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HEART ATTACK PREDICTION USING ARTIFICIAL NEURAL NETWORK

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Abstract— Nowadays, Heart disease are increasing day by day due to lifestyle, heredity, etc. As this is becoming more common, life of people is at risk. When considering death rates and large number of people who suffers from heart disease, it is revealed how important early diagnosis of heart disease is. Apart from traditional ways nowadays Computer based information along with advanced Data mining techniques are used for appropriate results. Neural network is widely used tool for predicting heart condition diagnosis. In this paper, a heart disease prediction system which uses artificial neural network backpropagation algorithm is proposed. 14 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.

Keywords— Prediction, Artificial Neural Network, Heart disease.

I. INTRODUCTION

Heart is one among the foremost important organs within the physical body. Heart function is to pump blood round the body. Heart contain two separate pumps, one for each circulation, which simultaneously issued a similar quantity of blood into the circulatory large and small blood circulation. Heart is made up of various Nerves and muscles. Any failure or defect of heart may lead to sudden death. Nowadays, within the world, heart condition is that the major explanation for deaths. The World Health Organization (WHO) has estimated that 12 million deaths occur worldwide, per annum thanks to the gut's diseases. In 2008, 17.3 million people died thanks to heart condition. Over 80% of deaths in world are due to heart condition. WHO estimated by 2030, almost 23.6 million people will die thanks to heart condition? This is one among the explanations why researcher has focus more in designing intelligent system which will be wont to diagnose heart diseases with high accuracy, to avoid misdiagnosis. Besides, many of us live with heart condition without awareness. If heart condition might be predicted before, many patient deaths would be prevented and also a more accurate and efficient treatment way might be provided. In today's time at many places clinical test results are often made based on doctors' intuition and experience rather than on the rich information available in many large databases. Many a times this process leads to unintentional biases, errors and a huge medical cost which affects the quality of service provided to patients. Today many hospitals installed some sort of patient's information systems to manage their healthcare or patient data. These information systems typically generate large amounts of data which can be in different format like numbers, text, charts and images but unfortunately, this database that contains rich information is rarely used for clinical decision making. There is a lot of information stored in repositories that can be used effectively to support decision making in healthcare. This raises an important question: "How can we turn data into useful information which can enable healthcare practitioners to make effective clinical decisions?" This is the main objective of this research. The more risk factors that owned it also compounded the chances of developing heart disease. Risk factors in question are advanced age, male gender, heredity, hypercholesterolemia, high blood pressure, diabetes, and smoking habits. From the statistics given it indicate the need for prediction of heart disease. Prediction of heart disease is expected to reduce the number of patients with heart disease with early detection. Algorithm Artificial Neural Network (ANN) and Support Vector Machine (SVM) has been widely used for recognition of heart disease, some are also used to predict. Prediction is done by inserting a few variables that be a symptom of heart disease. Predictions generally only use the initial medical record alone. It is necessary for prediction of medical record data at regular intervals so that the accuracy can approach 100%. When the prediction is getting accurate, then the prospective patient can take preventive measures so that heart disease as the number one killer in the world can be reduced.

II. LITERATURE SURVEY

Tremendous works in literature related with heart condition diagnosis using data processing techniques have motivated our work. The researchers within the medical field diagnose and predict the diseases additionally to providing effective look after patients by employing the info mining techniques. The data mining techniques are employed by various works within the diagnosis of diverse diseases, for instance: Diabetes, Hepatitis, Cancer, Heart diseases and more A model Intelligent Heart Disease Prediction System (HDPS); 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 condition prediction was studied by Carlos Ordonez. The assessed data set encompassed medical records of individuals having heart condition with attributes for risk factors, heart perfusion measurements and artery narrowing be removed before mining process occurs. Association rule mining may be a major data processing technique, and may be a most ordinarily used pattern discovery method. It retrieves all frequent patterns during a data set and forms interesting rules among frequent patterns. Most commonly used association rule mining methods are Apriority and Growth. Frequent Item set Mining (FIM) is taken into account to be one among the basic data processing problems that intends to get groups of things or values or patterns that co-occur frequently in a dataset. The term heart condition encompasses the various diseases that affect the guts. Heart disease was then major explanation for casualties within the us, England, Canada and Wales as in 2007. Heart disease kills one person every 34 seconds within the us. Coronary heart condition, Cardiomyopathy and disorder are some categories of heart diseases. The term "cardiovascular disease" includes a good range of conditions that affect the guts and therefore the reform the blood vessels and the manner during which blood is pumped and circulated through the body. Cardiovascular disease (CVD) leads to severe illness, disability, and death.

