

Optimal Delineation of Ambulatory Holter ECG Events via False-Alarm Bounded Segmentation of a Wavelet-Based Principal Component Analysis Decision Statistic

Mohammad Reza Homaeinezhad*

Department of Mechanical Engineering, KN Toosi University of Technology, Tehran, Iran

The aim of this study is to develop and describe a new ambulatory holter electrocardiogram (ECG) events detection-delineation algorithm with the major focus on the bounded false-alarm probability (FAP) segmentation of an information-optimized decision statistic. After implementation of the appropriate pre-processings, a uniform length sliding window is applied to the synthetic scale and in each slid, six feature vectors namely as summation of the nonlinearly amplified Hilbert transform, summation of absolute first order differentiation, summation of absolute second order differentiation, curve length, area and variance of the excerpted segment are calculated. Then all feature trends are normalized and utilized to construct a newly proposed principal components analyzed geometric index (PCAGI) by application of a linear orthonormal projection. In the next step, the α -level Neyman-Pearson classifier (which is a FAP controlled tester) is implemented to detect and delineate QRS complexes. To show advantages of the presented method, it is applied to MIT-BIH Arrhythmia Database, QT Database, and T-Wave Alternans Database and as a result, the average values of sensitivity and positive predictivity $Se = 99.96\%$ and $P+ = 99.96\%$ are obtained for the detection of QRS complexes, with the average maximum delineation error of 5.7 msec, 3.8 msec and 6.1 msec for P-wave, QRS complex and T-wave, respectively showing marginal improvement of detection-delineation performance.