Predicting Cardiac Arrest Recovery with Shallow and Deep Learning Models

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Introduction: Out of the 6 million cardiac arrests occurring globally each year, barely 10% survive. Most of the deaths are caused by severe brain injury. One conundrum is deciding who should be in intensive care for recovery. Shallow and deep learning classifiers may be useful to predict which patient would recover if kept in intensive care.

Methods: International Cardiac Arrest Research Consortium (I-CARE) data containing 607 patients were used in this study. The brain signal recordings were collected using an 18-channel electroencephalogram (EEG), recorded continuously over 72 hours. A total of 173 features were extracted from the 5 minutes recordings from each recording file. These features represented by patient information and spectral analysis including frequency bands, Hjorth parameters and Shannon entropy. Average was done for the features from multiple recoding files for the same patient. A random forest (RF) classifier was trained and tested using the extracted features. A deep learning model was also trained with only raw data from recordings with a quality score of 1. One sample from each recording size of 18x1000 was used as input to the model and labeled according to the patient for training. Testing process was implemented by dividing each patient recording into sections for majority voting. The models were trained and tested using five-fold cross-validation.

Results: The challenge score (True Positive Rate at False Positive Rate less than 0.05), F-measure, and accuracy of the shallow and the deep learning model after validation were 0.18±0.05, 0.51±0.01, 0.55±0.01; and 0.16±0.03, 0.78±0.01 and 0.79±0.03, respectively.

Conclusions: Shallow and deep learning classifiers are potential approaches for predicting the recovery from coma after the cardiac arrest. The shallow model achieved better results on the challenge score, but the deep learning had better outcomes on the F-measure and accuracy. An ensembled approach may further improve the results achieved.