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ECG SIGNAL PROCESSING USING BPNN & GLOBAL THRESHOLDING METHOD

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ABSTRACT

Electrocardiogram represents electrical activity of the heart. Sinus tachycardia and Sinus Bradycardia are among the most common ECG abnormalities. Millions of ECGs are taken for the diagnosis of various classes of patients, where ECG can provide a lot of information regarding the abnormality in the concerned patient; ECGs are analyzed by the physicians and interpreted depending upon their experience. The interpretation may vary by physician to physician. Hence this work is all about the automation and consistency in the analysis of the ECG signals so that they must be diagnosed and interpreted accurately irrespective of the physicians. This would help to start an early treatment for the problems and many lives could be saved. Many works have been done previously but this paper presents Electrocardiogram (ECG) classification to diagnose patient's condition is essential. For classification of such Difficult-to-Diagnose-Signals, P-Wave, PR-Interval, QRS-Interval, ST-Interval, T-Wave etc analysis of each Input pulse used to train the neural network. Output of the neural network gives weight factors of each signal to create a data set. Electrocardiogram (ECG) PQRSTU-waveforms time intervals and weight factors and prediction of particular decease infection or state of a patient condition saved in database. a software program is written in Matlab. Corresponding output-datasets indicates related disease and predict the causes. In this paper analysis of 'Electrocardiogram (ECG) PQRSTU-waveforms and prediction of particular disease infection or state of a patient' is done using Back Propagation Neural Network (BPNN), The overall system accuracy 90-93 % was obtained with the use of BPNN classifier

Keywords: BPNN, ECG, Heart; RRP Algorithm;

I . INTRODUCTION

Electrocardiogram (ECG) represents the electrical activity of the heart showing the regular contraction and relaxation of heart muscle. The heart condition is used to diagnose by an important tool called Electrocardiography. The analysis of ECG waveform is used for diagnosing the various heart abnormalities. ECG signal processing techniques consists of, de-noising, baseline correction, parameter extraction and arrhythmia detection. An ECG waveforms consists of five basic waves P, Q, R, S, and T waves and sometimes U waves. The P wave represents

atrial depolarization, Q, R and S wave is commonly known as QRS complex which represents the ventricular depolarization and T wave represents the repoalrization of ventricle [1]. The most essential content of the ECG waveform analysis is the morphology of QRS complex. The ECG signal may differ for the same person such that they are different from each other and at the same time similar for different types of heartbeats [2].The pacemaker cells inside the sinoatrial (SA) node used to generate and regulate the rhythm of the heart, which is located at the top of the right atrium. Normal heart beat is very regular, and atrial depolarization is always followed by ventriculardepolarization. In sinus tachycardia , the production rate is faster and In sinus bradycardia the production rate is less , but the signal will be guided by the normal route.BPNN has a significant advantage to solve problems that either do not have an algorithmic solution or solution that is too complex. These networks have been applied effectively with in medical domain for clinical diagnosis, image and signal analysis and interpretation of these signals .The conventional (Heart Attack perdition system) has been identified as one of the BPNN structures that can accurately perform Classification tasks. Neural Network is one of the most used methods of ECG beat classification, Multi-Layer Perception (MLP) based on the Neural Networks has been chosen to be able to classify the ECG signals. they are trained with Supervision, using Back- Propagation which minimize the squared error between the actual outputs of the network and the desired outputs. Neural network structure consists of four layers (an input layer, two hidden layers, and output layer). using Feed-Forward Back-propagation, the input is mapped onto each node like P,QRS,ST,T Intervals in the hidden layer weight factors of Sinus tachycardia,Sinus Bradycardia and output layer is a linear combination of hidden layer outputs multiplied by their weights.

