An Ensemble of Deep Recurrent Neural Networks for P-wave Detection in Electrocardiogram

Detection of P-waves in electrocardiogram (ECG) signals is of great importance to cardiologists in order to help them diagnosing arrhythmias such as atrial fibrillation. This paper proposes an end-to-end deep learning approach for detection of P-waves in ECG signals. Four different deep Recurrent Neural Networks (RNNs), namely, the Long-Short Term Memory (LSTM) are used in an ensemble framework. Each of these networks are trained to extract the useful features from raw ECG signals and determine the absence/presence of P-waves. Outputs of these classifiers are then combined for final detection of the P-waves. The proposed algorithm was trained and validated on a database which consists of more than 111000 annotated heart beats and the results show consistently high classification accuracy and sensitivity of around 98.48% and 97.22%, respectively.