A SURVEY ON ECG SIGNAL MONITORING THROUGH SENSOR AND PREDICTION OF HEART ATTACK WITH THE HELP OF OPTIMIZED NEURAL NETWORK USING GENETIC ALGORITHM

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ABSTRACT: Heart Attacks are the major cause of death in the world today, particularly in India. The need to predict this is a major necessity for improving the countries healthcare sector. Accurate and precise prediction of the heart disease mainly depends on Electrocardiogram (ECG) data. Heart disease is a major life threatening disease that cause to death and it has a serious long term disability. The time taken to recover from heart disease depends on patient's severity. Heart disease diagnosis is complex task which requires much experience and knowledge. Nowadays, health care industry contain huge amount of health care data, which contain hidden information. Advanced data mining techniques along with computer generated information are used for appropriate results. Neural Network is widely used tool for predicting heart attack. A Heart Attack Prediction System we are going to develop using Neural Network and Genetic Algorithm. This system calculates the number of hidden nodes for neural network which train the network with proper selection of neural network architecture and uses the global optimization of genetic algorithm for initialization of neural network.

KEYWORDS: ECG (Electrocardiogram), Neural Network, Genetic Algorithm.

I. INTRODUCTION

The electrocardiogram (ECG) is the most important bio signal used by cardiologists for diagnostic purposes. The ECG signal provides key information about the electrical activity of the heart. The heart signals are taken from ECG, which is known as Electrocardiography. That the heart signals are picked by using electrodes in arms, leg, chest of our body. By using this signal heart disorder can be find out. Depend on the shape of the ECG waveform, find out the cardiac health. ECG signal readings and their analysis are carried out from signal processing. Today signal processing plays a major role in ECG signal analysis and

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interpretation. The aim of ECG signal processing is diverse and comprises the Improvement of measurement accuracy and reproducibility (when compared with manual measurements) and by taking out the information is not readily available from the signal through visual assessment. ECG is composite from 5 waves - P, Q, R, S and T. This signal could be measured by electrodes from human body in typical engagement [2].

Heart Attacks are the major cause of death in the world today, particularly in India. The need to predict this is a major necessity for improving the countries healthcare sector. Accurate and precise prediction of the heart attack mainly depends on Electrocardiogram (ECG) data. Neural Network is widely used tool for predicting heart diseases diagnosis. A Heart Disease Prediction System is developed using Neural Network and Genetic Algorithm. This system calculates the number of hidden nodes for neural network which train the network with proper selection of neural network architecture and uses the global optimization of genetic algorithm for initialization of neural network [1].

In today's world, an optimal and intelligent problem solving approaches are required in every field, regardless of simple or complex problems. Researches and developers are trying to make machines and software's more efficient, intelligent and accurate. This is where the Artificial Intelligence plays its role in developing efficient and optimal solutions. Data mining techniques are used to explore, analyze and extract data using complex algorithms in order to discover unknown patterns in the process of knowledge discovery. Prediction is done with the help of available knowledge or previous values so accuracy in prediction is the main challenge. The artificial neural network (ANN) can use for pattern recognition, classification as well as prediction because it is based on biological neurons, an artificial neural network (ANN) is a self-adaptive trainable process that is able to learn to resolve complex problems based on available knowledge Genetic algorithm is one of most pervasive and advanced developed heuristic search technique in Artificial Intelligence.

A. SCOPE:

The System can enhance the accuracy of predicting heart attack and heart attack diseases by optimizing neural network using genetic algorithm on ECG signals. It is used in the following areas –

- In Health care Applications
- For Wellness Management
- For Activity Management

B. OBJECTIVES:

- The major objective of this research is to monitor heart related activity using ECG sensor for prediction of heart attack using optimized neural network using genetic algorithm and enhance the prediction accuracy.
- Increase the efficiency and prediction accuracy.
- Reduce the Patients death caused by heart attack.

II. LITERATURE SURVE

This section describes the work that has been done in the area of health monitoring systems. Jubadi et al.[13] has proposed heart rate monitoring alert via SMS. In this an alert system is used to monitor the heart beat rate of a patient. This heart rate measurement is based on the principle of photoplethysmography (PPG) technique. Then this PPG signal was processed

using PIC16F87 microcontroller to check the heart beat rate per minute. An alert was given to medical experts or family members via SMS. With the help of this system doctors could monitor & diagnose patient's condition continuously & could suggest them precautions if any. Saravanan designed remote patient monitoring system using computer communication networks through Bluetooth, WiFi, Internet Android Mobile. ECG, EMG, Pulse, BP, arterial oxygen saturation, blood glucose concentration & temperature signals were monitored. They had designed android Bluetooth API & constructed a simple peer-to-peer messaging system to work between two paired Bluetooth. The monitoring section receives data via Bluetooth, Wi-Fi & Internet. This system was mainly designed to send data to the doctor.

