OPEN ACCESS INTERNATIONAL JOURNAL OF SCIENCE & ENGINEERING

HEART ATTACK PREDICTION AND PREVENTION USING ARTIFICIAL NEURAL NETWORK

Aditi Bagul[1], Aniruddha Gorde[2], Arpita Gargade[3], Sneha Amrutkar[4], Monali Mahajan[5]
Student, Department of Computer Engineering, K.K.W.I.E.E.R, Nashik, India[1,2,3,4]
Assistant Professor, Department of Computer Engineering, K.K.W.I.E.E.R, Nashik, India[5]
adibagul17@gmail.com[1], gordeanu97@gmail.com[2], arpitagargade47@gmail.com[3], snehaamrutkar18@gmail.com[4], mjmetkar@kkwagh.edu.in[5]

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 country's health-care sector. Accurate and precise prediction of the heart disease mainly depends on Electrocardiogram (ECG) data and clinical data. This information is being fed to a nonlinear disease prediction model. This nonlinear heart function monitoring module is being able to detect heart abnormalities. The proposed system develops an efficient method to acquire the clinical and Electrocardiogram (ECG) data, so as to train the Artificial Neural Network to accurately predict the heart abnormalities if any. The proposed system will analyze Electrocardiogram (ECG) and clinical data to train the neural network for predicting chances of the heart attack and then which will generate a report predicting the abnormalities in the heart or its functioning.**

Keywords: Artificial neural network, Electrocardiogram Data, Clinical Data, heart abnormalities

---

I INTRODUCTION

With the rising number of population from corner to corner in the world and with recent changes of human's living style, there is increasingly higher numbers of individuals with complex medical conditions, especially related to heart. This has lead to higher numbers of people visiting hospitals and put pressure on the Medicare health care systems. Thus, there is a huge need for isolated health care systems that can give support to with these challenges. Recently, there has been increasing attention to the advances in the areas of electronic and bio-medical engineering and the enormous applications that these technologies can offer mainly for health analysis and monitoring. Smart phones and wearable sensors are now handy for many people worldwide with affordable prices. These devices together with artificial intelligence techniques can be efficient for monitoring and diagnosis of people with heart diseases reducing the number of visits to hospitals and improving people's lives. Many people are dying due to incorrect or late analysis of heart attack. Therefore, it is necessary to develop a system that will help to diagnose heart attack at early stage. The developed system should be able to diagnose in less time. Artificial neural network is area of artificial intelligence that consists of neurons. Artificial neural network can be used to develop such system that can predict about heart attack. In 2010, CAD was a major reason of death worldwide and was responsible for one in every nine deaths in the United States. In some cases, people with heart disease may have symptoms like chest pain and fatigue. However, in many cases, there are no symptoms until a heart attack occurs. This was the major motive to build a smart system that can constantly monitor the person's heart and raise attention whenever there is any heart related problem. In addition, the proposed system can efficiently diagnose the presence of a heart disease problem based on the use of Artificial Neural Networks and intelligent genetic algorithms.

II RELATED WORK

The literature in this topic suggests the need for ECG classification and various approaches to perform the classification.

Sarathasathasivam et.al [1] they have analyzed the different prescribed data of 1094 patients from different parts of India. Using this data, they have built a model which gets trained using this data and tries to predict whether a new out-of-sample data has a probability of having any heart attack or not. They 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.They implemented the signal preprocessing using three-point FIR notch filter,running median filter.

Vishal Jadhav et.al [2] proposed a neural network for P wave feature extraction using two asymmetric basis functions. Data mining algorithms such as J48, Naive Bayes, REPTREE, CART, and Bayes Net are applied in this research for predicting heart attacks. The research result shows prediction accuracy of 99 percent. Data mining enable the health sector to predict patterns in the data-set.

Miller M et.al [9] proposed a feed forward multilayer perceptron neural network with a single hidden layer for classification. The use of pattern recognition and data mining techniques into risk prediction models in the clinical domain Of cardiovascular medicine is proposed. The data is to be modeled and classified by using classification data mining technique.

