Predicting Coma Recovery After Cardiac Arrest With Residual Neural Networks

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Aims: Interpretation of continuous electroencephalograms (EEG) is a demanding task that requires the expertise of trained neurologists. However, these experts are not always available in many medical centers. As part of the George B. Moody PhysioNet Challenge 2023, we developed a method based on deep learning to analyze EEG data with the aim of recognizing patterns in EEG of comatose patients and predicting prognosis following cardiac arrest.

Methods: Our approach is a two-step pipeline that consists of a prediction model and a decision-making strategy. The prediction model is a residual neural network (ResNet-18) that extracts features and makes a prediction based on a short (5 minute) EEG recording. The provided dataset consists of such EEG recordings obtained hourly for each patient, with some data points missing. The model predicts prognosis for each recording of a patient separately. In the second step, a majority vote over the predictions determines the final prognosis.

Results: Based on 10-fold cross-validation on the training set, we achieved an average TPR of 0.677. During the unofficial phase of the challenge, our team ZIB_Visual achieved a TPR of 0.73 at 72 hours, resulting in the first place in the competition's leaderboard (shared with another team), TPR of 0.66 at 48 hours (rank 3 out of 172), TPR of 0.63 at 24 hours (rank 1 out of 172) and TPR of 0.19 at 12 hours (rank 30 out of 172).

Conclusion: We demonstrate that our suggested two-step pipeline offers competitive performance in predicting coma recovery after cardiac arrest. Despite its simplicity, our approach is effective and the proposed model learns to solve the task well even before the 72-hour mark.