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Classification and Prediction of Cardiac Arrhythmia using Machine Learning: A Survey

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Abstract: Heart disease is the most common cause of death globally. According to a recent study by the Indian Council of Medical Research (ICMR) near about 25% of deaths between the ages of 25-69 years cause due to different heart-related problems. The cardiovascular diseases are the highest increased diseases. So, we should also have jumped on techniques and methods used for alertness and care to avoid the sudden death of the people because of the heart attack.

Heart disease prediction using data mining is one of the most imperative and challenging tasks. The shortage of specialists and high wrongly diagnosed cases has espoused the need to develop an efficient detection system.

This paper provides a quick and easy review and understanding of available prediction models using different techniques.

Keywords: Data Mining, Support Vector Machine, Heart Disease Prediction, ECG Signal Parameter.

I. INTRODUCTION

The healthcare industry has the huge amount of medical data, which is not mined. The medical data of the patients has hidden patterns which are necessary for data analysis in the detection of heart disease. Heart disease is a leading cause of death worldwide from past 15 years. As the clinical applications in remote health monitoring systems stored the patient's data for long-term recording, management and clinical access to patient's physiological information. Heart disease Diagnosis is basically based on patients Electrocardiogram (ECG) test. The continuous recording of an electrocardiogram (ECG) by a wearable sensor provides a realistic view of a patient's heart condition by tracking such factors as high blood pressure, stress, anxiety, diabetes, and depression; during normal daily routines we can predict the heart disease.

In this project, cardiac arrhythmia type will be classified and predicted. Cardiac arrhythmia describes an irregular heartbeat- heart may beat too slow, too fast, too early or irregularly. It indicates the malfunctioning of the heart's electrical system. Arrhythmias are broken down into various types such as tachycardia, bradycardia, supraventricular tachycardia, atrial flutter, atrial fibrillation, etc. These types will be classified as well as the chamber of the heart which has a blockage will be predicted. Thus, early detection of heart disease is essential because it can ease the treatment and also save people's lives.

II. LITERATURE REVIEW

Miss. Chaitrali et al. [1] expanded Heart Disease Prediction system (HDPS) system using a neural network. The HDPS system predicts the likelihood of a patient getting a Heart disease. For prediction, the system uses sex, blood pressure, cholesterol-like 13 medical parameters. Two more parameters are also added i.e. obesity and smoking for better accuracy.

Sunita Soni, Jyoti Soni, et al. [2] gives a frequent feature selection method for Heart Disease Prediction. Use of the fuzzy measure and the relevant nonlinear integral gives a good performance. The non-additivity of the fuzzy measure reflects the prominent of the feature attributes as well as their interactions. Using features such as age, sex, blood pressure and blood sugar can predict the likelihood of patients getting heart disease. And this improves the accuracy and reduces the computational time.

D. Mendes, et al. [3] gives a decision tree model structure that uses a reduced set of six binary risk factors. The validation is performed using a recent dataset provided by the Portuguese Society of Cardiology of 11113 patients, which originally comprised 77 risk factors.

Many health monitoring systems use wearable sensors that produce continuous data and generate many false alerts. Hence, these systems become unsuitable for use in clinical practice. To solve this problem some machine learning approaches are explained in [4] i.e. data generated by the wearable sensors are combined with clinical observations to provide early warning of serious physiological changes in the patients. Combining these data with manual observations the clinical staff makes important decisions about the patients.

Aishwarya B. Chavan Patil et al. [5] use two data mining classification techniques like Artificial Neural Network (ANN) and Naive Bayes is used to assist in the diagnosis of the heart disease to provide medication accordingly. The AVR-328 microcontroller is used

as a gateway to communicate to the various sensors along with temperature sensor, heartbeat sensor, ECG sensor, the sensor for keeping a track of drip levels and a sensor to keep track of motion. The system is efficient with low power consumption capability, easy setup, high performance and time to time response.

Dimitra Azariadi et al. [9] develop an algorithm for ECG analysis and classification for heartbeat diagnosis, and implement it on an IoT-based embedded platform. This algorithm is our proposal for a wearable ECG diagnosis device, suitable for 24-hour continuous monitoring of the patient. We use a Discrete Wavelet Transform (DWT) for the ECG analysis and a Support Vector Machine (SVM) classifier.

Salma Banu N.K et al. [10] provides a survey of different DM techniques available involving Decision tree (DT), Neural network (NN), the Genetic algorithm (GA), Naïve Bayes (NB), and Clustering algorithms like KNN, and Support vector machine (SVM).

Abdul Aziz et al. [11] gives detection of cardiac disease using data mining classification techniques. The classification technique used by this application provides decision tree for the detection of heart disease. Classification tree uses the factors including age, blood sugar, and blood pressure; it can detect the probability of patients fallen in CD by using fewer diagnostic tests which save time and money.

