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Diagnosis of Cardiovascular Abnormalities from Compressed ECG through a Data Mining-Based Approach

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ABSTRACT:

Compressed Electrocardiography (ECG) is being used in modern telecardiology applications for faster and efficient transmission. ECG diagnosis algorithms require the compressed ECG packets to be decompressed before diagnosis can be applied. This additional process of decompression before performing diagnosis for every ECG packet introduces undesirable delays, which can have severe impact on the longevity of the patient. ECG signal analysis has shown an important role in the prognosis, diagnosis and survival analysis of heart diseases. ECG signal compression is required due to three main reasons: low storage data space, reduction of low data transmission rate and transmission bandwidth conversation. The electrocardiogram (ECG) signal compression using clustered under Premature Contraction (PC), Premature Ventricular Contraction (PVC), and Arterial Flutter (AF) is presented in this paper. Principal Component Analysis (PCA) technique is used for dimensionality reduction and data classification. The methods are applied to the MIT/BIH arrhythmia ECG database. The results are efficient promising that this approach can useful for data compression of ECG signals. The experimental results are analyzed on the basis of Percentage of root mean square difference (PRD and compression ratio (CR).

INRODUCTION

ECG signal has been intensively used by cardiac specialists to efficiently diagnose diseases Cardio Vascular Disease (CVD) for the last seven decades. Apart from diagnosing CVD, Electro Cardio Gram (ECG) is also used for monitoring breathing pattern, mental stress, and condition of autonomous nervous system. In addition to monitoring different physiological states, ECG can also reveal the identity of a person using ECG-based biometric techniques.CVD being the number one killer of the modern era; researchers are providing wireless cardiovascular monitoring facilities to save life. Since ECG signals are enormous in size, usage of compression technology makes whole telecardiology-based diagnosis faster and efficient. A faster solution is of crucial importance for diagnosis and treatment of CVD, as delay of every second counts toward patient's mortality. Even though ECG compression enables faster transmission, it introduces a slight delay as the compressed ECG needs to be decompressed before performing any diagnosis. To mitigate this delay, our previous research has successfully detected few CVD anomalies straight from the compressed ECG (without decompressing them) Therefore, the work has initiated a completely new direction of research in CVD diagnosis from compressed ECG that establishes the basis for a fast, secured, and efficient telecardiology solution.

Problem statement and significance

Detecting cardiac abnormality from compressed ECG presented in rule-based algorithm for detection of a particular disease. Therefore, to identify all the cardiac abnormality, the presented system in requires hundreds of complex algorithms to be integrated under one computationally system. Maintaining and updating such a system for every new abnormality is intrinsically complex. This introduces a problem of

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finding a simple and fast solution toward heart disease recognition from compressed ECG that raises alert to the cardiac specialist as soon as a cardiac disease is recognized. In previous works we have only performed CVD abnormality detection with essentially two clusters (i.e., normal cluster and abnormal cluster). According to the literature and to the best of our knowledge, CVD recognition on compressed ECG with multiple clusters where each cluster represents one cardiac abnormality has never been reported.

Proposed System

The Proposed system is on the diagnosis of cardiovascular abnormalities which makes use of advanced information and Computer Technology such as Data Mining in order to diagnose and detect heart abnormalities

Terminology

- Cardio Vascular Disease (CVD).Electro Cardio Gram (ECG).
- Data Mining (DM).
- Atrial Flutter (AF).
- Premature Ventricular Contraction (PVC).
- Atrial Premature Contraction (APC).

Literature Survey

Cardiac abnormality detection

Compressed Electrocardiography (ECG) is being used in modern telecardiology applications for faster and efficient transmission. However, existing ECG diagnosis algorithms require the compressed ECG packets to be decompressed before diagnosis can be applied. This additional process of decompression before performing diagnosis for every ECG packet introduces undesirable delays, which can have severe impact on the longevity of the patient. In this , first used an attribute selection method that selects only a few features from the compressed ECG. Then we used Expected Maximization (EM) clustering technique to create normal and abnormal ECG clusters. Twenty different segments (13 normal and 7 abnormal) of compressed ECG from a MIT-BIH subject were tested with 100% success using our model. Apart from automatic clustering of normal and abnormal compressed ECG segments, this paper presents an algorithm to identify initiation of abnormality.

Therefore, emergency personnel can be contacted for rescue mission, within the earliest possible time. This innovative technique based on data mining of compressed ECGs attributes, enables faster identification of cardiac abnormalities resulting in an efficient telecardiology diagnosis system. (5)

In Wireless telecardiology applications ECG signal is compressed before transmission to support faster data delivery and reduce consumption of bandwidth.

