IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Issue-5, May 2019 E-ISSN: 2347-2693

Smart Heart Consulting System

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DOI: https://doi.org/10.26438/ijcse/v7i5.679683 | Available online at: www.ijcseonline.org

Accepted: 24/May/2019, Published: 31/May/2019

***Abstract*—** Heart is the major organ comparing to other organs in the human body. It pumps the blood and supplies to all organs of the whole body. It is a significant work to predict the heart disease. Accurate and on time diagnosis of heart disease is important for heart failure prevention and treatment. Detecting heart disease is one of the major issue. Heart disease diagnosis is a very complex task which requires much experience and knowledge. Since heart is the most important part of human body, one should have healthy heart for their lifetime. Heart disease is a prevailing disease nowadays. The cost of diagnosis itself is very large and due to this many people who are not financially affordable step back from early diagnosis. Hospitals and clinic have a huge amount of patient data over years, and these data can be used for analysis of risk factors of many disease. Artificial neural network has emerged as an important tool for classification, they helps for efficient classification of given data. In this SMART HEART CONSULTING SYSTEM, we are proposing a prediction system for heart disease using artificial neural network. The proposed system is using 13 attributes and 80 datasets. Here in the system the user gives results of various clinical tests and the system provides the chances for heart disease.

***Keywords*—**ANN, Backpropagation algorithm, ECG

I. INTRODUCTION

Heart disease is the one of the prevalent disease that can lead to reduce lifespan of human beings nowadays. Each year 16.9 million people are dying due to heart disease. Heart is necessary part of our body and any failures affected with working with the proper working of heart can be considered as heart disease**.** Heart attack is a common problem in all human beings with the age above 30. There exists huge amount of clinical data in which many vital information is hidden and are seldom visited .Data mining helps to extract huge amount hidden and thus unknown patterns, knowledge etc. Traditional methods sometimes fail to analyze huge amount of data. Predicting and discovery of disease is a great task in medical field, and it can cause unpredictable effects.

Data mining techniques and machine learning algorithms play vital roles in the analysis of data. Some of the common attributes used for heart disease prediction are BP, chest pain type, ECG, Serum cholesterol, ST depression. The provision of quality service at affordable cost is the major goal of the system. Quality service in the sense that efficient diagnosis and effective treatment providing. Clinical predictions often may predict error results. Neural Network has been widely used in the medical field for disease prediction. ANN has been established significant role in many domains related with medical forecasting and diagnosis. They can never replace the human hands but can assist them and making their work easy. It has the ability to make decision on past experience. Sometimes physicians fail to take correct decisions on the diagnosis.ANN can help in decision making, classifying, screening etc. The dataset has several attributes like age, sex, BP, blood sugar etc.

Neural Network is a model of human nervous system implemented in such a way that it works similarly as if nervous system acts in our body. ANN consists of no. of neurons interconnected with connection links which having weights on them. There are 2 levels in ANN, first is activation transfer where activation is transmitted throughout the network and another level is learning. Here back propagation algorithm is using and it is a technique used in developing multilayer perceptron neural networks in supervised manner. The goal of NN is that it can solve problems in the same way that the human brain solves a problem.

Section I contains the introduction of Smart heart consulting system., Section II contain the related works, Section III contain the methodology used in proposed system along with algorithm, Section IV contains the result and discussion and Section V contains conclusion and future scope.

II. RELATED WORK

There exist a lot of researches and studies related to disease prediction systems using different data mining techniques and machine learning algorithms. The main aim of all is to achieve better accuracy and to make the system more efficient so that it can predict the chances of heart attack. Factors considered for heart disease prediction are heartbeat, cholesterol, BP etc. In this section, several papers are studied comparatively for better analysis and implementation of the project.

A.T Sayad, P.P.Halkarnikar[1] proposed diagnosis of heart disease using neural network appoarch. In this paper back propagation algorithm is used as training algorithm.system acts as apromising tool for diagonsis

Mudasir Manzoor Kirmani et.[2] proposed Heart disease prediction using Decision tree a Data mining technique**.** The research includes the investigation of the results after applying a range of techniques to different type of DT in order to get better performance. Normally applied J48 DT with gain ratio and binary discretization. Specificity, sensitivity, accuracy are calculated. This work proposes a model that is better than J48 DT and Bagging algorithm. Paper systematically investigates applying multiple classifiers voting technique with multi-discretization methods such as equal width, equal frequency and entropy with different types of DT such as Information gain ,gini index and gain ratio. Different combinations of discretization methods, different DT types and voting are tested to identify which combination gives the best performance. Decision tree is one of the best data mining techniques but compared to other data mining techniques it have less accuracy.

M.Marimuthu et.[3] focuses on review on heart disease prediction using ML and data analytics approach. This paper provides an insight of existing algorithms and its gives overall summary of existing works. An insight of the existing algorithms and it gives an overall summary of the existing works.

