Analysing the risk of heart disease using ANN

Aarti Londhe, Prof. Amol Joglekar

Abstract- Heart disease is a major cause of death across the world. We have medical facilities to treat heart disease still this count of death is increasing day by day. The healthcare industry gathers enormous amounts of heart disease data which unfortunately are not processed to discover hidden information for finding the root cause. Heart diseases affect approximately 70 million people worldwide where most people do not even know the symptoms. This research examines the early signs of heart disease and heart risk using proposed model. It aims to facilitate users to detect heart disease risk before time, independently. It will also try and suggest measures to decrease heart disease risk using Artificial Neural Network.

Index Terms **-** heart disease, heart disease risk, early signs of heart disease, Artificial Neural Network

I. INTRODUCTION

Heart disease is the leading cause of death for over the past 10 years. The World Health Organization (WHO) reported that heart disease is the first leading cause of death in high and low income countries. According to statistic of World Health Organization (WHO), Heart disease is the number one causes of deaths worldwide in 2011[1]. Heart disease caused 7 million deaths in 2011. If current trends are allowed to continue, by 2030 an estimated 23.6 million people will die from heart disease. So there is a need to find out accurate signs of heart disease in early stage and to treat these signs with proper medical treatment to save someone's life. Hence there is a need to develop predictive applications which will help to find out early signs of heart disease and its risk. This research takes different parameters such as age, personal information, medical history, diet, lifestyle, etc which tries to cover all the important factors which can lead to heart diseases. Based on this information it will give the proper guidelines to control it. These parameters are processed using artificial neural network to predict heart risk.

Many neural network model, even biological neural network assume main simplification over actual biological neural network. Such simplifications are necessary to understand the intended properties and to attempt any mathematics analysis. Even if all the properties of the neurons were known, simplification still needed for analytical purpose. All such models are known as artificial neural network, here after called as ANNs. In ANNs, all the neurons are operating at the same time leading to parallel structure, which makes them to perform tasks at much faster rate compared to conventional computer [2].

Manuscript received March, 2016.
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An artificial neural network (ANN) is a computational model that attempts to account for the parallel nature of the human brain. An (ANN) is a network of highly interconnecting processing elements (neurons) operating in parallel. These elements are inspired by biological nervous systems. As in nature, the connections between elements largely determine the network function. A subgroup of processing element is called a layer in the network. The first layer is the input layer and the last layer is the output layer. Between the input and output layer, there may be additional layer(s) of units, called hidden layer(s) [3].

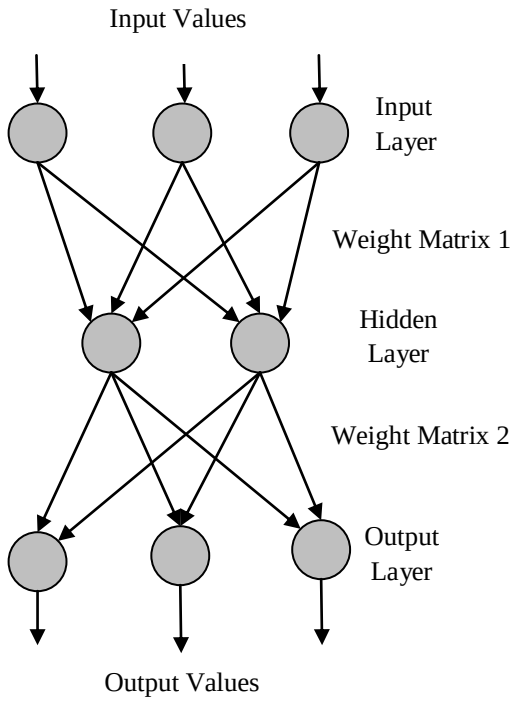

Figure 1: Artificial Neural Network

Artificial neural networks work as a leading tool that helps doctors to evaluate, model and get sensible results from complex data. Most applications of artificial neural networks in medicine are diagnostic systems, biomedical analysis, image analysis, drug development.

Feed-forward neural networks are widely and successfully used models for classification, forecasting and problem solving. A typical feed-forward back propagation neural network is proposed to diagnosis diseases. It consists of three layers: the input layer, a hidden layer, and the output layer [4].

In a feed-forward neural network information always moves one direction; it never goes backwards. It allows signals to travel one-way only; from source to destination; there is no feedback. The hidden neurons are able to learn the pattern in data during the training phase and mapping the relationship between input and output pairs. Each neuron in the hidden layer uses a transfer function to process data it

ISSN: 2278 – 1323

receives from input layer and then transfers the processed information to the output neurons for further processing using a transfer function in each neuron [5].