However, most of the ECG analysis and diagnosis algorithms are based on processing of the original ECG signal. Therefore, compressed ECG data needs to be decompressed first before the existing algorithms and tools can be applied to detect cardiovascular abnormalities. Decompression will cause delay on the doctor's mobile device and in wireless nodes that have the responsibilities to detect and prioritize abnormal data for faster processing. This is undesirable in body sensor networks (BSNs) as high processing involved in decompression will waste valuable energy in the resource and power constrained sensor nodes. In order to diagnose cardiac abnormality such as Ventricular tachycardia, we applied a novel system to analyze and classify compressed ECG signal by using a rule based algorithm and clustering algorithms for clustering of normal and abnormal ECG signals.(5)

AUTOMATIC assessment of Cardiac Vascular Diseases (CVD) for patients has been a long time research; the cardiovascular disease is one of the leading causes of death around the world. The cause of CVD are due to the variations in the heart rate or irregularities and are characterized by the Electrocardiogram (ECG also known as EKG, abbreviated from the German Electrocardiogram) beats or patterns. The ECG signal is a representation of the

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bioelectrical activity of the heart representing the cyclical contraction and relaxation of the human heart muscles. To acquire the signal, ECG devices with varying number of electrodes (3– 12) can be used. Multi lead systems exceeding 12 and up to 120 electrodes are also available. Accurate detection of the ECG beats is the key requirement for detecting CVD. (6)

MODULES OF THE SYSTEM

The functional requirements of the system have been described above. These requirements are logically divided into the following modules.

Designing GUI

The system should have good user interface in order to allow the user to easily interact with the application. In our project I simply taken two users they are Admin and Patient where admin will have tasks like, add patient details and update patient details and start the server, and Patient bind to the hospital server where he can sent the ECG Data to the hospital . In the hospital server the ECG is analyses and perform operations within in a quick time the patient receive the disease classification from hospital server and finally give precautions to patient. In this attributes are the patient Compressed ECG character frequency count that the attribute affinity (or) utility toward a particular class (i.e what frequency /value range for a particular character can allocate a particular compressed ECG to a specific disease). That the attribute's correlation with other attributes (i.e.., if the value ranges for character a ,b and c have the same impact for allocating compressed ECG packet to be under five different clusters then we might just consider character a, for attribute selection as having b and c would be redundant).

Implementation of EM Algorithm and Rule based algorithm:

We consider the EM algorithm to perform mining on patients reported cardio problem and rule based system for disease classification in client side.

Attribute generation and attribute selection are in the EM algorithm in which to find out the cardiac abnormalities from compressed ECG character count of frequency and based on the representation that the algorithm revolves around the concept of the compressed ECG character count from the original ECG to encoding the ECG from that the attribute generation is done in the server side. The operations done in this was the input dataset and that is ECG which was in special characters involved in it there are some disease recognition characters that frequently repeating in every part of the data set in real time there are multiple data is sent but in this we are taking the individual data and checking the disease possibility of the character frequency the algorithm. in this algorithm this values was kept in the loop for each iteration check the number of instances that calculate the probability that instance belongs to clusters A1,A2,….An: and the P(A1/I) in which is probability and A1 is the cluster and I is the instance which check the every possibility to get the frequency count in different instance if the instance complete than it will close the loop and then it will go to the next one and then start the frequency count of the character this process is done in the server side. In the client side we take rule representation is done that setting the max and min beat range of the frequency using the association rules in which we are setting the cluster ranges that is frequency in this we can find out the disease detection from client side.

Results

ECG DATA have been used as inputs to execute the present project.They are given below. The final result is also given as output after each input data set.

INPUT: ECG DATA

OUTPUT: ATRIAL PREMATURE CONTRACTION (APC)

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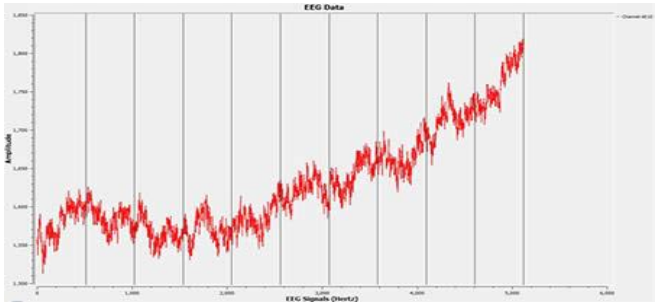
INPUT: ECG DATA

