for aligning the title as we examine the papers.

Nevertheless, the rest of the names are based. Now find a means of removing the malicious word. Until now, contracts study the database a little further until we get all up and attempt scripting using Fig. 2.

This pattern concentrates solely on terms, or often on a sequence of words, but typically fails to answer the so-called framework. The method term bag generally includes a wide list typically best understood as a kind of "directional", which has been regarded as experiencing words. Each of these phrases has its own "importance" in the document. Usually, the factors are all incorporated, resulting in a perception evaluation. There are several different equations to attach and extract. However, this template concentrates mostly on terms and doesn't try to grasp the function of knowledge.

Fig. 2 Depicts the process and data flow of CA-IDF malicious identification

As we're seeing, a bunch of sentences are still occurring only once. Such phrases are due immediately of the instead of again for the group in which they take place. Even so, that authentic-class distribution of both the term is not estimated at all. Thus, it is important to establish any "occurrence cut-off value", which will not include lower terms towards this meaning. By separating each component across each column even by quantity, including its items in the row, divergent thinking comprises all comparative occurrences of each term in each column. When such terms are finished, in category 1, they can be regarded as low, and in-class 5, the terms with the obligate can be viewed as a positive term. It may develop such a feeling dictionary from of the classification model and use it to quantify the rationality during assessments. The vocabulary of both the opinion for prediction is correct based on the learning collection scale.

4 Experimental Results and Comparison

It is a really popular method to assign specific weights to names and limbs. We only have to take a body + title into the text, and we could find the vocabulary. So we have to send a word in title various lengths so terms throughout body-specific

weights. Let us look at an illustration to illustrate this better. It's just the volume disparity that we'll offer. The term will not decrease the worth of the TF-IDF when included both in the description and core. The weights of structure for this specific term do not apply to the TF of that term if the term is just present in its description and conversely given in Table 2.

$$\text{File}\,L = \text{Malicious Post Scripts} + \text{Malicious Keywords}$$

$$TF \quad IDF\left(\text{malicious file}\right) = TF \quad IDF\left(\text{Malicious Post Scripts}\right)* \\ \text{alpha} + TF \quad IDF\left(\text{Malicious Scripts}\right)*\left(1\text{ - alpha}\right) \tag{5}$$

Then let us be wise and pre-hand DF estimate. All the terms of both records must be iterated, and the language definition for each term must be processed. We could use a database to do so, as it can be used as a button and text collection. However, if the text is being inserted several times, I've listed the set since it does not only receive repeat properties. Also, for titles and structure, we have to hold specific scales. We will remember both the heading and the subject when measuring the TF-IDF of the object or description. To make our work easier, we'll use the database as a cornerstone and as a reference for some TF-IDF meaning(malicious script, malicious keywords). We merely ought to append thru these records, using the cutner to send us the intensity of the symbols, measure tf and idf and store everything ultimately in tf idf as a (doc, credential) collection. For the body, the tf idf database constructs a tf idf title vocabulary for tagline terms, following a certain principle. The various loads are measured. First, we have to maintain an alpha number, although for the system is the point, instead, of course, 1-alpha was its descriptive volume. So let still go into a few things: unless the term is visible in either location, we have mentioned that the TF-IDF valuation of a phrase should be the same for this same body and the tagline. Two tf-idf dictionaries, one for body and one for the title, have been preserved. We'll be a little clever, and we'll measure TF-IDF for the entire body, subtract the TF-IDF quality for alpha throughout the body, optimize the description symbols and substitute the TF-IDF value title throughout the body TF-IDF worth of the (file, symbol) pair.

The rate of similar terms in multiple suspicious articles was defined mostly during the study as follows:

Table 2 Wide CA-IDF vs potential malware tactics conceptions indicated

Approaches	Number of threat software identification	Precise number (%)	Inaccurate declared	Inaccurate actual share (%)
I. Bulut	997	91.13	97	0.08
N. Penning	961	87.84	133	0.11
Proposed CA-IDF	1037	94.78	57	0.05

[('<a>', 154), ('share', 35), ('click', 54334), ('like', 4234), ('sh', 423), ('exe', 4320), ('time', 3231), ('<iframe>', 1107), ('love click', 1873), ('offer', 1844), (best', 1824), ('tick', 5452), ('like', 1735), ('get', 1214), ('character', 1233), ('my show', 5453), ('level', 5523), ('see', 4212), ('way', 3243), ('cricket', 5642), ('score', 1231), ('really', 4534), ('book', 2133), ('threat', 1233), ('plot', 1288), ('people', 3219), ('could', 1248), ('new', 1248), ('scene', 1241), ('download', 1238), ('never', 1201), ('best', 4323), ('update', 4321), ('songs', 1135), ('man', 4241), ('many', 1321), ('doesnt', 4323), ('know', 1092), ('dont', 1421), ('hes', 1024), ('great', 1014), ('another', 992), ('action', 985), ('love', 977), ('us', 3212), ('go', 952), ('enter', 3213), ('age', 321), ('group', 678), ('pills', 567)]

The method clears vocabulary data and eliminates all minor occurrence situations and all observations, either occasionally. For example, the present study will only illustrate the fingerprints that appear on two or perhaps more occasions in will study.

A few certain two-thirds of the vocabulary are decreased using the example defined for this exclusion from 42,251 to 15,732 expressions. The hidden layer is a text presentation approach that shows any vocabulary term as a really helpful variable in a really large area. The parameters are instructed to apply the same significance to words in the component's inheritance (just next to that distribution's purview). It is a far more surrealistic text than traditional methods such as the package of verbs, where relations are ignored or pushed through word vectors or pos tagging between sentences and touches in Fig. 3.

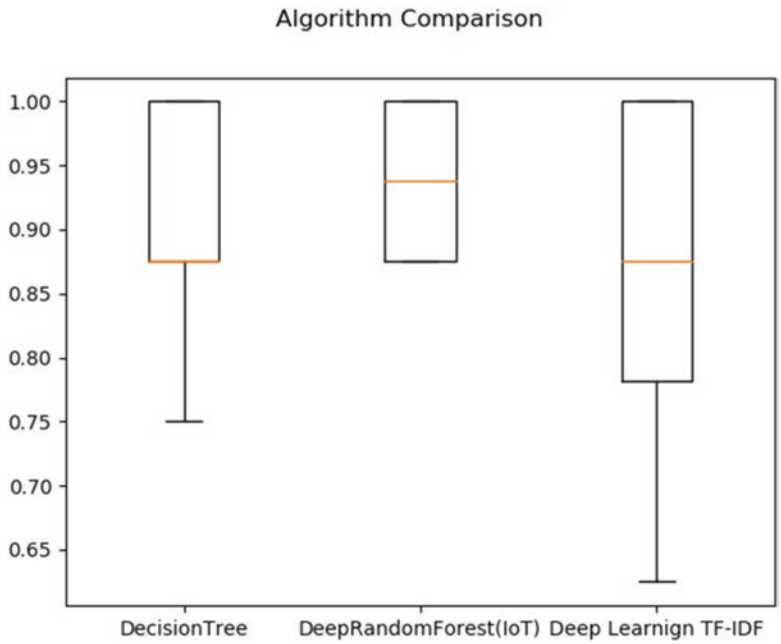

Fig. 3 Specific posts collected with deep CA-IDF in the social networking community

Full botnet studies used: 1094
Traditional Group Analysis Document Number: 1123

5 Conclusion and Future Work

A trifling portion of those attacking workstations is the number of smartphone attacks. Nevertheless, as smartphones carry out highly critical and potentially high-quality activities, mobile safety risks rapidly become a rising issue. Deceitful threats could be used at social media sites such as Facebook, Google+ and Twitter users. Most of them are not clients, friends or seasoned people. The intention is specifically to benefit the business or the product. Many of the inserted bugs in a particular operating device were used to perform known phishing software through instant messaging and site-related calling. Trojan gathers the personal records, passes them to the cyber archive, distributes malicious spam and utilizes every system to the full implementation. A CA-IDF classification model was eventually used to check for further commonalities to certain detrimental scripts. The result is a genuinely favourable outcome of 94.78% of the Internet and social networking threats, and 0.05% is assuredly a scam. In the future, the entire cycle is done by scanning diverse APIs that allow malicious device incorporation throughout the long term.

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An Efficient Authentication Using Monitoring Scheme for Node Misbehaviour Detection in MANET

A. Christopher Paul, D. Bhanu, R. Dhanapal, and D. Jebakumar Immanuel

Abstract Voluntarily cooperating nodes of the infrastructure are less and self-configuring ad hoc networks where the direction in a very operative way. Certain nodes among this refuse to cooperate and exhibit selfish behaviour thus called selfish nodes. Those are nodes that decline the frontward packets to the neighbouring user saving their properties from degrading the network performances. The existing local watchdog system in each node may fail to detect every selfish node and also may produce incorrect detections, therefore indications of improper action, which can, in turn, alter the system performance through promptness and accuracy. The nodes have a considerable preference in systems such as for opportunistic network and delay-tolerant networks, which have sporadic contacts. In such networks, watchdog could not detect the selfish nodes because of the lack of enough time and information required for recognition. Thus, a collaborative approach is proposed in which every node diffuses the local selfish node awareness whenever a new contact appears, leading to advanced speed and precision. Such nodes can then ostracize from the network while routing.

Keywords Cooperating nodes · Mobile nodes · Clustering · Quality of service · Overhead

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1 Introduction

The mobile node has self-configuring, self-organizing, and self-healing infrastructure less multihop wireless networks capable of forming a temporary routed network structure with the aid of cooperating nodes; such a network is the mobile ad hoc networks (MANETs). Each node is moving at a different speed. They can communicate with other neighbours in the communication range whenever a new contact is accomplished in the network, that is, whenever the nodes are aligned in the communication range. Some nodes refuse to transmit the packet received to other nodes with selfish characteristics among such mobile nodes. Such nodes are referred to as selfish nodes, which greatly influence the network's overall performance, such as packet drop, decreased throughput, probability of reachability, data accessibility, and increased delay time. The detection and exclusion approach is adopted [1–8].

One of the effective approaches proposed here for the detection is the collaborative contact-based approach along with the watchdog mechanism. The local watchdog system in each node can overhear the traffic associated with its neighbour nodes. It also analyses the traffic to distinguish and store the information about the node acting selfishly [9–12]. Then this information is disseminated by the collaborative approach that the information about selfishness is communicated to the other nodes whenever a new contact occurs among the nodes. Along with this, multicast and multipath routing are incorporated to compare the packets through each route, thus detecting and removing the false and corrupted information, thus improving overall performance [13–18].

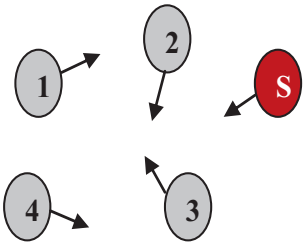
2 Proposed Model

The node which denies packet forwarding is referred to as the selfish node, which neither provides proper routing nor relays proper packet forwarding. Such a node can be detected and excluded while routing from the network with the local watchdog and the collaboration of the information [19–22]. The monitoring node will get the status of retransmission of the packet to its neighbour node. It produces the malicious and non-malicious node detection at that time communication it considers node behaviour [23–25]. When the source node communicates with a neighbour node or leaves from the communication range, each user shares the information to the neighbour group nodes that exists, that is, and two nodes are in the communication range with sufficient time for communicating within them. The selfishness characteristics will degrade the system's overall performance, the feasibility of the packet vanishes, and the presence of such nodes will make the retransmission impossible.

