

Analysis of Techniques to Diagnose and Monitor Cardiac Diseases Using Data Mining

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Abstract

In the recent years of research, there is a main focus on Analysis of Health care datasets and it emerged as a new research trends across all over the industry. The Abundant availability of the data made many experts to focus more to obtain valuable knowledge for their research. Even though there is unlimited opportunities to transform this datasets into valuable knowledge, researchers have to navigate more complexities in these analysis. In this field, cardiac analysis will have a high influence of research findings by the availability of enormous amount of data. Cardiac patient records (CPR) can be mined deeply and there is a chance of predicting cardiac problems in the near future. This analysis is a technical application which retrospectively evaluates population data sets. This powerful diagnostic measure compares the heart problems before and after premature ventricular contractions. These comparisons are used to determine the status of the cardiovascular systems like cardiac arrest, cardiac attack etc. which can be indicative of cardiac health. Pattern mining algorithms and classification algorithms will be very useful in finding the problems of Cardiac diseases effectively.

Keywords: CPR, Cardiac attack, Cardiac arrest, Premature Ventricular contractions, Pattern mining and Classification algorithms.

I. INTRODUCTION

Cardiovascular diseases (CVD) [1] are the most common cause of death globally as of recent surveys, accounting for more than 30% of deaths. Mainly in this 30% of death record, 3/4th of the death was caused because of non-functionality of heart or by stroke. The main problem for cardiac diseases which includes obesity, cigarette smoking, lack of physical fitness, excessive alcohol consumption, high cholesterol, high blood pressure, poorly diet, diabetes, age and heredity too. Mostly there will be no symptoms to find the non functionality of heart but sometimes it may cause heart pain or problems in breathing. The heart diseases are often diagnosed by considering the medical history, listening to the heart-beats with a stethoscope, ECG, and ultrasound. The reports collected from the above factors can be used to supplement disease management or population health management efforts.

The poor heart conditions include diseased vessels, structural problems and blood clots. The most common types of Cardio Vascular Diseases [2] are

- Coronary artery disease: The heart's major blood vessels might be damaged from birth or destroyed for any other factors.
- High blood pressure: A condition in which the force of the blood against the artery walls is too high.
- Cardiac arrest: Sudden, unexpected loss of heart function, breathing and consciousness.
- Congestive heart failure: A chronic condition that affects the chambers of the heart.
- Arrhythmia: Improper beating of the heart, whether irregular, too fast or too slow.
- Peripheral artery disease: A disease in which plaque builds up in the arteries that carry blood to the head, organs, and limbs which reduce blood flow to the limbs.
- Stroke: Damage to the brain from interruption of its blood supply.
- Congenital heart disease: A defect or a problem with the structure of the heart. It is present at birth.

II. SYMPTOMS OF CARDIO VASCULAR DISEASES

The Complications [3] of Cardio vascular diseases are

- **HEART ATTACK OR MYOCARDIAL INFARCTION:** A heart attack is a medical emergency. A heart attack usually occurs when a blood clot blocks blood flow to the heart. Without blood, tissue loses oxygen and dies.
- **HEART FAILURE:** Heart failure can occur if the heart cannot pump (systolic) or fill (diastolic) adequately. Symptoms include shortness of breath, fatigue, swollen legs and rapid heartbeat. And also the heart does not have

enough strength to pump blood all the way round the body efficiently.

- **ARRHYTHMIA:** Cardiac arrhythmia occurs when electrical impulses in the heart don't work properly. There may be no symptoms. Alternatively, symptoms may include a fluttering in the chest, chest pain, fainting or dizziness.

III. RELATED WORK:

Sudden Cardiac Death (SCD) [4] is a major cause of death in the growing population of patients with Heart failure. Patients with Sudden Cardiac Arrest and Heart attack are one among the greatest risk of SCD. No Single test reliably predicts arrhythmic risk in patients with Heart Failure. Optimal Prediction and Medical treatment will reduce this risk. The Primary Prevention of SCD can be done by Implantable cardioverter-defibrillator (ICD) .

Analysis of ECG [5] can benefit in diagnosing most of the Heart diseases. ECG provides all information about the electrical activity of the heart. It classifies the ECG Signal using Artificial Neural Network. Three Common types of Heart beat signals are identified using ECG. If there is any variation in the normal Pattern of heartbeat it helps to diagnose the heart disease. ECG will be classified using artificial network. The Different types of heartbeats are recorded to find out the variations. Nature of the Recorded Heartbeats is nonlinear. Artificial Neural Networks is used to sort the non linear problems.

