MTFNet: A Morphological and Temporal Features Network for multiple leads ECG Classification

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Aims： The 2021 PhysioNet/CinC challenge's goal was to develop an algorithm that can classify cardiac abnormalities in 12-lead, 6-lead, 3-lead, and 2-lead ECG. Simultaneously, we evaluate whether we can use fewer leads to achieve the same performance as 12-lead to provide a theoretical basis for small, low-cost, and easy-to-use ECG equipment.

Methods：Initially, to ensure data consistency, we resampled each recording to a frequency of 500Hz, and the signals were segmented into 10 seconds. 30172 records were obtained as training sets, and 7544 records were used as validation sets. We propose an MTFNet model for extracting morphological and temporal features. Inspired by the VGG network, we use a one-dimensional convolutional neural network with multiple layers of small convolution kernels, and each layer has similar hyperparameters. To prevent overfitting, we use the dropout layer between every three convolution modules. Then the Bidirectional LSTM is used to obtain the temporal characteristics and finally identify one or more categori es in each record and the probability or confidence score of each class.

Results：In the unofficial phase of the Challenge, we(team name =csu_anying) achieved a challenge validation score of 0.57 for 12-lead, 0.55 for 6-lead, 0.55 for 3-lead, and 0.55 for 2-lead. Our cross validation scores on the training set are as follows 0.588 for 12-lead, 0.56 for 6-lead, 0.569 for 3-lead, and 0.546 for 2-lead.

Conclusion：Our algorithm can achieve high classification performance for different lead signals. It shows that fewer leads can also provide helpful characteristic information, which offers a theoretical basis for portable devices.