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SVM BASED LIFE THREATENING ARRHYTHMIAS DETECTION

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ABSTRACT

Electrocardiogram (ECG) is the most important and widely used method to study the diseases related to heart. The detailed study of ECG graph helps the medical practitioner to diagnose the condition of the heart. Based on the information provided by ECG graph, an appropriate treatment can be given to the patient. The patient with the medical history of heart alignments should maintain a record of ECG papers for timely analysis and diagnosis of the diseases, which requires large storage space and extensive manual effort. The visual technique of analyzing the ECG signals is tedious and time consuming. In order to overcome this problem, an automatic system which involves digital signal integration and analysis tool is developed using MATLAB. This provides an effective strategy for analog to digital conversion of legated paper biomedical map, equipped with a plottingter. The conversion of electrocardiography (ECG) information from charts into digital ECG signals is designed using MATLAB. This method is cost effective, efficient paper work conversion, provides convenient storage and retrieval of ECG information and does not require dedicated hardware. In addition, this tool can be used to potentially integrate ECG information with the patient's disease analysis.

Key words: Sequential minimal optimization, Support vector machines, Daubechies-discrete wavelet transform, Electrocardiogram.

INTRODUCTION

Digital equipments are nowadays largely preferred to analogical ones especially due to their high-quality and flexibility of working with their output. Medical equipments that use digital technology have emerged as a true revolution in signal acquisition, analysis and diagnosis. Today, electrocardiograms, electroencephalograms, electromyogram and other biomedical signals are all in digital. Digital signals allow very high signal processing capabilities, easy storage, transmission and retrieval of information. The well recognized advantages of digital technology turns it the first-choice. One of the limiting factors of

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adopting the digital technology is the high cost of some modern digital equipment. This is a serious barrier to be crossed by those who already have a working analogical device and/or face budget limitations. An alternative to device replacement is adopting an A/D converter and a suitable interface to a digital microcomputer or laptop. This would also allow digitizing legated analogical data, something of paramount importance in many areas, overall in medicine as the history of patients would be kept and case studies may be correlated, etc. We describe the development of a software tool intended to convert a version of signals and/or spectra digitalized by a scanner (files of the extension .jpg .tiff .bmp etc.) to a data file, which can be efficiently processed and stored. It deals with an alternative approach to the classical A/D conversion without requiring any specific hardware.

Literature review and related works

Willams et al.[1] has carried out the measurement analyzed independently by a group of cardiologists & AHA. Analysis of set of recommendations aimed at standardizing measurement in quantitative ECG is presented. These AHA recommendations have led to the world wide recognition.

Bekir Karhket et al.[2] carried out artificial Neural network of ECG signal analyzed in the time domain thus corresponding arrhythmias are determined by using ANN, around 94% result is achieved for identification of arrhythmia. Chuang-Chien et al.[4] has done efficient arrhythmia detection algorithm using correlation coefficient in ECG signal for QRS complex are detected, the correlation coefficient and RR interval were utilized to calculate the similarity of arrhythmia.

Saxena et al.[3] has done combined modified Wavelet transform tech for Quadratic spline wavelet is used for QRS detection and Daubechies six coefficient wavelet used P and T detection and diagnosis of cardiac disease.

Stefan Gradland Patrick Kugler[4] had carried out analysis of (A) Pan-Tompkins algorithm for QRS detection (B) Template formation and adaptation; (C) Feature extraction; (D) Beat classification. The algorithm was validated using the MIT-BIH Arrhythmia and MIT-BIH Supra-ventricular Arrhythmia databases. More than 98% of all QRS complexes were detected correctly by the algorithm. Overall sensitivity for abnormal beat detection was 89.4% with a specificity of 80.6%.

Lee et al.[5] have carried out input feature by wavelet transform and linear discriminate analysis. This proposed algorithm he obtain good accuracy of arrhythmia detection that of NSR, SVR, PVC and VF was 98.42, 98.44, 98.49 and 98.88%, respectively.

Proposed system

SVM is a supervised learning method for linear separable data with maximum margin value. There are 4 types of signals: Normal beat, Left bundle branch block beat, Right bundle branch block beat and premature ventricular contraction. Single lead is used for training (MLII or limb lead II). High quality of feature vector will yield the better result of classification. Then data preprocessing is applied for this purpose. Digital filtering is used for eliminate noise on ECG signal. After that Discrete Wavelet Transform and PCA is used for enhance features of filtered ECG signal.

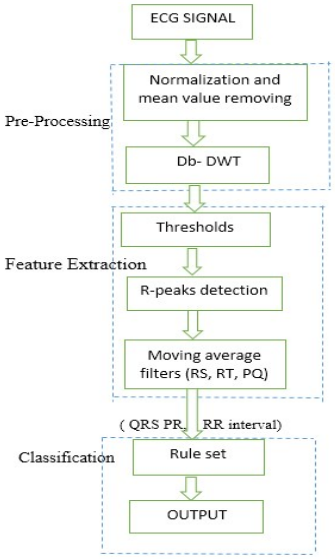

Fig. 1: Block diagram of algorithm

The Pan-Tompkins beat detection algorithm work flow is shown in the Fig. 2.

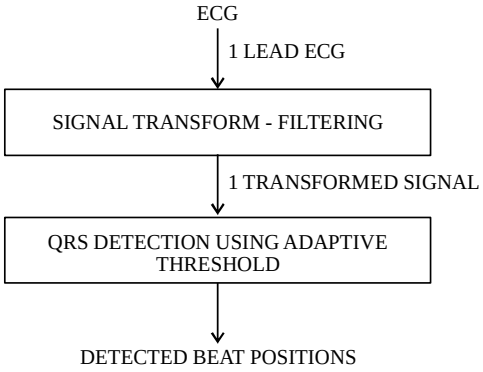

Fig. 2: Pan-Tompkins beat detection algorithm work flow

RESULTS AND DISCUSSION

In this paper, an efficient method for extraction and digitization of ECG signal from various sources such as thermal ECG printouts, scanned ECG and captured ECG images from devices is proposed. The methodology produced a reasonably accurate waveform that is free from printed character and as tested through heart rate, QRS width and stability calculations.We propose MATLAB software for the Pan and Tompkins QRS detection algorithm for detection of diseases related to heart, implementation every stage processes the entire sample and then can the next stage begin.

Fig. 3: Transmitter module

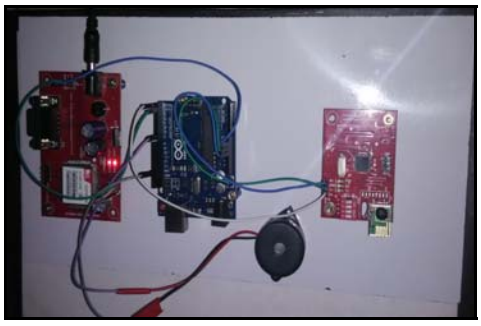

Fig. 3: GSM module

This paper describes the foundation of an efficient tool to generate digital data signals from legated paper charts. The solution proposed is a low-cost software tool that can be particularly helpful to scientists and engineers. In particular, research institutes, laboratories, clinical center's, hospitals and medical offices can largely have benefit of this up-and-coming technique, particularly due to its user friendliness, cost-effectiveness, and accuracy. One still can save data as MATLAB file or as ASCII files and edit or complement the data.

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