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Improving of QRS complex detection in ECG signal Using Combination of Fourier Transform and Wavelet method

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Electrocardiography (ECG) signal is very important signal for identifying heart disease. It composes of five main characteristics which can be specified by the P-QRS-T signals. One of the most important segment in the signal is the QRS complex because it is the heart activity that electricity run all over heart which can tell many heart disease. There have been many studies on identifying the complex location and interval in the ECG. For instance, in field of physics, electronic circuit simulations were used to image QRS complex for identifying heart disease. However, in complex simulation, there requires primitive knowledge where the location of QRS complex, which is unknown parameter and has to guess from visual inspection. On the other hand, in the field of signal processing area, a regular used technique to achieve this QRS characteristic is the application of the wavelet transform to identify QRS signal. Although, this technique has proved that it has high accuracy in detecting QRS complex, it too bases mainly on trial and error method where one firstly need to estimate and guess where about the QRS is and how long the QRS interval lasts. Therefore, to overcome this problem, this study aim to provide an automate technique to replace the estimating module by firstly coarse scanning for QRS complex position using Fourier Transformation. After that, the wavelet transform will be used as fine scanner to specify more precise QRS complex position. Twenty ECG signals with various characteristic, such as shockable rhythms and non-shockable rhythms, were investigated in this work. To detect QRS complex, Fourier Transform was used to identify fundamental frequency range of ECG by choosing the ones with comparatively high amplitudes. After that, these frequencies were added to Wavelet method to identify the range of interest for extracting Wavelet coefficients. After that, the Wavelet function was used to transform ECG signal and mark the position of QRS complex. From our preliminary results, the Fourier Transform can extract unique frequencies for each type for the Wavelet to locate QRS complex position, where more than 98% accuracy on the results was obtained. Note that without our proposed Fourier Transform part, using only Wavelet Transform in some ECG type gives less than 80% accuracy. This implies that our combined Fourier and Wavelet Transforms technique in detecting QRS complex position in normal and abnormal ECG signals, and may help to specify heart diseases with more reliability and efficiency. Therefore, one can elaborate our proposed module to design automatic heart disease diagnostic system, which can benefit medics outside heart diagnostic field for initialize emergency treatment of sudden heart attack.

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