"CORONARY ARTERY DISEASE DETECTION BASED ON ECG USING MACHINE LEARNING APPROACH"

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ABSTRACT

The well known (ECG)electrocardiogram is one of the commonly employed tools to diagnose cardiovascular issues. The electrical and muscular functions of the heart are frequently assessed using a diagnostic instrument called an electrocardiogram (ECG or EKG). Although the test itself is relatively straightforward, it takes a lot of training to interpret the ECG charts. Such paper ECG records can be digitally digitized for automated analysis and diagnosis. The main goal of this project is to transform paper recordings of electrocardiograms into a 1-D signal using machine learning. The P, Q, R, S, and T waves that are available in ECG data may be extracted in order to illustrate cardiac electrical activity by applying a variety of methods. The techniques include splitting the original ECG report into 13 Leads, extracting and converting into the signal, smoothing, converting them to binary images using threshold and scaling. Post-feature extraction, dimension reduction techniques like Principal Component Analysis are applied to understand the data. Multiple classifiers like the use of k-nearest neighbor (KNN), logistic regression (LR), Support Vector Machine (SVM), and voting-based ensemble classifier will result in to the the conclusion of the model once it satisfies the necessary standards for precision, recollection, accuracy, f1-score, and support. This final model will aid in the diagnosing of cardiac diseases, to detect whether a patient has/had Myocardial Infarction, Abnormal Heartbeat, or the patient is hale and healthy by inferring the ECG reports.

Keyword- *Internet of Things(IoT), Wireless Sensor Networks, Data Transmission, Temperature sensor and smoke sensor, Camera Trap.*

1. INTRODUCTION

Heart disease is the primary major reason of mortality in high-income nations and the second main reason of death in low-income countries, according to the World Health Organisation (WHO). For the last two decades, it has continued to be the reason for death on a global scale. This research examines several approaches to data mining used in recent years to identify coronary artery disease. At present, there are plenty of algorithms available that could detect and predict heart anomalies from clinical reports. However, in this project, the focus is more on discovering and extracting patterns from Electrocardiogram (ECG or EKG) image reports.The majority of ECG readings were formerly preserved on paper. Therefore, manually reviewing and rereading the ECG paper copy can frequently be a tedious and difficult process. The amount of time-consuming manual intervention to understand the report may be removed by the digitization of ECG recordings. With digitization, the automation of diagnosis and analysis can be achieved quicker.

2. RELATED STUDY

Many papers related to cardiovascular prediction focused on other features that included diet, age, gender, and many other dimensions, and then predicted for cardiovascular diseases based on these features. Our work is more on predicting diseases by providing the ECG chart.

•Mohammed B. Abubaker (2022) presented "Machine Learning and Deep Learning Methods for Detecting Cardiovascular Diseases in ECG Images" This study describes an automated system that was created to automatically classify electrocardiograms as abnormal or normal. The unbalanced dataset had been balanced using the dataset and some weight balancing.

•Seemab Zakir (2020) proposed a "Effect of Image Augmentation on ECG Image Classification using Machine Learning"a model that was created using neural networks. This article made advantage of challenging research issues from several fields. We frequently employ it since it represents cutting-edge AI technology and has demonstrated excellent performance in medical studies.

•Sutedja (2021) designed "Descriptive and Predictive Analysis on Heart Disease with Machine Learning and Deep Learning" The implementation of a detection contrast between many deep learning and machine learning(ML) models is the study goal. To achieve the maximum accuracy in predicting cardiac disease, three (ML)machine learning models and deep learning models are combined.

•In 2019 Mirsaeid Hosseini Shirvani designed "Prediction and Diagnosis of Heart Disease by Data Mining Techniques" They used, several categorization approaches are used to identify cardiovascular disease. The datasets are divided using classifiers such as KNN, SVM classifier, and Decision Tree.

•K. Prasanna Lakshmi, Dr. C.R.K.Reddy (2018) designed "Fast Rule-Based Heart Prediction using Associative Classification Mining" They used associative sorting mining over a landmark window of data streams in the proposed Stream

