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Heart Disease Prediction Using Artificial Neural Network

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Abstract: Mortality rate increases all over the world on daily basis. The reasons for this could be increase in the numbers of patient with cardiovascular disease. When considering death rates and large number of people who suffers from heart disease, it is revealed how important early diagnosis of heart disease. Traditional way of predicting Heart disease is doctor's examination or number of medical tests such as ECG, Stress Test, and Heart MRI etc. Nowadays, Health care industry contains huge amount of heath care data, which contains hidden information. This hidden information is useful for making effective decisions. Computer based information along with advanced Data mining techniques are used for appropriate results. Neural network is widely used tool for predicting Heart disease diagnosis. In this paper, a heart disease prediction system which uses artificial neural network backpropagation algorithm is proposed. 13 clinical features were used as input for the neural network and then the neural network was trained with backpropagation algorithm to predict absence or presence of heart disease with accuracy of 95%.

Keywords: Heart Disease; Artificial Neural Network; Cleveland Database; Data Mining and Machine Learning

I. INTRODUCTION

Heart is made up of various Nerves and muscles. Any failure or defect of heart may lead to sudden death. Nowadays, in the world, Heart disease is the major cause of deaths. The World Health Organization (WHO) has estimated that 12 million deaths occur worldwide, every year due to the Heart diseases. In 2008, 17.3 million people died due to Heart Disease. Over 80% of deaths in world are because of Heart disease. WHO estimated by 2030, almost 23.6 million people will die due to Heart disease. This is one of the reasons why researcher has focus more in designing intelligent system that can be used to diagnose heart diseases with high accuracy, to avoid misdiagnosis. Besides, many people are living with heart disease without awareness. If heart disease could be predicted before, lots of patient deaths would be prevented and also a more accurate and efficient treatment way could be provided. Predication should be done to reduce risk of Heart disease. Diagnosis is usually based on signs, symptoms and physical examination of a patient. Almost all the doctors are predicting heart disease by learning and experience. Developing a medical diagnosis system based on machine learning for prediction of heart disease provides more accurate diagnosis than traditional way and reduces cost of treatment. In this paper, prediction of heart disease by an automated medical diagnosis system based on machine learning is proposed to satisfy this need. Backpropagation Algorithm which is commonly used Artificial Neural Network learning methodology was used for the prediction system. This system can help in diagnosing disease with less medical tests & effective treatments.

II. LITERATURE SURVEY

Tremendous works in literature related with heart disease diagnosis using data mining techniques have motivated our work. The researchers in the medical field diagnose and predict the diseases in addition to providing effective care for patients by employing the data mining techniques. The data mining techniques have been employed by numerous works in the literature to diagnose diverse diseases, for instance: Diabetes, Hepatitis, Cancer, Heart diseases and more

A model Intelligent Heart Disease Prediction System (IHDPS) built with the aid of data mining techniques like Decision Trees, Naïve Bayes and Neural Network was proposed by Sellappan Palaniappan, Rafiah Awang. The problem of identifying constrained association rules for heart disease prediction was studied by Carlos Ordonez. The assessed data set encompassed medical records of people having heart disease with attributes for risk factors, heart perfusion measurements and artery narrowing be removed before mining process occurs. Association rule mining is a major data mining technique, and is a most commonly used pattern discovery method. It retrieves all frequent patterns in a data set and forms interesting rules among frequent patterns. Most frequently used association rule mining methods are Apriority and Growth. Frequent Item set Mining (FIM) is considered to be one of the elemental data mining

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problems that intends to discover groups of items or values or patterns that co-occur frequently in a dataset. The term Heart disease encompasses the diverse diseases that affect the heart. Heart disease was then major cause of casualties in the United States, England, Canada and Wales as in 2007. Heart disease kills one person every 34 seconds in the United States. Coronary heart disease, Cardiomyopathy and Cardiovascular disease are some categories of heart diseases. The term "cardiovascular disease" includes a wide range of conditions that affect the heart and the blood vessels and the manner in which blood is pumped and circulated through the body. Cardiovascular disease (CVD) results in severe illness, disability, and death.

III. HEART DISEASE

The heart is important organ of human body part. It is nothing more than a pump, which pumps blood through the body. If circulation of blood in body is inefficient the osrgans like brain suffer and if heart stops working altogether, death occurs within minutes. Life is completely dependent on efficient working of the heart. The term Heart disease refers to disease of heart & blood vessel system within it. A number of factors have been shown that increases the risk of Heart disease

- Family history
- Smoking
- Poor diet
- High blood pressure
- High blood cholesterol
- Obesity
- Physical inactivity
- Hyper tension

Factors like these are used to analyse the Heart disease. In many cases, diagnosis is generally based on patient's current test results & doctor's experience. Thus the diagnosis is a complex task that requires much experience & high skill.

A. **Artificial Neural Networks**: An ANN also called as neural network is a mathematical model based on biological neural networks. Artificial neural network is based on observation of a human brain .Human brain is very complicated web of neurons. Neuron has axons, dendrites and synapses. The designed ANN has three layers: namely an input layer, a hidden layer and an output layer.

