Real-time Detection of Abnormal Beats in Electrocardiogram by Artificial Neural Networks

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Cardiovascular diseases have been the main health problems in this modern society. Many homecare devices and services have been developed based on Electrocardiogram (ECG) recording and transmission. Generally in such framework the interpretation of ECG is off-line and manually performed by health care professionals. Such interpretation is expected to lead to medical diagnosis and support further treatment decision making. However sometimes it is more necessary to alarm or record an abnormal cardiovascular event in time than to provide such precise interpretation. Therefore we developed a method to detect abnormal beat in ECG based on artificial neural network (ANN) to provide real-time cardiovascular homecare in this study. Traditionally Holter ECG analysis for classifying normal or abnormal beat is based on template method. Such methods need time to create templates for different patterns of heart beats and hence is not satisfied to real-time application. ANN can be trained by correctly annotated data to construct a model for classification. In this study we used the annotated arrhythmia data from Physionet to train an ANN for classification of heartbeats. The input features of ANN are the 200ms ECG signals around R-wave. The preprocessing of ECG includes R-wave locating, detrending, rectification and normalization of ECG signals. This ANN model was tested by other data not for training for performance evaluation in a simulation environment. The results reveal that this model can perform 85% high sensitivity for abnormal beat alarm but 32% low specificity which may cause more false alarms. However this study could be a reference for development of real-time cardiovascular homecare services.