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RESEARCH ARTICLE

Design and Implementation of ECG (Electrocardiograph) Feature Extraction using Biomedical Workbench and LabView

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Abstract— Different ways have been submitted and used for ECG feature extraction with reasonable percentage of right detection. Although the problem stays open especially with respect to superior detection accuracy in raw ECGs. In this paper using biomedical workbench and LabView 2013 which is a graphical programming language that uses icons instead of lines of text to create programs to denoising and feature extraction. Unlike text based programming language.

LabVIEW uses the data flow programming, where the flow of data determines execution. The elasticity, standard nature and simplicity to use programming possible with LabVIEW, makes it less complex. The proposed algorithm is executed in two steps. First step, it preprocesses de noises the signal to remove the noise from the ECG signal, Then it detects heart rate, heart rate stander deviation , QRS amplitude ,QRS stander deviation ,QRS width, QRS width stander deviation, PR-interval, PR-stander deviation, QT-interval and QT stander deviation their onsets and offsets. LabVIEW and the related toolkits, advanced signal processing toolkit and math script are used to build the graphical program for both the stages. The algorithm is evaluated with MIT-BIH data files, with different ECG morphologies and noise content taken from MIT-BIH multi lead database which contains 15000 samples per ECG, recorded at a sampling frequency of 360Hz.

I. INTRODUCTION

The analysis of the shape of ECG curves as well as the identification of relevant intervals between different waves is of major importance for the diagnosis of cardiac disorders. The ECG pattern contains a large amount of information about the functionality of the heart as for example its electrical conduction. Amplitudes of the different waves (P, QRS and T wave) as well as particular intervals in a cardiac cycle can indicate an underlying heart disease [1]. Manual beat-by-beat measurements of all characteristic points in every lead are impractical in routine clinical practice [2]. Especially for long term ECGs. For this reason, automatic ECG feature extraction methods are of major relevance. There are number of features that related to ECG signal:-

P wave: Identify the wave of depolarization that spreads from the SA node throughout the atria. It typically has 80-100 ms in duration.

P - R interval: It normally lasts from 120 to 200 ms. it represents the time between the onset of atrial depolarization and the onset of ventricular depolarization. If the P-R interval is =200m sec, there is an AV conduction block. It is also termed as a first-degree heart block if the impulse is still able to be conducted into the ventricles.

QRS Complex: The QRS complex represents the ventricular depolarization. It is the most prominent amplitude of the ECG. It can be used to diagnose bundle branch blocks or abnormal pacemaker site located in the ventricles. This can be detected when the QRS complex is prolonged above 100ms.

ST Segment: The ST segment is measured from the onset of the S wave to the onset of the T wave. The T wave represents the repolarization of the ventricles. The ST segment is the time at which the entire ventricle is depolarized. The ST segment is important in the diagnosis of ventricular ischemia or hypoxia because under those conditions, the ST segment can become either depressed or elevated.

II. QT INTERVAL: THE QT- INTERVAL REPRESENTS THE TIME FOR BOTH VENTRICULAR DEPOLARIZATION AND REPOLARIZATION TO OCCUR. THEREFORE, IT ALMOST ESTIMATES THE DURATION OF AN AVERAGE VENTRICULAR ACTION POTENTIAL. THIS INTERVAL CAN RANGE FROM 350 TO 440 MS.

Review of related work

ECG feature extraction has been deliberate from early time and lots of advanced techniques as well as transformations have been proposed for easy, accurate and fast ECG feature extraction. This section discusses various techniques and transformations proposed earlier in literature for extracting feature from ECG.

