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ECG Based Early Heart Attack Prediction Using Neural Networks

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***Abstract*—In today's world, a large amount of data is being collected every minute. This data came from different sources: health care, social media, business applications, manufacturing industries, and many more. The healthcare industry gives a large amount of data. Especially heart disease, which stops the flow of blood from vessels, resulting in chest pain and heart attack. Heart diagnosis at starting stage of the disease can lead to a successful cure of the disease. The classifications that are used to prevent the diagnosis are: - Naive Byes classification, the Support Vector Machine classification, and the k-NN classification. Hence, some deep learning techniques need to be tested on the dataset which has been taken and needs to be tested on it. The primary goal of this paper is to identify novel deep learning accuracy and a better neural network between convolutional neural networks and artificial neural networks..**

***Index Terms*—Heart Attack Detection, Deep Learning, Artficial Neural Network,Convolution Neural Network, Neural Networks**

I. Introduction

The research about ECG gives results about declined heart function. An irregular ECG signal helps us recognise various circumstances as spotting changes in geometric variation. As per the statistics that have been shown, the heart rate generally ranges from around 60 beats per minute to about 100 beats per minute, which is in the case of a normal person. The main features which are used in the identification of the ECG are in very wide use these days, which can be referenced from [2].But the problems stay in their place where they are generally not resolved due to many factors which need to be taken into consideration. We use CNN to better classify the detection with better accuracy and in less time with better precision. The major variables in recognising any abnormality in an ECG are the main aspects which need to be catered to or taken in mind during the process of detection. There are still a lot of difficulties to be resolved before useful data can be obtained. From patient to patient, the accuracy with which diseases are recognised varies. We use CNN to better categorise the detection with more precision and accuracy in less time [3].

II. Related Work

The general term "heart" is a main aspect of the research as the bodies are operated through it and there are many other diseases which can be caused due to the following heart problems. The different problems have been classified as a kind of the different names, but the thing that is related to all of them, despite the name, is the part or the organ heart. The heart rate is found with the help of many devices that are available in the market and the ECG, which is used to see if a patient is having a cardiac arrest or not. While some of the diseases are not at all serious, whereas at the same time other diseases may prove fatal [4]. Hence, we need to classify different types of heart diseases. To classify different heart disease, we need to use and take advantage of CNN algorithm. According to a study on ECG [7], an irregular ECG signal aids us in recognising various scenarios, such as noticing changes in geometric variation. As per the statistics that has been shown, the heart rate generally ranges from around 60 beats to about 100 beats per minute, which is in

the case of a normal person. The main features which are used in the identification of the ECG are in very use these days, which can be referenced from [2]. Therefore, having 1 minute having larger sample data means training of CNN would yield better results and the accuracy of classification would also be higher. Using this system not only reduces the need of using manual measures but also can check the status of heart with less cost. The accuracy is 99.46 percent, and distinct patients can be treated, all thanks to CNN [8]. The factors which are the main reason for the electrical impulse are also the main factors in recognising any issue in ECG. There are still a number of issues that need to be addressed in order to obtain meaningful data[6]. The precision with which illnesses are detected varies from patient to patient. We employ CNN to better categorize the detection with more accuracy and precision in less time.Health care industry plays a major role in database. But the main thing is to improve health care services at an affordable value. In heart disease, deformity of heart takes place, which causes chest pain. There is lots of data which health care industry has to manage. That's why it's the most difficult task to do. So, classifiers came into play which are used to detect and avert heart disease. These classifiers are different kind of machine learning classification algorithms which are used for the case [10]. This paper focuses on different type of classifiers used for storing data as there is a large amount of data that has to be stored. These classifiers work really well and are able to detect disease[11]. These classifiers use High tech technologies, which also increase the accuracy and increase the growth of the healthcare industry [5].

