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Heart Disease Prediction using Deep Learning Techniques

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Abstract - *Anticipating heart illness has continuously been a basic and challenging errand for healthcare specialists. Hospitals and other clinics offer expensive treatments and operations for heart disease. So, predicting heart disease in the early stages will be beneficial for people all over the world to take necessary actions before they become seriously ill. Heart disease is a big problem lately; The main cause of this disease is the consumption of alcohol, tobacco, and lack of physical exercise. Over the years, machine learning has shown effective results in making decisions and predictions from a wide range of data produced by the healthcare industry. Some of the supervised machine learning techniques used in this heart disease prediction are Artificial Neural Network (ANN), Decision Tree (DT), Random Forest (RF), Support Vector Machine (SVM), naïve Bayes) (NB) and k-nearest neighbor algorithm. Moreover, the performance of these algorithms is summarized.*

Keywords— Deep Learning, Machine learning, supervised learning, health care services, heart disease.

1. INTRODUCTION

The term "cardiology" alludes to a few sorts of heart malady. The foremost common sort of heart infection is coronary supply route infection (CAD), which influences the bloodstream to the heart. Coronary course infection is the build-up of plaque within the supply routes that supply oxygen-rich blood to the heart. Plaque causes a narrowing or blockage that may lead to a heart attack. Indications incorporate chest torment or inconvenience and shortness of breath.

Coronary artery disease is thought to start with harm or damage to the inward layer of the coronary supply route, now and then as early as childhood. The damage may be caused by defects you're born with, high

blood pressure, diabetes, smoking, drugs, alcohol. Sometimes in heart disease, the infection also affects the inner membrane which is recognized by symptoms such as fever, fatigue, dry cough, and rash. Causes of heart infection are bacteria, viruses, parasites. Sorts of heart infection: Cardiac arrest, Hypertension, Coronary artery illness, Heart failure, Heart contamination, Inherent heart malady, Moderate pulse, Stroke sort heart illness.

Deep Learning Algorithms

1.1 Artificial Neural Network

It is an exertion to simulate the network of neurons that make up a human brain in order to empower computers to learn things and make choices similar to people. It comprises many layers and each layer has numerous neurons. At first, an ANN experiences a preparing stage where it learns to observe and organize design in the dataset, whether outwardly or textually. Amid this preparing stage, the organization makes a comparison of anticipated yield with genuine yield, the variation between both results is balanced utilizing backpropagation. 2-ANN is an Artificial neural network with 2hidden layers.

1.2 Deep Neural Network

A deep neural network (DNN) can be considered as stacked neural systems, i.e network composed of a few layers. DNNs, where there's more than one hidden layer and the network, moves in as it were forward heading (no loopback). These neural systems are great for both classification and prediction. 2-DNN is a Deep neural network with 2hidden layers.

Machine Learning Algorithms

1.3 Support Vector Machine

Support Vector Machine or SVM is one of the foremost well-known supervised learning algorithms, which is utilized for classification issues in machine learning.

The objective of the SVM algorithm is to make the most excellent line or choice boundary that can segregate n-dimensional space into classes so that we will effortlessly put the modern information point within the adjusted category in the future. The best choice boundary is called a hyperplane. SVM chooses the extraordinary points that offer assistance in making the hyperplane. These extraordinary cases are called support vectors, and consequently, the calculation is named as Support Vector Machine.

1.4 Decision Tree

A decision Tree in Machine Learning is utilized to create the classification models. This classification model is based on the tree-like structure. This comes beneath the category of supervised learning, where the target result is as of now known. Both the categorical and numerical information can be connected to the Decision tree algorithm. The decision tree comprises root hubs, branches, and leaf hubs. Data is assessed on the premise of navigating the way from the root to a leaf hub.

1.5 Naïve Bayes

Naïve Bayes classifier could be a machine learning approach that we moreover utilize for classifying and foreseeing the probability of an occasion. Each Naïve Bayes classifier assumes that the esteem of a specific include is distinct from any other features values given within the course factors, for example, a machine can consider any specific natural product as an apple on the off chance that it is ruddy, circular, and its breadth is approximately 12 cm. credulous Byes classifier looks on each one of these highlights to see on particularly to the probability that the fruit is an apple, paying small regard to any interrelation between the shading, roundness, and estimation highlights. The classifier has risen from the Bayes hypothesis.