Lancet et.al [8] a meta-analysis of individual records of diabetes, fasting blood glucose concentration, and other risk factors in people without initial vascular disease from studies in the Emerging Risk Factors Collaboration. Analyzed regressions that were adjusted for age, sex, smoking, systolic blood pressure, and body-mass index to calculate hazard ratios (HRs) for vascular disease. They classified subjects based on their RR intervals, systolic and diastolic blood pressure measured at different postures. They proposed K-Nearest Neighbor algorithm as a classifier for classifying the subjects based on lying and standing postures

Mosima Anna Masethe et.al [3] adopted supervised learning algorithm for heart disease prediction at the early stages using patient's medical records.The results where compared with known supervised classifier support vector machine. The patient information is classified using a cascaded neural network.

Shruti D. Deshmukh et.al [5] 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. A fundamental problem in neural network research, as well as in many other disciplines, is finding a suitable representation of multivariate data, random vectors. For reasons of computational and conceptual simplicity, the representation is sought as a linear transformation of the original data.

Jee, Sun Ha, et.al [4] designed remote patient monitoring system using computer communication networks hrough Bluetooth, Wi-Fi, and 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.

Robert A. Phillips et.al [11] The Korea initiatives on coronary artery calcification (KOICA) registry has been designed to identify the effectiveness of CAC score for primary prevention of CVD in asymptomatic Korean adults. This review discusses the important role of CAC score for prognostication, while also describing the design and rationale of the KOICA registry. They proposed wireless transmission system which is having a wireless sensor platform along with remote monitoring capability. They have designed sensor nodes for temperature and heart Rate.

III PROPOSED SYSTEM

The overall system process can be categorized into three steps

1. Firstly, the acquired ECG is processed, amplified, filtered to remove the noise and is converted into digital format by A/D converter. This step is prerequisite to proposed system
2. Secondly system acquires 4-5 relevant clinical data's like mean arterial pressure (MAP), fasting blood sugar (FBS), heart rate (HR), cholesterol (CH), and age/gender
3. ECG and clinical data trains the neural network for predicting the heart attack.
4. Preventive measures are also added to the system

Above first step is pre-requisite to the system which is being developed. The Electrocardiogram data is extracted after ECG test and this data is converted into numerical format within a particular range. Both Electrocardiogram data and clinical data are given to the system in numerical format as input. Neural network is trained using front feed network and back propagation algorithm. Neural network is dynamically trained using input data; this is done using front feed network. To calculate the threshold, sigmoid activation function is used. The actual output is compared with desired output. The difference between this two is checked using sum of squared errors. If difference is more output is back propagated .The weight and biases are balanced to generate new output. This process is repeated until desired output is obtained.

IV SYSTEM ARCHITECTURE

Input:

1) ECG Data Acquisition:

ECG data is 1st input to the system. After ECG test is done the result is acquired and converted into numerical format. The numerical values of electrocardiogram are given to system as input

2) Clinical Data Section:

The basic clinical information like Age, Gender, Blood Pressure, Obesity, etc. are considered in this section

