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Prediction of heart disease using neural network

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Abstract - *Healthcare involves an vital portion in human lives. The healthcare industry contain huge sum of psychiatric data hence machine learning models were utilized to supply conclusion effectively within the heart illness forecast. The classification of healthy individual and non-healthy individual can be done dependably by using machine learning strategies. We created a system in this investigation that can get it the standards of predicting the chance profile of patients with the clinical data parameters. The proposed model is built utilizing Deep Neural Network gives better results on both the testing and preparing information. DNN and ANN were utilized to dissect the effectiveness of the demonstrate which accurately predicts the nearness or nonappearance of heart infection. This paper gives the web based framework for prediction of heart disease utilizing Deep Learning (DL) calculations with a great exactness compared to other works.*

Keywords— Deep Learning, Machine learning, Artificial Neural network, health care services, heart disease.

1. INTRODUCTION

One of the discernible disease that impact numerous individuals in old age is coronary illness, and numerous times, it in the long run leads to dangerous issues. Cardiovascular diseases are getting to be more in common in India. It is considered that suitable health care administrations should be accessible for a customary checkup of one's wellbeing. Nearly 31% of all passings are due to heart-related malady in all over the world. Early discovery [1] and treatment of a few heart infections is exceptionally complex, particularly in developing nations, since of the need of diagnostic centers and qualified specialists and other assets that influence the exact guess of heart malady. With this concern, in later times computer innovation and deep learning strategies are being utilized to form restorative help program as a back framework for early conclusion of heart infection. Identification of any heart related sickness at essential organize can diminish the passing chance. Different DL strategies are utilized in medical information to get it the design of information and making expectation from them. Healthcare information are for the most part enormous in volumes and complex in structure. DL calculations are capable to handle the enormous information and mine them to discover the significant data. Deep Learning calculations learn from past information and do forecast on genuine time information. This sort of DL system for coronary sickness desire can energize cardiologists in taking faster actions so more patients can get medications inside a shorter time period, hence sparing expansive number of lives.

Deep Learning is a department of AI investigate [2] and has gotten to be an awfully well known viewpoint of data science. The Deep Learning calculations are outlined to perform a large number of errands such as prediction, classification, choice making etc. To learn the DL calculations, preparing information is required. After the learning stage, a show is delivered which is considered as an output of DL calculation. This model is then tested and approved on a set of unseen genuine time test dataset. The final precision of the model is at that point compared with the genuine esteem, which legitimize the general rightness of the anticipated result.

2. RELATED WORK

Lots of research work have been done for appraisal of the classification correctnesses of diverse deep learning and machine learning calculations by utilizing the Cleveland heart illness database which is uninhibitedly available at an internet information mining store of the UCI. Various systems for coronary disorder forecast utilizing AI calculation was created early. Algorithm like support vector machine, K-nearest neighbor and Artificial Neural Network was created early to expect the existence or nonappearance of cardiac disorder. Study demonstrates that ANN-based models are generally utilized in heart disease forecast and the precision of past works was less in differentiate with the created model. A self-operating demonstrate for cardiac disease discovery employing a Deep neural network and ANN. The proposed model had 2 covered up layers, Convolutional DNN is less precise than the proposed model i.e 2-DNN, and the exactness of 2-ANN is less as compared to 2-DNN. [5].

system was based on the dataset quality classification out of eighteen qualities they chose eight qualities as the most quality are Age, sexual orientation, smoking propensity, diabetes, cholesterol, chest torment, hypertension, family history. The creator has utilized different ML strategies and SVM gave 91% exactness utilizing eight properties and 86.03% utilizing eighteen qualities [3]. proposed several models for anticipating heart illness. Decision tree, naïve Bayes, multilayer recognition, and Ensemble classification in which RF, NB are combined and in proposed model author

connected the random forest classifier for feature extraction and k-means at that point connected the decision tree strategy for classification, The proposed demonstrate gave the most elevated exactness rate of 94.44% [4].

3. PROPOSED SYSTEM

3.1 Problem Statement Elaboration

"To Predict the heart disease using the Neural network." The study analyzed by the world health organization (WHO) gages that 24% of people passed on in India due to cardiac disorder. Analysts have recorded the distinctive components that increment the possibility of cardiac disorder and coronary supply course disease[12]. We point to apply Deep Learning strategies to the dataset to anticipate heart infection.

3.2 Proposed System Methodology

In practical application high accuracy comes about are generated using a neural network. The proposed framework increments the classification exactness. The dataset is separated into the testing data and training dataset. The training dataset was given to the neural network. Neural systems are set of algorithms that are utilized to recognize designs. The layers within the neural network are made up of activation function.