III. Methodology

A. Data preparation

The dataset was collected from the UCI ML Dataset. The dataset has 383 data points (or rows) and 14 features (or columns). Features present in the dataset are:Age, Sex, excang, caa, cp, trtbps, oldpeak, chol, fbs, restecg, thalachh, target, thall, slp. The information can be seen in figure 1.

	age	sex	cp	trtbps	chol	fbs	restecg	thalachh	exng	oldpeak	slp	caa	thall	output
0	63	1	3	145	233	1	0	150	0	2.3	0	0	1	1
1	37	1	2	130	250	0	1	187	0	3.5	0	0	2	1
2	41	0	1	130	204	0	0	172	0	1.4	2	0	2	1
3	56	1	1	120	236	0	1	178	0	0.8	2	0	2	1
4	57	0	0	120	354	0	1	163	1	0.6	2	0	2	1

Fig. 1. Dataset overview

B. Data Preprocessing

The dataset is analysed very carefully before submitting the data to the model to train from and give predictions. The dataset has 8 categorical features and 6 are numerical features. The dataset has no null values

C. Feature Visualisation

Figure 2 represents the number of people having heart attacks in the given dataset. Figure 3 depicts effects of different features present in the dataset on the heart attack.Figure 4 shows the correlation matrix between the features of the dataset which is a very important part to know which feature correlates the most with which other feature and vice versa.Figure 5 shows the distribution of the features (age, trtbps, chol, thalachh, oldpeak) in the dataset according to the target vaiable. Figure 6 shows the distribution of the features (chest pain, number of major vessels, cholestrol, sex, thall, excng and age) in the dataset according to the target vaiable.

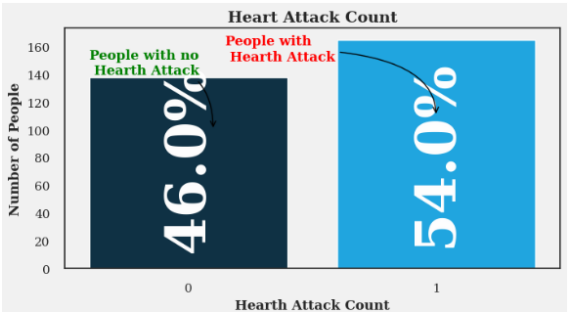

Fig. 2. Number Of People Having Attacks

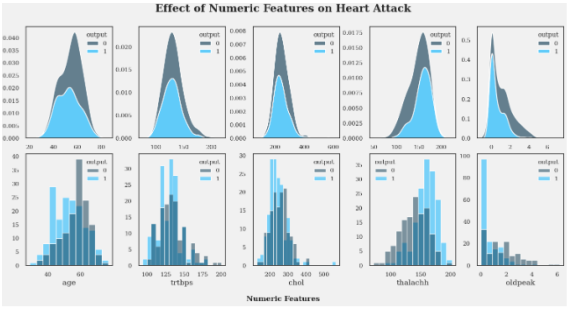

Fig. 3. Features Present In The Dataset

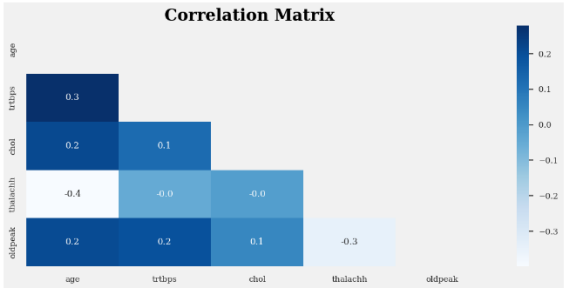

Fig. 4. Correlation Matrix

D. Model Architecture

Convolutional neural networks are known for their high performance, their ability to identify and distinguish objects and images of similar or dissimilar types. A Convolutional Neural Network consists of 3 main layers: Convolutional layers, pooling layers, fully connected layers.It is the main

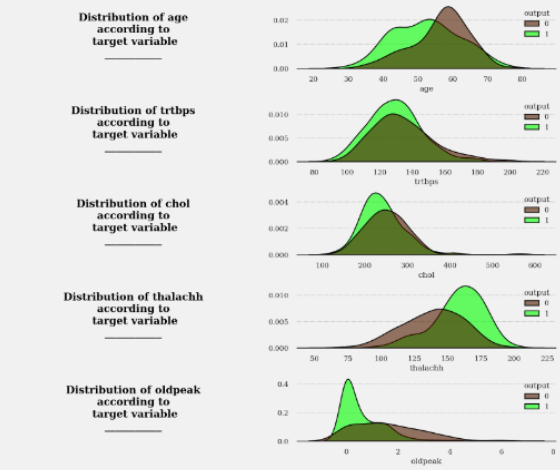

Fig. 5. Distribution of features-I

Fig. 6. Distribution of features-II

convolutional and computational layer; in this layer, the operation includes multiplication of set of weights with input images represented in matrices. Here, the array of weights is known as kernels. The input images become smaller of size to perform better and more performance centric operations. The image becomes gray-scale and is downgraded or down sampled. It is done to reduce the number of parameters in the input. We know the values denoted by each pixel is not connected directly to the output of the image. Therefore, in fully connected layer, each node of an input pixel is directly connected to the output pixel value. Similarly, a process needs to be followed in the case of the artificial neural network .

