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DETECTION OF CARDIAC DISEASE USING DEEP LEARNING

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Abstract : Many medical problems may be diagnosed, detected, and predicted using Deep learning and machine learning. The fundamental goal of this research is to provide doctors with a tool for detecting cardiac abnormalities at a preliminary phase. As a consequence, it will be simpler to provide patients with proper medication while minimizing major side effects. Heart disease has become a serious and widespread condition in recent decades, caused by fat accumulation in the heart as well as poor lifestyle choices. A deep learning model can forecast cardiac-disease using several sorts of characteristics in the dataset. The intent of this system is to enhance the precision of detecting heart disease via deep learning in which the target variable tells whether an individual has cardiovascular disease or not.

Index Terms - Deep Learning, Cardiac disease detection, predictive model, medical field, CNN.

I. INTRODUCTION

In clinical cardiology, analysis of heart function is crucial for patient care, illness diagnosis, risk assessment, and treatment choice.
The greatest cause of mortality worldwide is cardiovascular disease, according to a previous research by Mathers .
For the past 30 years, cardiac illness has been the major cause of death globally. Statistics show that there are more people with heart disease than those with other conditions. The heart serves as a pumping organ for carrying blood to different organs and tissues. Blood transports nutrients and oxygen for cell metabolism as well as waste products from metabolism[1]. However, as people age, their hearts become less efficient, and occasionally this inefficiency leads to cardiovascular disease. The different nations rises in line with the constant extension of the average human lifespan. Consequently, cardiovascular illness has attracted a lot of attention. The valves control how blood normally circulates. The combinations of valves are essential to the function of the heart because they may regulate the direction of blood flow. Heart dysfunction results from the inability of the heart ventricle or atrias to adequately supply blood when the valves have lesions or are inadequate. The major causes of valvular heart disorders include valve rupture, valve inadequacy, and valvular stenosis. In wealthy nations, aortic stenosis frequently affects the elderly.

In its early stages, valvular heart disease frequently shows no overt clinical signs. But when the illness progresses, it frequently seriously impairs a person's physical health. As a result, medical professionals continue to be interested in heart disease detection methods. Electrocardiography (ECG) is a type of heart disease detection methods now available. ECG uses electrodes placed in a certain pattern on the skin's surface to look for possible heartbeat irregularities. By investigating several possible fluctuation signals and their correlations, it is possible to predict the physiological state and function of the heart in the past[3].

A widely used diagnostic method for cardiac disease is echocardiography, which is frequently combined with an ECG. When compared to an electrocardiogram (ECG), echocardiography may immediately provide 2D or 3D pictures of the heart and its contractions in real time. When a sonic sensor detects several sequentially returned sound waves, the interior tissues composition and the body mass may be rebuilt using computerized calculations. Moreover, by merging a variety of various photos, dynamic visuals may be created. The use of this method by doctors in clinical diagnosis is advantageous.

II. EXISTING SYSTEM.

There are several existing systems for cardiac disease detection using deep learning. One example is a system developed by researchers at the National University of Singapore, which uses a deep learning algorithm to analyze cardiac magnetic resonance (CMR) images and predict the likelihood of a patient having coronary artery disease[2].Another example is a system developed by researchers

at the University of Edinburgh, which uses a deep learning algorithm to analyze electrocardiogram (ECG) data and predict the likelihood of a patient having a cardiac arrhythmia. These are just a couple of examples, but there are many other systems that use deep learning for cardiac disease detection[4].

The LSTM (Long Short Term Memory) network is trained on a large dataset of ECG data, and is able to identify patterns and features in the data that are indicative of a cardiac arrhythmia. Once trained, the LSTM network is able to make predictions on new ECG data, providing a non-invasive method for detecting cardiac arhythmias.

Some other systems which detect cardiac disease are using the machine learning are given below:

A system developed by researchers at the University of Ottawa uses a machine learning algorithm to analyze electrocardiogram (ECG) data and predict the likelihood of a patient having a cardiac arrhythmia. The system is reliant on a SVM algorithm, which was trained on a huge dataset of ECG images and is able to identify patterns and features in the data that are indicative of a cardiac arrhythmia. Once trained, the SVM algorithm is able to make predictions on new ECG data, providing a non-invasive method for detecting cardiac arhythmias[5].

A system developed by researchers at the University of Glasgow uses a machine learning algorithm to analyze cardiac magnetic resonance (CMR) images and predict the likelihood of a patient having coronary artery disease. The system is based on a random forest algorithm, which is trained on a large dataset of CMR images and can find various heart diseases. Once and evaluating of results, even deep learning algorithms can be fed into the smart devices like watches etc which can be used to notify user of some abnormal heart activity trained, the random forest algorithm is able to make predictions on new CMR images, providing a non-invasive method for detecting coronary artery disease[6].

III. PROPOSED SYSTEM

3.1 Block Diagram:

Figure 3.1 illustrates the operational flowchart of the proposed system, and provides a comprehensive overview of the system's functioning.