II. LITERATURE SURVEY

Numerous works in literature related with heart disease diagnosis using fuzzy and artificial intelligence techniques were demonstrated in [1,2].In their work three classes of ECG signals selected viz, the normal sinus rhythm, malignant ventricular ectopic and atrial fibrillation were selected and the shape of the PQRST waveforms was demonstrated. the different classes of ECG signals were also reported in [3]. Nikon E.mastorakis have developed [4] an Expert system for ECG Analysis that works by hierarchically organizing the knowledge in a context free Environment. They have used Turbo C for analysis and Turbo prolog for diagnosis Hamiltonp[5] has developed a software for ECG beat detection and classification and made available as an open source system for use by researchers. silipo R and marchesis[6] used neural networks for automatic ECG analysis for the classification of different cardiac abnormalities. The premature ventricular contraction (PVC) and the premature atrial contraction (PAC) Are cardiac arrhythmias which are widely encountered in the cardiologic field they can be detected using electrocardiogram signal parameter. Implemented Neuro-fuzzy approach to identify these abnormal beats. Classifier was also reported in [9].

III. DATABASE

For this Paper, Sinus tachycardia,Sinus Bradycardia Database directory of ECG signals from physionet is utilized. Database are exemplified by- a text header file, a binary file and a binary annotation file. The header files explain

the detailed information such as number of samples, sampling frequency, format of ECG signal, type of ECG leads and number of ECG leads, patients history and the detailed clinical information. The ECG signals are stored in 212 format , in binary annotation file, which means each one sample imposes number of leads times 12 bits to be stored and the binary annotation file consists of beat annotations [9].

IV. INTERPRET HEART SIGNAL

The ECG signals must be interpreted and examined systematically. A convenient method is as follows Determine the cardiac rate and rhythm. Assess the P-R interval and the width of the QRS complex. Examine the Pwave the QRS complex. Examine the S-T segment and T wave.

V. ECG SIGNAL

ECG signal is generated by rhythmic contractions of the heart measured by electrodes .This signal can be effectively used for heart disease diagnosis. The analysis problem can be divided into two parts, the feature extraction and classification. The feature extraction procedure is necessary to detect abnormality of the signal, while the classification procedure is used to distinguish disease type. There are four major ECG intervals RR,QRS,QT,ST,T segments. The heart rate (beats per minute)can be readily computed from the inter beat(R-R) interval by dividing the number of large(0.20s) time units between consecutive R waves into 300 or the number of small (0.04s) time units between consecutive R waves into 300 or the number of small(0.04s)units into 1500.The PR interval measures the time(normally 120 to 200 ms) between atrial and ventricular depolarization.Which includes the physiologic delay imposed by stimulation of cells in the AV junction area. The QRS interval normally 100ms or less) reflects the duration of ventricular depolarization .The QT interval includes both ventricular depolarization and repolariation times and A rate related QT interval, QTc can be calculated as QT/R-R and normally is <=0.44 s.The QRS complex is subdivided into specific deflections or waves if the initial QRS deflection in a given lead is negative it is termed as Q wave[6]. The first positive deflection is termed an R wave, A negative deflection after an R wave is an S wave subsequent positive or negative wave are labeled R and s respectively .Lowercase letter(qrs)are used for waves of relatively small amplitude. An entirely negative QRS complex is termed a QS wave.The ECG signal is made up of a group of repetitive PQRST signals

VI. METHODOLOGY

Two classes of ECG signals have been selected for the classification tasks. Firstly data is uploaded to the system. Then on raw data file processing is done in which RRP values are calculated using RRP algorithm as mentioned above. The there is global thresholding method to select the threshold value. Then this signal is passed to BPNN algorithm . Remaing task is described as below. The normal sinus tachycardia, sinus bradycardia.From the web site of physionet the database is taken.The signals from the two classes are sampled. All signal input to neural network .These feature representations involve one set of PQRST-wave from a series of PQRST-waves in a period of one second. To extract accurate information from each set of ECG data, five sets of PQRST-wave from different

locations in one ECG signal input to neural networks. For every ECG data .Five sets of PQRST-wave were extracted using wavelet decomposition technique. This technique would detect the location of maximum P-wave and P-R interval, QRS, S-T segment and T wave. Detection by mat lab provides valuable information found in the interval and amplitude of ECG signals. Input to train the neural network. Output of the neural network gives weight factors of each signal. Each weight factors input to a software program is written in visual basic result to be displays risk factors.