1.6 Random Forest

Random Forest is a troupe of unpruned classification-based trees. It gives astonishing execution with concern to a number of real-life issues because it is non-effective to commotion within the dataset and hazard of overfitting is additionally less. In comparison to numerous other tree-based calculations, it works speedier than others and for the most part, moves forward precision for testing and approval information. Random forests are the conglomeration of the expectations of individual decision tree calculation. There are different choices to tune the execution of random forest when building an irregular tree.

1.7 K-nearest Neighbour

KNN calculation utilizes the information and characterizes unused information points dependent on resemblance measures is essential, we can say the KNN Calculation acknowledges that comparative things are near to one another. In KNN, Classification occurs by considering the larger part vote to its neighbors. The data point goes to the course that has the foremost intimate neighbors, as we increase the number of nearest neighbors, the estimation of k and precision may increase.

2. LITERATURE REVIEW

P. Ramprakash[] developed a self-operating model for cardiac disease detection using a Deep neural network and ANN. The proposed model had 2 hidden layers, Convolutional DNN is less accurate than the proposed model i.e 2-DNN, and the accuracy of 2-ANN is less as compared to 2-DNN.

Vijeta Sharma[2] recommended the ML technique in which SVM and Random Forest performed exceptionally well in comparison to Gaussian Naive Bayes and Decision tree. Demonstrate created with SVM gives 98% precision which is 8% more prominent than the Naïve Bayes and Naïve Bayes gives 90% precision and the Decision tree gives 85% precision. In the same way, the model construct with Random Forest gives the best forecast result with 99% precision, which is itself more exact than SVM for heart disease expectation.

Ezaz Ahmed[3] proposed a system based on the dataset attribute classification out of eighteen attributes they chose eight attributes as the main attribute are Age, gender, smoking habit, diabetes, cholesterol, chest pain, hypertension, family history. The author has used various ML techniques and SVM gave 91% accuracy using eight attributes and 86.03% using eighteen attributes.

Dr.Ashish Oberoi[4] proposed several models for predicting heart disease. Decision tree, naïve Bayes, multilayer perception, and Ensemble classification in which RF, NB are combined and in proposed model author applied the random forest classifier for feature extraction and k-means then applied the decision tree technique for classification, The proposed model gave the highest accuracy rate of 94.44%.

Savitha Kamalapurkar[7] used ML algorithms K-Nearest Neighbour, Decision Tree, SVM, RF out of all the four Random Forest performs well with 92% accuracy and SVM accuracy is 90%. SVM and RF are combined with voting classifier then accuracy is increased by 3% i.e 95% and this method is named as Ensemble method.
Voting classifier incorporates including the estimates made by other models or averaging the expectation made by regression models.

COMPARATIVE STUDY OF LITERATURE SURVEY

Author	Technique used	Accuracy
P. Ramprakash[5]	Artificial Neural Network and Deep Neural Network	2-DNN gave the better performance as compared to DNN and 2-ANN
Vijeta Sharma[2]	Random Forest, Support Vector Machine, Naïve Bayes	RF gave the best accuracy of 99% SVM accuracy-98%, Naïve Bayes – 90%
Ezaz Ahmed[3]	Used dataset attribute classification and SVM	SVM with 8 attribute-91% SVM with eighteen attributes – 86.03%
Dr.Ashish Oberoi[4]	Combined use of RF and Naïve Bayes	Accuracy is 94.44%
Savitha Kamalapurkar[7]	Random forest, SVM, Combined RF, SVM, and voting classifier this method named as Ensemble method.	RF- 92% SVM-90% Ensemble method-95%

3. PROPOSED SYSTEM

3.1 Problem Statement

"To Predict the heart disease using the deep learning techniques."

3.2 Problem Elaboration

The study analyzed by the world health organization (WHO) gauges that 24% of individuals passed on in India due to cardiac disorder. Examiners have recorded the different components that increase the possibility of cardiac disorder and coronary supply route malady. We aim to apply Deep Learning techniques to the dataset to predict heart disease.