(a) Initial state: each node does not have information about the malicious nodes. (b) Node 2 detected the selfish node and marked it as positive detection by using its

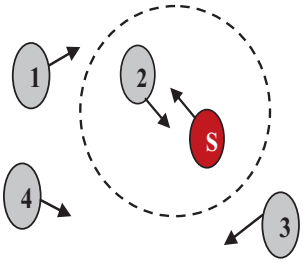
watchdog. (c) Node2 communicate with neighbour node 3 and share the information about malicious node information node 3.

The proposed method with the assumption of only one selfish user is selected, as shown in Fig. 1. At the initial stage, every node in the network does not know about



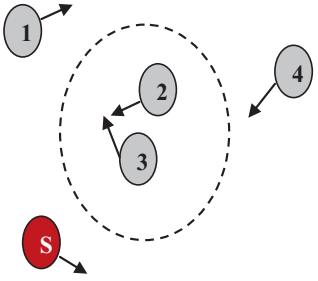
Node	Status
1	No Status
2	No Status
3	No Status
4	No Status

a) Initial State



Node	Status
1	No Status
2	Positive
3	No Status
4	No Status

b) Selfish contact (Positive), Local Watchdog Operation



Node	Status
1	No Status
2	Positive
3	Positive
4	No Status

c) Dissemination of information by Collaborative Contact

Fig. 1 Shared communication-based monitoring node operation. (**a**) Initial state. (**b**) Selfish contact (positive), local watchdog operation. (**c**) Dissemination of information by collaborative contact

the malicious node information. Based on the behaviour, any one of the detected malicious node is marked either as positive or negative. Afterwards, when this node contacts other users to share, the malicious node's resources get transmitted. From this, it's clear that a node can get aware of a selfish node directly or indirectly through the local watchdog or shared transmission shares the table information resources through the watchdog.

3 Simulation Output

The simulation is performed through the network simulator version 2 software. Selfish monitoring system finds the malicious node or non-malicious node communication. Here we assume N is the number of mobile nodes, finding the number of destination nodes using formula $D = N - 1$.

Figure 2 shows the varying number of nodes on different detection time. An estimation of $D = N - 1$ assesses the malicious detection for every group of users to find the maximum malicious user. The $D = 1$ assesses the identification period for just a single mobile node detection, the individual recognition. Accordingly, the maximum identification assesses the whole system's exhibition, although the single recognition assesses the uninformed node performance.

The number of mobile nodes participating in communication is considerably high, then the detection time will be shorter, but the messages will be greater. This is due to increasing the number of mobile node communication. Their contact between the neighbour nodes is also increased based on the information positive

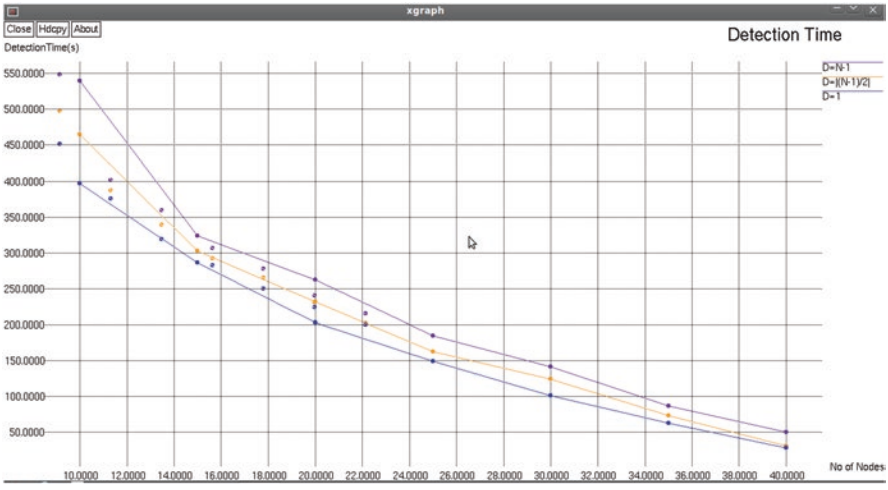


Fig. 2 Number of nodes vs detection time

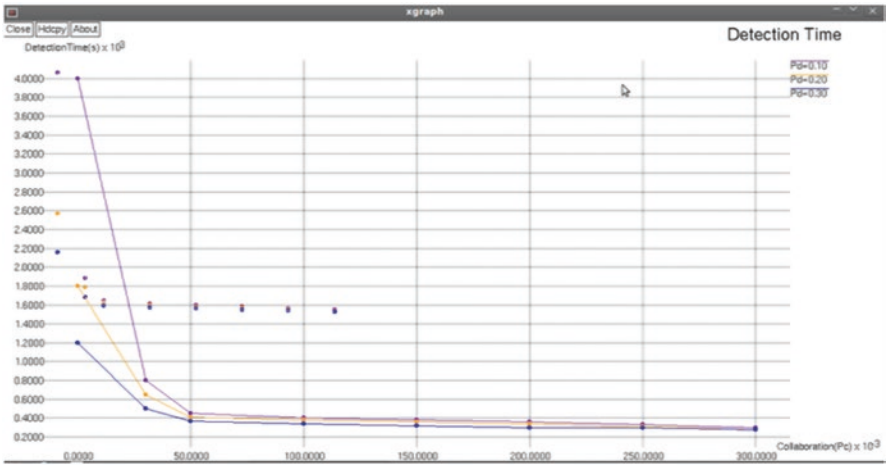


Fig. 3 Detection time with degree of collaboration

malicious node can be dispersed more rapidly. This will make the detection of selfishness and dissemination of the information more effective.

Figure 3 shows the degree of collaboration on detection time. Assume in a network there is a single malicious user available ($S = 1$). The experimental method gives the identification time for all mobile node in a system based on various possibilities identifying the abnormal user and their requirement (Pd). The possibility of abnormal user identification (0.1), regular delay tolerant, and multihop mobile networks shows the highest identification proportions (0.3) average of MANETs. When the level of cooperation shifts from 0 to 0.2, the identification time is getting decreased exponentially.

Figure 4 shows the effect of threshold on detection time. Where detection parameters are local watchdog parameter δ and threshold, the direct information to the nodes impacts the malicious node finding period. Therefore the consequence of the parameter δ has included here. It shows that better than the threshold values suggest minimum accuracy detection times, based on the event to make a decision. Likewise, the value of δ is increasing, that is, giving more trust to nearby occasions, suggesting a decrease in both identification times.

4 Conclusion and Future Work

The community-oriented contact-based guard dog strategy for recognizing egotistical users will diminish the period and improve the malicious user identification and minimize data packet forwarding to malicious users. The results show that an increased detection rate compares to the existing technique while varying the node's number. To increase this method's merits, further developments can be done by

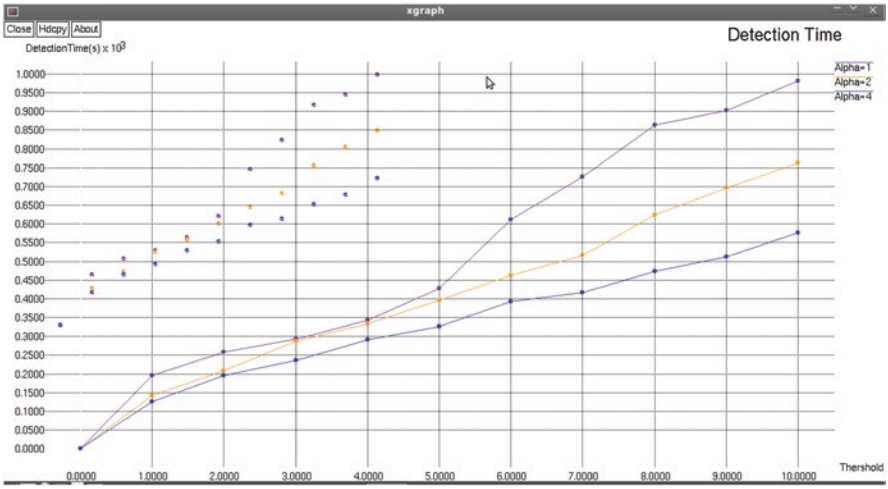


Fig. 4 Detection time with threshold

incorporating more efficient protocols and mechanisms to the networks, such as multipath routing and multicast routing, and utilizing the advantages of AODV on the collaborative approach.

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A Framework for Analysis of Network Traffic Using Predictive Algorithm

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Abstract Network security has been one of the most important computer network management problems, and intrusion is the most publicized security threat. Intrusion detection is an important component of infrastructure protection mechanisms. Gatecrashers find new assault types every day; accordingly, they should be distinguished effectively utilizing interruption identification group to forestall these assaults. Thinking about the expanding intricacies of the present organization conditions, an ever-increasing number of hosts are getting defenceless against assaults. Henceforth, it is imperative to take a gander at organized, productive and mechanized methodologies for intrusion detection. As of late, interruption location has arisen as a significant field for network security. The current research aims to improve detection rates and assist users in developing safe information systems. AI and deep learning calculation is utilized to construct the information model for interruption discovery with better exactness. The machine learning calculation utilized is the decision tree calculation. In this model recursive feature elimination technique is utilized to beat the high bogus positive rate. The deep learning algorithm utilized is data autoencoder. The model gives a generous improvement over other profound learning-based methodologies regarding exactness, bogus alert rate. AI and deep learning strategies are analysed about their exactness and location potential to identify various sorts of interruption.

Keywords Security · Intrusion · Algorithm · Network · Accuracy

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1 Introduction

Interruption is an activity that arranges the three security prerequisites: confidentiality, availability and integrity of the assets. An Interruption Detection System is an application that reviews network frameworks for any interruptions [1]. Any dubious movement will be accounted for to the executive or halfway controlled security data and occasion the board framework. At whatever point dubious action is distinguished, it issues alarms. IDS are utilized to identify different security assault. An Intrusion Detection System is utilized to recognize a wide range of toxic organization traffic and PC use that an ordinary firewall can't distinguish. This includes network attacks against vulnerable administrations, data-driven attacks on programmes, have-based assaults, such as benefit escalation, unapproved logins, and access to sensitive data, and malware [2]. An IDS contains three segments: sensors, which sense the organization traffic or framework action and create occasions; reassure, to screen occasions and alarms and control the sensors; and recognition engine, that records occasions logged by the sensors in a data set and uses an arrangement of rules to create cautions from the got security occasions [3]. There are a few different ways to arrange an IDS relying upon the kind and area of the sensors and the motor's approach to produce cautions. In numerous straightforward IDS execution, each of the three parts is joined in a solitary gadget or machine. AI calculations are applied to prepare the framework and arrange the information into typical or assault information [4]. There are four ways to deal with machine learning procedures. They are supervised learning – it is comparable to the management of an educator in the class. This calculation utilizes marked information for preparing and predicts the new information dependent on the preparation it acquired [5]. They are delegated grouping and relapse. Unaided learning – unsupervised learning utilizes unlabelled information and discovers structures, designs and information in the information. They are delegated bunching and affiliation. Semi-administered learning is a blend of both marked and unlabelled information. Support learning – this strategy frequently gains from the climate dully to make moves that would augment the reward or limit the danger.

2 Description

2.1 Decision Tree (Machine Learning)

The choice tree calculation orders information utilizing a progression of rules. The model is tree-like, which makes it interpretable. The choice tree calculation can consequently reject unimportant and excess highlights. The learning cycle incorporates highlight choice, tree age and tree pruning [6–7]. When preparing a choice tree model, the calculation chooses the most reasonable highlights exclusively and produces kid hubs from the root hub. The choice tree is an essential classifier. Some

high-level calculations, such as the arbitrary woods and the limit slope boosting (XG Boost), comprise numerous choice trees.

2.2 Deep Autoencoder (Deep Learning)

An autoencoder contains two even segments, an encoder and a decoder. The encoder removes highlights from crude information, and the decoder recreates the information from the extricated highlights. During preparing, the uniqueness between the encoder's information and the decoder's yield is steadily diminished [8–9]. When the decoder prevails with regard to remaking the information through the separated highlights, it implies that the highlights extricated by the encoder address the pith of the information. Note that this whole interaction requires no regulated data.