Pan and Tompkins have developed a real –time algorithm for detection QRS complex of ECG signals [3]
A Ghaffari et al. use detection algorithms of QRS complex all proseser use MIT-BIH arrhythmia data base[4]
A.K.M.Fazlul Haque et all found fast fourier transform method successful in finding the abnormalities in ECG signal [5]
Channappa bhyri et al. use CSE multilead data base which contains 5000samples per ECG proposed denosing and feature extraction [6]
A.K.M.Fazlul Haque frequency analysis and feature extraction by using fourier transform, short time fourier transform and wavelet transform [7]
Adam et all have developed a new method for ecg signal feature extraction [8]
M.sabarimalai and k.soman A novel method for detecting R-peaks in electrocardiogram signal which is based on the Shannon energy envelope ,Hilbert-transform(HT)and moving average (MA)filter [9]
Vanisree k et al. Have developed automatic detection of ecg R-R interval using discrete wavelet transform [10]
Tang and shu use wavelet transform for feature extraction before this possessor normalization of the ecg signal [11]
Rahul pitale et all heart rate variability classification and feature extraction by using discreet wavelet transform [12]

2- DESCRIPTION OF THE ALGORITHM

The algorithm presented in this section is applied directly a tone run over the whole ECG signals which are available as data files.
The algorithm is divided into two parts:
A. Preprocessing of the ECG signal (Denoising).
B. Feature extraction of the ECG signal.
They evaluated the algorithm on the MIT-BIH Arrhythmia Database, which consists of 48 ECG recordings. Each one has a duration of 30 min. and includes two leads .the modified limb lead II and one of the modified leads V 1, V 2, V 4 or V5 [12]. The sampling frequency is 360Hz with a resolution of 5 microvolt per bit. Two cardio legists' have annotated all beats.

3- Characteristics of Normal ECG Signal

Amplitude and duration of different wave, interval and segment as follows-

Amplitude:

- P wave: 0.25mV
- R wave: 1.60 mV
- Q wave: 25% of R wave
- T wave: 0.1 to .5mV

Duration:

- P-R interval: 0.12 to 0.20 sec
- Q- T interval: 0.35 to 0.44 sec
- S- T segment: 0.05 to 0.15 sec
- P wave interval: 0.11 sec

A. *QRS interval: 0.09 sec*

Table 1 feature extraction

File no	Sex,edge,type of lead	Features mean value										Total no of beat
		HR(beat per mint)	HR Std.	QRS (amp.) Mv	QRSstd.	QRS Width(ms)	QRS std	PR-interval (ms)	PR-std	QT-interval (ms)	QTstd.	
101	Female,75,v1-II	62	6.4	1.6	0.6	64	27	187	12.2	514	77	1846
102	emale,84,v2-v5	70	10	0.95	0.24	45	29	170	34.7	489	109	1998
103	Male,v2-II	69	4.7	1.3	0.94	39	33	167	12.4	34	81.7	2048
104	Female,66,v5-v2	67	16	1.6	0.41	1	20	1.19E+3	1.03E+3	2.61E+3	1.99E+3	442
106	Female,24,v1-II	63	23	1.9	0.91	67	25	254	182	808	427	1446
107	Male,63,v1-II	69	7.6	1.5	1.1	45	33	181	582	576	114	1988
108	Female,87,v1-II	59	9.7	1	0.37	73	23	274	93.8	704	241	1599
109	Male,64,v1-II	84	0.8	2	0.42	77	9.1	139	22.5	434	79	2458
111	Female,47,v1-II	65	13	1.2	0.22	76	27	187	31.6	643	184	1795
112	Male,54,v1-II	84	4.5	0.9	0.44	53	28	137	7.81	410	46.1	2509

