Cardio Vascular Disease Analysis using Artificial Neural Networks

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Abstract - Cardiovascular disease is one in all the diseases that involve the guts or blood vessels. Disorder includes arterial blood vessel diseases like angina and myocardial infraction diseases are commonly referred to as a coronary failure. Cardiovascular diseases are the leading reason behind death all told areas of the globe. Prediction of disorder is viewed one in all the foremost essential situations in clinical information analysis. Now a days, most peoples had died by that kind of disease. For that, the medical system has to identify the analysis of the human heart diseases is necessarily. But this is often very easy, thanks to the large dataset within the scientific industry. round the world, consistently in far more than 10 million individuals die for this malady. To beat this difficult situation, the medical system has to identify that disease at early stage. If it finds early then the person could easily endure the death. The identification can be made by making some classification models. That models will be designed by using some machine learning algorithm techniques. Neural Network gives the most effective accuracy compared to the previous studies.

Key Words: Artificial Neural Network, Machine Learning, Cardiovascular Disease, Classification Model, ReLU (Rectified Linear Unit)

1.INTRODUCTION

Cardiovascular disease is one in all the key diseases within nowadays. In step with the world, the World Health Organization (WHO), provides the report of the death of 17 million those that died against heart condition. Now a day's people don't know the notice of heart condition. It's important to provide the notice among people to avoid death against CVD. Among all the diseases, the center disease may be easily identified due to the symptoms and health habits. Clinical databases have various databases associated with heart condition. Various tests are performed before diagnosis of CVD, including auscultation, ECG, force per unit area, cholesterol, and blood glucose. These tests are often long and long when a patient's condition could also be critical and he or she must start taking the medication immediately, so it becomes important to prioritize the tests. By using Machine learning algorithm, the classification model may be easily created for identifying a heart condition. The Neural Networks are best at distinguishing patterns or trends in knowledge which they're similar for

predicting or statement. Therefore, neural networks are extensively applied to medicine systems. Associate analysis is disbursed to encourage neural network applications in diagnosis. A special note is made on neural network effort on cardiovascular disease designation. Artificial neural networks are finding several uses within the diagnosis application. The goal of this paper is to measure Artificial neural network in malady designation. A broad measure of information is presently accessible to clinical authorities, going from details of clinical side effects to different varieties of biochemical information and yields of imaging gadgets. Each form of information gives data that has got to be assessed and allotted to a selected pathology during the analytic procedure. To streamline the symptomatic procedure in each day schedule and neglect misdiagnosis, computer science techniques (particular Computer helped determination and Artificial neural systems) may be utilized. The models were created by the foremost popular machine learning technique neural network with activation function Rectified Liner Unit (ReLU). ReLU is that the most used activation function for Artificial neural networks with state-of-the-art results. It gives better performance and generalization compared to other activation functions. These versatile learning calculations can pander to different varieties of clinical information and coordinate them into arranged yields.

2. DATASET

The databases were collected form the UCI Machine learning repository. This repository has four major databases associated with heart condition (i.e. Cleveland, Hungary, Switzerland, and therefore the VA Long Beach). But most of the researchers use the Cleveland database because the records of the database are most complete. Although, the Cleveland dataset has 76 attributes, but the repository provides only 16 attributes. Figure 1 shows the distribution of target variable among 303 records. The first 16 attributes give information associated with symptoms and therefore the health habits of patients. So, the last attribute target gives information about the one that is full of heart condition or not.

Combined with UCI Cleveland dataset, some extra attributes are having to increase be added because of getting accurate results of heart condition. The additional features are Cigarettes per day, Smoker, Wheezing with cold. Table 1 shows the outline of the dataset.
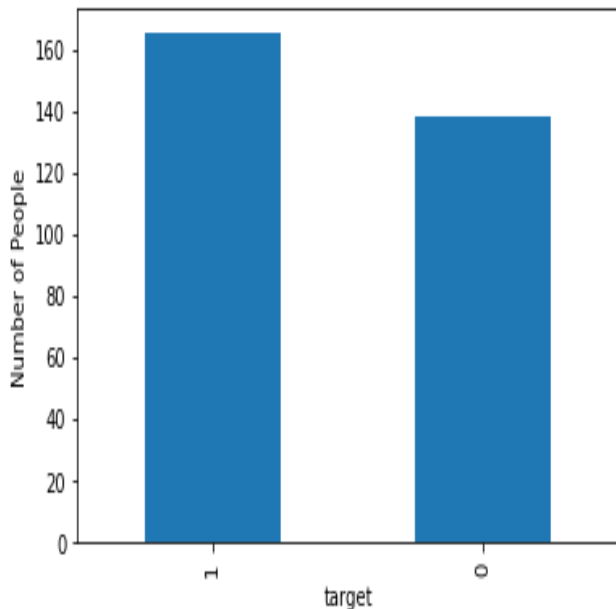

Chart - 1. Distribution of "target" in UCI Cleveland dataset

Table - 1: Attribute Description of the Dataset.