2.3 UNSW-NB15

The information classifications incorporate typical information and nine sorts of assaults. A stream highlights, critical highlights, content highlights, time inclusion, extra highlights, and indicated highlights are all included in the highlights. The UNSW-NB15 is illustrative of new IDS datasets and has been utilized in some new investigations. Albeit the impact of UNSW-NB15 is as of now second rate compared to that ofKDD99, it is important to build new datasets for creating interesting IDS dependent on AI [10]. The absolute number of records is 2000,000 and 540,044whichare put away in the four CSV documents, specifically, UNSW-NB15_1.csv, UNSW-NB15_2.csv, UNSW-NB15_3.csv and UNSW-NB15_4.csv. The quantity of records in the preparation set is 175,341records, and the testing set is 82,332 precedents from the various kinds, assault and typical in Table 1.

Table 1 Training and testing records of Unsw-Nb 15 dataset

Class	Description	Train	Test
Normal	Normal connection records	56,000	37,000
Fuzzers	Scan html file penetration and spam	18,184	6062
Analysis	Scan html file penetration and spam	2000	677
Backdoors	Evading the background existing security	1746	583
DoS	Network resources down and consequently, resources and inaccessible to authorized users	12,264	4089
Exploits	An attacker with aim to exploit the vulnerability	33,393	11,132
Generic	Related to block-cipher	40,000	18,871
Reconnaissance	A target system to gather information for vulnerability	10,491	3496
Shellcode	Payload used in the exploitation of software	1133	378
Worms	Distributed to another system through computer network	130	44
Total		**93,500**	**28,481**

3 Working Principle

3.1 Decision Tree Model

3.2 Data Preprocessing

Information preprocessing is a significant advance in building an information model. Information preprocessing must be done because the dataset contains both mathematical and non-mathematical case. Scikit-learn, an AI library written in python, is utilized to fabricate the model in Fig. 1. This library functions admirably on the mathematical information, so the one-hot encoding strategy is utilized to change information. The one-hot encoding strategy changes over the absolute information into the mathematical arrangement, which helps the AI calculation work effectively. This interaction is trailed by adding the missing classifications to the test dataset from the preparation dataset, which helps construct the dataset with better exactness.

3.3 Unsupervised Techniques

These techniques can be used for unlabelled data.

The feature selection method is used to remove the irrelevant data from the dataset, which helps get better accuracy. Generally, it is a method of getting a subset of relevant features. This is useful in restricting the number of features. The irrelevant

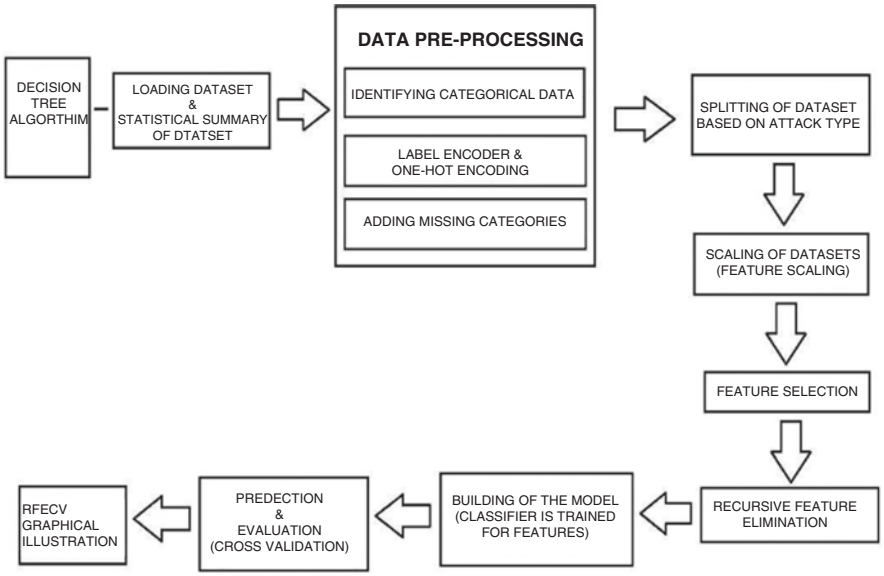

Fig. 1 Steps involved in building decision tree model

data can cause a correlation between the feature and the target class, reducing the classifier's efficiency. Thus feature selection technique is used. Feature selection also helps in reducing the computation time of the model.

3.4 Recursive Feature Elimination

The recursive element disposal approach is utilized for dispensing with highlights from the preparation dataset in include choice. Recursive element end is a covering style including determination calculation that additionally utilizes channel-based element choice inside. RFE works by looking for a subset of highlights by beginning with all highlights in the preparation dataset and effectively eliminating highlights until the ideal number remains.

3.5 Prediction and Evaluation

The prediction is made in the model using the training dataset. The efficiency and accuracy of the model built were validated in this step. Cross-validation is for the validation of the model. For evaluating the various model parameter was considered such as accuracy, precision, recall and f-score. The values are calculated for each category's features and the reduced feature for each category in Fig. 2.

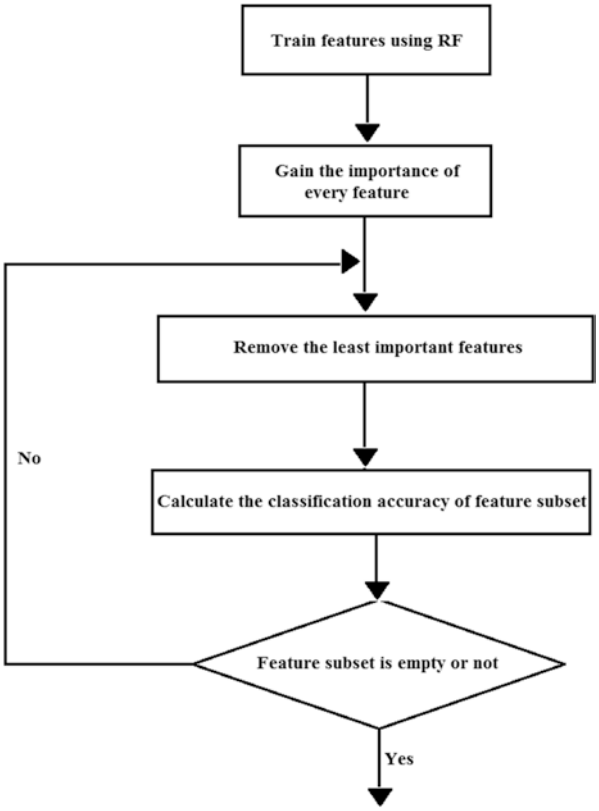

Fig. 2 Steps in recursive feature elimination

4 Autoencoder

4.1 Data Preprocessing

In the data preprocessing method, the dataset is checked for the missing and duplicate values as it may reduce the model's efficiency. The categorical features are identified from the dataset. In the identified categorical features, feature encoding is done. This feature encoding is done using the one-hot encoder. The non-numerical data in the dataset is converted to a numerical using the one-hot encoding method. This also helps in representing the categorical features in a more expressive manner, which improves the model's better performance in Fig. 3.

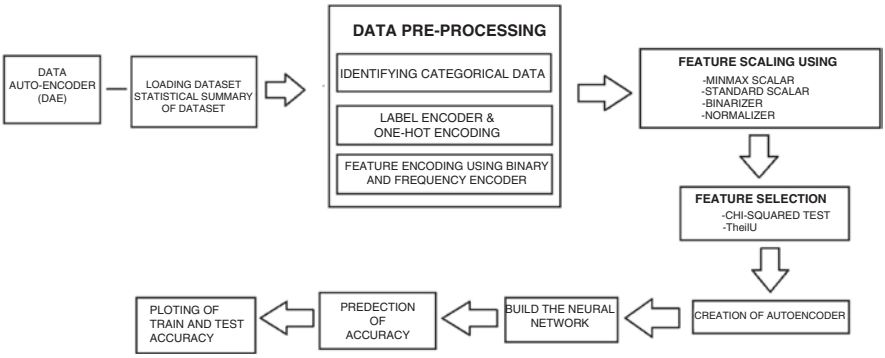

Fig. 3 Steps involved in building autoencoder model

4.2 Data Preprocessing

In the data preprocessing method, the dataset is checked for the missing and duplicate values as it may reduce the efficiency of the model. The categorical features are identified from the dataset. In the identified categorical features, feature encoding is done. This feature encoding is done using the one-hot encoder. The non-numerical data in the dataset is converted to a numerical using the one-hot encoding method. This also helps in representing the categorical features in a more expressive manner, which improves the model's better performance.

4.3 Build the Model

The model is pre-trained using an extra tree classifier algorithm to avoid overfitting and local optima [11]. This autoencoder takes the architecture of the bottleneck, which has the lower dimensions data. The autoencoder learns these lower dimension data to minimize the error. The training data is fitted over the defined autoencoder. After the training is completed, the autoencoder loss curve is plotted as its being fit. Hidden layers are created using the autoencoder layers.

4.4 Prediction of Accuracy

The maximum accuracy during training and validation is calculated. The graph is plotted for the training and testing accuracy and also for training and testing loss. Through its hidden layer architecture, the autoencoder model gives better accuracy and helps the model work efficiently in Fig. 4.

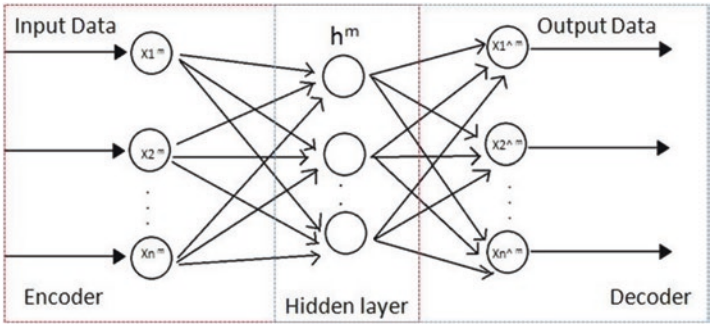

Fig. 4 The architecture of autoencoder neural network

Table 2 Using all the features for each category

Attack category	Accuracy	Precision	Recall	F-Score
Fuzzers	93.9%	80.9%	81.7%	78.7%
Analysis	99.5%	98.2%	88.1%	91.5%
Backdoors	99.6%	96.0%	92.8%	94.2%
DoS	98.4%	95.4%	96.2%	95.8%
Exploits	97.4%	96.2%	96.7%	96.4%
Generic	99.3%	99.2%	99.2%	99.2%
Reconnaissance	99.4%	98.1%	98.2%	98.1%
Shellcode	99.2%	84.4%	83.5%	82.8%
Worms	99.9%	84.7%	75.9%	77.0%

5 Result and Future Scope

The proposed network traffic analysis framework uses both machine learning and deep learning algorithm. The machine learning algorithm used is the decision tree algorithm's non-parametric supervised learning method for classification and regression tasks. The deep learning algorithm used is deep autoencoder, an unsupervised learning method though trained with the supervised learning algorithm. The decision tree model is built using the recursive feature elimination technique in the machine learning algorithm, one of the feature selection techniques. This reduces the high weight features; it creates a subset of the features recursively and eliminates the large features. This technique is repeated recursively until the desired number of attributes to select is eventually reached. The UNSW_NB15 data set used nine categories of attack. Two decision tree classifier is built; one contains all the features for each category and contains 13 features for each category. The classifiers are trained on the scaled dataset, and validation was made using the cross-validation technique [12]. Analysis was performed to evaluate the model's accuracy, and the detail is summarized in Tables 2 and 3. The Recursive feature elimination cross-validation (RFECV) cure is obtained for each category for the selected features as illustrated in Figs. 5, 6, 7, 8, 9, 10, 11, 12, and 13. The proposed model has

