

# Heart Attack Prediction System using Artificial Neural Network

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**Abstract:** *The most important organs in the entire human body is our heart. Heartbeat is the measure of how many times our hearts contract in order to pump blood throughout the body. Without a heartbeat, blood cannot be pumped throughout the body. A heart attack is the death of a segment of heart muscle caused by a loss of blood supply. Heart disease, also called cardiovascular disease, mainly affects older people and means that there are problems with the heart and blood vessels. The need to predict this is a major necessity for improving the country's healthcare sector. So, a system is proposed which will give accurate and precise prediction of the heart disease mainly depends on Electrocardiogram (ECG) data and clinical data. These data's must be fed to a non-linear disease prediction model. The analog data of ECG is converted into digital format by A/D converter. Secondly, 4-5 relevant clinical data's such as mean arterial pressure (MAP), fasting blood sugar (FBS), heart rate (HR) this heart rate is detect using Pulse rate Sensor it determines the condition of the heart, cholesterol (CH), age/gender etc. are considered. Finally, these two data's are used in Neural Network and Back Propagation Algorithm for heart attack prediction.*

**Keywords:** *Artificial neural network, electrocardiogram, Clinical data, Back Propagation Algorithm, Heart Disease Introduction*

## I. INTRODUCTION

The heart pumps blood through the network of arteries and veins called the cardiovascular system. The mass of a human heart is between 200–450 g, however approximately 300 g. A heart attack occurs when the flow of blood to the heart is blocked. The interrupted blood flow in heart can damage or destroy part of the heart muscle. There's a node in the upper right section of heart which monitors your body's need for blood. It's called the Sino atrial (SA) or sinus node, and it acts like a natural pacemaker. So, Sinus node is the main control and source of each heartbeat. It can speed up your heart rate when you need it, like when you exercise or get sick when that system has issues, though, you get a change in your heart's rhythm that's called arrhythmia. A normal heart rate is 60-80 beats per minute, but during a heart attack that rate is altered due to the disrupted blood flow.

Heart rates during a heart attack can vary from too slow or fast to palpitations and even skipped beats. The blockage occurs in the heart has a direct correlation on the type of heart rate. Some of the common types of arrhythmias are a) Tachycardia, b) Bradycardia, c) Skipped beat or pause, d) Atrial, ventricular fibrillation, e) Premature ventricular contraction (PVC) and f) Rhythm and electrical conduction disorders. So, to predict heart attack an efficient system or a model is needed in which inputs are highly uncertain, non-linear and continuously varying irrespective of time. Also, each input is unique and different from the other inputs. For the prediction the results based on the inputs fed to it Artificial Neural Network (ANN) is used. Some of the features of artificial neural networks are Non-linearity, Input-output mapping, Adaptivity, Fault tolerance, Uniformity of analysis and design, Neurobiological analogy, Contextual information. Some of the other features are it is highly precise, very accurate and has a good learning rate. Due to these superior features, artificial neural network as is chosen as the best tool for predicting a diagnosing the heart diseases. For predicting heart diseases five crucial such as Data acquisition stage, Processing stage, Network training stage, Disease predicting stage and finally Data transmission stage are used.

## II. OBJECTIVE OF STUDY

- A. To monitor heart related activity using ECG data and clinical data for prediction of heart attack using optimized neural network and back propagation algorithm and enhance the prediction accuracy.
- B. To develop web application for detection of heart attack.
- C. To calculate pulse rate of a patient.
- D. To efficiently predict heart attack of a person.
- E. To provide suggestion about diet plan if heart attack detected.

### III. LITERATURE REVIEW

About 7.4 million people died due to coronary heart disease, and 6.7 million were only due to stroke (WHO, 2015) for this reason the heart disease remains one of the favourite topic for reaserch. In order to investigate the misfortune of heart attack, certain factors that are associated with different risks need to be addressed. Therefore, people with heart disease due to the presence of chest pain, resting blood pressure, cholesterol, fasting blood sugar resting electro cardiographic and maximum heart rate need early detection and prediction for better counselling and appropriate medicine. The literature surveys on heart disease suggests the need for ECG classification and various approaches to perform the classification.