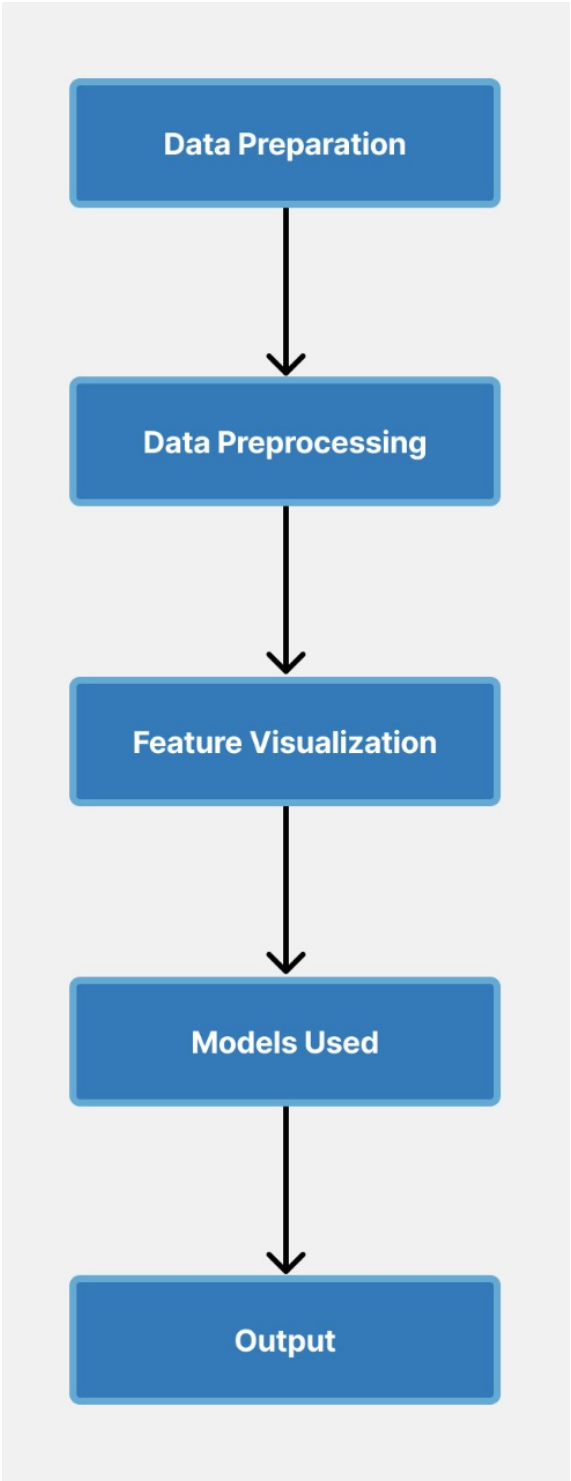

Fig. 7. Flowchart

IV. Experimental Results

The feature visualisation that has been performed by the authors really helped in getting to know the features and how the parameters can be kept for the models which have been

TABLE I
ACCURACY TABLE

Model Name	Author's Accuracy	Precision	Average F-score
Convolution Neural Network	98%	97%	98% [10]
Artificial Neural Network	94%	95%	94%

there.The artificial neural network and the convolution neural network were parameterised according to the observations which had been taken.The accuracies can be seen in table 1

V. CONCLUSION

Due to the increasing factors which can cause a problem to the heart are increasing day by day hence an approach to solve it needs to be incorporated at a very early stage so that the attack can be stopped. Hence the authors devised an approach using the deep learning in which the convolution neural network outperformed the artificial neural network by 4 percent.

FUTURE WORK

More and more data can be collected in the following problem statement and as this is a rising problem hence more people might face it up which can cause to give more and more data of them and a more precise one. The following models compared can also be done using comparison between the machine learning models.

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