Table 3 Using 13 features for each category

Attack category	Accuracy	Precision	Recall	F-Score
Fuzzers	99.8%	99.7%	99.7%	99.6%
Analysis	99.7%	95.8%	97.3%	96.4%
Backdoors	99.7%	96.4%	94.8%	95.1%
DoS	98.0%	94.7%	94.5%	94.6%
Exploits	96.6%	95.7%	95.8%	95.7%
Generic	99.3%	96.5%	98.17%	97.2%
Reconnaissance	99.1%	96.5%	98.1%	97.2%
Shellcode	99.2%	85.7%	83.2%	82.7%
Worms	99.8%	77.9%	82.4%	79.2%

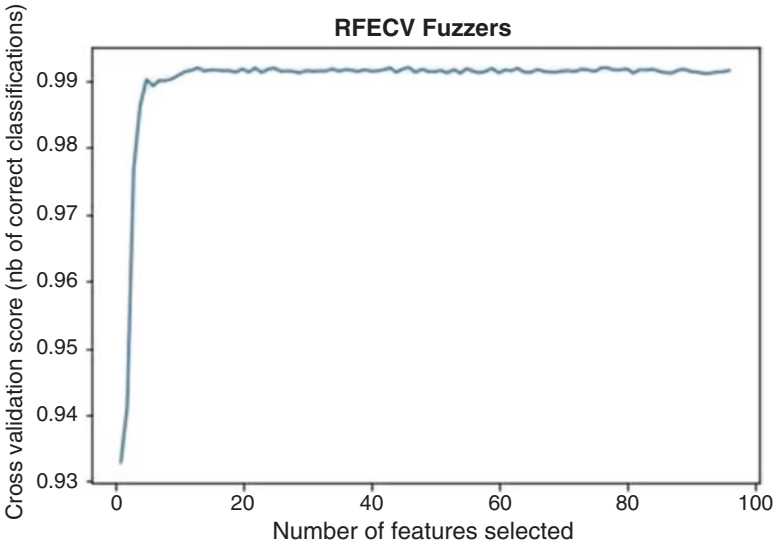

Fig. 5 REFCV curve for fuzzers category

been observed. The autoencoder model is defined in a deep learning algorithm; it is pre-trained using an extra tree classifier algorithm. The built autoencoder is trained using the training dataset and training loss, and validation loss is plotted as illustrated in Fig. 14. The hidden layers are created in a neural network, and the model is built. The validation of the model is made on the 9261 sample. The training and validation accuracy is calculated as illustrated in Fig. 15. The data model built using machine learning and deep learning algorithm is evaluated, and the accuracy of the model is calculated. In indecision tree model, the accuracy is calculated using cross-validation for each category of attack with the selected features; the average of the accuracy calculated is compared with the accuracy obtained in the autoencoder model [13]. As illustrated in Fig. 16, the accuracy obtained from the deep learning model is higher than the accuracy obtained from the machine learning model [14].

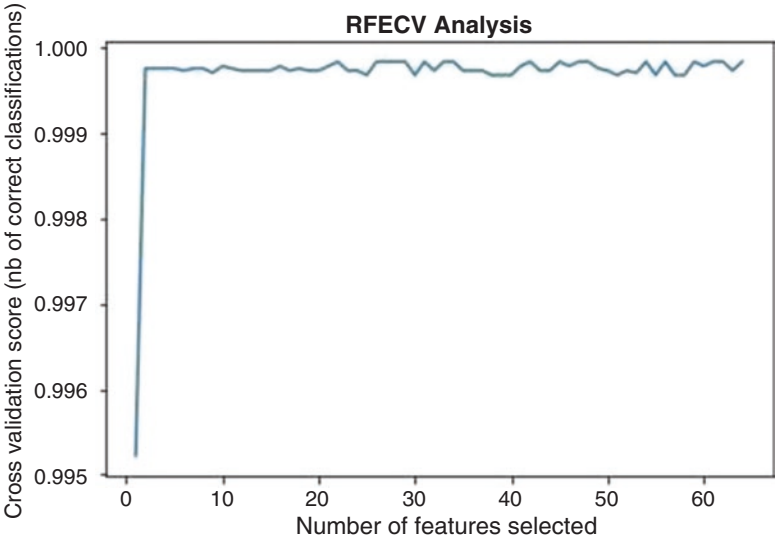

Fig. 6 REFCV curve for analysis category

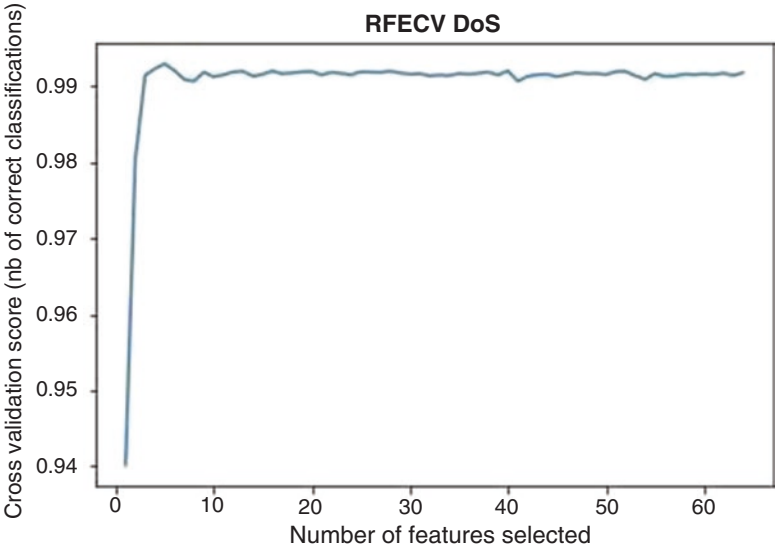

Fig. 7 REFCV curve for DoS category

5.1 Intrusion Detection Will Evolve in Different Paths

IoT: An expanding attack surface. It will take the emerging IoT into the equation [15]. At the initial step of the execution, it determines whether or not there is an

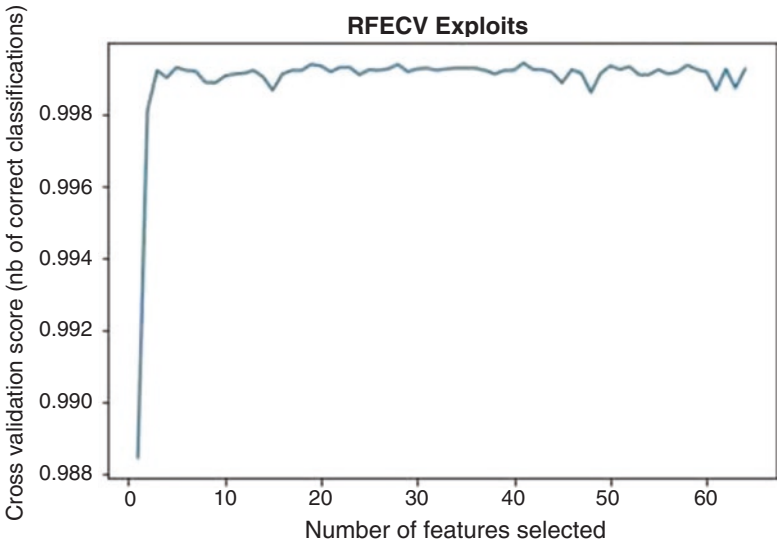

Fig. 8 REFCV curve for exploits category

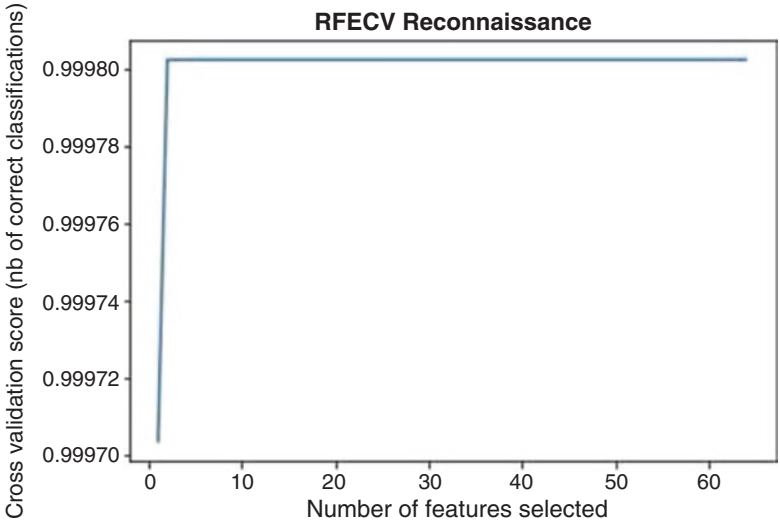

Fig. 9 REFCV curve for reconnaissance category

IDS. It considers the following actions in Fig. 17:

- Employs special techniques to evade the specific detection algorithm
- Remains dormant, hiding its malicious intent until it's in a safe environment
- Attacks the defence system itself

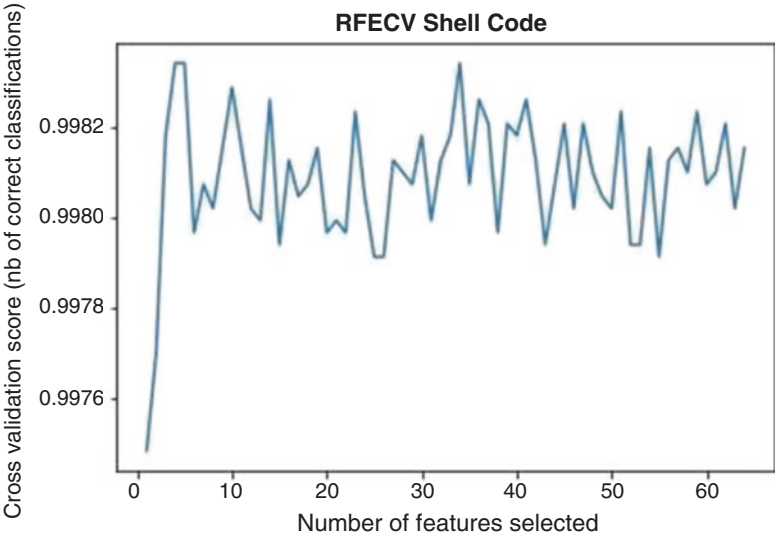

Fig. 10 REFCV curve for shellcode category

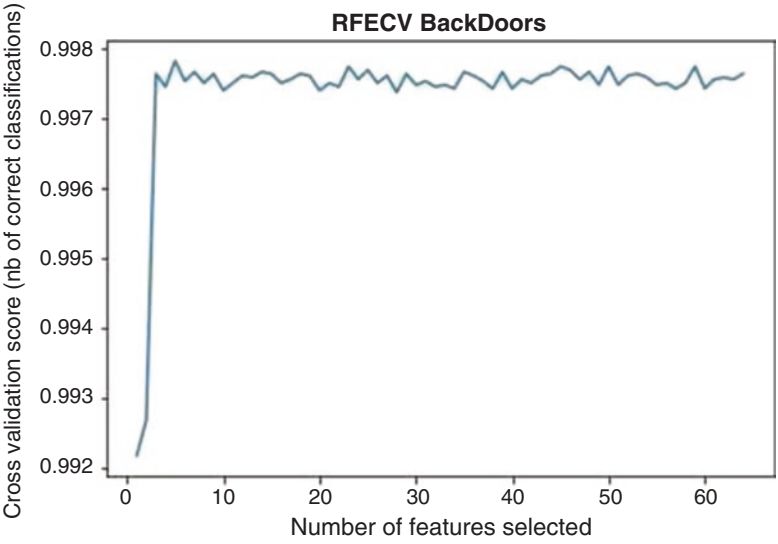

Fig. 11 REFCV curve for backdoors category

6 Conclusion

This paper gives a broad audit of the organization interruption location instruments dependent on machine learning and deep learning strategies. This will give the new scientists the refreshed information, ongoing patterns and field progress. In light of