Mythili T., Dev Mukherji et.[4] A Heart disease prediction model using SVM –DT-Logistic regression.This paper proposes a rule based model to compare the accuracies of applying rules to the individual results of Support vector machine, decision tree and logistic regression on the Cleveland Heart Disease DB in order to present an accurate model of predicting heart disease.

Ramin Assari et.[5] Heart disease diagnosis using data mining techniques.Data Mining techniques are applied on heart related datasets,the main heart diagnosis indices were identified.

K.Polaraju et al[6] proposed and shows that this method is good to predict heart disease chance. Worked with 3000 instances with 13 different attributes. From here it is clear that accuracy of multiple regression is much better comparatively.

Athul kumar pandey et.[7] proposed heart disease prediction model using decision tree. They select 14 important clinical data and developed a prediction model using J48 decision tree for classifying heart disease based on clinical features. Accuracy is much less compared to others.

S.Maheswari et,[8] proposed heart disease prediction system using decision tree and naïve bayes algorithm. Various symptoms of the heart diseases are fed into the system. The ID3 and Naïve Bayes techniques in DM is used to retrieve details associated with patient.

III. METHODOLOGY

3.1. PROPOSED SYSTEM

The proposed system is "SMART HEART CONSULTING SYSTEM". In this system we propose a novel system for heart disease prediction using ANN. Here we provide some of the data such as heart beat rate, cholesterol ,BP etc as inputs. Neural network is a machine learning algorithm which can model a human brain and contains number of neurons. Each neurons in ANN accepts a number of input and the output can be connected to artificial neurons.

The algorithm used is back propagation algorithm. We are implementing this system by using 80 datasets. The data consist of 11 attributes and 2 classes. The output of our system have two classes, either 0 or 1.If the output is class 0 it denotes that there no disease found. Output class 1 indicates disease exists. The result of one patient test may result 0.98 it approximately considered as calss1.In this system we assign a threshold value. If the threshold is 0.5 all resulted value below the threshold included class 0.Value above 0.5 is included in class 1

Attributes are:

1.Age

2.Chest Pain

3.resting blood pressure

4.Serum Cholesterol in mg/dl

5.Fasting Blood Sugar > 120 mg/dl

6.Resting electrocardiographic result

7.Maximum heart rate achieved

8.Maximum exercise induced angina

9.Slope of ST

10.Major vessels number

11.Thal (observation defect)

3.2 PROPOSED ALGORITHM

The algorithm used is Back propagation algorithm. This algorithm can be used for developing multilayer perceptron neural network. Back propagation algorithm is also known as error back propagation algorithm. This algorithm consists of two passes: a forward pass and backward pass.

Forward pass: Activity pattern is given to the input nodes and it propagates through the network layer by layer. As the actual response of the network a set of output are produced. Weights at the functional points are fixed.

Backward pass: Synaptic weights are adjusted by using error-correction rule. Error signal is produced by subtracting actual response from desired output. Through the network the error signal is propagated back.

While designing networks(neural networks) at beginning, we initialise weights with some random values which can be correct or incorrect. The back propagation algorithm searches for minimum value of error function. The weights that minimize error function is then considered to be a solution in learning problem. Their include 3 steps in back propagation

- Forward propagation
- Backward propagation
- Putting all values together and calculating the updated weight value

Here ,11 neurons are used to give input and we taken 8 hidden neurons from the inputs given. Weights and bias are applied to get proper output

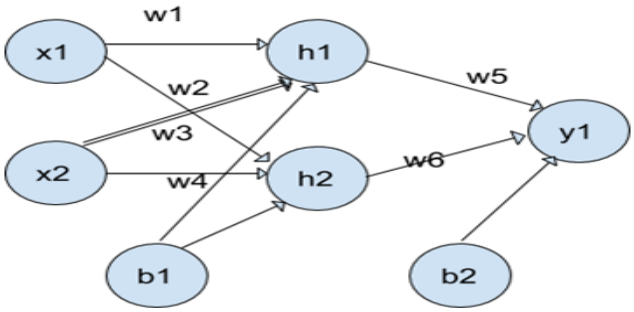

Fig 1: simple representation of back propagation algorithm

ALGORITHM

Inputs:

D, a data set consisting of training tuples &target values.

l, learning rate

Network, a multi layer feed forward network

Method:

1)Initialize all weights and biases in network

2)**While** terminating conditions is not satisfied {

3)**For** each training tuple X in D{

//Propagate the inputs forward

4) **For** each input layer unit j{

5) Oj=Ij;//o/p of input unit is its actual value

6)**For** each hidden or output unit j {

Ij =θi wij Oi+θj//compute net i/p of unit j with respect to previous layer

θj =1/1+e^-1;}//compute output of each unit j

//back propagate errors

7)**For** each unit j in o/p layer

Errj=Oj(l-Oj)(Tj-Oj)