II. LITERATURE REVIEW

AH Chen, SY Huang, PS Hong, CH Cheng, EJ Lin [6] proposed a heart disease predict system that can assist medical professionals in predicting heart disease status based on the clinical data of patients. Their approaches include three steps. Firstly, they select 13 important clinical features, i.e., age, sex, chest pain type, trestbps, cholesterol, fasting blood sugar, resting ECG, max heart rate, exercise induced angina, old peak, slope, number of vessels coloured, and thal. Secondly, they develop an artificial neural network algorithm for classifying heart disease based on these clinical features. The accuracy of prediction is near 80%. Finally, they develop a user-friendly heart disease predict system (HDPS). The HDPS system will be consisted of multiple features, including input clinical data section, ROC curve display section, and prediction performance display section. Their approaches are effective in predicting the heart disease of a patient. The HDPS system developed in this study is a novel approach that can be used in the classification of heart disease.

Fadilla Zennifa, Fitrilina, Husnil Kamil, Keiji Iramina [7] examines the prototype of early warning system for heart disease by android application. It aims to facilitate users to early detect heart disease which can be used independently. To build the application in android phone, variable centered intelligence rule system (VCIRS) as decision makers and pulse sensor - Arduino as heart rate detector were applied in this study. Moreover, in Arduino, the heart rate will become an input for symptoms in Android Application. The output of this system is the conclusion statement of users diagnosed with either coronary heart disease, hypertension heart disease, rheumatic heart disease or do not get any kind of heart disease. The result of diagnosis followed by analysis of the value of usage variable rate (VUR) rule usage rate (RUR) and node usage rate (NUR) that shows the value of the rule that will increase when the symptoms frequently appear. This application was compared with the medical analysis from 35 cases of heart disease and it showed concordance between diagnosis from android application and expert diagnosis of the doctors.

Shaikh Abdul Hannan, A.V. Mane, R. R. Manza , R. J. Ramteke[8] proposed this paper. They examined that Radial Basis Function is used to predict the medical prescription of heart disease. This work includes the detailed information about the patient's symptoms and pre-processing was done. The trainee doctors can also use this web based tool for diagnosis and appropriate medical prescription of heart disease using radial basis function. About 300 patient's data were collected from Sahara Hospital, Aurangabad under the supervision of heart specialist. The radial basis function is applied to heart disease data for prediction of medical prescription of heart disease. Results obtained show that radial basis function can be successfully used for prescribing the medicines for heart disease. The role of effective diagnosis and the advantages of data training on neural networks-based automatic medical diagnosis system are suggested by the authors.

Mai Shouman, Tim Turner, Rob Stocker[9] proposed a model for measuring if applying data mining techniques to heart disease treatment data can provide reliable performance as that achieved in diagnosing heart disease patients. This paper provides an overview on using data mining techniques to help health care professionals in the diagnosis of heart disease investigates future trends in using data mining techniques to help healthcare professionals in diagnosing and providing suitable treatments for heart disease patients, discusses the proposed research model. They claimed that applying data mining techniques in identifying suitable treatments for heart disease patients is fruitful and needs further investigation.

III. RESEARCH METHODOLOGY

A. OBJECTIVE

The main goal of this research is to find out the heart disease and its risk in early stages and to give proper guideline to user related to its medical background and other major factors which affects his health. In today's fast life, unhealthy diet, obesity, high blood pressure and physical inactivity have increased the risk of heart attacks. So this research tries to consider all these and more such factors and evaluate those inputs using Artificial Neural Networks.

B. DATA AND METHOD

The following factors are being considered for predicting heart risk by applying Artificial Neural Networks:

1. Personal Information
2. Medical History
3. Diet
4. Lifestyle

Table 1: Input Variables

SR.NO.	INPUT VARIABLES	OPTIONS
1	Gender	Male Female
2	Age	20-30 31-40 41-50 51-60 More Than 60
3	Weight	>=25 and <=200
4	Height	>=4 and <=7
5	Previous heart attack	Yes No
6	Blood pressure	Yes No
7	Diabetes	Yes No
8	Diet habits	
9	Exercise	Less than once a week 1 – 2 times a week 3 – 6 times a week
10	Alcohol	Usually No Daily Monthly Occasionally

ISSN: 2278 – 1323

SR.NO.	INPUT VARIABLES	OPTIONS
11	Smoking	Usually No 1 - 2 times per day 3 - 4 times per day More than 4 times per day
12	Sleep	0 – 4 5 – 6 7 – 8 More than 8 hours
13	Stress	Death of family member Financial Issues Health Issues Family Issues Other Issues

The working of the proposed system and algorithm are explained in detail below.

