Detection of 12-Lead ECG arrhythmia using Combination of Squeeze-and-Excitation Module and residual U-Net

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Aims: Automatic detection of arrhythmia through electrocardiogram (ECG) is of great importance for the prevention and treatment of cardiovascular disease. This paper aims at proposing a novel method to detect the rhythm/morphology abnormalities on 12-lead ECG signal.

Methods: Our method combines the U-net and the residual convolutional module and the *Squeeze-and-Exception* module to extract features from the original ECG signal. The *Squeeze-and-Exception* module adaptively enhances the discriminative features and suppresses noise by explicitly modeling the interdependence between the channels, which can adaptively integrate the information from different leads of ECG. The shortcut connection takes care of the degradation problem in the deep network and makes the network easier optimize. The convolutional neural network cannot accept variable–length input signals. We add the ECG signals to the back with zero to equal length. U-Net first encodes the input signal through one-dimensional convolution and sub-sampling operations. The up-sampling operation in U-Net can adaptively decode the encoding and produce features for classification.

Results: We use the China Physiological Signal Challenge 2018 dataset to train model, which has 6,877 12-lead ECG recordings for training the model. The F_beta score and G_beta score are used to evaluate the performance of the model. Our model achieves a F_beta score and G_beta score of 0.74 and 0.54, respectively.

Results of the Challenge

Type	Scores	Time
F_beta G_beta average	0.742 0.541 0.634	24 min

Conclusion: The final results show that our model has good performance and has great potential in practical applications.