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CLASSIFICATION OF ARRHYTHMIA BASED ON VEBF NEURAL NETWORK

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ABSTRACT
In today's world, heart disease cases are being increases rapidly. So we have to develop a system which can classify heart disease. This paper proposed a learning algorithm which is used to classify arrhythmia. Arrhythmia is abnormal heart beat which means irregular pattern of heart beat. MIT-BIH database is used to train and for learning the system. VEBF is used to classify the arrhythmia so that positive rates are found out. Levenberg-Marquardt algorithm is used to train the network which produced better results than previous work had done. The trained network has 96.01% accuracy which improves the system performance and produces results faster.

Keywords: **Arrhythmia, VEBF, Levenberg-Marquardt, Neural Network, ECG signals.**

I. INTRODUCTION
Heart disease is major problem in all over the world. Arrhythmia is irregular pattern of heartbeat. When heart pumps then blood is pushed through sequence contractions in its four chambers. The problem of arrhythmia occurred when this sequence is disturbed. MIT-BIH arrhythmia database is used for classification and to train the network for better results. ECG signals help us to identify the symptoms of heart disease in a particular human being. Arrhythmia ECG signals are different from ECG signals of healthy person.
Neural network performs complex computations with ease. VEBF (Versatile Elliptical Radial Basis Function) method classifies the classes of arrhythmia which helps doctors to diagnose easily. The numbers of non-linear inputs are given at input space which produces linear output at output space. Levenberg-Marquardt is learning method for non-linear least square problems. Weights are assigned at hidden units of hidden layer. Depending on weights, the algorithm may converge to local minima. VEBF is used k-means clustering for training the network in choosing the centre with unsupervised learning. Euclidean distance is one of feature of k-mean clustering which is used as a metric of cluster. Support Vector Machines (SVM) used to classify linear as well as non-linear data. [18] We use single line which separate data for classification. The data resides on that line called support vector which is used to maximize the margin. It means dataset increases margin automatically increased that is helpful to classify easily. Neural network takes the input and produced one or more outputs according to requirements. The hidden layers are used having functions classification, feature extraction.

II. RELATED WORK
In year 2011, Jadhav, S.M., Nalbalwar, S.L., Ghatol and A.A. discussed MLP based modular neural network used for arrhythmia classification. The classification is measured with the help of accuracy, mean square error (MSE), testing and training. The Receiver Operating Characteristic (ROC) and Area under Curve (AUC) learning mechanism was proposed and experimental results are more than 82.22% for testing. [1] In year 2011, Alma Secerbegovic, Aljo Muj, Nermin Suljanovi, Midhat Nurkic, Jurij Tasic discussed integration of modern technology with medical care. The developed algorithm detects the parameters of ECG signals with the help of mobile applications via telecommunication network. ECG sensor emulator is used as source of ECG signals. [2]
In year 2010, Saichon Jaiyen, Chidchanok Lursinsap, and Suphakant Phimoltares proposed learning algorithm for classifying eye, iris and heart diseases. The learning algorithm is based on hyper ellipsoidal function used to train the network. [3] In year 2010, Miad Faezipour, Adnan Saeed and Mehrdad Nourani proposed a technique which classifies heart beat using ECG for diagnose purposes. The experimental results give good accuracy by wavelet transform. Support Vector Machines (SVM) has three phases: - input space, feature space and output space. [4]
In year 2010, Parham Ghorbanian, Ali Ghaffari, Ali Jalali, C Nataraj developed a new algorithm for classifying and detecting the ECG signals. Continuous Transform Wavelet and Principal Component Analysis (PCA) methods are used in learning process and for data filtering. [5] In year 2010, Dipti Patra, Member IEEE, Manab Kumar Das, Smita Pradhan discussed the method for classification using PCA (Principal Component Analysis), FCM (Fuzzy C-mean) clustering. PCA is used for data compression. MIT-BIH database is used for comparative study of six different beat types from ECG signals. [8]

III. PROPOSED METHOD

After reviewing the related work, we arrived at problem identification. It is to find out the positive rates and classify these into arrhythmia classes. There is need to analyze and classify the dataset of subjects (patients), having the problem of arrhythmia. So there is having an intelligent system which helps accurately to classify such subjects (patients). This research is based on hypothesis that we shall be able to develop fairly high accuracy algorithm in which false positive rates are calculated in such a way that they help us to give less number of false rates. Therefore, our hypothesis is based that our classification give good accuracy minimizes false negatives. So that it is better for someone to think that person's heart is unhealthy than to tell someone that he is fine then that is not true.

Fig. 1 describes the main steps in proposed system. This proposed method generates better results than previous ones. Figure briefly explains that what we have done after previous step is completed. Firstly MIT-BIH database is downloaded from physionet website which is used for pre-processing. In pre-processing, wavelet transform converts the dataset into ECG signals. [6] ECG signals are used in feature extraction phase where these values are classified. [11] In feature extraction, values of dataset are stored and classify the dataset according to the properties of dataset.

