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«Machine-learning based technique for reduction of false cardiac arrhythmia alarms in ICU»

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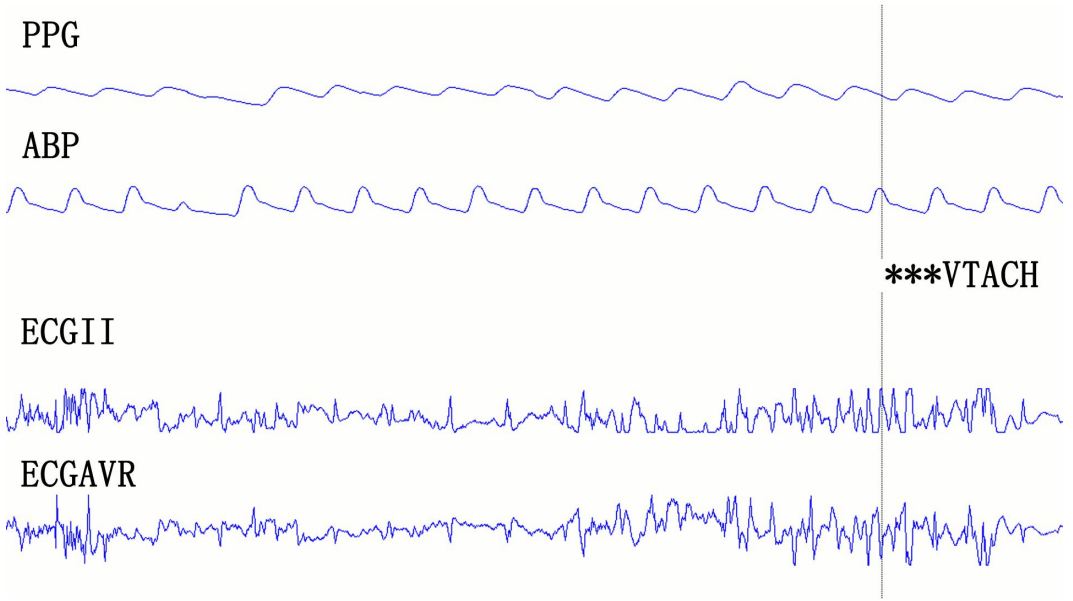
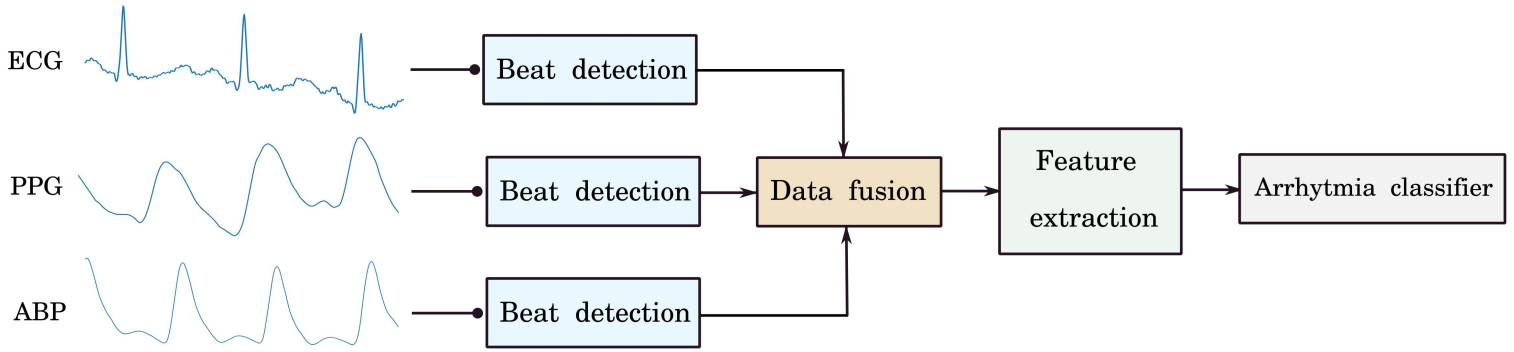
Research motivation

- The number of false alarms in intensive care units (ICU) have been reported to be 40–86%;
- There is little evidence that alarm thresholds are optimized for any population, particularly in any multivariate manner with simultaneous physiological waveforms, such as ECG, arterial blood pressure (ABP) and photoplethysmographic (PPG) signals.



Machine-learning based framework



- After obtaining the indicator signal for each waveform, the following strategy was used to data fusion the detected beats;
- After robust beat detection from ECG, ABP and PPG waveforms the selected features are fed into a classification algorithm to distinguish between the true and false arrhythmia alarm;
- Machine-learning based classification algorithm uses separate Random Forest classifiers, each trained for one type of arrhythmia.

Results

- On average, 89 % of the true alarms were detected in the test set;
- The best false alarm detection accuracy (97 %) in the test set was achieved for TC;
- Compared to the rhythm-based arrhythmias, such as ASY, EBR, ETC, false alarms of ventricular arrhythmias were more difficult to classify resulting in a lower detection rate. The average detection rate of true alarms was 80 % in the test set;
- The detection rate was 96 % or higher for TC and BR. Since misclassification of true alarms should be minimal, further modifications are required for improving the classification of true alarms for ASY, VFB, and VTA;
- Further improvements can be made by possibly adding features and selecting the classifiers for every arrhythmia, separately.

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