3. PROPOSED SYSTEM

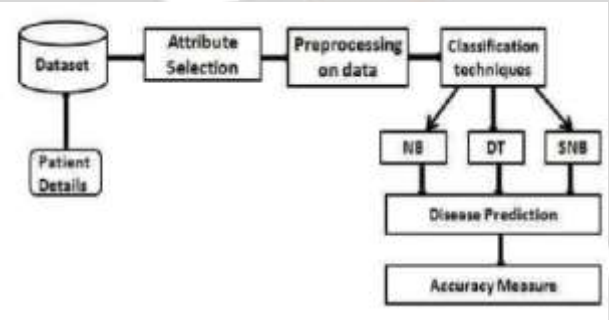

Fig: 1 Model for Predicting Coronary Artery Diseases

For recognising and detecting cardiac irregularities, several researchers have employed various data mining approaches, such as neural networks, classification based on clustering and KNN. In this study, we employ many supervised classification methods, including k-nearest neighbor (KNN), logistic regression, support vector machines (SVM), and ensemble classifiers based on voting and CSV data. Prior to data training, myocardial infarction patients' ECGs, irregular heartbeats, myocardial infarction past, and Normal heart are combined on the lead level, and then, the goal column is converted utilizing a groups encoder, into a numeric number using an array (['PM', 'MI', 'HB', 'NO']). Post dimension reduction technique like Principal component Analysis is applied to understand the data and validate the variance explained is under acceptable limit. Here, in this case, Total Variance Explained: 99.5. Post Dimension reduction, data mining techniques, are applied on 12 leads combined

4. STEPS INVOLVED IN THIS SYSTEM

1. **Input Images :** ECG report images are given as the input for the system.

Fig: 2 Input image

2. Grey-Scale Imaging:

Fig : 3 Grey-Scale Image

3. Dividing into different Leads:

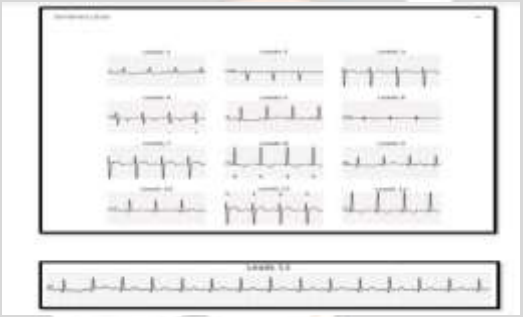

Fig : 4 Dividing the leads

4.Data Cleaning & Feature Transformation:

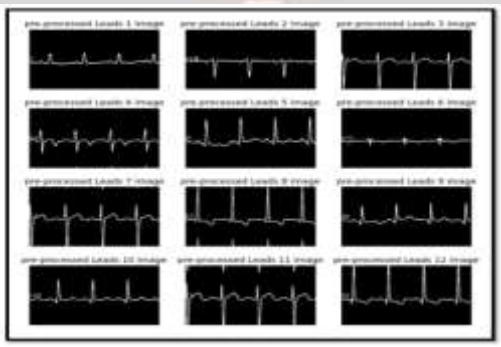

Fig 5:Transformation of attributes and data cleaning

In order to prepare Leads (1–13) for further analysis, each individual lead image is transformed. Gridlines removed, the lead image is converted to Grayscale, Gaussian filtering is used, and the lead image is thresholded to create a binary image.

5.Contour Images Processing :

A method for determining the skeletal outlines of an object in a picture, which may then be used to determine the physical configuration of the item.

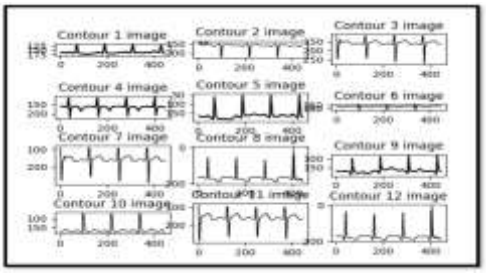

Fig : 6 Contour Images

6.Normalized 2D Signal:
As the observation above shows, the X-axis deals with both the high and low points, whereas the Y axis deals with the curve or shape. Because the lower or higher points will be the primary focus of our analysis, the normalized scaled 1D signal contains X-axis values separately in a CSV file.

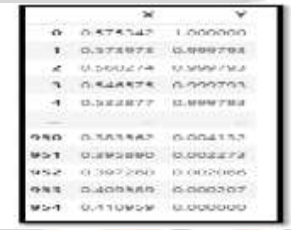

Fig : 7 CSV file of 2D signals

7.Normalized 1D Signal :

The transpose method has been used to change all of the 1D rows into columns. With 1D and 2D CSV files, as well as cropped 1 to 13 lead image files by using different algorithms can be applied on csv files.

Fig : 8 CSV file of Normalized 1D signals

8.Combining All Leads :

Once we have extracted all of the image's 12 lead 1D values, we combine them into a single csv for further analysis.

Fig : 9 CSV file of Combined leads

9.Performance Dimensionality Reduction : An approach to dimensionality reduction effectively reduces a sizable portion of the dataset's dimensions while retaining a minimal amount of data, it is considered to be effective.

Fig : 10 Dimensionality Reduction

10. Prediction :

Fig : 11 Final Output Prediction

5. CONCLUSION

The experiments conducted demonstrate that by using the provided predictive model to the ECG scans of new patients, we can quickly and accurately predict outcomes for cardiac patients. If the extraction of features from pictures is carried out correctly and ideally, coupled with increasing accuracy of our model, this study may also be expanded to incorporate a variety of various heart illnesses

6.REFRENCE

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