III. PROBLEM STATEMENT AND OBJECTIVE

A. Problem Statement

Now day's Heart disease is main reason for death in the world. So, we want to make a system which will predict the presence of heart disease in human body at an early stage. System will also suggest the nearby doctors to the user.

B. Objective

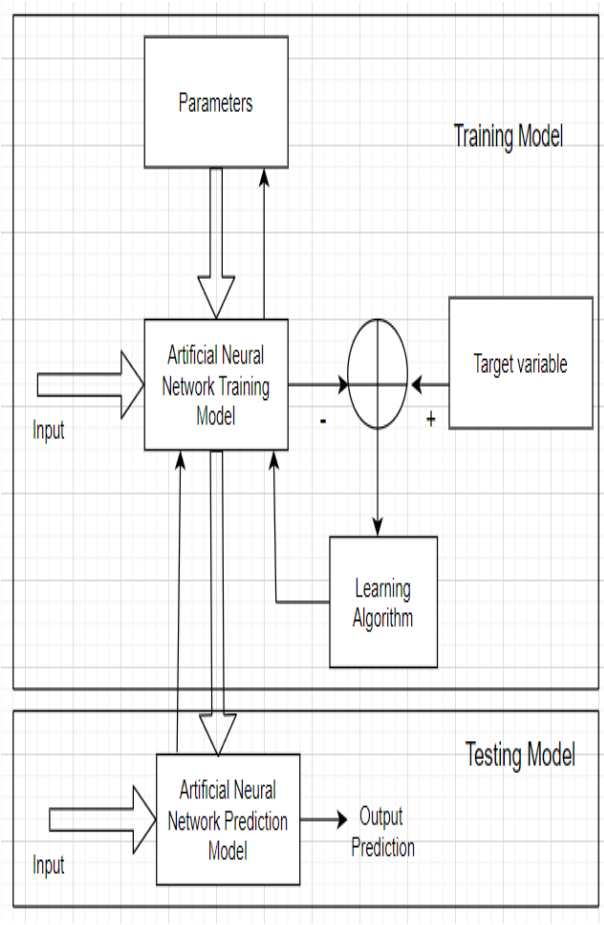
The main objective of this project is to develop a system for diagnosis of heart condition using data processing modelling technique. This system can discover and extract hidden knowledge related to heart condition from historical heart condition database. It assists healthcare practitioners to form intelligent clinical decisions which traditional decision support systems cannot. Here, system can classify the patients supported risk level using data processing technique into two classes as Low, High. So, these diagnosis helps healthcare personals in taking effective decision in following condition:

1) Patient at high risk requires lowering treatment and special attention.

2) Patient at low risk and no risk may be encouraged by their doctor to follow Health Recommendation for prevention of heart disease. So, the proposed system significantly acts decision support system for doctors in taking clinical decisions.

IV. Artificial Neural Network Working

The idea of ANNs is predicated on the assumption that working of human brain by making the proper connections, are often imitated using silicon and wires as living neurons and dendrites. The human brain consists of 86 billion nerve cells called neurons. They are connected to other thousand cells by Axons. Stimuli from external environment or inputs from sensory organs are accepted by dendrites. These inputs create electric impulses, which quickly travel through the neural network. A neuron can then send the message to other neuron to handle the difficulty or doesn't send it forward. ANNs are composed of multiple nodes, which imitate biological neurons of human brain. The neurons are connected by links and that they interact with one another. The nodes can take input file and perform simple operations on the info. The result of these operations is passed to other neurons. The output at each node is named its activation or node value. Each link is associated with weight. ANNs are capable of learning, which takes place by altering weight values.