The training features are given to the network through the input layer. The highlights are given to the hidden layer where genuine processing happens with the assistance of a weighted connection. The output layer of the organisation is joined with the hidden layer. Era of theory through deep learning models was the point of the predictive model. Hypothesis is the relationship between information which can be tried by collecting data and making observations[12]. Ready to produce the hypothesis by limiting the blunder within the training occasions.

The execution of the network is dependent on the number of rules utilized which decide the behaviour of the network. A model with less parameter leads to low capacity which comes about in under fitting. Model with more number of parameters than required leads to high capacity which results in over fitting subsequently the model ought to be in such a way that it produces a hypothesis with ideal capacity. The hypothesis is defined using forward propagation. The input is given to the neurons which perform a few operations to create the yield this handle is called the activation function. The activation work characterizes the output of a node.

3.3 Dataset Description

The Cleveland coronary disorder dataset is utilized which was taken from an online AI document. This dataset is used for research studies. The dataset has 303 occasions and 14 attributes[5].

Table I gives the description of dataset

Sr. no	Attribute	Description	Range
1.	AGE	Patient age	29-77
2.	SEX	Patient gender	1 = male 0 = female
3.	CP	chest pain type	0 = Atypical angina, 1 = typical angina, 2 = asymptotic, 3 = non angina pain
4.	TRESTBPS	Resting Blood pressure	94-200
5.	CHOL	Serum cholesterol level	126-564
6.	FBS	Fasting blood sugar 1>= 120, 0<=120	0 = false 1= true
7.	RESTECG	Resting electrocardiographic result	0 = normal 1 = ST – T wave abnormalities 2 = left ventricular hypertrophy
8.	THALACH	Maximum heart rate Achived	71-202
9.	EXANG	Exercise Indused Angina	0= no 1 = yes
10.	OLD PEAK	ST depression induced by exercise related to rest	0.0 – 6.2
11.	SLOPE	Slope of the peak exercise ST segment	0 = un sloping 1 = flat 2 = down sloping
12.	CA	Count of major vessels colored by Fluoroscopy	0-3

13.	THAL	Thallium Scan	3 = normal 6 = fixed 7 = reversible effect
14.	Target	Class Attribute	0 = no 1 = yes

4. IMPLEMENTATION

4.1 Data Preprocessing

One of the most crucial milestones in the process of putting deep learning models into practice is this one. To make the dataset more appealing and practical for the model training phase, we deliberately applied all data cleaning strategies to our dataset[9]. We removed all the unnecessary and irrelevant data from our dataset throughout the data cleaning process.

- Data cleaning had the following goals in mind-
- Removal of missing data
- Removal of duplicate entries
- Remove rows with NaN values

4.2 Exploratory Data Analysis

Exploratory data analysis is a strategy for examining data sets to highlight their key properties, frequently utilising statistical tools and other techniques for data visualisation. it aids

we better comprehend our dataset[11]. Executing EDA on our dataset assisted us in:

- Recognize and handle NULL values.
- Recognize and eliminate outliers.
- Identify the underlying relationships and structure.

Additionally, we created a word cloud and several graphs. to learn more about the data.

5. Training and Testing

After preprocessing and EDA, we had the final dataset that had been thoroughly cleaned and analysed. The 80-20 train-test validation method was used, which specifies that 80% of the information is used for planning and 20% is used for testing. The sklearn library is used to divide the data into training and testing portions. Out of 303 samples, 242 examples or instances are chosen and used to create the model[5]. The remaining 61 samples are used as testing data to judge how well the constructed model performs.

To implement the model, we proceeded forward. We carried out two distinct sorts of experiments during the implementation. Both the considered deep neural network and the artificial neural network were implemented individually. As a result, we were able to determine how accurately each of these models performed.

A Deep neural network has multiple hidden layers. Whereas the Artificial Neural network has one or two hidden layers in it.

The activation of neurons is present at the output layer.

$$f(x) = \frac{1}{1 + e^{-x}}$$

In the output layer, the sigmoid activation function is applied. The dataset's redundant features are removed using feature selection. Feature extraction and feature selection are different. Finding relevant components from the existing data is called feature extraction. By removing unnecessary features through feature selection, the neural network is fed with pertinent information.

