MMCTNet: Multi-Modal Conv-Transformer Network for Predicting Good and Poor Outcomes in Cardiac Arrest Patients

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Objective: Electroencephalography (EEG) has been demonstrated to be a valuable tool for predicting neurological outcomes after cardiac arrest. However its complexity limits timely interpretation. In consequently, we propose a Multi-Modal Conv-Transformer network to accurately and timely assess probability of coma recovery with complex EEG.

Method: Our proposed method is divided into two parts: In pre-processing part, we selected the most recent EEG for 12, 24, 48, and 72 h from each patient. The EEG was segmented into 10-second equal-length slices and filtered using a 5th-order Butterworth bandpass filter (0.5-30 Hz). Then, the time-frequency spectrograms of each channel of EEG as a kind of modal input to the network, were extracted by short-time Fourier transform (STFT). The second part, feature extraction and prediction, is performed by the network model we built. The network is a two-branch structure. In the branch with 1-D signal as input, we used the large kernel convolution structure to extract the spatial-correlation between different polar associations of EEG; in the branch with spectrogram as input, we use the module before the classification layer of ResNet18 as a feature extractor to obtain the spectrogram features. The features output from the two branches are connected and input to the Transformer. By Transformer encoder module captures the long-term dependencies of the EEG signal, allowing the network to learn time-correlation features of the input EEG. Finally the features were input the fully connected layers to predict the results.

Results: Our (CQUPT_FP_mana) method was evaluated using the challenge validation dataset, and we obtained the best challenge metric score of 0.21, 0.30, 0.42, 0.48 corresponding to 12 h, 24 h, 48 h and 72 h in the unofficial stage. Scores of 0.26, 0.40, 0.49 and 0.59 were obtained in local ten-fold cross-validation using only the open challenge training set corresponding to different times.

Conclusion and Outlook: The results show that the method performs well in Predicting Good and Poor Outcomes in Cardiac Arrest Patients. In the official phase, we will also try to use transfer learning to strengthen our model, trying to improve the model structure by using existing high-quality pre-trained models. Also try to add attention module to the model. Try to use multi-classifier voting to improve the prediction accuracy.