V. ANN IN MEDICAL FIELD

A neural network (NN) may be a parallel, distributed information science structure consisting of multiple numbers of processing elements called node, they're interconnected via unidirectional signal channels called connections. Each processing element features a single output connection that branches into many connections; each carries an equivalent signal i.e. the processing element output signal. The NN are often classified in two main groups consistent with the way they learn,

1) Supervised learning

It is an easy model, during which the networks compute a response to every input then compare it with target value. If the computed response differs from target value, the weights of the network are adapted consistent with a learning rule.

e.g. Single-layer perceptron, Multi-layer perceptron.

2) Unsupervised learning:

These networks learn by identifying special features in the problems they are exposed to.

e.g.: Self-organizing feature maps.

The advantages of Neural Networks for classification are:

1) Neural Networks are more robust because of the weights

2) Any Neural Network improves its performance by learning. This may continue even after the training set has been applied.

3) The use of Neural Networks can be parallelized as specified above for better performance.

4) there's a coffee error rate and thus a high degree of accuracy once the acceptable training has been performed.

5) Neural Networks are more robust in noisy

certain timeline for the access granted to the individual. This will eliminate the incidents of medical record hoarding.

VI. PROBLEM FORMULATION

A. Data Collection

The data is collected from Kaggle. The database contains 14 clinical features or attributes and approximately 900 test cases for training and prediction. Data is also collected from certain heart patient too. The 14 attributes as shown below

No.	Attributes	Description
1	Age	Age (in years)
2	Sex	0: Female, 1: male
3	Chol	Serum Cholesterol in(mg/dl) (chol<200)
4	Trestbps	Resting blood pressure in (mm/hg) (value in 80 to 120)
5	CP	Chest Pain type (1. Typical angina; 2.Atypical Angina 3.Non-anginal 4.Asymptomatic)
6	Fbs	Fasting blood sugar (80<=fbs<=120)
7	Restecg	Resting Electrocardiographic Result
8	CA	Number of major vessels(0-3) coloured by fluorescent.
9	Thalach	Maximum Heart rate achieved
10	Exang	Exercise induced Angina (0:No ; 1:Yes)
11	Oldpeak	ST depression Induced by exercise relative to rest.
12	Heredity	Family History of coronary artery disease (0:No ; 1:Yes)
13	Smoking	Patient Smoke or not (0:No ; 1:Yes)
14	Thal	Inherited blood disorder (Thalassemia)

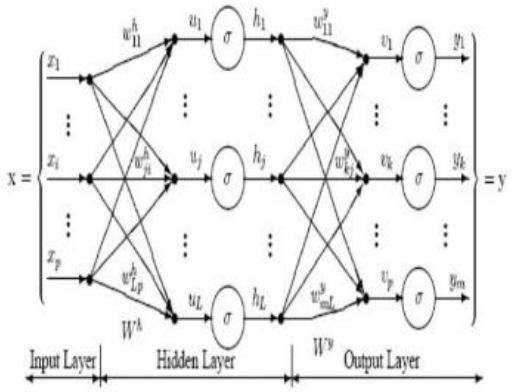
B. Data Pre-processing

The collected data were used to create a structured database system. The fields were identified, duplications were extracted, missing values were filled and the data

VII. CLASSIFICATION ALGORITHM

1. Multi-Layer Perceptron Neural Network (MLPNN)

A kind of feedforward neural network mechanism is the Multi-layer Perceptron Neural Networks (MLPNN). The structure of MLPNN is shown in below Fig.



Structure of MLPN

In MLPNN the lone and primary task of the neurons in the input layer is the division of the input signal xi among neurons in the hidden layer. Every neuron j in the hidden layer adds up its input signals xi once it weights them with the strengths of the respective connections wji from the input layer and determines its output yj as a function f of the sum, given as

$$Y_i = f(\sum w_{ij} x_i)$$

At this instant it is possible for f to be a simple threshold function such as a sigmoid, or a hyperbolic tangent function. The output of neurons in the output layer is determined in an identical fashion. The working of Multi-Layer Perceptron Neural Network is summarized in steps as mentioned below:

1) Input data is provided to input layer for processing, which produces a predicted output.

