Beat-Level Quality Control for Improved Screening of Atrial Fibrillation

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Background: Early detection of AF is essential and emphasize the significance of AF screening. Several rhythm-based AF detectors have been proposed, using the RR interval (RRI) series as input. However, the applicability of such detectors to ECG screening using a handheld portable device is limited because of high susceptibility to noise. Often, large numbers of false alarms are produced.

Aim: The performance of a rhythm-based AF detector is highly dependent on the performance of the preceding QRS detector. However, the lower signal quality of screening ECGs may cause falsely detected beats which, in turn, cause falsely detected AF episodes. In this study, the feasibility of applying machine learning-based quality control, inserted between the QRS detector and the low-complexity AF detector, is investigated with the aim to improve the performance of the AF detector.

Methods: A convolutional neural network (CNN) was trained to classify detected beats into either true or false. The network was trained and validated using beats in the database of the Physionet/CinC 2017 challenge. Falsely detected beats were excluded and an updated series of RRIs was fed to the AF detector. The effect of using the CNN-based quality control on detection performance was evaluated using the StrokeStop I database.

Results: The results show that the CNN-based quality control reduces the number of false alarms by 33.3% at the expense of a slight reduction in sensitivity from 93.6% to 91.7%.

Conclusion: These results show that a significant reduction in false alarms can be achieved when performing CNN-based quality control between QRS and AF detection.