Rosaria et.al [1] proposed that, the availability of low cost high performance computing technology encourages improvement in ECG by offering a reliable and comprehensive solution to the automatic diagnosis of the ECG. Anton Bartolo et.al [3] has implemented the preprocessing of signals using three-point FIR notch filter, running median filter. Eduardo et.al [5] proposed a neural network for P wave feature extraction using two asymmetric basis functions. Omer et.al [8] proposed a feed forward multilayer perceptron neural network with a single hidden layer for classification. InduSaini et.al [13] classified subjects based on their RR intervals, systolic and diastolic blood pressure measured at different postures. The author has proposed K-Nearest Neighbor algorithm as a classifier for classifying the subjects based on lying and standing postures. R.Chitra et.al [17] adopted supervised learning algorithm for heart disease prediction at the early stages using patients' medical records. The results where compared with known supervised classifier support vector machine. The patient information is classified using a cascaded neural network. Feng Xiao et.al [11] used evolutionary neural network as the predictor. The predicted HR can trace the actual HR. Feed forward neural network is trained with back propagation method. 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.

### IV. SYSTEM ARCHITECTURE

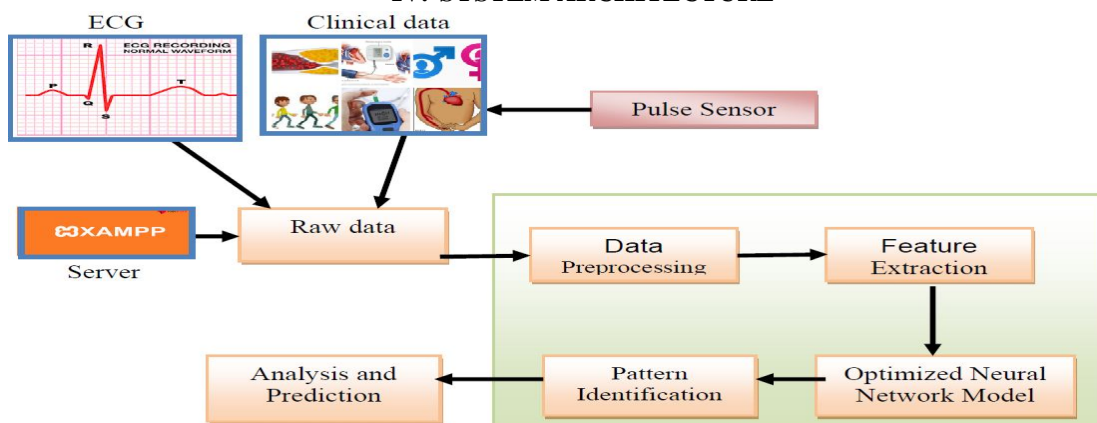


Fig. 1 Proposed System Architecture for Heart Attack Prediction

- 1) *Raw Data*: In raw data clinical data and ECG records are included. Clinical data contains mean arterial pressure (MAP), fasting blood sugar (FBS), heart rate (HR), cholesterol (CH), blood pressure and age/gender.
- 2) *Data Pre-Processing*: In this phase data cleaning is done to filter out noisy data elements from ECG and analog data. Also ECG is converted into digital format by A/D converter.
- 3) *Feature Extraction*: This process includes operations for representing the data appropriately by selecting specific features from ECG data such as QRS duration, R-R interval, P-R interval, Q-T interval, Isoelectric line, R-wave amplitude, P-wave duration, T- wave duration are extracted.
- 4) *Optimized Neural Network Model*: Modelling problems can be classified into six broad categories: 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. Optimized neural network is applied using GA for classification and prediction of Heart Attack.
- 5) *Pattern Identification*: In this stage, the system identifies the pattern of normal ECG dataset as well as abnormal ECG dataset for the analysis and prediction purpose.
- 6) *Analysis and Prediction*: In this stage results of pattern identification process are used for analysis and prediction of heart attack.

## V. ADVANTAGES

- A. User can search for doctor's help at any point of time.
- B. User can talk about their Heart Disease and get instant diagnosis.
- C. Very useful in case of emergency.

## VI. CONCLUSION

The proposed heart attack prediction system has been designed as a Multilayer connectionist neural network. The clinical data and ECG records are used to train Back Propagation Algorithm in order to predict whether heart attack present or not in the patient. If the system predicts the presence of heart attack symptoms in a person then diet plan along with precautionary measures is given. As the symptoms are detected in early stage so it will avoid the death of person caused by the heart attack.

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