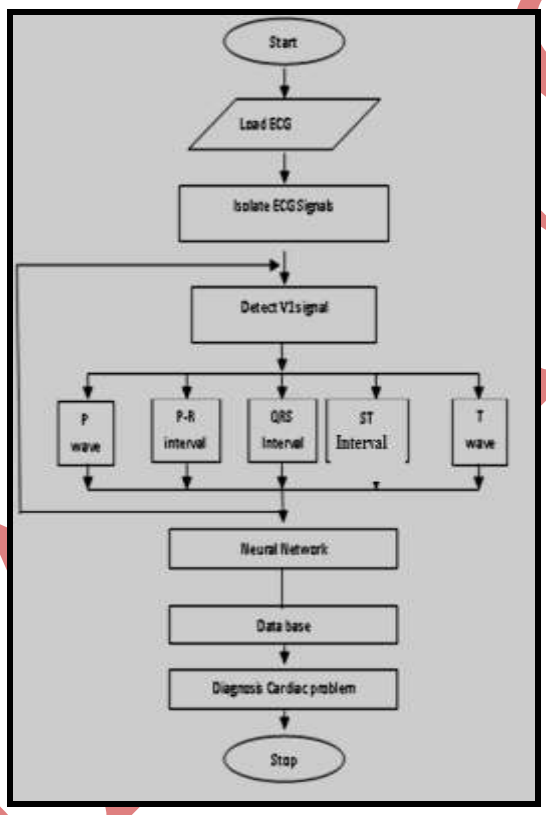

Figure.1 Detection Process

VII . NETWORK ARCHITECTURE AND TRAING METHOD

An NN classifier is presented as a diagnostic tool to aid physicians in the classification of heart diseases [5]. For the classification of the cardiac beats a A Multi-Layer Feed-forward Neural Network (MLFN) used to Analyze the PQRST is referenced to as NN in this paper. NN was constructed using the neural network software packages in Matlab. Fig.8 illustrates the architecture of NN. which included an input layer a hidden layer and an output layer .neurons in the input layer act only as buffers for distributing the input signals .Input signals are P-Wave, PR-Interval, QRS-Interval, ST-Interval, T-Wave in the hidden layer sums up its input signals xi after weighting them with the strengths of the respective connection w_{ij} form the input layer and computes its output as an activation

function f of the sum . Where f is hyperbolic tangent function. The back propagation (BP) algorithm was chosen as the training algorithm for NN.

VIII . BACK PROPAGATION ALGORITHM

Back propagation or propagation of error, is a common method of teaching artificial neural networks how to perform a given task. The back propagation algorithm is used in layered feed-forward ANNs. This means that the artificial neurons are organized in layers , and send their signals "forward", and then the errors are propagated backwards. The back propagation algorithm uses supervised learning, which means that we provide the algorithm with examples of the inputs and outputs we want the network to compute, and then the error (difference between actual and expected results) is calculated. The idea of the back propagation algorithm is to reduce this error, until the ANN learns the training data.

RESULTS

Parameters	values
CC Correct Classification	93
FC False Classification	7

Figure.2 Results table

IX. CONCLUSION

Based on the results it can be concluded that Y_i can accurately classify ECG Signals into Sinus brady cardia,Atrial tachy cardia**.**The result indicate a high level of efficient the proposed method outperforms the other methods with an impresive accuracy of 90-93% our system has many advantages including efficiecy and simplicity,We believe that it is a very fast retrival method of large amount of ECGs signals data base.

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