Hybrid Feature Fusion with CNN for Predicting Prognosis of Postanoxic Comatose Patients

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As part of the George B. Moody PhysioNet Challenge 2023, our team, am_vision, aims to provide a Machine Learning(ML) based solution to predict the outcome of postanoxic comatose patients.

Methods: The Electroencephalography(EEG) signals of the patients are decomposed into four frequency bands: delta, theta, alpha, and beta. The Power Spectral Density(PSD) values of the bands are computed using Welch method by passing the entire five minutes of signal data without overlapping. The statistical features such as: maximum, minimum, mean, standard deviation values of the signal and frequency bands along with skew, kurtosis, and alpha-delta ratio, Shannon Entropy are extracted from the data and multiplied by quality scores of the signal as weights. These features along with the patient metadata were vectorized as input to the ML classifiers. Our further approach includes extracting features like Regularity, Spike frequency, Isoelectric patterns, Burst-Suppressions, and Identical bursts which show prominent relations with outcome even at 12 hours and 24 hours after the cardiac arrest. To compare our solution with the baseline model, we extend our investigation to build a hybrid neural networks which combines Convolution Neural Networks(CNN) and Bi-directional Long-Short Time Memory recurrent neural networks (Bi-LSTM) where features are automatically learned with CNN and historical trends are extracted using Bi-LSTM. The feature fusion of the two can be used as input to the ML model.

Results: The initial scores of the model tested in the hidden challenge data are 0.10, 0.18, 0.39, 0.51(with rank 37 on leaderboard) and cross validation scores on the training set are 66%, 70%, 72%, 71% for 12 hours, 24 hours, 48 hours, and 72 hours respectively. We plan to implement a hybrid featurizer and fusion methodology to capture long-term spatial and temporal patterns that are more predictive of such prognosis.