P.K. Anoojet et al. [12] proposed a weighted fuzzy rule-based clinical decision support system (CDSS) for the diagnosis of heart disease, automatically obtaining knowledge from the patient's clinical data. In this mining techniques like attribute selection and attribute weighting methods are used to obtain the weighted fuzzy rules. The weighted fuzzy rules and chosen attributes are used to construct the fuzzy system. Finally, the experimentation is carried out using the datasets obtained from the UCI repository and the performance of the system is compared with the neural network-based system utilizing accuracy, sensitivity and specificity.

Mai Shouman, [13] Tim Turner, and Rob Stocker et. al. performed a work "Applying k-Nearest Neighbor in Diagnosing Heart Disease Patients". In this paper, the author details work that applied KNN on a Cleveland Heart Disease dataset to investigate its efficiency in the prediction of heart disease. The author also investigated if the accuracy could be enhanced by integrating voting with KNN. The results show that applying KNN achieved an accuracy of 97.4 %. The results also show that applying to vote could not enhance the KNN accuracy in the diagnosis of heart disease.

In the Year 2011, A.Q. Ansari et al. [14] performed a work, "Automated Diagnosis of Coronary Heart Disease Using Neuro-Fuzzy Integrated System". In this paper, the author offered a Neurofuzzy integrated system for the analysis of heart diseases. To show the effectiveness of the projected system, Simulation for computerized diagnosis is performed by means of the real causes of coronary heart disease. The author concluded that this kind of system is suitable for the identification of patients with high/low cardiac risk

III. PROPOSED SYSTEM

Cardiovascular disease causes most of the deaths today. This system proposed will help to predict heart disease depending on the patient's ECG values related to heart disease. Medical dataset of the patients will be used to extract the ECG values. After that SVM classifier as well as CNN will be used in order to predict the heart disease. Figure 1 shows the architecture of the proposed system.

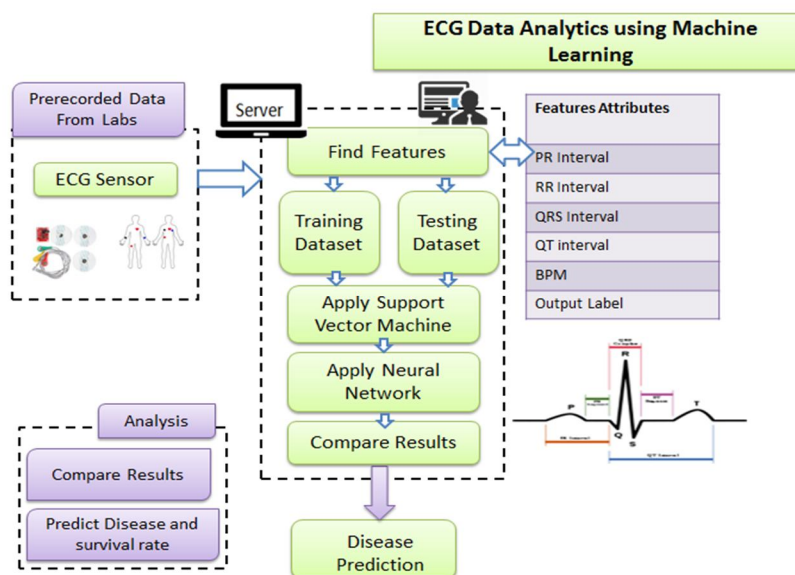


Figure.1 System Architecture

With the help of the ECG signal, we can extract the ECG values. Then by evaluating the ECG values and the other parameter related to heart disease like age, blood pressure, alcohol consumption, sex in the trained dataset and by applying data mining technique i.e. Support vector machine prediction of the disease can be done. A comparison can also be done using CNN algorithm.

An SVM classifier is a linear classifier where the separating hyper plane is chosen to minimize the expected classification error of the unseen test patterns. SVM classifies the test image to the class which has the maximum distance to the closest point in the training.

In CNN, connectivity pattern between its neurons is inspired by the organization of the animal visual cortex. Individual neurons in CNN are arranged in such a way that they respond to overlapping regions tiling the visual field.

IV. ADVANTAGES OF PROPOSED SYSTEM

- A. Helps to predict the disease based on ECG values.
- B. To explore data mining classification technique to predict precise symptoms and enhance the accuracy in prediction.
- C. To get better accuracy in the prediction of heart disease by comparing the result with the help of SVM and CNN.

V. CONCLUSION

Heart disease prediction is a popular exploration area in computer vision. The parameter on which heart disease is mostly dependent is extremely susceptible and variant. So, getting historical information about the patient we can predict the heart disease

In this paper, we give a brief review of different methodology in the prediction of heart disease detection. A large collection of methods is identified for recognition of heart disease. but none of the can give 100% accuracy in the prediction. So, there is a need to develop a system which can predict the heart disease with higher accuracy.

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