Purnima et al. [14] proposed health monitoring systems based on GSM &Zigbee technology. In this ECG, temperature & heart beat signals are continuously transmitted & monitored through Zigbee. A Zigbee node was connected to every patient monitoring system. The data are transmitted to the doctors PC via Zigbee as well as GSM technology is used to send data to doctor's mobile.

Singh et al. [15] proposed wireless transmission system which is having a wireless sensor platform along with remote monitoring capability. They have designed sensor nodes for temperature & heart rate. This sensor data are wirelessly transmitted to the controller using RF transmitter & receiver module. This data is also wirelessly transmitted to the remote monitoring station.

Venugopal et al. [16] presented a centralized heart rate monitoring system. The data obtained from sensors of various patients are then transmitted over a WBAN and then this data is transmitted to the main location with the help of Wi-Fi.

Kiran Kumar et al. [17] developed health monitoring system using PSOC mixed signal. They developed data acquisition system to remotely monitor patient's parameters like temperature, heart rate, blood oxygen saturation, blood pH level & ECG. In this system doctor was able to monitor patient on PC using Zigbee wireless communication technology.

Different machine learning technique in ECG for classification

Sr. No	Paper Name	Feature Extraction/Reduction	Classification Model	Accuracy
1	**SVM(Support Vector Machine)**			
1	Detection of ECG Arrhythmia using a differential expert system approach based on principal component analysis and least square support vector machine [18].	Symptoms that are obtained from patients /PCA	SVM	98
2	Support vector machine classifier algorithm based on a perturbation method and its application to ECG beat recognition systems [19].	DWT(Discrete Wavelet Transform) and DCT(Discrete Cosine Transform)	SVM	94.3 with DWT 96.4 with DCT
2	**FUZZY SET THEORY**			
3	AFC-ECG: An Adaptive Fuzzy ECG Classifier [20].	DWT	Fuzzy logic	98.1
4	Classification of cardiac abnormalities using heart rate signal [21].	Certain parameters that extracted from the ECG signals	Fuzzy logic	95-100

3	**ARTIFICAIL NEURAL NETWORK**			
5	Combining recurrent neural networks with eigenvector methods for classification [22].	Eigenvector methods	RNN MLPNN	98.06 for RNN 90.83 for MLPNN
6	ECG beat classifier designed by combined neural network model [23].	DWT	ANN	96.94
7	Electrocardiogram beat classification based on wavelet transformation and probabilistic neural network [24].	DWT	PNN	99.65
4	**ROUGH SET THEORY AND HIDDEN MARKOV MODEL**			
8	An Approach to a Rough Set Based Disease Inference Engine for ECG Classification [25].	Important coefficients: age, body surface area, and smoking history (RST)	RST	87
9	Automatic P-wave analysis of patients prone to atrial fibrillation following Cardiac Surgery using Rough Set Derived Rules [26].	Wavelet analysis Method(HMM)	HMM	65% specificity 70%. sensitivity
5	**HYBRID METHODS**			
10	Fuzzy clustering neural network architecture for classification of ECG arrhythmias [27].	Segments of arrhythmia	MLP-BB+FCNN	98.9 for ANN 99.9for FCNN
11	Classification of heart rate data using artificial neural network and fuzzy equivalence relation [28].	Spectral entropy	ANN + Fuzzy	80-85

III. SYSTEM OVERVIEW

From the above literature survey we have concluded that heart activity is very important in health care monitoring system. And it is done through the ECG signals. Different machine learning algorithms were used for predicting the heart diseases as well as heart attack. The all research is done using MATLAB tool.

DISADVANTAGES OF EXISTING SYSTEM:
I. Lack of optimized solution
II. Lack of Prediction accuracy and efficiency.

A. PROPOSED SYSTEM APPROACH

In the proposed research work to design and implement a system which will predict the heart attack and heart diseases using optimized neural network by genetic algorithm for greater accuracy. System will implement using R tool and java without using MATLAB tool.

ADVANTAGES OF PROPOSED SYSTEM:
I. Chances of getting optimal solution are more.
II. The proposed system can support Multi-objective.
III. The proposed system can increase the prediction accuracy and efficiency.

