

Detection of Supraventricular Tachycardias in Single-Lead ECGs Recorded from a Handheld Device

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Background: Short irregular supraventricular tachycardias (SSVT), are associated with higher risk of developing atrial fibrillation (AF). Such episodes may also be an indicator of undetected paroxysmal AF. Therefore, detection of SSVT may be used to improve atrial fibrillation screening efficiency. Detection of SSVT is, however, challenged by the lower signal quality of ECGs recorded from handheld devices.

Aim: The present study introduces and evaluates a detector for SSVT episodes in 30s single lead ECGs recorded from a handheld device. SSVT is defined as at least 4 consecutive irregular RR intervals that appear in ≤ 2400 ms.

Methods: The proposed detector is based on the assumption that the beats within SSVT episodes exhibit similar morphology, and that episodes with beat of different morphology, either due to noise/artefacts or aberrant ectopic beats, should be excluded. A support vector classifier is trained, using simulated ECGs with varying signal-to-noise ratio and inserted aberrant ectopic beats, to classify a sequence of 5 events produced by a QRS detector into either similar or non-similar detections. The choice of 5 events is motivated by the fact that the shortest SSVT episode contains only 5 beats. Next, the episodes identified as similar are subjected to a set of rhythm criteria. These criteria are 1) 4 RR-intervals ≤ 2400 ms, 2) irregularity, and 3) considerably faster heart rate compared to the rest of the recording.

Results: The performance of the proposed detector is evaluated using the StrokeStop II database, which contains 187000 30-s ECGs from more than 6,000 75-76 years old participants in an AF screening study. For SSVT detection, the resulting sensitivity, specificity, and positive predictive value were 84.6%, 99.6%, and 22.7%, respectively.

Conclusion: The results show that given the size of the database, a significant reduction in the expert review burden is achieved using the proposed detector.