2) The predicted output is subtracted from actual output and error value is calculated.

3) The network then uses a Back-Propagation algorithm which adjusts the weights.

4) For weights adjusting it starts from weights between output layer nodes and last hidden layer nodes and works backwards through network.

5) When back propagation is finished, the forwarding process starts again.

6) The process is repeated until the error between predicted and actual output is minimized.

2. Back-Propagation Training

The back-propagation algorithm can be employed effectively to train neural networks; it is widely recognized for applications to layered feed-forward networks, or multi-layer perceptron. The back-propagation learning algorithm can be divided into two phases: propagation and weight update **[5].**

Phase 1: Propagation

1) Forward propagation of a training pattern's input through the neural network in order to generate the propagation's output activations.

2) Back propagation of the propagation's output activations through the neural network using the training pattern's target in order to generate the deltas of all output and hidden neurons.

Phase 2: Weight update

For each weight-synapse:

1) Multiply its output delta and input activation to get the gradient of the weight.

2) Bring the weight in the opposite direction of the gradient by subtracting a ratio of it from the weight.

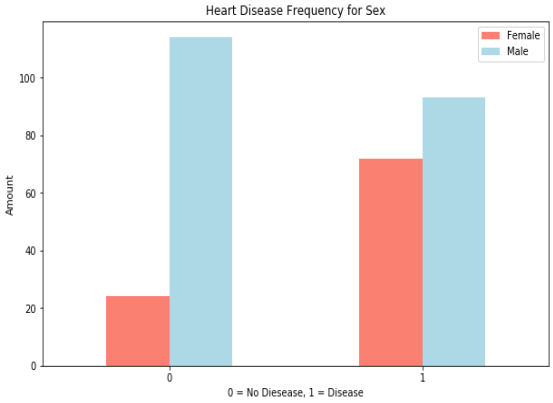
Repeat the phase 1 and 2 until the performance of

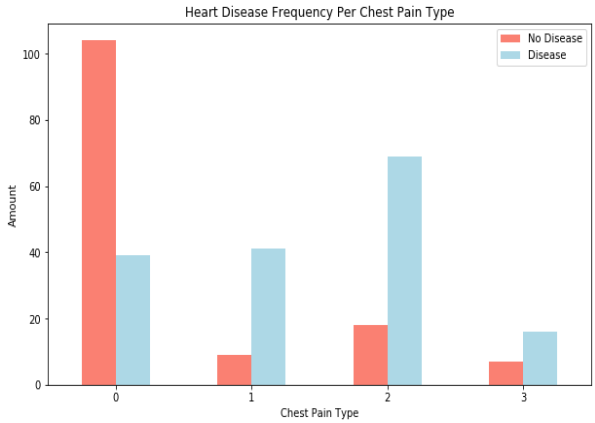
VIII RESULT ANALYSIS

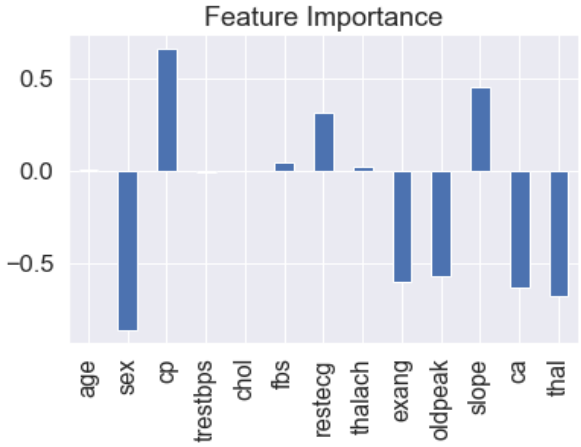
A. Data Source

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 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.







IX CONCLUSION

In this research paper, we have presented Heart disease prediction system (HDPS) using artificial neural network (ANN) technique. 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 98% accuracy.

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