B. PROPOSED SYSTEM ARCHITECTURE

- **Sensors:**

These sensors measure attributes of gross user activity, different from narrowly focused vital sign sensors. Good examples are accelerometers used for gait monitoring. Shoe manufacturers like Nike have enabled many of their running shoes with sensors capable of tracking walking or jogging activities. And here ECG sensor capture heart related activities.

- **Sensors Data Acquisition**:

This includes operations involved in collecting data from external sensor data sources. Here collect the data from ECG sensor.

- **Data Preprocessing:**

This includes operations applied to the data to prepare it for further analysis. Typical pre-processing operations include data cleaning to filter out noisy data elements, data interpolation to cope with missing values, data normalization to cope with heterogeneous sources, temporal alignment, and data formatting.

- **Feature Extraction:**

This includes operations for representing the data appropriately and selecting specific features from this representation. This stage is often called feature extraction and selection.
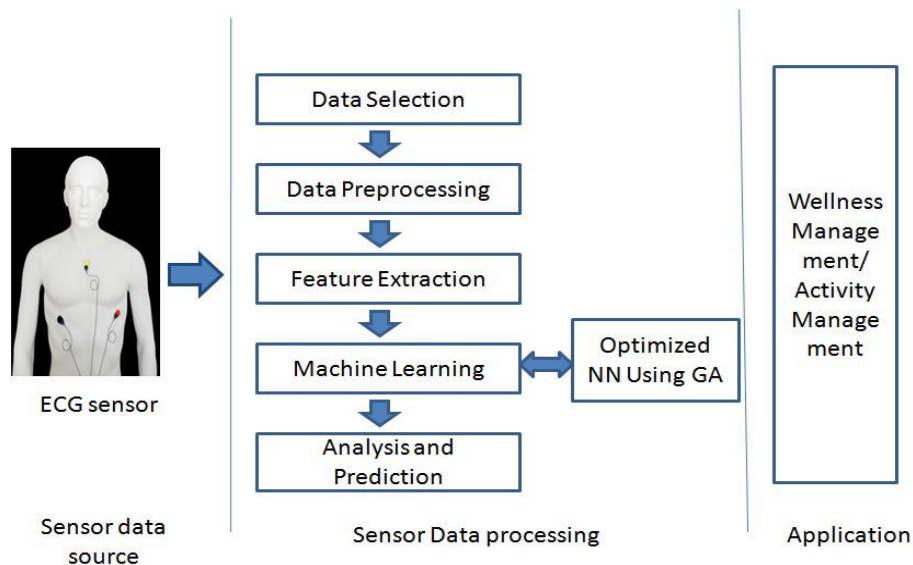

Figure: Proposed System Architecture

- **Machine Learning:**

This stage, also called mining applies knowledge discovery algorithms to identify patterns in the data. Modeling problems can be classified into six broad categories: anomaly detection to identify statistically deviant data, association rules to find dependencies and correlations in the data, clustering models to group data elements according to various notions of similarity, classification models to group data elements into predefined classes, regression models to fit mathematical functions to data and summarization models to summarize or compress data into interesting pieces of information. Here, we are applying Optimized neural network using GA for classification and prediction of heart Attack.

- **Analysis and Prediction**:

This stage includes operations for analysis and prediction of the results of the machine learning process.

- **Wellness or Activity Management:**

The analysis and prediction is useful for application like wellness management or activity management for the person.

IV. CONCLUSION AND FUTURE WORK

The ECG is mainly used for diagnosis of heart disease. Genetic Algorithm is used to optimize the initialization of neural network weights. Genetic Neural Network based prediction of heart disease for patient by improving the performance using optimize neural network architecture and predicts whether the patient is suffering from heart disease or not. Also find out possibilities of heart attack based on heart activities. Back propagation is having disadvantage like slow convergence, long training time and local minima. Genetic algorithm is use to solve this problem and gives optimal result as well as get accuracy to predict heart attack.

As the healthcare domain is dynamic and this issue is a challenge to the data mining. It is also a forcing motivation to the data mining applications in healthcare. This dynamism gives way to new horizons and more data mining applications will be employed to discover new patterns and associations. In the view of the subjects examined in this study, future data mining studies seem to take place, not limited but in considerable weight, in distributed data mining applications and text mining algorithms. With the help of data mining algorithms, the classification performance increases. This can be further enhanced and expanded with more prediction algorithm for major life threatening diseases. The further enhancement observes on utilizing different method that provides higher accuracy in feature extraction and classification.

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