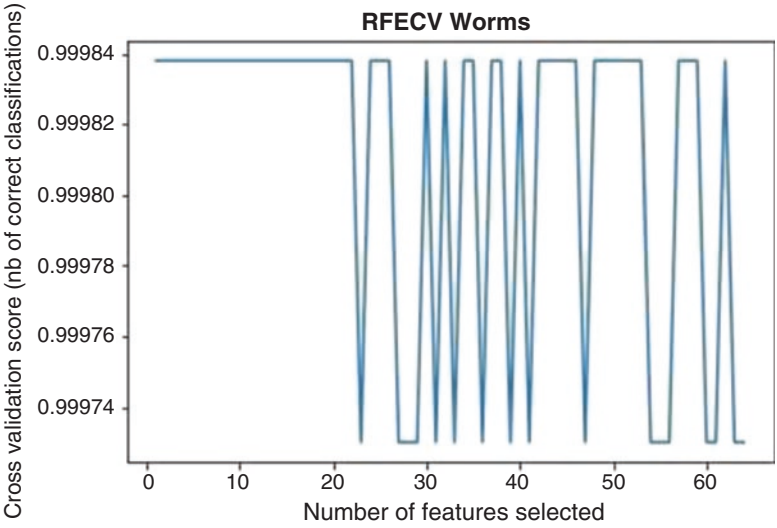

Fig. 12 REFCV curve for worms category

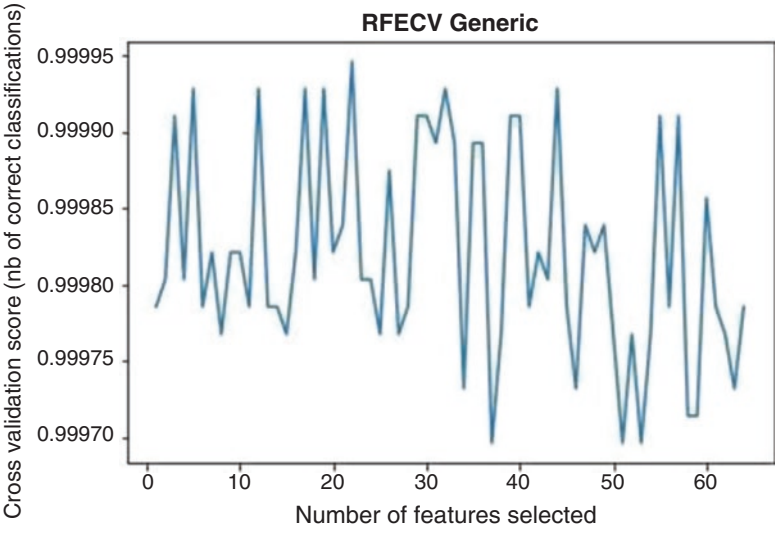

Fig. 13 REFCV curve for generic category

this examination, the new pattern uncovers the use of deep learning-based strategies to improve network interruption recognition framework execution and viability in discovery exactness and decrease in false acceptance ratio. About 80% of the proposed arrangements dependent on the deep learning approaches with autoencoder and deep neural network are the most often utilized calculations. Albeit deep learning plans have a lot of unrivalled execution than the machine learning-based

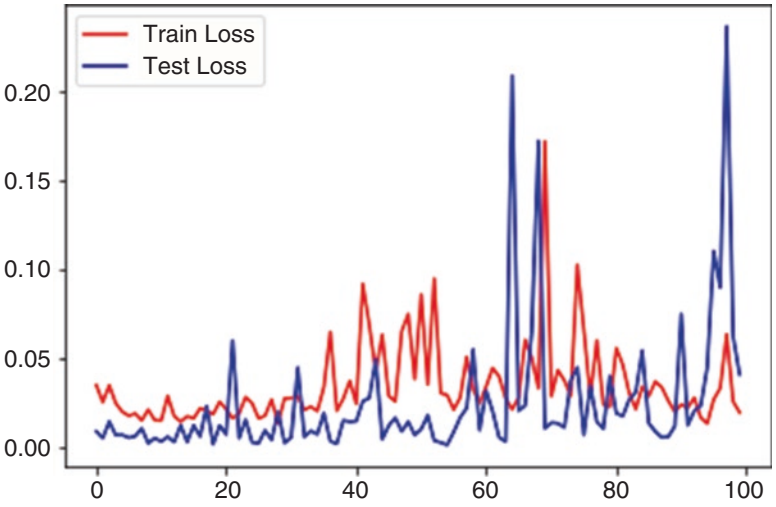

Fig. 14 Training and testing loss

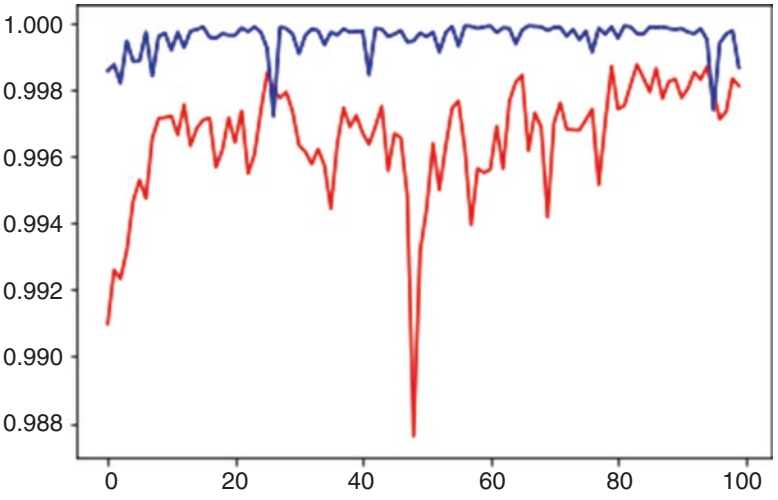

Fig. 15 Training and testing accuracy

strategies in their capacity to learn highlights without anyone else and more grounded model fitting capacities. However, these plans are very intricate and require broad figuring assets to prepare force and capacity abilities. These moves should be routed to satisfy real-time prerequisites for NIDS and thus improve NIDS execution. The examination also shows that 60% of the proposed philosophies were tried utilizing WE-CNSW datasets based on broad outcomes utilizing these datasets.

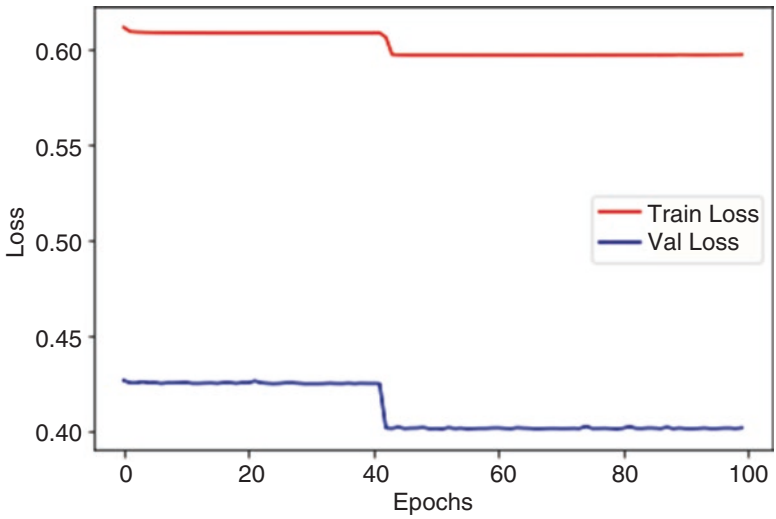

Fig. 16 Autoencoder loss curves

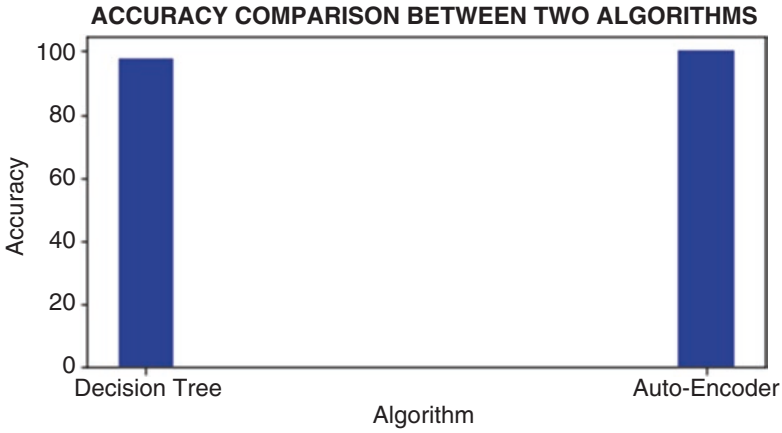

Fig. 17 Accuracy comparison between algorithms

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A Review on Deep Learning Technique on Basis of Different Types of Crop Diseases

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Abstract Agriculture has a vital role in world's economy. Farming is required for the food resources and also providing required materials to various industries. Future agriculture will include lots of technology, for instance, robots, moisture and temperature detecting sensors, aerial imaging, and global positioning techniques. Farmers invest billions of dollars often on disease management. Due to inadequate technical support, disease control in crop results very poor. Such conditions results in shortage of food regarding to world's population. Numerous researches have been employed on field of agriculture regarding diseases on crop, hence various techniques for solving such problems to be evolved. This paper discuss about the various technique implemented over crop disease using deep learning and remote sensing. The future development discusses about the efficiency and effective control over various crop disease using convolution neural network (CNN) trained with keras/tensor flow deep learning framework.

Keywords Deep learning · Convolution neural network (CNN) · Precision agriculture · Machine learning · IoT

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1 Introduction

In these recent times, it is not about obsessive to become as farmer. In starting period, weed detection and seed sowing was employed by manpower in the agriculture field. Agriculture mostly depends upon water availability, climate condition, composts, and seeds. The state of climate can't be anticipated by any outside phenomena. The identification of the manure and seed plays a major role in production. In recent times there is shortage in human labour due to evolution of other industrial opportunities. The cause for this is shifting emerging of people to other areas of interest from agricultural field which has an effect on food production.

In this current situation, agronomist mostly sticks to established farming methods by handling huge quantity of fertilizers and pesticides, which has an impact of irreversible damages on the environment. The specific clutches of plants have little expertise in specified environment and grouping of soil. Farmers need particular expertizing awareness in data analysis, law, agriculture, economics, and accounting to reach productive agriculture. A deep learning handles the progressive techniques to systematize crop monitoring, and it requires only minimum manpower. In forthcoming circumstances, it is necessary to acknowledged about how treatment of every individual plant should be handled by knowing its necessitate. In recent times, farmers are in the need of expert's advice, which is cost-effective always. Attaining help from advanced agricultural system which constitute Internet of Things and deep learning methods, farmers can possibly acquire helps technically at reasonable price. Due to high population and regular assets diminished, the value for agribusiness has reached a certain heights. Scientists create several algorithm enabled with IoT to improve the agriculture.

2 Introduction: Deep Learning

Deep learning, which is kind of machine learning that makes computers to obtain information from experience and also knows the world according to hierarchical concepts. When the computer acquires information from known database, the need for a human interface will not be required to specify knowledge needed by the system. The idea of hierarical concepts gives permission to the computer to obtain information about the problematical concepts by sorting out them out of easier these hierarchies are graphical representation of many deep layers.

