A Cardiod Based Technique to Identify Premature Ventricular Contractions on Mobile Platforms

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Cardiovascular disease (CVD) is a major health problem affecting many people. Premature Ventricular Contraction (PVC), which can occur in healthy people of any age, might lead to more severe CVDs and is linked to mortality when associated with myocardial infarction. There has been voluminous research that focuses on PVC detection to provide immediate treatment for patients. However, some pre-processing techniques such as wavelet filtering may cause delay by extracting features on frequency domain rather than time domain. Furthermore, many classifiers are only suitable for powerful processing systems. Significant differences in PVC and normal beat morphologies in large ECG datasets might also reduce the accuracy rates of those proposed methods.

In this paper, we provide a faster and more efficient patient-specific technique to detect PVC using cardioids, which are two dimensional loops obtained from QRS complexes of normal and PVC heart beats. Pre-processing time is reduced significantly since cardioids can be drawn directly from raw QRS complexes. Each cardioid loop possesses features such as x-y coordinates of centroid, upper, lower, left and right extreme points that can be combined to form 10-point feature sets to differentiate a normal and PVC QRS complex. Using Multilayer Perceptron neural network as classifier, we perform experiments over 20 subjects of the MIT/BIH arrhythmia database and obtain an average detection accuracy of 99.78%, average sensitivity of 97.25%, and average positive predictive value of 98.69%. Due to a reduced feature set of only 10 data points and a reasonably high accuracy rate, we show that the proposed cardioid technique can be applied in real-time wireless telecardiology applications running on mobile platforms.