An Innovative Method based on Shannon Energy Envelope and Summit Navigation for Detecting R Peaks of Noise Stress Test Signals

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Abstract:

In recent decades, there has been an increased demand for the processing of electrocardiogram (ECG) signals because of its significant role in diagnosing cardiac diseases. The QRS complex is the dominant feature of the ECG signal. The detection of QRS complexes is thus an essential part of almost any ECG signal processing systems. This paper presents a developed QRS complex detection method using dominant peak extraction and Shannon energy envelope for useful ECG signal analysis. The algorithm is divided into three main stages: pre-processing, searching for dominant peaks, and removing false R peaks. The proposed algorithm is validated in static ECG recordings from the MIT-BIH Arrhythmia Database (MITDB) and noise-contaminated ECG stress tests from the Glasgow University Database (GUDB), separately. The method compares favorably with conventional and recently published results of many QRS detection algorithms on the same MITDB. Subsequently, valuable performance coefficients are also found on the GUDB. The average detection accuracy of finding R peaks exceed 99% on both the databases, especially for cardiac stress test records with high interference levels. The method enables a highly effective ECG signal processing tool under various noises, artifacts, abnormalities, and morphologies.

Key-words: *ECG, R-peak detection, Summit Navigator, Shannon Energy Envelope, noise stress test*