Since the 1940s, single-layered artificial neural networks are used as superficial constructive design; but disadvantage is deficiency in processing data effectively. Architectures with deep layers are required to analyse data with extra complexity. Later in the 1980s, a complex neural network became successful and makes promising exercise to neural networks successfully. Hence created the line of attack meant for organizing further deeper as well as complex architectures. In current times the need for neural networks has been grown abnormally, so many changes have been undergone. At this time, deep learning along with neural networks is highly utilized

[1]. As repellent of name, artificial neural networks are computational structure which replicate network along nerve cells [2]. Processing units which are used to one another are called as artificial neurons in turn which transfers the data with rest numerous layers, which in turn create an artificial neural network [3]. After receiving input as either in 0's and 1's or in form of floating point from numerous dataset, the artificial neuron starts to duplicate and aggregates with weights. The resulting data of one level of artificial unit can be provided as input for the other artificial unit layers.

3 Convolution Neural Network (CNN)

Convolution networks [8], also called as CNN or neural networks. These are specific kind of neural network for dealing out known data with grid-like topology.

CNN has an advantage to increase the chances to do classifications correction. It is used for feature extraction of given input images, where pooling layers reduces the dimensionality. The entirely linked layers in CNN are generally works as classifiers. Commonly the advantage of the last layer is taken by fully associated layers in turn distinguish input data into predefined classes. The CNN models have exceedingly hierarchical structure and huge learning capacity which permits them to execute predictions and classification but also flexible to various complexing challenges.

CNN can obtain any kind of input data, namely, images, audio, video, and natural languages; CNN has successfully applied in various domains by abundant organizations, namely, application regarding web like finding out of diseases from MRI in health sector and disaster identifications by remote-sensing images.

4 Challenges

4.1 Classification of Plants

Harvesting is time-consuming and protracted mission in manufacturing fruits, whereas harvesting was majorly employed physically. Considering of reducing manpower, many fresh innovations are projected for evolution of harvesting automated robots. Hence such methods cannot be widely used by researchers who purposefully developed many systems for crop-specific agriculture [4]. provides the case study on harvesting sweet pepper using robot [5]. proposed an idea for apple counting and disease detection methods in orchards [6]. describes a method for plant identification on basis of vein morphology [7]. proposed method for tomato production and pests using automatic estimation employing robotic handling [8]. detailed description in real time on self-learning CNN by using the visual sensor data to distinguish individual types of plants [9]. deals with haploid maize seeds for sorting by using deep convolutional networks (CNN) [10]. compared the different

deep learning architectures and its performance [11]. uses harvesting robot for strawberry fruit detection.

4.2 Detection of Diseases

Diseases in plant majorly affect the agricultural production. It is very tough for observing plants clause as well as have power over widen of diseases. The plant types will have different prevention methods over its diseases and also diagnosing methods [12]. proposed a method for detecting grapevine yellows symptoms using an approach based on artificial intelligence [13]. explored an algorithm for identifying tomato plants pests using deep learning [14]. proposed a learning method of low shot for in tea leaves disease identification [15]. proposed an idea for disease identification with extracting feature in pearl millet by employing transfer learning [16]. proposed detection using deep learning structure for disease in vine using a technique of vegetation indices and colorimetric spaces. Deep convolution neural network-based approach for classification on wheat infection is proposed by [17, 18]. explains a diagnosis of wheat infection using automatic method which works directly in fields.

4.3 Pests Recognition

Some insects are beneficial for crop production, but in the same time some species causes severe damage to production. These kinds of insects are called as agricultural pests. Several precautions are needed for correct identification and control treatment in order to decrease the resulting smash up. Recognizing annoyance is not the type of aimed detection; it is a more difficult task that should be handled by a unique method [19]. proposed a helpful strategy of data augmentation in order to detect pest and locating in the field based on CNN [20]. handled techniques of deep learning algorithm for the different moth images [21]. handles AI technique to extend an automated vision-based technique which is used for regulating Asian citrus pests [22]. apply a deep neural network for the finding out of stored-grain insects [23]. proposed idea for the pests recognition using image-based transfer learning [24]. performed finding out pests through deep residual learning algorithm even in a background with higher complexity.

4.4 Detection of Weed

Weeds are unwanted vegetation usually raise up between useful crops which results in losses of yield because it contends forth wealth obligatory for the crop. Multisensor technique is specially constructed for higher-end precision application in agriculture in order to detect distinction between crops and weed control through mechanically. A detailed knowledge in the agricultural field is required in order to identify along the row cultures to point out the single plants and the altered qualities of crop. The mechanical, geometric, or any spectral properties have a direct influence on the environmental conditions. Various sensors are involved in different configurations like filters, CMOS – cameras and photodiodes. Host microcontroller is used to control the multi-sensor system. Working of sensors can be controlled depending on the properties of field or ecological circumstances.

Detection of smartweed allows probability to concern treatments for herbicide particularly to detection of weeds [25]. intended and developed a AI and machine vision along with smart sprayer method. This smart sprayer is used to differentiate intended weeds from useful crops and effectively sprays on the weed projected in order to remove it.

[26] projected neural network along with deep learning for habitual find out of main crop from weeds by handling row guided robots [27]. employs combined classifier technique for recognition of weeds by handling techniques of transfer learning [28]. employs CNN in crop images for detecting weeds in soybean and divides all broad leaf weeds and grass [29]. explains method for detection of weed by employing CNN, whereas the input images are acquired by UAV which undergoes unsupervised collection of dataset.

5 Future of Deep Learning

There are copious active applications in the field of cultivation using computer vision, in order to overcome the problems such as crop phenology, detection of weed, estimation of crop type, and classification of land cover. These can be approximated with the help of deep learning. The fascination is about that DL, how to perform in agricultural-based issues such as water erosion assessment, green house monitoring, seed classification, leaf and content of nitrogen in soil, soil irrigation, detection of water stress level in plants, pest and weeds identification, using of herbicide, recognizing beverages, infective factors, or problems on quality of food as well as crop. Since many of the search areas employed in techniques of data analysis with parallel ideas and relatable performance to DL such as KNN, Wavelet-based filtering, K-means clustering, SVM, logistic, and linear regression, [30] then it could be value to study the applicability of DL on these troubles too.

Availability of dataset are limited in real time environmental conditions, datasets available on the web are free to download that can be utilized by scientist to initiate

Table 1 Literature survey on various papers related to crop diseases

S.No	Article name	Source of data	Handled problem	Proposed method	Advantages
1.	"Weed detection in soybean crops using CNN"	4500 weed images	Detection of weed in agricultural crops	CNN is used to detect weed in given set of crops and classify them among broad leaf and grass	Obtained precision value is about 96.0%
2.	"A low shot learning method for tea leaf's disease identification"	From individual types tea leaves 40 images taken as input	Involves in identification of specific diseases tea leaves	Low shot learning method is used to identify the disease	Classical learning methods along with deep architectures produce accuracy up to 90%
3.	"Fast spectral clustering for unsupervised hyperspectral image classification"	Synthetic dataset and hyper spectral images dataset	Image classification	Enhancing hyperspectral images classification using spectral clustering method	Large-scale HSI classification was effectively solved by using improved algorithm
4.	"Citrus rootstock evaluation utilizing UAV based remote sensing and artificial intelligence"	UAV collected data	Phenotype data analysis	UAV is used to collect images for input data involving many sensors with it	Manual methods get reduced
5.	"Deep learning for real-time fruit detection and orchard fruit load estimation: benchmarking of mango YOLO"	300 test images	Mango fruit detection	Deep learning architectures	Proposed method gives out precision up to 0.983 and F1 score up to 0.968
6.	"Deco Fungi: a web application for automatic characterization of dye decolorization in fungal strains"	1204 image dataset	Estimation of dye decolorization in fungal strains	Deep learning method is used for characterization	Using SVM 96.5% accuracy is attained

(continued)

Table 1 (continued)

S.No	Article name	Source of data	Handled problem	Proposed method	Advantages
7.	"Application of deep learning architectures for accurate and rapid detection of internal mechanical damage of blueberry using hyperspectral transmittance data"	Blueberry collected samples up to 737	Detecting internal damages in blueberry	Deep CNN algorithm is employed for classification	On comparison, deep models are considered to be better than traditional method learning methods
8.	"Crop yield prediction with deep convolution neural networks"	Images obtained from Airinov Solo 3DR UAV	Yield prediction	CNN models of images in RGB	CNN handles and process well with RGB data input when compared to images of NDVI images
9.	"Long-short-term memory based classification using high resolution optical images and multitemporal SAR data"	Multitemporal data of SAR and images with high resolution	Parcel-based classification of crops	Deep learning along with LSTM to fabricate cataloguing of crops	LSTM produces accuracy values about 80.71%
10.	"Maize silage kernel fragment estimation using deep learning based object recognition in non- separated kernel RGB images"	1393 images involving kernel instances	Quality of harvested crop is determined	(i) Deep learning-based kernel processing in absence of stover (ii) Kernel separation before image obtained	Kernel processing scoring (KPS) is identified within a minute
11.	"Computer vision detection of foreign objects in walnuts using deep learning"	781 image dataset	Foreign objects detection	CNN and automatic detection is employed to identify manmade and natural foreign objects	Succeeded classifying foreign objects up to 95% is successfully validated in dataset

(continued)

Table 1 (continued)

S.No	Article name	Source of data	Handled problem	Proposed method	Advantages
12.	"An in-field automatic wheat diagnosis system"	Database of wheat diseases	Controlling the disease spreading in wheat	Weakly supervised deep learning and automatic diagnosis system	Mean accuracies about 97.95% and 95.12%, respectively
13.	"Deep count: fruit counting based on deep simulate d learning"	Real and synthetic data	Helps in decision-making by giving counts of trees, flowers, and fruits	Deep CNN and automatic yield estimation	For testing one image average time taken is 0.006 seconds
14.	"Detection of stored grain insects using deep learning"	Images with 1944 × 2592 pixels from OTTD systems	Identification of insects in stored grain	Deep neural network	Extracted feature maps with precision of 87.99
15.	"Deep neural networks with transfer learning in millet crop images"	124 web available images	Finding and sorting out of mildew diseases	Transfer learning with feature extraction is employed	Accuracy is 95%and f1 score obtained is 91.75%.
16.	"A comparative study of fruit detection and counting methods for yield mapping in apple orchards"	Consisting of 2874 image dataset.	Counting and detection of fruits.	Novel schematic segmentation based approach	Better approach in fruit detection with accuracy range from 95.56% to 97.83%
17.	"Automatic image based plant disease severity estimation using deep learning"	Web available dataset of 50,000 images	Disease prediction and yield loss management	Deep CNN	Overall accuracy obtained is 90.4%
18.	"Pest identification via deep residual learning in complex background"	Database of pest images	Analysing images captured from the field	Deep residual learning	98.67% accuracy in Res-Net model
19.	"Approximate Bayesian neural networks in geometric prediction"	3534 image dataset	Genome-wide prediction	Single nucleotide polymorphisms (SNPs) tool is used	Verified that shallow model has valid good performance than models with complexity

(continued)

Table 1 (continued)