Heart beat patterns [6] are detected using the Sequential Pattern Mining framework. ECG and BP Patterns are used to identify the true beat occurrences. Multi-modal dataset is used to predict the heart beat. This turns out to be an important problem in a Clinical Context.

Heart disease diagnosis [7] is a complex task. Data Mining plays a Major role for predicting the disease. Association rule Mining and Classification are two functionalities of Data Mining. Researchers have applied different data mining techniques for diagnosis & achieved different probabilities for different methods. The three different data mining classification techniques, i.e. Neural Networks, Decision Trees, and Naive Bayes are used to analyze the dataset. Associative classifiers are especially fit to applications where maximum accuracy is desired to a model for prediction. The overall objective is to study the various data mining techniques available to predict the heart disease and to compare them to find the best method of prediction. This will lead to efficient prediction and achieve Maximum accuracy.

Hypertension is a key risk factor for Cardiovascular Disease (CVD) [8] and the authors developed a dataset model used to predict cardiovascular disease in a rural area (Vietnam). Prediction of CVD risk by using the most appropriate model for

Vietnamese population by considering attributes like age, smoking habits, BP and blood test would help to manage and prevent the CVD.10% Risk of CVD was found in Vietnam dataset by comparing with Asian, Chinese and US dataset

Heart disease describes a range of conditions that affects the heart. Heart disease is often interchangeably used with the term Cardio vascular disease. Conditions that involve blocked blood vessels leads to Heart attack, chest Pain and stroke. So Data Mining Technology can be applied in cardiology Database to Predict Heart disease effectively.

IV. MATERIALS AND METHODS:

Data Mining (DM) is the important stage of information discovery in databases (KDD), which is an extraction of implicit, unique, and potentially useful information from data. The difference between mining of data and discovering knowledge is that the latter is the utilization of different intelligent algorithms to excerpt patterns from the data whereas information discovery is the complete process that is involved in discovering knowledge from data. The ultimate objective is to abstract high-level information from low-level data. Association rule mining and classification are two main functionalities of data mining. Association rule mining is used to find interrelations among the item sets. It is an unsupervised learning where no class attribute is involved in finding the association rule. As well as, classification is a supervised learning where class attribute is involved in the construction of the classifier and is used to classify or predict the data unknown sample. The different machine learning algorithms like Naive Bayes, K-NN, Decision tree are used to classify the data to validate the results.

The motivation of Decision is simple and easy to implement because it requires no domain knowledge or parameter setting to handle high dimensional data. Decision Trees are easier to interpret. Decision tree has the ability to access the profile of the patient. Naive Bayes provides no dependency between the attributes by statistical classifier and posterior probability in determining the class as maximized. Naïve Bayes classifiers work well in the real time situations where the other algorithms fail in meeting those criteria. The k-nearest neighbour's algorithm (k-NN) is a method used for classifying the objects instance-based learning. It is the simplest algorithm among all machine learning algorithms. But the accuracy is severely less because of the noisy or irrelevant features, which has no importance. A Heart Disease Prediction System using data mining techniques by mainly considering the below attributes was developed and it can estimate the likelihood of patients getting a heart problems.

The main factors which should be considered for predicting Cardio vascular diseases involves these mandatory attributes

Primary key Attribute	Patient ID
Input Attributes	Age
	Gender
	Chest Pain
	Stress
	Blood Pressure
	Blood Sugar
	ECG
	Exercise
	Thyroid
	Cholesterol
	Tobacco consumption
	Alcohol consumption
	Hereditary
	Over Weight
Past Medical Record	

The training data have to be mined by classification data mining technique. Then Pattern mining algorithms have to be applied over this classified data to predict the heart diseases.

V. ISSUES AND CHALLENGES:

Medical diagnosis is the most important factor to be done under the guidance of a Medical Practitioners. In case of Heart failure, the heart is continuously becoming weak and atrial fibrillation is a heart rhythm problem. Both conditions have been increasing as the population ages.

There has been a real need to bring modern science to the problem of heart disease risk prediction, which has relied on traditional risk factors for decades. This proposed system helps the people just to have the overview about their health. The people can

take this prediction to be final can get unwanted tensions about their health.

Data mining is the very rich domain and it is useful for getting information to provide quality in the treatments by the Medical experts. By using mining techniques and its algorithm, there is a great chance of evaluating the cardiac diseases as promptly for the better safe of human's life.

VI. CONCLUSION

This research is focussed on the various algorithms that were used for the prediction and the algorithms which were efficient to use in the predictive analysis. Then it is necessary for an effective algorithm for further processing to predict the cardiac diseases efficiently. This helps mainly to focus the people who would not be aware that they are at risk for heart disease and might be targeted for preventive therapies.

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