

Long-Duration ECG Signal Events Detection-Delineation via Segmentation of a Wavelet-Based Independent Components Analyzed Metric

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The aim of this study is to describe the development procedure of a new ambulatory long-duration 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 an appropriate pre-processing scheme, a uniform length sliding window is applied to the modified signal 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 independent components analyzed geometric index (ICAGI) by application of a blind source separation (BSS) method. The ICAGI metric is then used as decision statistic and α -level Neyman-Pearson classifier (which is a FAP controlled tester) is implemented to detect and delineate QRS complexes. The presented method was 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 $Se = 99.97\%$ and $P+ = 99.97\%$ were obtained for the detection of QRS complexes, with the average maximum delineation error of 5.6 msec, 3.8 msec and 6.1 msec for P-wave, QRS complex and T-wave, respectively.