S.No	Article name	Source of data	Handled problem	Proposed method	Advantages
20.	"Plant disease and pest detection using deep learning-based features"	Real pest and disease images of 1965 in eight clusters	Plant disease diagnosis	For detection of diseases in plant, nine various techniques of deep architecture are employed	ResNet + SVM gives out highest accuracy of 97.86%
21.	"Automatic moth detection from trap images for pest management"	Coding moth dataset	Management of pest	For finding out and counting pest, automatic deep learning method is used	Requires only minimal manpower and does not require huge knowledge about pest-specific engineering
22.	"An supervised deep hyperspectral anomaly detector"	Downloaded dataset from NASA	Anomaly detection	Detection based on DBN	Outperforms local RX detector and collaborative representation detector
23.	"Deep learning for plant identification using vein morphological patterns"	Dataset containing soybean, white bean, and red bean leaves	Plant identification	Task-specific module created by deep convolution network	Reduces manual search and has positive effect on final accuracy
24.	"DeepSort: deep convolution networks for sorting haploid maize seeds "	4731 corn seeds RGB images dataset	Distinguish haploid maize seeds from diploids	Application of deep convolution networks	When layer decreases, performance gets decreased which was the resulting factor
25.	"Classification of high resolution hyperspectral remote sensing data using deep neural networks"	Hyper- spectral remote sensing data	Analysing of spectral data	Softmax classifier, stacked encoder, DNN	Points out accurate identification of roads, agricultural areas, and buildings
26.	"seed-per-pod estimation for plant breeding using deep learning"	7853 + 10325 images	Determination of seed per soybean pod	DL-based method of computer vision	86.2% and deep learning outperforms on classic vision approach

(continued)

Table 1 (continued)

S.No	Article name	Source of data	Handled problem	Proposed method	Advantages
27.	"Deep learning based multi-temporal crop classification"	2014 survey in Yolo County	DL based organization for distantly sensed time series	EVI, LSTM, and EVI are employed	ConvID with high accuracy of 85.54%
28.	"Deep learning for soil and crop segmentation from remotely sensed data"	DSM data	Differentiating crops from soil	Segmentation of crops using DSM images along NDVI are employed	Produces results four times better than NDVI marker output
29.	"Deep learning models for plant disease detection and diagnosis'	Around images of 87,848 from 25 plants are collected as database	Disease detection and diagnosis in plants	CNN model was developed and works on leaf images to produce output	99.53% success rate is obtained in healthy plants
30.	"Classification of tree species and stock volume estimation in ground forest images using Deep learning"	Using Canon EOS 700D camera, 3000 ground forest images are taken	Determining number of trees in an image	Non-linear mixed effect model	Accuracy obtained was 96.03% using UNET
31.	"Hybrid deep learning for automated lepidopteran insect image classification"	Lepidoptera images of 1301 collected from 22 species	Recognition of butterfly species	SVM and deep convolution neural network (DCNN) is employed to identify species from images	Attains 100% accuracy as well as requires only 200 ms for recognition of species
32.	"Heterogeneous sensor data fusion by deep multimodal encoding"	Real-time dataset obtained from an agriculture sensor network	Enhancing prediction and interface	Based on deep learning, deep multimodal encoder (DME) is employed	Capability of finding missing data is up to 90%
33.	"Detection of grapevine yellows symptoms in Vitis Vinifera L. Artificial intelligence"	Images of leaf clipping obtained from the Internet	Grapevine yellows disease detection	CNN is applied to leaf clippings to detect the grapevine disease.	The result outcomes with best specificity about 99.40% and sensitivity about 98.96%

(continued)

Table 1 (continued)

S.No	Article name	Source of data	Handled problem	Proposed method	Advantages
34.	"Deep learning classification of land cover and crop types using remote sensing data"	Satellite images from multitemporal multisource	Discrimination of crop types	For crop classification multilevel deep learning approach is handled	Overall classification accuracies are 94.6% for 2-D CNN, 93.5% for 1-D CNN, 88.7% and 92.7% for MLP and RF, respectively
35.	"In vivo prediction of intramuscular fat using ultra sound and deep learning"	3037 animal images	IMF prediction	Deep convolution neural networks on ultrasound images for determination of IMF	Works best on low IMF images and produces correlation $R = 0.82$
36.	"Apple flower detection using deep convolution networks"	147 images	Blooming intensity estimation	For flower detection pre-trained convolution neural network is used	Outperforms precision rate 90% higher than HSV
37.	"An explainable deep machine vision frame work for plant stress phenotyping"	Healthy leaf images up to 4174	Biotic and abiotic stress detection in crops	Machine learning framework foliar stress identification	Accurately identifies and distinguishes the foliar stress
38.	"Automatic recognition of lactating sow postures from deep images by deep learning detector"	Recorded images using Microsoft Kinect v2 sensor	Detecting automatic postures using computer vision	Deep learning-based Faster R-CNN framework	Detects 20 frames in a second so very useful for real-time applications and abnormal behaviour is found out within short time
39.	"Pixel-level aflatoxin detecting based on deep learning and hyperspectral imaging"	146 image cubes of peanut samples	Detection of aflatoxin	CNN-based hyperspectral imaging system	Recognition rate is up to 96%

(continued)

Table 1 (continued)

S.No	Article name	Source of data	Handled problem	Proposed method	Advantages
40.	"Modelling spatio-temporal distribution of soil moisture by deep learning based cellular automata model"	Database collected from 172 sensors	Irrigation scheduling	Soil moisture content (SMC) and deep belief network (DBN) were employed	Reduces RMSE by18% when compared to other models
41.	"Optimized wishart network for an efficient classification of multi-frequency PolSAR data"	PolSAR images	Prediction of disaster in agriculture	Layers with single-hidden OWN and extended OWN are employed to identify classification	It outperforms deep architecture for many hidden layers
42.	"Recognition pest by image-based transfer learning"	500 images	Pest identification	Diagnostic system is developed by transfer learning for recognition of pest	Performed better when compared with models of traditional neural network and human expertises
43.	"Automated pig counting using deep learning"	Dataset collected from around 30,000 pigs	Pig counting	Deep learning method is employed	Proposed method results in 1.67 of mean absolute error
44.	"Fruit detection and segmentation for apple harvesting using visual sensor in orchards"	800images collected from orchards	Fruit detection on real-time	Visual sensor for real-time detection	Object detection attains F1 score 87.6% and 77.2% on apples and branches segmentation, respectively
45.	"Apple detection during different growth stages in orchards using improved YOLO-V3 model"	Using data augmentation, 4800 images expanded from 480 images	Apple detection real-time in orchards	YOLO-V3 is used in various stages of apple growth	0.304 is average detection time which is used for real-time detection

(continued)

Table 1 (continued)

S.No	Article name	Source of data	Handled problem	Proposed method	Advantages
46.	"Real-time sow behavior detection based on deep learning"	1912 images captured using 3 million pixel IR cameras	Sow behaviour detection	Sow-behaviour detection algorithm based on deep learning (SBDA-DL) is used	Higher accuracy is obtained even in faster speed of detection
47.	"A two-branch CNN architecture for land cover classification of PAN and MS imagery"	Gard dataset, Reunion dataset	Earth surface monitorization	Direct deep learning-based classification	This method works well on images with very high spatial resolution (VHSR)
48.	"Estimation of vegetative indices for high-throughput phenotyping of wheat using aerial imaging"	3DR solo drone is used	Estimating vegetative index	Deep neural networks using RGB colour images	Accurately estimates vegetative index at low cost
49.	"Machine learning algorithms to predict core, skin and hair-coat temperatures of piglets"	200 sensor data points	Livestock's surface temperature is predicted	Machine learning algorithm is used	Four machine learning algorithms are compared and DNN produces best prediction ratio
50.	"Improving efficiency of organic farming by using a deep learning classification approach"	4742 plants constitute dataset	Analysing individual classes of plants (50% weed, 50% carrot)	Self-learning convolution neural network is proposed	Accuracy is about 98% and parameters identified are compared to be best

analysing the DL algorithm. Those datasets has ability to pre-train architectures of DL and then adjust it to further outlook extent of challenges in agricultural area.

The problems related to land and crop cover classification remote sensing information consisting of multitemporal, multi-spectral, and multi-source images which are available from the satellites in addition to these datasets that could be used for analysing. Further approaches employing LSTM or any former CNN algorithms are likely accepted in the further upcoming criteria, in order to increase performance classification or prediction. Table 1 describes the various algorithm used in real-time projects in the field of agriculture.

6 Conclusion

In this paper, a survey of deep learning-based research efforts practical in the field of agricultural area is briefly discussed. Comparison of deep learning and existing techniques are done on basis of performance and accuracy. Our detailed review implies that deep learning gives better performance and outperforms when compared to other popular techniques of image processing. The progress of this work, involves implementation of deep learning as described through this survey and in the field of agriculture will be implemented where other modern technique has not yet been sufficiently used. The aim of this survey is to motivate more researchers to learn and implement deep learning, in various agricultural problems such as classification, prediction, image analysis, and so on.

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Food Plant Diversity of Homestead Gardens in Cherangode Panchayath of Nilgiris District, Tamil Nadu, India

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Abstract Homestead garden is an age-old land-use system that has a high level of productivity, stability, and sustainability. The present study was conducted in one of the Panchayaths of Nilgiris District called the Cherangode Panchayath which is a major portion of the Pandalur Taluk. The study revealed a total of 102 species and 223 varieties cultivated by 130 households for consumption. The study also revealed that most people owned land area between 0 and 10 cents land area, i.e., 49 households. A total of 77 species were cultivated by the Mooppan community followed by the Thiyya community with 63 species. The Muslim community cultivated about 52 species, Christian 37 species, and the least of 30 species by the Paniya community. It was found that the most cultivated species belonged to the Cucurbitaceae family, about 12 species were cultivated and about 8 species were cultivated from the Leguminosae family. The most plant type cultivated included herbs (32) and trees (31). The survey pointed to a big problem faced by the Tamilian community who unknowingly spray various chemical pesticides that can create serious health problems. Another fact revealed by the survey is the engagement of women in homestead gardens. This involvement will help children to develop an interest in agriculture and help the transfer of traditional knowledge from one generation to another. The study revealed that almost every household cultivated cucurbits and legumes as they can be used all year round by drying and storing properly. The study also revealed the need for government to interfere in the supply of seed to the people and check the use of various chemicals that are available easily in the market.

Keywords Homestead garden · Traditional knowledge · Pesticides · Artificial intelligence · Computing

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1 Introduction

The beginning of agriculture can be dated back to subsistence production systems that started in small plots near or around the household. Since then, there has been a lot of contribution to this subject defining new species, structural features, composition, and the cultural relevance of these land plots near households [1]. Homestead gardens is a practice that is adopted by various communities that have limited economic resources and support [2]. Cultivation of plants near dwelling areas on small plots is regarded as the oldest form of cultivation from which agriculture on large landmasses started [3]. Mostly the homestead gardens are classified as mixed, kitchen, backyard, farmyard, compound gardens.

A typical home garden usually integrates trees with field crops, livestock, poultry, etc. [4, 5]. Mostly the farmers cultivate a variety of plants that are locally acceptable and add to the biodiversity of the garden and indicate their choices. This cultivation is usually done to meet their varied needs, which provides them with a variety of products and gives them food security throughout the season. They also add to the nutritional requirement of the household. The surplus is sold to local markets which gives them a small income. Today, food insecurity in India is at an alarming state. Report points toward the agrarian crises, widespread hunger, and the consequent negative impact on the health and well-being of the rural population.

2 Methodology

The present study aimed to document the various plant species consumed, type of plants cultivated, source of seed, key caretakers, and the maximum cultivated species. People belonging to different communities were selected, throughout the Panchayath, and were visited and interviewed personally [6]. A structured questionnaire was administered to the head(s) of the household to collect information regarding the survey. Respondents were asked about landholdings, garden history, cultivated species, and garden caretakers [7].

The study was based on data collected directly from the fields, and the random sampling method was also adopted for data collection [8, 9]. Samples of different communities were selected based on the land area to include people from every community and people with different landholdings. A total of 130 households were selected based on the community and land area possessed. Conversation with the farmers was done to collect information. A personal observation was also made. The research was conducted to obtain qualitative descriptive data and field experiments [10].

3 Result and Discussion

The study accounted for a total of 102 species and 223 varieties from a sample of 130 households. Most of the people owned 0–10 cents of land, and they cultivated about 71 species and 132 varieties (Fig. 1).