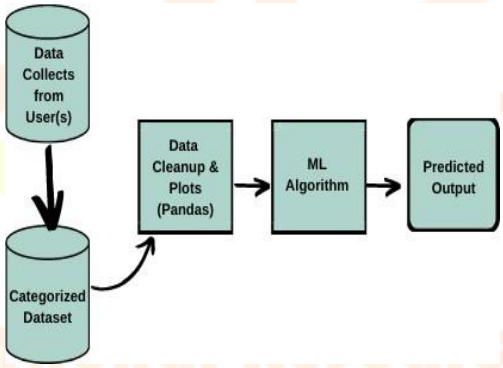

Fig. 3.1 – Above is the Proposed system block diagram

3.2 Logic Diagram:

Fig 3.2 illustrates a flow diagram of the prospective system. This flowchart provides a comprehensive overview of the system's architecture and workflow of the website[1].

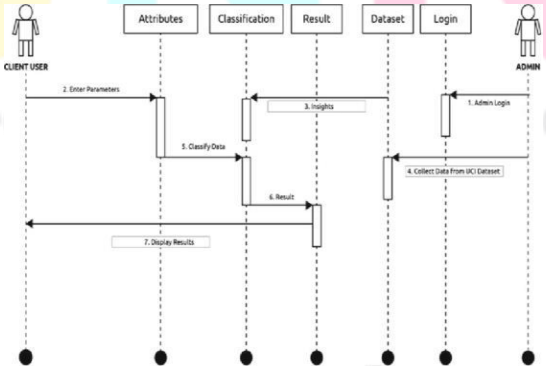

Fig. 3.2 – Architectural diagram representing roles of all the entities and actual work flow.

This model will be made available to the users in the form of a web service that includes an authentication page and a data input page where users may input their data. The diagnosis of disease in clinics solely relies on the doctor's skill set, which can be ineffective at times, thus the objective of this application is to assist the medical professional in detecting and resolving the condition

by reducing the errors during the detection of heart related illness.

IV. MODEL USED

Neural Networks are used in various medical imaging applications, including the detection of cardiac disease.
One way that CNNs can be used for cardiac disease detection is by analyzing images of the heart, such as echocardiograms or MRI scans, and identifying abnormalities that may indicate the presence of a cardiac condition. The CNN can be trained on a large dataset of labeled images, where the labels indicate whether or not a particular image contains evidence of a cardiac disease. The CNN can then be used to predict the presence of cardiac disease in new, unseen images.
Another way that CNNs can be used for cardiac disease detection is by analyzing time series data, such as electrocardiogram (ECG) signals. In this case, the CNN can be trained to identify patterns in the ECG data that are indicative of various cardiac conditions.

Overall, CNNs have shown promise as a tool for the automated detection of cardiac disease, although further research is needed to fully understand their capabilities and limitations in this context[2].

V. METHODOLOGY

Model implementation methodology is as follows:

1. Collection of the Data
2. Preprocessing of Data
3. Training the Model
4. Evaluation of the Model
5. Deployment of the Model on a server

5.1 Collection of Data:

In order to train a deep learning model to detect cardiac diseases, you will need to collect a large dataset of examples that include both individuals with and without cardiac diseases. This data may include medical images such as x-rays, MRIs, and ECGs, as well as other types of data such as demographic information, medical history, and physiological measurements. It is compulsory to make sure that the dataset is varied, in order to avoid bias in the model.

5.2 Preprocessing of Data:

Before the data can be used to train a deep learning model, it will need to be cleaned and processed to ensure that it is in a usable format. This may include tasks such as converting images to a standard size and format, filling in missing values, and normalizing numerical data.

5.3 Training Model:

Once the data is prepared, it can be used to train a deep learning model to detect cardiac diseases. This will typically involve using a supervised learning approach, where the model is trained on a labeled dataset of examples with known cardiac disease status. The model will learn to identify patterns in the data that are associated with cardiac diseases, and will be able to make predictions on new, unseen examples based on these patterns.

5.4 Evaluation of the model:

This step may involve using a separate test dataset to assess the model's ability to generalize to new examples, as well as comparing its performance to other models or to human experts.

5.5 Deployment of Model on server:

After the evaluation, it can be deployed for use in the real world to assist in the diagnosis and treatment of cardiac diseases. This may involve integrating the model into clinical workflows or creating a user-friendly interface for the user.

VI. CONCLUSION

The objective of this project is to provide users and doctors with a web application that predicts cardiac diseases when they enter the necessary data, and the model built using Convolutional Neural Networks (CNNs) will be successfully used for the detection of cardiac diseases in medical images. They have been shown to be effective at classifying various cardiac abnormalities, such as cardiomegaly, atrial fibrillation, and myocardial infarction. CNNs are particularly useful for this task because they are able to automatically learn features from the input images, which can improve the accuracy of the diagnosis. However, it is important to note that the performance of CNNs for cardiac disease detection can be influenced by the quality and quantity of the training data, as well as the design of the CNN architecture.

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