Detection of QRS Complexes from a Standard Recording of EKG Signals

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Team common language
English

Abstract

A QRS event relates to a contraction of the heart and is depicted in an EKG waveform by a major deflection in electrical potential. The deflection is defined by the labels Q, R, and S on a figure supplied by the company. This electrical activity is normally measured on the surface of the body, and is generated by depolarizing and repolarizing heart muscle. Its clinical importance lies in knowing when the heart behaves irregularly. The main objective of this problem is to develop an algorithm that will locate the position of the R-wave (landmark) of each beat. Once the location of the R landmark is known, the time between subsequent beats can be calculated and enables one to determine the instantaneous heart rate. Moreover, when the instantaneous heart rate is known, a history of heartbeats can be analyzed to isolate the beats that correspond to premature contractions of the heart (QRS events).

In the literature there are many algorithms available for the QRS detection problem. However, in the cases of noise contamination (60 Hz, movement, baseline drifts, ...), the problem becomes especially difficult and the available algorithms may not work very well. In this project, the aim is to identify the QRS complexes for the varying types of EKG signals available in the files provided by the company. There are 5 text files, each containing 60 seconds of EKG data for varying types of noise and various scenarios. Each file contains a header and the two columns of data (time and voltage), which are separated by a comma. The sampling rate for each of the signals is set to 200 Hz. The output should consist of the estimated location of each QRS complex (R-wave location) for each file. The results can be presented in an ASCII file with the sample numbers of the locations of the R-waves.