3.3 Proposed Methodology

Deep Learning Algorithms such as Deep Neural Network, Genetic algorithm, As studied the 2-DNN gives better performance than the DNN and ANN and Random Forest gives better accuracy as compared to SVM Naïve Bayes. Deep Learning algorithms play an imperative part in health care applications. So, applying deep learning strategies for heart disease forecasts may provide a way better result.

In an existing system given in [5], only DNN and ANN are used and 2-DNN was better. We will use the Deep Neural Network, genetic algorithm, and family history of heart disease is additionally a reason for developing heart disease, consequently, this data of the patient can also be included within the dataset which improves the accuracy of the model.

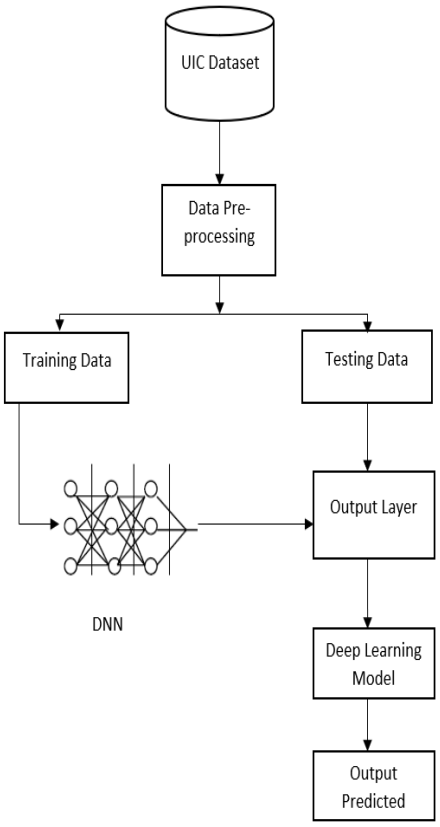

Fig-3.3 System Architecture

1. Data Collection

We will collect the Dataset from the UIC which includes the age indicating the age of the patient, sex demonstrates the sex of the patient, trestbp demonstrates the resting blood weight, cp demonstrates the chest torment, fbs indicates the fasting blood sugar, chol demonstrates cholesterol, etc.

2. Training

Before training the model we will split the dataset into two sets training set and testing set. We are going to use the Deep neural network and genetic algorithm, a deep neural network(DNN) is an artificial neural network(ANN) with numerous layers between the input and yield layers. There are different sorts of neural systems but they always comprise the same components: neurons, neural

connections, weights, predispositions, and capacities. These components work comparable to human brains.

3. Testing

We will test our model on testing data and we will evaluate the performance of our model using evaluation metrics like accuracy, precision, etc.

4. CONCLUSION

In this paper, we have introduced a method using a deep neural network and genetic algorithm that we are going to experiment on existing methods of heart disease prediction. After that, we will get the model with more to improve accuracy which can detect heart disease more accurately. Existing methods were using the support vector machine and naïve Bayes which are giving less prediction of a system with the help of this proposed method, we will try to build a more efficient and accurate model to predict the heard disease.

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Prof. Pramila M. Chawan is working as an Associate Professor in the Computer Engineering Department of VJTI, Mumbai. She has done her B.E.(Computer Engineering) and M.E.(Computer Engineering) from VJTI College of Engineering, Mumbai University. She has 28 years of teaching experience and has guided 80+ M. Tech. projects and 100+ B. Tech. projects. She has published 134 papers in International Journals, 20 papers in National/International Conferences/ Symposiums. She has worked as an Organizing Committee member for 21 International Conferences and 5 AICTE/MHRD sponsored Workshops/STTPs/FDPs. She has participated in 14 National/International Conferences. She has worked as NBA Coordinator of the Computer Engineering Department of VJTI for 5 years. She had written a proposal under TEQIP-I in June 2004 for 'Creating Central Computing Facility at VJTI'. Rs. Eight Crore were sanctioned by the World Bank under TEQIP-I on this proposal. Central Computing Facility was set up at VJTI through this fund which has played a key role in improving the teaching learning process at VJTI.