C. WORKING OF THE PROPOSED MODEL

The proposed model will have a very intuitive user interface that will facilitate the collection of data from the user. The questions as listed in Table 1 will be displayed to the user across multiple screens and the data will be collected. This data will be fed into the model as shown in Fig. 2. The basic results like BMI, risk factor based on age will be calculated first. Based on the BMI, the person can be classified to be Under-weight, Normal and Over-weight. Based on the data collected about the person's medical history, if the person has previously had either one or more of the following - heart related problems, high blood pressure, diabetes, cholesterol - there will be a higher chance for the person to have heart disease risk. Further analysis is done using the person's diet, what kind of food he/she consumes, in how much quantity, how frequently, etc. These factors are again fed into the model we have developed. Lifestyle related information is also collected because small day-to-day habits can also have a positive or negative effect on the person's health and transitively on the heart disease risk. The proposed model will further predict an overall risk result, which will also be accompanied with some good points and bad points that can help the person to take easy steps to improve health and decrease heart disease risk.

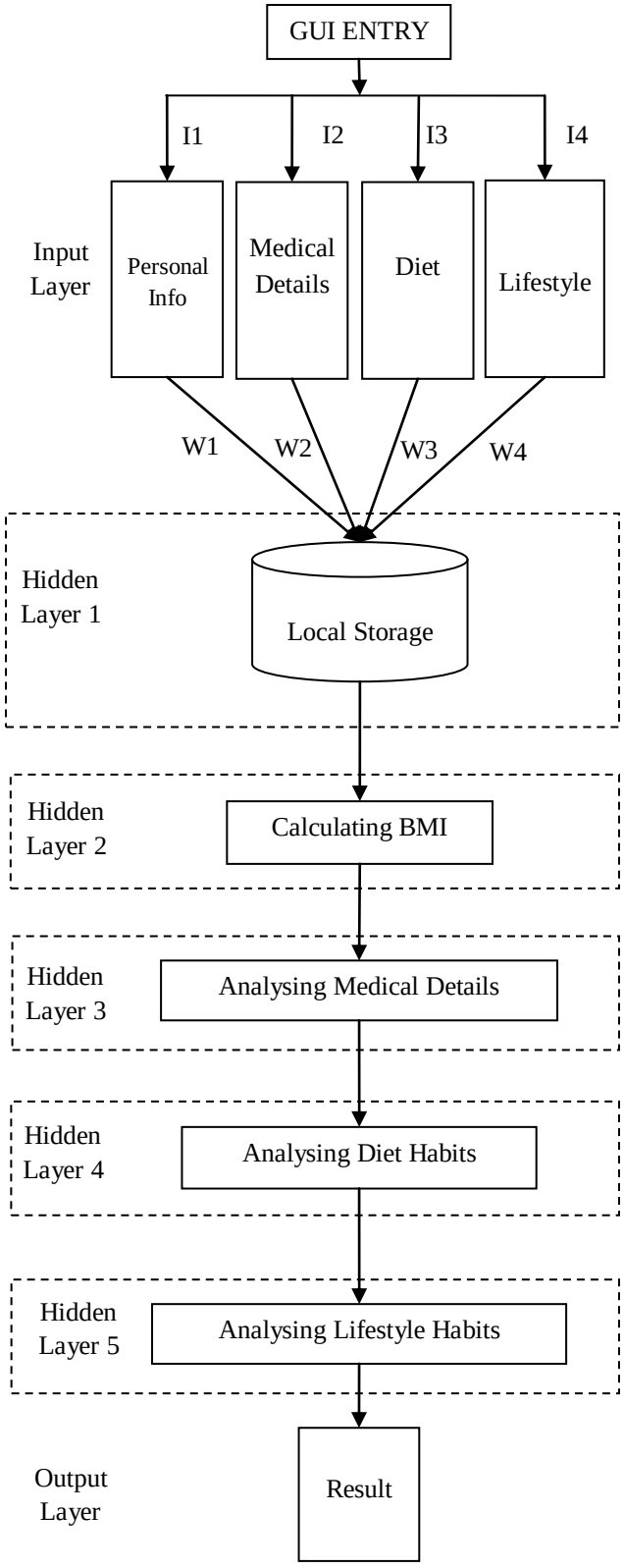

Figure 2: Proposed Model

D. ALGORITHM

The algorithmic steps are as follows:

1. Take input from users.
2. Initialize weights with some random values.
3. Transmit the data received to the first hidden layer.
4. In this hidden layer, calculate the net input (X), by using the following equation

ISSN: 2278 – 1323

$$X_i = \sum_{i=1}^{n} I_i W_i$$

where I is input and W are the weights for the inputs.

5. Compute the output of the hidden layer by applying activation function over X and send it to the next hidden layer.
6. Repeat steps 4 & 5 for the rest of the hidden layers.
7. The final hidden layer will send its output to the output layer.
8. The output is computed by using the following equation

$$Z_i = \sum_{i=1}^{n} X_i$$

where Z is the output.

V. CONCLUSION AND FUTURE SCOPE

The proposed algorithm was tested with some medical data collected from different people which shows the system is 70% accurate but in real life it is not yet implemented. In future the model will be trained according to training data which will help doctors to take appropriate decisions.

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ISSN: 2278 – 1323