Chapter 1

Arrhythmia Detection Based on Hybrid Features of T-Wave in Electrocardiogram

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ABSTRACT

An electrocardiogram (ECG) is used as one of the important diagnostic tools for the detection of the health of a heart. An automatic heart abnormality identification methods sense numerous abnormalities or arrhythmia and decrease the physician’s pressure as well as share their workload. In ECG analysis, the main focus is to enhance degree of accuracy and include a number of heart diseases that can be classified. In this chapter, arrhythmia classification is proposed using hybrid features of T-wave in ECG. The classification system consists of majorly three phases, windowing technique, feature extraction, and classification. This classifier categorizes the normal and abnormal signals efficiently. The experimental analysis showed that the hybrid features arrhythmia classification performance of accuracy approximately 98.3%, specificity 98.0%, and sensitivity 98.6% using MIT-BIH database.

INTRODUCTION

The digitalised electrocardiogram accession techniques form an important part of the contemporary framework in recognising and saving the signals at real time in order to assist in acknowledging the cardiac conditions.

This method does not incorporate dissection of the body or use of any insertion instruments. This technique is non-invasive and caters to a wide range of heart conditions like arrhythmia, heart rate variability, etc. that can be diagnosed with ease by employing the classifiers techniques in discussion system (Senapati, Senapati, and Maka, 2014). The process of analysing ECG signals is time consuming and very laborious for the cardiologists and the possibility of omission of vital information due to human error is high and thereby computerized techniques for the determination of arrhythmia from the
various available medical data is much required (Dong, Wang, and Si, 2017 & Jadhav, Nalbalwar, and Ghatol, 2014). Many times the medical practitioner are in a situation where in the signals obtained are; two signals having same patterns but indicate non-identical diseases and also the vice-versa where in the two signals with dissimilar patterns but revealing the same disease thus, complicating the task of ailment diagnosis for the doctor with. Hence, it can be noted that the appearances of the ECG signals are not completely accurate for the identification of the diseases. Therefore, employing the different characteristics of these signals would aid to corroborate the analyzing the respective heart conditions (Hassan, Saleem, and Habib, 2017). Many methods are used to identify and categorize the diseases interconnected to heart like abnormal and normal sinus rhythm etc.

Numerous methods for heart disease detections and ECG analysis have been discovered/developed in past few years for improvised classification of heart abnormality. P, Q, R, T and U are the five basic waves of an ECG waveform. Atrial depolarization is indicated by the P wave, ventricular depolarization is indicated by the QRS complex and repolarization of ventricle is indicated by T wave. The shape of the QRS complex is the most important and plays an integral role in the ECG signal analysis (Alickovic and Subasi, 2016).

The electrocardiogram signals are similar for different types of heartbeats as well as differ for the same person. Heart abnormality classification can be can be carried out by various existing techniques like; Support Vector Machine (SVM), Radial Basis Function (RBF), Linear Discriminant Analysis (LDA), Principle Component Analysis (PCA) (Elhai et. al, 2016). The method of using ECG signals for the detection of heart abnormality has major drawbacks due to the variations in signals depending on individual persons based on gender, age, etc. Another drawback includes the variations of the signals for the same person caused by few physical conditions. And due to these limitations following a single permanent method to carry out the detections seems inappropriate (Shadmand and Mashoufi, 2016).

In this chapter, characteristics based on both DWT coefficient and Time domain based features such as DE, peak magnitude RMS ratio, Auto regressive features like Yule-Walker Method, and Burgs method are used for the ECG signal feature extraction The improvisation of the ECG signal categorization is performed based on the above mentioned features and the two abnormalities of the heart can be identified using the SVM classifier.

**LITERATURE SURVEY**

A. Daamouche, L. Hamami, N. Alajlan, and F. Melgani (2012) presented a wavelet optimization strategy depends on the mixture of the poly phase representation of wavelets and PSO. This strategy finds the wavelets that indicate the beats of discrimination capability calculated through an empirical measure of the classifier efficiency. The SVM classifier illuminates the accuracy and stability of the proposed method and poly phase permits the wavelet filter bank from angular parameter. The wavelet method for ECG signal improves the classification accuracy but, this proposed technique not suitable for all datasets.

P. Kora and K.S.R. Krishna (2016) presented Wavelet Coherence (WTC) method for ECG signal investigation. The WTC measures the similarity among two waveforms in the frequency domain. The features are extracted from ECG signal after that optimized with the help of Bat algorithm. The optimized features are classified using Levenberg Marquardt neural network classifier. These techniques select the relevant features and reduce the feature redundancy as well as improve the classification accuracy but, this architecture is a bit time consuming.
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