8) **For** each unit j in hidden layers, from last to 1st hidden layer

Errj=Oj(l-Oj) θkErrk wjk //compute with respect to next higher Oj=Ij; //o/p of input unit is its actual value

9)**For** each weight wij in network{

Δwij=(l)Errj Oi //weight increment

wij=wij+ Δwij }//weight update

10) **For** each bias θj in network {

Δθj=(l)Errj//bias increment

θj= θj+ Δθj//bias update

}}

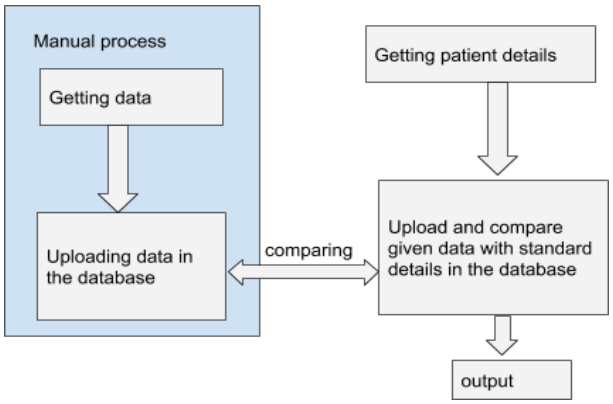

Fig 2 :Representation of the proposed system

IV. RESULTS AND DISCUSSIONS

The system predicts presence or absence of the system by evaluating input attributes by Back propagation algorithm. Here only 40 datasets are given for testing and accuracy is determined.
The screenshot of adding clinical data from user is shown in the figure 3

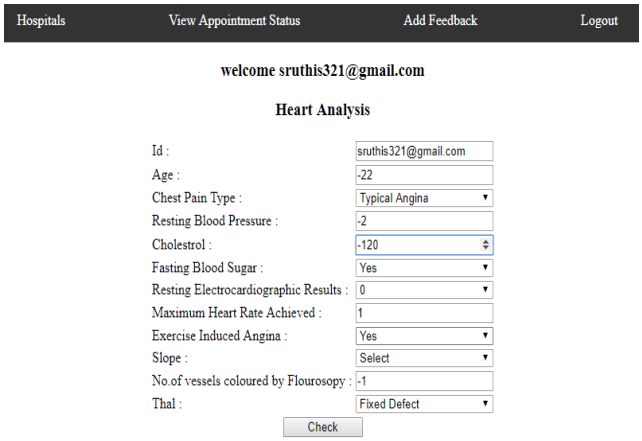

Fig 3:adding attribute data

Screenshot of final heart analysis prediction is shown in fig 4

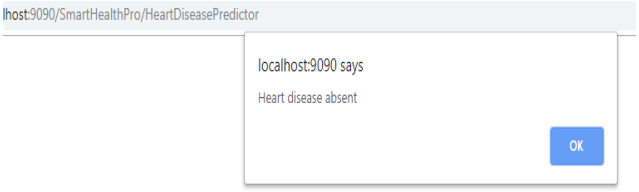

Fig 4:output of heart prediction

By using prediction and recall method, confusion matrix is used for evaluating. They give accuracy of the system in an efficient way by displaying the distribution of correct and incorrect instances. The performance can be evaluated by computing the percentage sensitivity(SE),specificity(Sp),Accuracy.

		Actual value		
		p	n	total
Predicti on n	p	TP	FP	P
	n	FN	TN	N
	total	P	N	

Table 1:Confusion matrix

SE = TP/(TP+FN)*100
SP = TN/(TN+FN)*100
AC = (TP+TN)/(TN+TP+FN+FP)*100
Where TP:no.of true positives
TN:no.of true negatives
FN:no.of false negatives
FP:no.of false positive
Here the outputs obtained are
Sensitivity: 86%
Specificity : 83%
Accuracy : 87%
Accuracy of the system can be increased by increasing the inputs to the system.

V. Conclusion and Future Scope

In this project, we are proposing a prediction system for heart disease using Artificial neural network. Data mining techniques and machine learning algorithms play vital roles in the analysis of data. Some of the common attributes used for heart disease prediction are BP, chest pain type, ECG, Serum cholesterol, ST depression. The provision of quality service at affordable cost is the major goal of the system. Quality service in the sense that efficient diagnosis and effective treatment providing. Clinical predictions often may predict error results. User login into system using username and password provided while registering to the system, there user can give clinical result data. Used dataset taken from UCL repository. Comparing the obtained data with user given data and predict the presence of the heart disease. The result shows using neural network the system predicts heart disease efficiently. Accuracy of the system is 87% by using 40 datasets As a future work, accuracy of the system can be increased by using more datasets. We expect doctor have direct involvement.

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