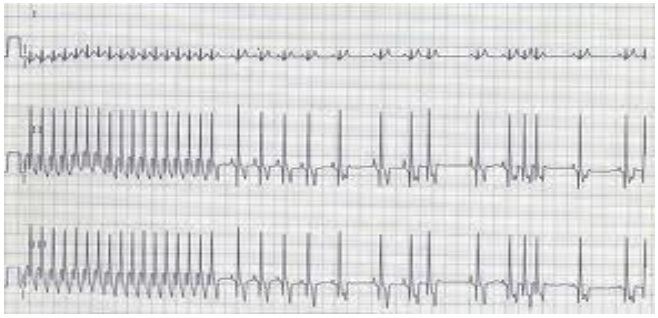


OUTPUT: NO DISEASE IS FOUND

INPUT: ECG DATA

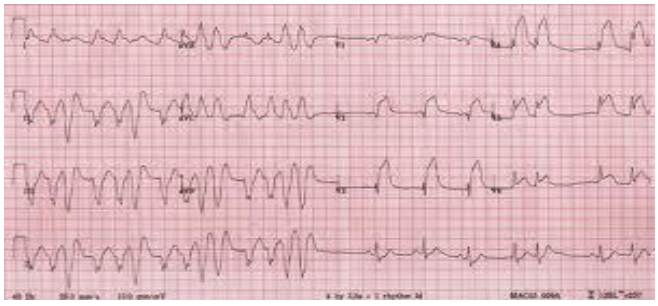
OUTPUT: NO DISEASE IS FOUND

INPUT: ECG DATA



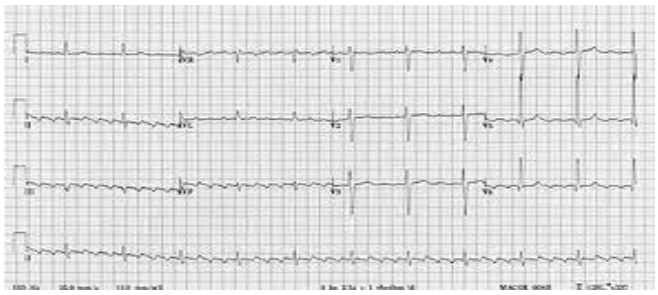
OUTPUT: PREMATURE VENTRICULAR CONTRACTION

INPUT: ECG DATA



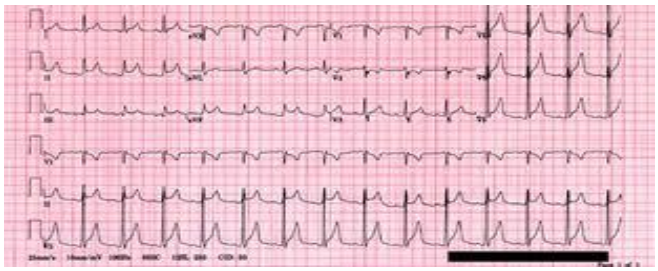
OUTPUT: ATRIAL FLUTTER

INPUT: ECG DATA



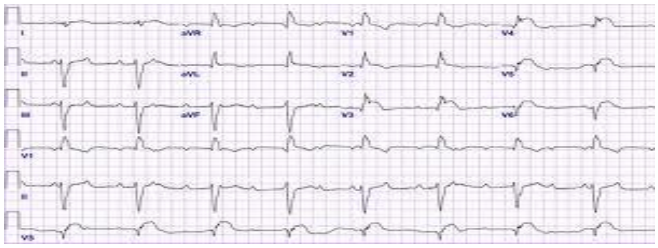
OUPUT: NO DISEASE FOUND

INPUT: ECG DATA



OUPUT: NO DISEASE FOUND

INPUT: ECG DATA SET



OUTPUT: ATRIAL PREMATURE CONTRACTION

CONCLUSION

The project was successfully implemented by using good graphical user interface where everyone can easily run the project and our main objective is using EM algorithm and rule based system for finding cardiovascular abnormalities cases where this can be used by care takers or Doctors to monitoring patient condition regularly

SCOPE FOR THE FUTURE WORK

1. In future we can develop our project for several chronic diseases in finding them such as diabetes etc. by making certain changes in our project.

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2. In our project we can include various other static procedures or methods in finding out effective results. We can provide effective treatment to the patient in the remote place itself.

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