EEG Signal Quality Filtering for Improved Prediction of Neurological Outcome after Cardiac Arrest

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Background: Accurate prediction of neurological outcome after cardiac arrest is critical in providing optimal care to comatose patients. Electroencephalography (EEG) monitoring has been established as a reliable tool for this purpose, but its interpretation is challenging and requires significant expertise and resources. Automated EEG analysis using machine learning has the potential to overcome these obstacles, but signal degradation due to artifacts and noise can hamper the accuracy of predictions.

Methods: We utilized the I-CARE dataset from PhysioNet, which contains continuous EEG recordings of 607 comatose cardiac arrest patients from seven hospitals. We applied a signal quality filter to exclude records with a quality score of less than 0.5 from the training set. We also used patient information as features to predict outcomes for patients without EEG data. The classification model used a random forest algorithm and performed 5-fold cross-validation.

Results: Our approach achieved a true positive rate (TPR) of 0.44, demonstrating a 15.84% improvement in performance compared to the approach without the signal quality filter (TPR = 0.36). In the unofficial phase, we achieved a score of 0.34 on the PhysioNet 2023 leaderboard (team name: ComaToss), representing a 21.43% improvement over the approach without the signal quality filter (TPR = 0.28).

Conclusion: Our study demonstrates that implementing a signal quality filter enhances the precision of automated EEG analysis in predicting neurological outcome following cardiac arrest. In future research, we aim to improve signal quality through the application of the denoising autoencoder method and employ a deep learning model utilizing the model's latent vectors as input.