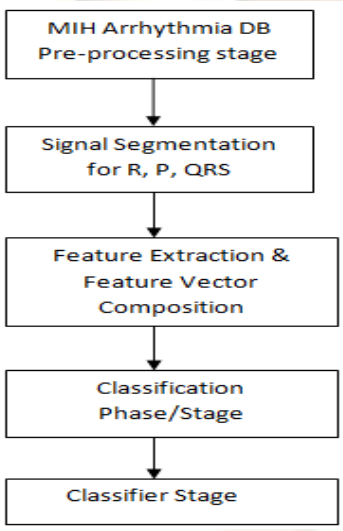

Fig.1. Main stages in research

After wavelet part, then we have to design the neural network. During training the network dataset is partitioned into cross-validation, training and testing with the help of k-means clustering. K-means clustering is used in finding the centre of RBF neural network. Radial Basis Function (RBF) neural network has important role in pattern recognition, pattern classification and signal processing. [10] Elliptic Basis Function (EBF) is Gaussian function with full covariance matrix. Versatile Elliptical Basis Function (VEBF) used for classification while Levenberg-Marquardt learning algorithm is used to train the network which gives better results than training with back propagation algorithm. After train the network, output layer generated two value i.e. positive and negative rates through which we can classify arrhythmia.

IV. RESULTS AND DISCUSSIONS

According to proposed system, a representative dataset of subjects have developed having arrhythmia. MIT-BIH arrhythmia dataset of subjects used for wavelet transform. Through this, ECG signal is generated having P, QRS and T characteristics. Figure 2 shows generated ECG signal which is used for further i.e. segmentation part. MIT-BIH arrhythmia dataset is taken to neural network. This dataset is partitioned into training, cross-validation and testing phase. This all have done with MATLAB tool.

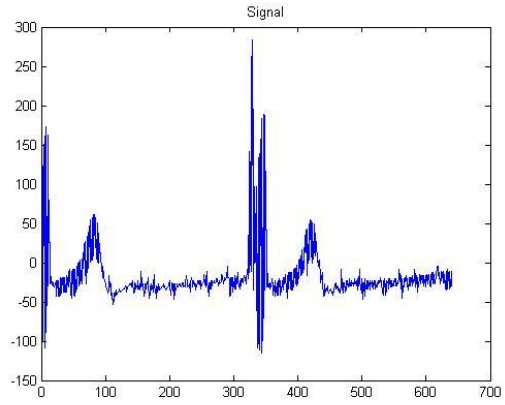

Fig.2. Generated ECG signal from dataset

Levenberg-Marquardt back propagation algorithm is used for training the network. The input pattern is given and targets are also set. The data is normalized in feature extraction. It means no repetition of data is there. Otherwise error may be occurred during output. Then we can identify normal and abnormal anomalies Network is trained at 1000 epochs and time is 00.00.11. After training the network we have to validate the results. Validation phase validates the results to check whether our goal is accomplished or not.

Experimental results are much better than previous ones with 96.01% accuracy. Here we classify 15 classes of arrhythmia. Levenberg-Marquardt back propagation algorithm is an extremely fast method for neural network learning when compared to the standard back propagation algorithm. VEBF neural network is used for classification with one input layer, 4 sub-hidden layers and one output layer which

gives two outputs. These two outputs describe whether patient has problem or not.

Fig. 3 refers to performance of trained network which generates after training is completed. Performance results are better than previous ones. Performance also checks the mean square error. Mean square error calculates the difference between actual and desired output. It also describes amount of difference of trained network and the goal that we have to achieve. Training is done at 1000 epochs based on RBF (Radial Basis Function). [15] The figure explains the difference between MSE and the output value. The performance is measured on the base of MSE (Mean Square Error). It means as MSE decreases accuracy will be increases. The line drawn defines trained network while dotted line refers to the goal defined for proposed system.

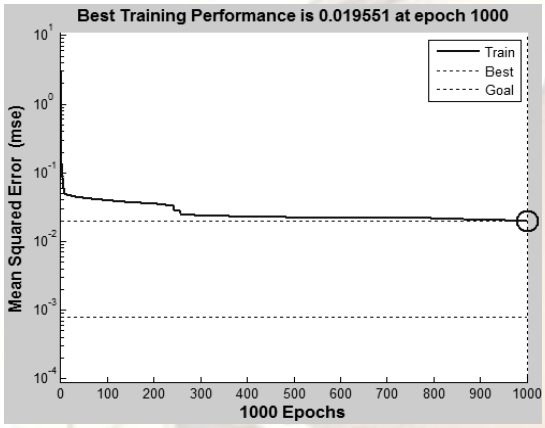

Fig.3. Performance of Trained network

V. CONCLUSION AND FUTURE SCOPE

A very fast classification technique based on elliptical basis function and VEBF neural network is proposed. ECG signal is used for classifying the normal and abnormal subjects. The performance is based on mean square error (MSE) means as MSE decreasing more we get better results. Therefore accuracy of the system improved and classification will be easy and fast.

In future, this algorithm which we have developed works very well as on one dataset. This algorithm trained on our dataset to produce highly accurate classification of arrhythmia disease classes. However, in future scope it is suggested that the algorithm must be deployed to increase true positive rates and reduce false negatives. But a trade off value must be taken so that unhealthy person should not be diagnosed as the healthy person which may complication to that person.

Therefore, we suggest that this algorithm should be experimented more with α, β values. We can change the values of α, β to improve the results and produced less MSE. We must be work on more dataset so that sample size increases to maximum possible limits. Hence MSE should be minimizing. Hence we suggest this algorithm having more possibilities. Its application must be more explored with other benchmark dataset so that its full potential can be utilized. We can change the dataset and implement those dataset with this algorithm. Thus we can get efficient results. We can take different dataset and improve the efficiency and could get accurate results. Thus it should be easy for classification in fast way.

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