Among the different communities, the Mooppans cultivated the maximum number of about 77 species, the Thiyya community cultivated 63 species, the Wayanadan Chetty cultivated 51 species, the Muslims cultivated 52 species, the Tamilian cultivated 38 species, the Christians cultivated 37 species, and the Paniyas cultivated 30 species (Fig. 2).

During the survey, it was observed that the people depended mostly on market available seeds and the consumption of wild edible plants was limited.

The study revealed the cultivation of 37 families by the people, of which the Cucurbitaceae family was the most cultivated. This is followed by Leguminosae, Rutaceae, Brassicaceae, Solanaceae, Dioscoreaceae, Myrtaceae, Zingiberaceae, Amaranthaceae, and Anacardiaceae (Fig. 3). Trees and herbs are the most cultivated type of plant crop (Fig. 4).

The result of the survey pointed toward the key role played by women in homestead gardens. About 80% of activities were carried by women (Fig. 5).

Homestead gardens are the site of the highest plant diversity which is due to the differences in the choice of plant materials [11]. Species composition, structure, and function of homestead gardens are influenced by ecological, socioeconomic conditions, the choices that pass from one generation to another, and cultural factors [12].

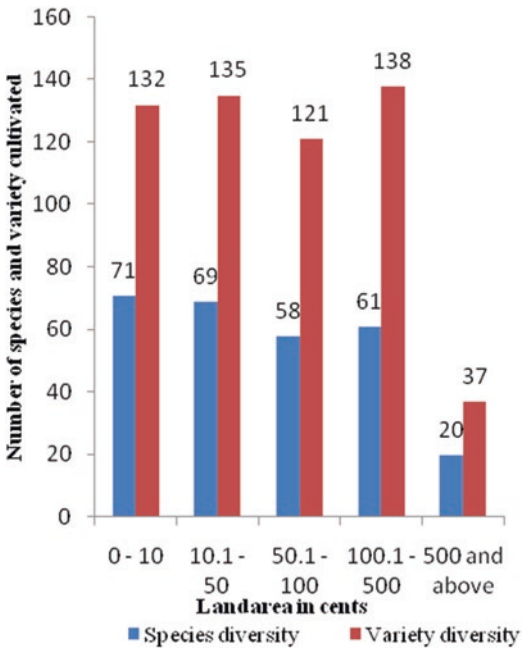

Fig. 1 Diagram showing species diversity and variety diversity of different communities

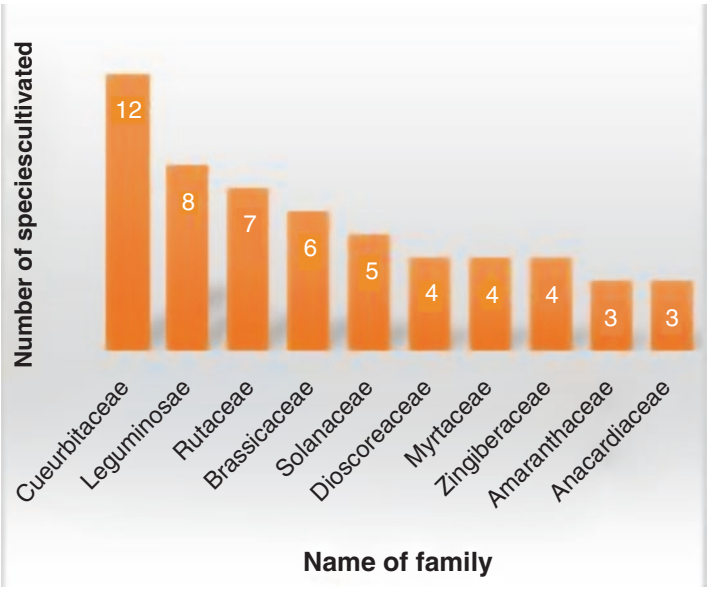

Fig. 2 Diagram showing the number of species cultivated by different communities

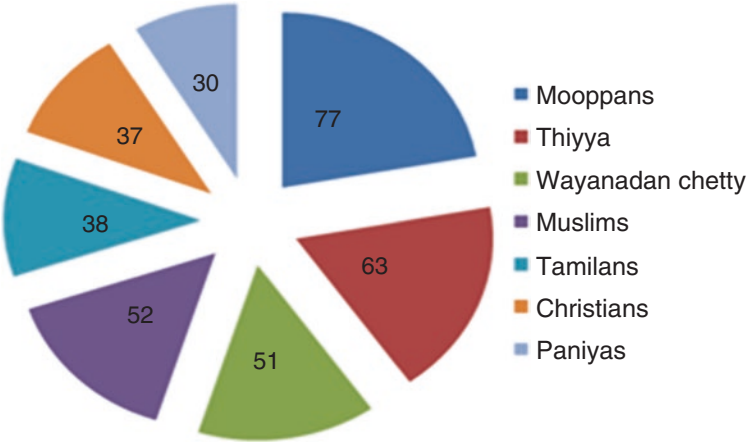

Fig. 3 Diagram showing the number of species cultivated from each family

The study revealed that people with the least land area have the highest species diversity of about 71 species. Similarly, a study in Khasi hills home gardens, Meghalaya, India, has reported 197 plant species (70 trees and 41 shrubs) belonging to 77 families from 150 home gardens [13]. In many studies, it was seen that species diversity is always high in homestead gardens and the higher species diversity is found to promote soil fertility, and for retaining soil humidity [14, 15]. In the present study, it was found the species richness did not increase with increasing garden

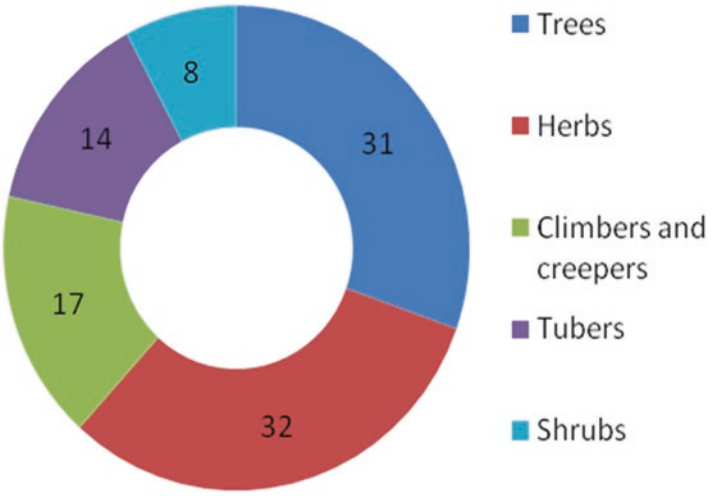

Fig. 4 Diagram showing types of plants cultivated

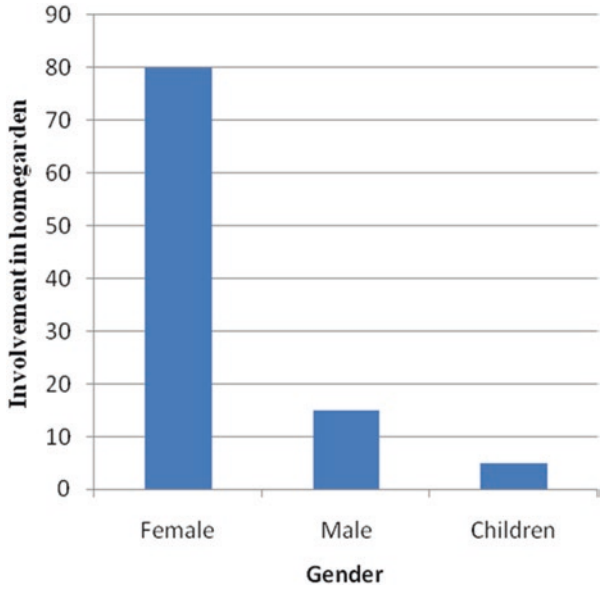

Fig. 5 Diagram showing gender role

area which suggests that owners cultivated plants to fulfill their regular needs and the increase in the land area did not have any effect on diversity. Another reason that emerged was that households with small home gardens opted to grow the most useful plant species in their home gardens and gave less focus with the plant of less use. They cultivated plants mainly for consumption which added to their kitchen basket.

Their cultivation helped them to reduce the expenditure of the family. Knowingly or unknowingly, it added to the nutrition of the family. Most of the plants cultivated were edible, and only a few were used for other purposes like fuel, shade, etc. This was like the work done in Costa Rica where people cultivated 46 edible plants in home gardens [16].

Among the different communities, the Mooppan community cultivated the maximum number of species. They cultivated mostly edible plants along with many wild edible plants. Similar results were found in the Wayanad tribal community who are also involved in the conservation of traditional knowledge [17]. In the present work, the Mooppan community still follows the traditional methods of cultivation and storage. They live in colonies known as Paadees where they live together and share the cultivated food products. Their settlements are far away from major institutions like Anganwadis, health centers, and educational institutions. This encourages them to cultivate varied food plants and the participation of different members of the family.

The present study revealed 31 trees and 32 herbs which were cultivated the most. Similarly, in total 127 trees were recorded in the homestead gardens of Ethiopia [18]. The total number of trees encountered in Kerala was 127 trees [19]. Similarly work done in Sidama revealed that tree species richness is high in highland agroecosystems [20]. A study in the Barak Valley of Northeast India showed a total of 161 tree species from 47 families. The study also revealed that tea garden labor communities hold more diversity in their home gardens [21]. But the present work showed a steep decrease in diversity in tea gardens. Tea garden holders engaged less in home gardens because they utilized the space for other activities such as livestock rearing and resting place.

The cultivation of shrubs, climbers, and tubers was less due to the availability of small areas for cultivation and scarcity in the availability of seeds. The working class lacks time and labor to take care of home gardens. They mostly cultivated trees which provided them with timber and were a source of income. Moreover, people think that the trees are easy to look after and did not need special care. Another major analysis done was about the role of women. The major labor input was contributed by women. They are involved in all activities related to home gardens. About 80% of work was carried by women. They played a prominent role in all surveyed home gardens. Similarly, the work carried in the Senegal River Valley also showed that the women were the key caretakers of the home gardens [22]. Similarly, the work carried in Gambia and Kumaun Himalaya, India, showed that most of the vegetables grown in home gardens are tended almost exclusively by women. This was proven to be productive and critically important to the nutritional and economic well-being of their households too [23–25].

4 Conclusion

The study revealed the need of educating people about the necessity of cultivating plants for their consumption. The statistical analysis indicates that homestead garden diversity is related to the garden characteristics, household socioeconomic features, and access to planting material including seeds, cuttings, and suckers. Maintaining a homestead garden will help to enhance the health and nutritional security of the people which will help in the progression of the state as well as the country. Agriculture today is facing a daunting challenge and is receiving little attention from the development point of view. Food production should come along with a transformation in the way in which food is cultivated.

Existing organizations, local institutions, and social organizations are the resources to be strengthened, changed, and developed, not ignored and suppressed. Attention needs to be given to community-based action with the help of local government bodies and including people from all groups and ages. Suitable methods which are found effective for the specific area need to be implemented for farming, food processing, storage, and distribution. The reliance on internal resource needs to be intensified so that the present generation benefits from it and pass the knowledge to the future generations. The goal must be to integrate the components so that overall biological efficiency is improved, biodiversity is preserved, and productivity is self-sustaining.

Thus, the homestead farming system should be considered in a broader context of national food security strategy. This simple yet effective method will help in maintaining nutritional status, health, mental ability, productivity, and food security and in the development of the economy. Maintaining a homestead garden provides direct access to food through self-reliance rather than dependence on externally supported programs such as work-for-food. Thus, homestead farming ensures a great increase in natural biodiversity and contributes to poverty alleviation if they are managed sustainably.

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