Classification of cardiac abnormalities using hand crafted features and convolutional neural networks

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Abstract

BERCLab team is working on developing a hybrid model combining hand-crafted features and a deep convolutional network with squeeze-and-excitation layers to classify cardiac abnormalities from 12 lead ECGs.

ECG recordings were filtered and resampled to 500 Hz. The baseline was then removed from ECGs using wavelet transform. Randomly 10s from ECG signals were selected to be used for further analysis. We extracted 700 features from 12 lead ECG, including morphological features, time, frequency, and time-frequency domain features. From the dataset provided by PhysioNet challenge, we used 28,737 ECG recordings for training and 14,386 for testing. The training and testing sets have similar label distributions. Three feature selection techniques, including recursive feature elimination, Lasso cross-validation, and permutation-based feature importance, were used to select the most important and meaningful features.

With only selected hand-crafted features and a stacking classifier approach, we obtained the challenge validation score of 0.23, - 0.1, 0.198, 0.17 using 12, 6, 3, and 2 ECG leads, respectively. Our preliminary results showed that our model performed better, as expected, on twelve ECG leads compared to six, three, and two leads. Future work will be focused on fusing the top selected hand-crafted features and the standard 50-layer one-dimensional ResNet generated features for improving the achieved results.