S.NO	Attribute	Type
1	Age	Numeric
2	Sex	Nominal
3	Cp	Nominal
4	Trestbps	Numeric
5	Chol	Numeric
6	Fbs	Nominal
7	Restecg	Nominal
8	Thalach	Numeric
9	Exang	Nominal
10	Oldpeak	Numeric
11	Slope	Nominal
12	Ca	Numeric
13	Thal	Nominal
14	Cigarettes per day	Nominal
15	Smoker	Nominal
16	Wheezing with Cold	Nominal
17	Target	Nominal

3. METHODOLOGY

In this research, python framework anaconda was used to conduct the experiment because it is dynamically typed language and easy-to-program environment for building of predictive analytics. In this experiment, the UCI Cleveland dataset was imported into jupyter notebook (Python Environment). The Process start from the pre-processing phase, followed by splitting data as train and test by using sklearn to create model using the keras code combined with Google's TensorFlow and then save the model for future prediction.

4. DATA PRE-PROCESSING

The data was pre-processed after collection. There were 6 records that have missing values in Cleveland dataset. All the records with missing values were removed from the dataset, thus reducing the number of records from 303 to 297.

5. CLASSIFICATION MODEL USING ARTIFICIAL NEURAL NETWORK

Artificial neural systems (ANN) or connectionist frameworks are figuring frameworks dubiously motivated by the organic neural systems that establish creature brains Such structures "learn" to perform tasks by considering models, all around without being altered with task-unequivocal norms. For instance, in picture affirmation, they'll decide the gratitude to perceive pictures that contain cats by separating model pictures that are genuinely set apart as "feline"(cat) or "no feline" and utilizing the outcomes to inform apart felines in several pictures. They're doing this with no earlier

Information on felines, as an example, that they have hide, tails, bristles, and feline-like appearances. Rather, they consequently produce recognizing qualities from the models that the procedure. Fig 2 shows the precise structure of Artificial Neural Networks. The greatest preferred position of ReLU is basically non-immersion of its inclination, which extraordinarily quickens the mixture of stochastic angle drop contrasted with the sigmoid/tanh capacities. The redressed straight enactment work beats the disappearing inclination issue, permitting models to be told quicker and perform better. The corrected direct initiation is that the default enactment when creating multilayer Perceptron and convolutional neural systems. Fig 5.1 shows the precise view of Artificial Neural Network. Fig 5.1. Artificial Neural Network's Architecture while ReLU joined with ANN, it works progressively advantageous and provides better outcome compared with CNN and Multilayer Perceptron. A hyper-parameter optimization selects which parameter is that the simplest way for learning for activation of function, network structure, number of batch sizes, and number of epochs. The activation function for activating the network within the backward propagation is that the Rectified measure (ReLU) is utilized for both input and so the hidden layer and so the sigmoid type for the outlet layers.
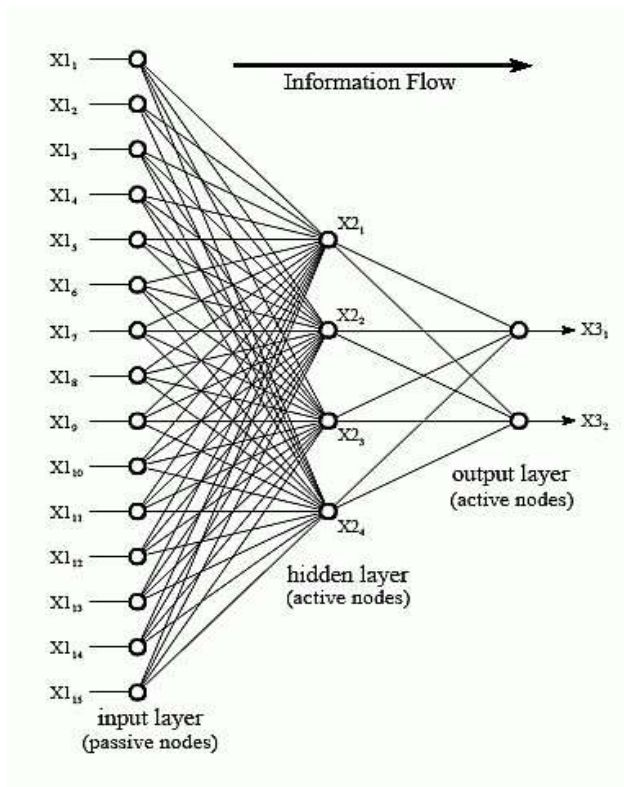
Figure –1. Artificial Neural Network's Architecture