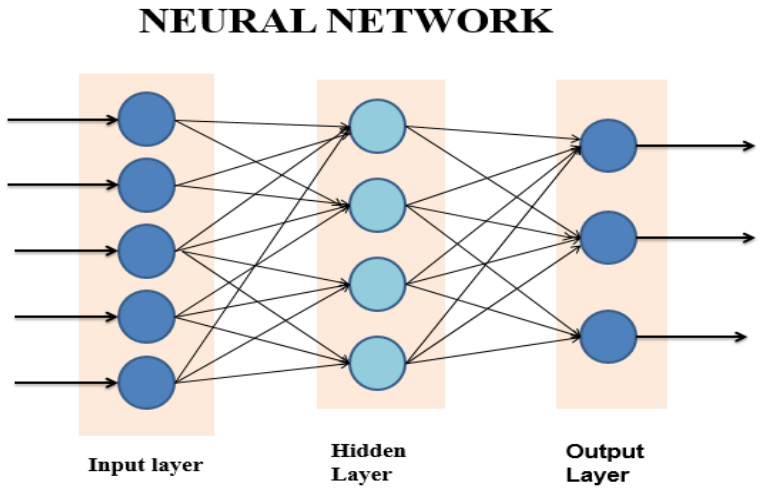

Fig 2.1 Simple neural network

IV. PROPOSED SYSTEM

This dataset was taken from the UCI machine learning repository. The heart disease dataset is made up of 75 raw features from which 13 features were published [11]. These features are very vital in the diagnosis of heart diseases. The features include fasting blood sugar test which must indicate < 120mg / dl for a patient with absent test result and test result of >120mg / dl for a patient that has heart disease. Also, a patient that has serum cholesterol greater than 180mg/dl is also considered as heart disease present.

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The 13 features considered in this research work are stated below:
Feature 1: Age
Feature 2: Sex
Feature 3: Chest pain type 4values
Feature 4: Resting blood pressure
Feature 5: Serum cholesterol in mg/dl
Feature 6: Fasting blood sugar >120mg / dl
Feature 7: Resting electrocardiographic result (value 0, 1, 2)
Feature 8: Maximum heart rate achieved
Feature 9: Exercise induced angina
Feature 10: family history.
Feature 11: The slope of the peak exercise ST segment
Feature 12: Diagnosis.

	age	sex	pain	BP	chol	fbs	ecg	maxhr	exang	famhist	slope	diagnosis
count	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000
mean	54.438944	0.679868	3.158416	131.689769	246.693069	0.148515	0.990099	149.607261	0.326733	1.039604	1.600660	0.937294
std	9.038662	0.467299	0.960126	17.599748	51.776918	0.356198	0.994971	22.875003	0.469794	1.161075	0.616226	1.228536
min	29.000000	0.000000	1.000000	94.000000	126.000000	0.000000	0.000000	71.000000	0.000000	0.000000	1.000000	0.000000
25%	48.000000	0.000000	3.000000	120.000000	211.000000	0.000000	0.000000	133.500000	0.000000	0.000000	1.000000	0.000000
50%	56.000000	1.000000	3.000000	130.000000	241.000000	0.000000	1.000000	153.000000	0.000000	0.800000	2.000000	0.000000
75%	61.000000	1.000000	4.000000	140.000000	275.000000	0.000000	2.000000	166.000000	1.000000	1.600000	2.000000	2.000000
max	77.000000	1.000000	4.000000	200.000000	564.000000	1.000000	2.000000	202.000000	1.000000	6.200000	3.000000	4.000000

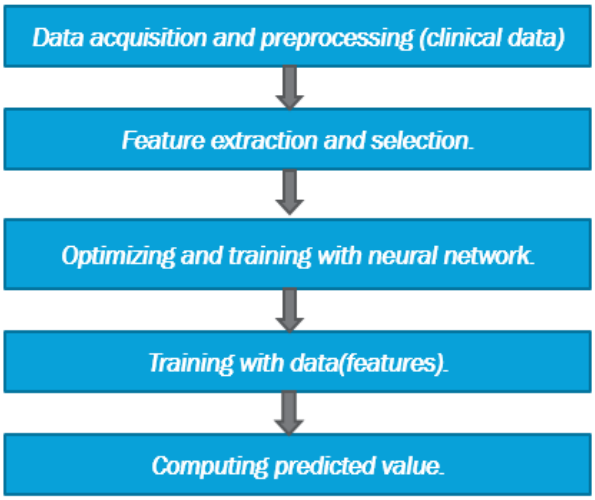

Fig.4.1 Proposed System

V. EXPERIMENTAL RESULTS

The proposed heart disease prediction system which uses neural network

A. Data Source
Cleveland database was used for heart disease prediction system. Because Cleveland database is the most commonly used database by ML researchers The dataset contains 303 instances and 76 attributes, but only 12 of them are referred by all published studies. The "goal" field which has varying values from 0(absence) to 4 denotes if heart disease present or not in the patient. Studies on the Cleveland database have focuses on distinguishing absence (value 0) from presence (values range from 1 to 4).The dataset has some missing values in it. Firstly missing values were filled with interpolation values. Then dataset was split into three parts: one for training (%70), second one for testing (%15) and

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third one for validation (%15). There are 213 instances and 12 attributes in training data. Test data and Validation data contain 45 instances and 12 attributes.