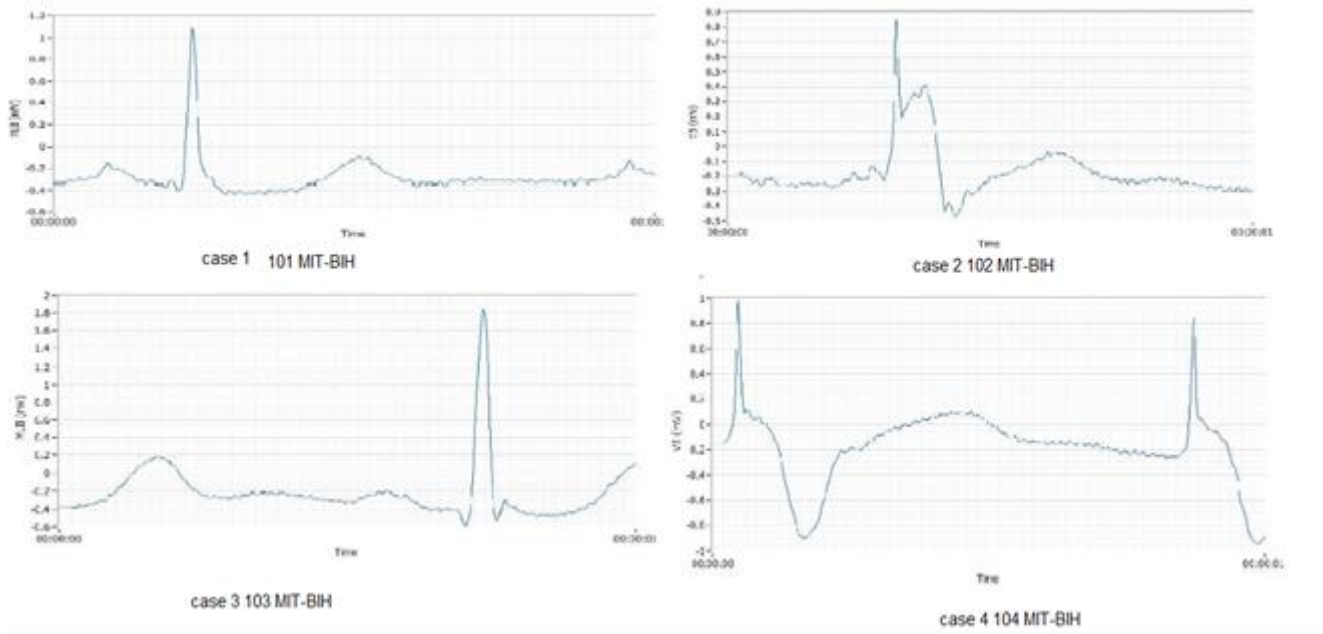

Figure (3) ECG signals cases

5- Obtained results

The detection performance of the proposed LabVIEW and biomedical work bench based algorithms were tested with different MIT –BIH data base. The results obtained are given in the table 1 and table 2. table 1 represents feature extraction. table 2 represents the determine whether the signal is normal or abnormal due to standard characteristic as shown above in section 3.

FILE NUMBER	HR	QRS AMP.	QRS WIDTH	PR INTERVAL	QT-INTERVAL
101	NORMAL	NORMAL	ABNORMAL	NORMAL	ABNORMAL
102	NORMAL	ABNORMAL	ABNORMAL	NORMAL	ABNORMAL
103	NORMAL	ABNORMAL	ABNORMAL	NORMAL	NORMAL
104	NORMAL	NORMAL	ABNORMAL	NORMAL	ABNORMAL
106	NORMAL	NORMAL	ABNORMAL	NORMAL	ABNORMAL
107	NORMAL	NORMAL	ABNORMAL	NORMAL	ABNORMAL
108	ABNORMAL	NORMAL	ABNORMAL	ABNORMAL	ABNORMAL
109	NORMAL	ABNORMAL	ABNORMAL	NORMAL	NORMAL
111	NORMAL	ABNORMAL	ABNORMAL	NORMAL	ABNORMAL
112	NORMAL	ABNORMAL	ABNORMAL	NORMAL	NORMAL

Table (2) diagnosis

CONCLUSIONS

As a result from this paper, The large assortment of ECG feature extraction algorithms, and the continuous efforts for their enhancement, proves that universally appropriate solution has not been found yet .Difficulties grow mainly from the huge diversity of the waveform the noise and artifacts accompanying the ECG signals. The main advantage of this G. programming is that, it provides a robust, easy and efficient environment and tool for generating very fast, less complex and useful algorithms

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