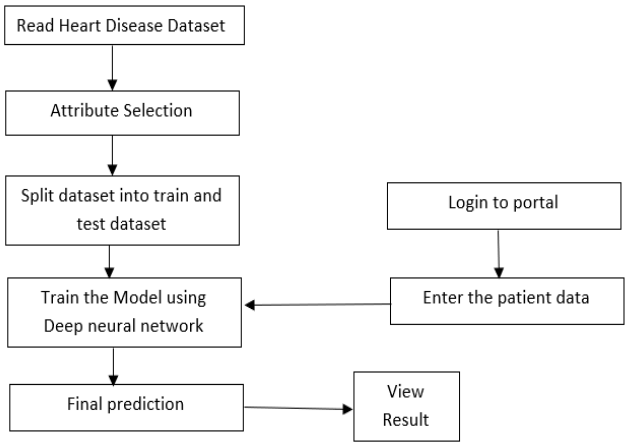

Fig 1: System Architecture

6. RESULT

The outcomes that we found after testing and putting the suggested algorithms into practice will be covered in this part.

The Deep neural network with the more hidden layer performs better than that of Artificial neural network. Accuracy of artificial neural network is 70% and accuracy of deep neural network is 95%. So the DNN is more accurate than that of ANN.

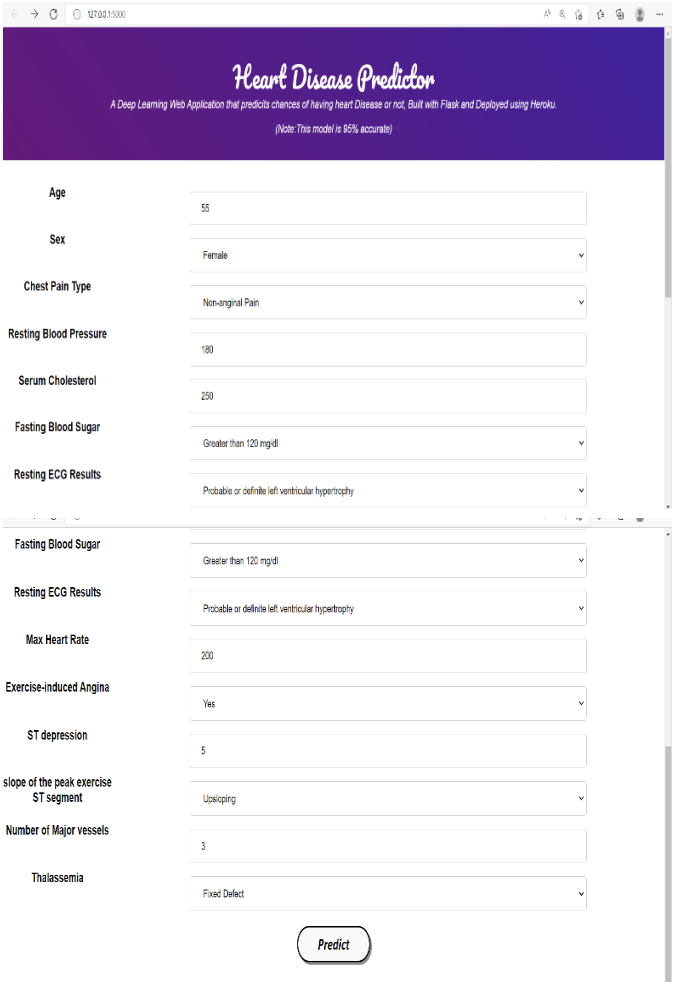

Fig. 2. Prediction result of test record

The model is tested using patient real-time data. When patient information is entered into the system, it determines the likelihood that the patient has a heart problem.

Table II gives the Precision, Recall and F1-Score of the model.

	precision	recall	F1-score
Without heart disease	0.94	0.97	0.96
With heart disease	0.96	0.92	0.94

7. CONCLUSION

The proposed work develops a web application employing deep neural networks and artificial neural networks to discover heart problems. The major goal of model construction is to create a system or model that provides high accuracy through which one can assure that patients won't undergo incorrect diagnoses due to inaccurate forecasts and it aids the patient in an emergency. Patients' lives are thereby saved since it aids in early disease prediction. Future iterations of the application could include a huge array of patient records and more attributes.

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Prof. Pramila M. Chawan, is workinhg 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 85+ M. Tech. projects and 130+ B. Tech. projects. She has published 143 papers in the International Journals, 20 papers in the National/International Conferences/ Symposiums. She has worked as an Organizing Committee member for 25 International Conferences and 5 AICTE/MHRD sponsored Workshops/STTPs/FDPs. She has participated in 16 National/International Conferences. Worked as Consulting Editor on – JEECER, JETR,JETMS, Technology Today, JAM&AER Engg. Today, The Tech. World Editor – Journals of ADR Reviewer -IJEF, Inderscience 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. Awarded by SIESRP with Innovative & Dedicated Educationalist Award Specialization : Computer Engineering & I.T. in 2020 AD Scientific Index Ranking (World Scientist and University Ranking 2022) – 2nd Rank- Best Scientist, VJTI Computer Science domain 1138th Rank- Best Scientist, Computer Science, India.