13 of the attributes listed above were used as input data for the network. The remaining attribute, num which is predicting value, was used as output data for the network. The num can get values between 0 and 4. Only 0 means absence of disease, the others show presence of disease levels. So, output of network was designed as having two output type: 0 indicates that heart disease is absent and 1 indicates that heart disease is present.

VI. RESULT

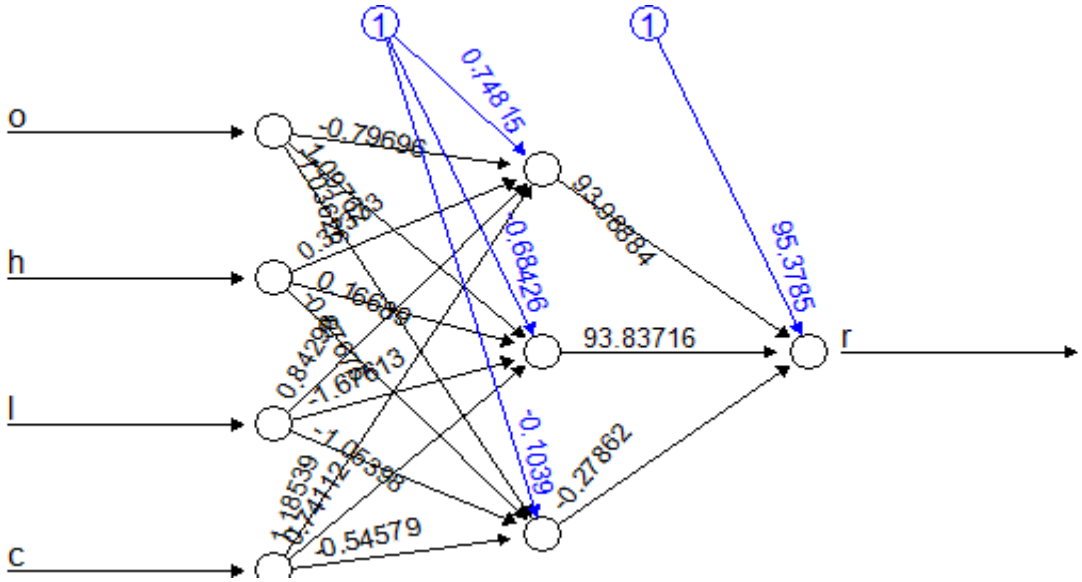

Fig.5.1 Neural Network

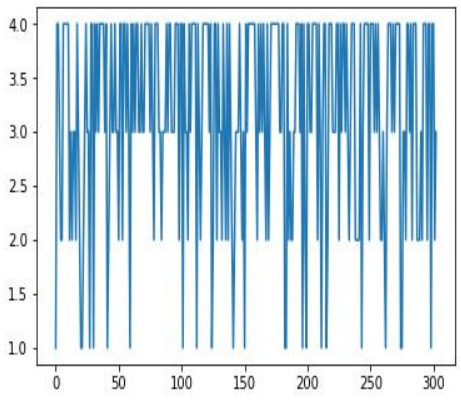

Fig 5.2(i)

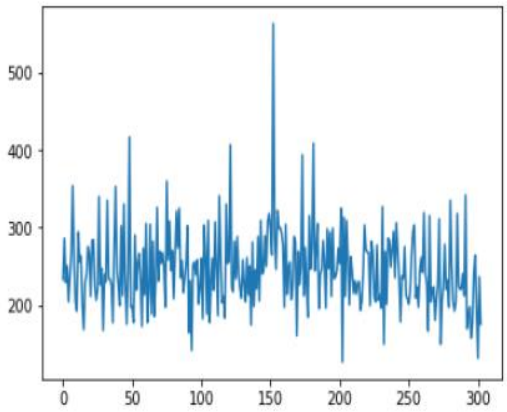

Fig 5.2(ii)

In Fig 5.2(i) & 5.2(ii) shows the prediction graph using neural network. The graph is of pain in fig 5.2(i) shows the visual representation of pain. And the fig 5.2(ii) shows the representation of cholesterol.

CONCLUSION

In this research paper, we have presented Heart Disease Prediction System (HDPS) using data mining and Artificial Neural Network (ANN) techniques. From the ANN, a multilayer perceptron neural network along with back propagation algorithm is used to develop the system. Because MLPNN model proves the better results and helps the domain experts and even person related with the field to plan for a better diagnose and provide the patient with early diagnosis results as it performs realistically well even without retraining. The experimental result shows that using neural networks the system predicts Heart disease with nearly 100% accuracy.

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