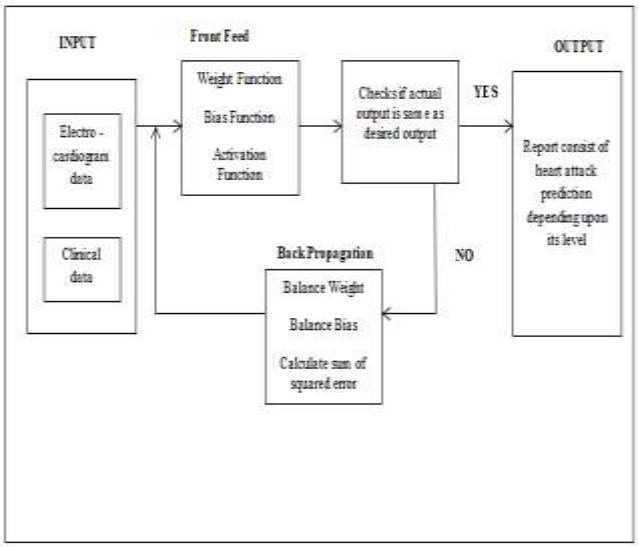


Figure 1 System Architecture

V METHODOLOGIES OF PROBLEM SOLVING

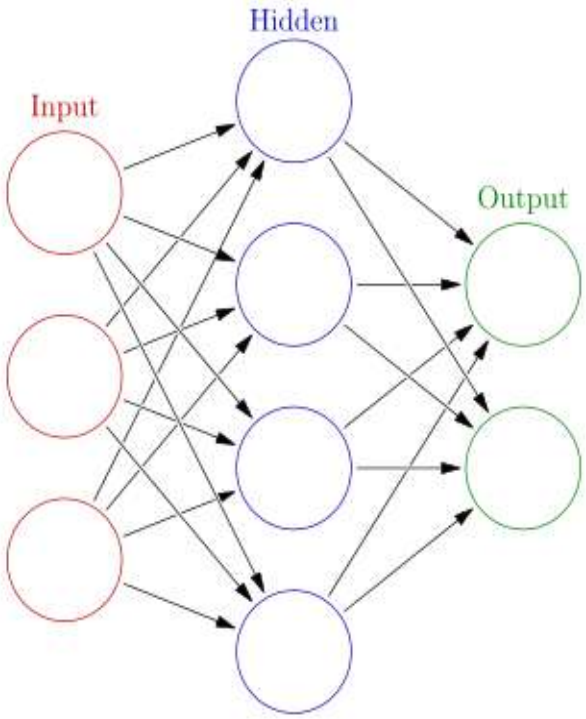
Artificial neural networks (ANN) are influential tools that can be used to manage knowledge and solve non-linear problems. It gives efficient result and its accuracy is high for nolinear data(clinical and ECG data is also nonlinear) .Hence ANN is used for solving the given problem definition. ANN includes information processing systems that are reproduced by computer, to function a very simplified biological neural network, composed of a certain number of interconnected neurons. Intelligent behavior springs from suitable communications between interconnected units.

Some of the features of artificial neural networks are:

a) Nonlinearity
b) Input-output mapping
c) Adaptivity
d) Fault tolerance
e)Uniformity of analysis and design
f) Neurobiological analogy
g) Contextual information.

Some of it's other features are highly accurate and has a good learning rate. Due to these finer features artificial neural network has been chosen as the most excellent tool for predicting and diagnosing the heart attack.

The ANN structural design consists of three layers of neurons. The neurons in a layer simply project onto those in the subsequent layer. The architecture of the artificial neural network shown in Figure 2 is said to be stratified because it consists of a number of layers of neurons. It is feed-forward because the connections only project frontward, that is, the flow of information moves in one direction from input to



output. The neurons in a layer only project onto those in the In a stratified feed-forward network all connections between neurons can be described quantitatively using a number of matrices equal to the number of pairs of neighboring layers. The ordered elements of each matrix represent the weights of the connections between consequent pairs of neurons in adjacent layers. succeeding layer. There are no associations between neurons in the same layer or between non-adjacent layers.

Figure 2 Architecture of Artificial Neural Network

To design an artificial neural network, it's very important to carefully identify the inputs (here clinical and ECG data) and outputs (report predicting chances of heart attack) to the system in order to define the context correctly and completely.

ANNs use a pattern-recognition approach to the problem, exploiting the information enclosed in available data (data driven) rather than an algorithmic perspective. In other words, once ANN structure has been chosen, the network is trained to solve a problem using a training set of examples. Examples must be chosen with care so as not to waste time or train the network in the wrong way. Thus the performance of ANNs depends greatly on the training set: here the proposed system is trained dynamically therefore more the set represents the problem and is complete, the better its performance and capacity to provide appropriate responses to ECG and Clinical data.