While ReLU joined with ANN, it works progressively advantageous and provides better outcome compared with CNN and Multilayer Perceptron. A hyper-parameter optimization selects which parameter is that the most effective way for learning for activation of function, network structure, number of batch sizes, and number of epochs. The activation function for activating the network within the backward Propagation is that the Rectified quantity (ReLU) is used for both input and so the hidden layer and so the sigmoid type for the outlet layers. The architecture was 17-20-20-20-1 during which there are 17 nodes within the input layer, 20 nodes within the hidden layer, followed thrice repeated hidden layer, so 1 node within the output layer (heart disease; yes 1, no 0). Within the method of propagation, "ReLU" was chosen because the activation function for the tuning hyper-parameter. Train the batches of 10 samples using the Adam optimizer for the back-propagation learning technique, 10 limiting our training to 100 epochs. Figure 2 shows the accuracy and loss rates on training and so the validated progresses. At the point when 2 advances met, there was no-over-fitting in our model. Models trained on 17 inputs of symptom-physical signs yielded an accuracy of 97.82%.
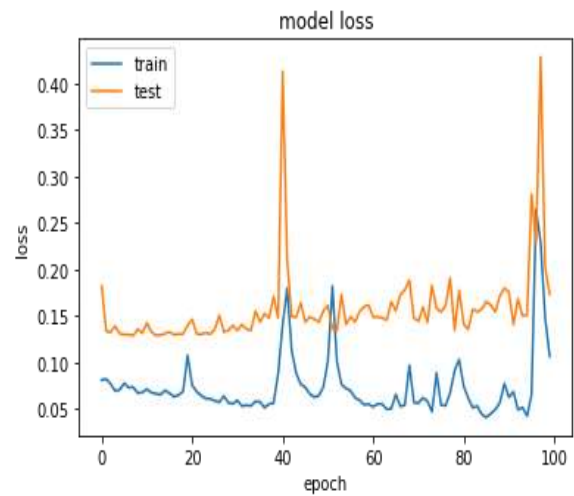

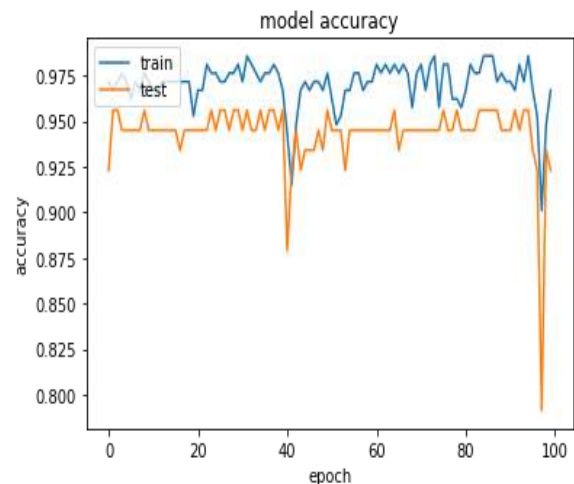**Figure –2**. Model Accuracy of the classified model

Figure – 3. Model Loss of the classified model

6. CONCLUSION AND FUTURE WORK

When comparing the accuracy of diagnosing heart diseases among the classifiers, we found that the best classification results were obtained by ANN with a 97.82% overall accuracy. The application of Neural Networks techniques currently has a very large advantage in both accuracy and data handling.

This ANN model was able to predict the heart disease with best accuracy. Then, the future work is to enhance the model by using other activation function and better kernel initializer for achieving the better accuracy.

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