VI RESULTS

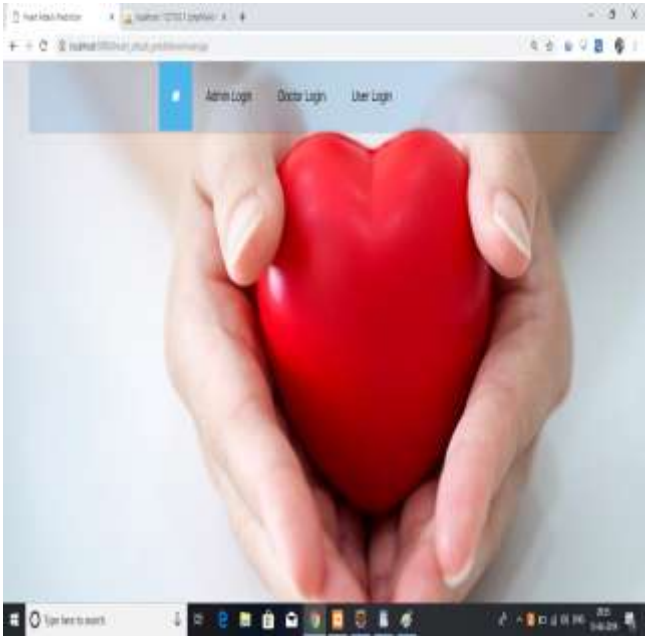


Figure 3 Home page of the system

Above is the home page of system through which one can log to Doctor Panel or Patient panel or Admin panel

Figure 4 Report Generated

Above is report generated after processing of patient's data

Figure 5 Report Generated

VII CONCLUSION

Heart Attacks are the major cause of death therefore it is necessary to develop a system that will help to predict it easily and efficiently. The proposed system reduces the time required to analyze the report of the patient. Since the system is based on artificial neural network its accuracy level is high for nonlinear data and gives efficient predictions. The report is generated describing the level at which heart attack can occur. It becomes beneficial in the cases where diagnosis needs to be done in short time. In addition to it preventive measures suggested by doctors can be seen by patients.

VIII FUTURE SCOPE

In future work tread mill ECG test (TET) data, more clinical trials and cardiologist suggestions in clinical parameter will help to develop a working model to predict myocardial infraction accurately. The work is encouraging and is in progress.

REFERENCES

[1] Sagir, Abdu Masanawa, and SarathaSathasivam. A Novel Adaptive Neuro Fuzzy Inference System Based Classification Model for Heart Disease Prediction.Pertanika Journal of Science ;Technology 25.1 (2017).

[2] Ratnaparkhi, Devendra, TusharMahajan, and Vishal Jadhav. Heart Disease Prediction System Using Data Mining Technique. International Research Journal of Engineering and Technology (IRJET) 2.08 (2015).

[3] Masethe, Hlaudi Daniel, and Mosima Anna Masethe. Prediction of heart disease using classification algorithms.Proceedings of the world Congress on Engineering and computer Science.Vol. 2.(2014).

[4] Jee, Sun Ha, et al. A coronary heart disease prediction model: the Korean Heart Study. BMJ open 4.5 (2014)

[5] Medhekar, Dhanashree S., Mayur P. Bote, and Shruti D. Deshmukh. Heart disease prediction system using naive Bayes. Int. J. Enhanced Res. Sci. Technol. Eng 2.3 (2013). [6] Pattekari, Shadab Adam, and AsmaParveen. Prediction system for heart disease using Nave Bayes. International Journal of Advanced Computer and Mathematical Sciences3.3 (2012).

[7] Peter, T. John, and K. Somasundaram. An empirical study on prediction of heart disease using classification data mining techniques.Advances in Engineering, Science and Management (ICAESM), 2012 International Conference on.IEEE
(2012).

[8] Emerging Risk Factors Collaboration. Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. The Lancet 375.9733 (2010).

[9] Miller, M. Dyslipidemia and cardiovascular risk: the importance of early prevention.QJM: An International Journal of Medicine 102.9 (2009).

[10] Decramer, Isabel, et al. Effects of sublingual nitroglycerin on coronary lumen diameter and number of visualized septal branches on 64-MDCT angiography. American Journal of Roentgenology 190.1 (2008): 219-225.

[11] Diamond, Joseph A., and Robert A. Phillips. Hypertensive heart disease. Hypertension research 28.3 (2005).

[12] US Department of Health and Human Services. The health consequences of smoking: a report of the Surgeon General. (2004): 62.

[13] Diaz, Marco N., et al. Antioxidants and atherosclerotic heart disease. New
England Journal of Medicine 337.6 (1997): 408-416.