

QEEG-based Machine Learning Algorithm to Predict Cognitive Impairment After Acute Ischemic Stroke

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Introduction

- Stroke is one of the worldwide major cause of mortality and vascular dementia.
- Although CT or MRI are commonly used to detect the lesion location and severity, their predictive power for vascular cognitive impairment is rather limited.
- Specific frequency band, power ratio between different frequency band and symmetric index are strongly correlated with patients' following status[1],[2].
- We discuss which QEEG features are relevant to the 3-month cognition level and whether QEEG can predict patients' status after acute stroke with machine learning models.

Methods

- 96 EEG data of ischemic stroke subjects were labeled as cognitive impairment or normal.
- 19 channels of 10-20 system resting state EEG.
- Bad epoch rejected and ICA analysis using iSyncBrain[®].
- Spectrum power, power ratio, source cortical activity and imaginary coherence were calculated.

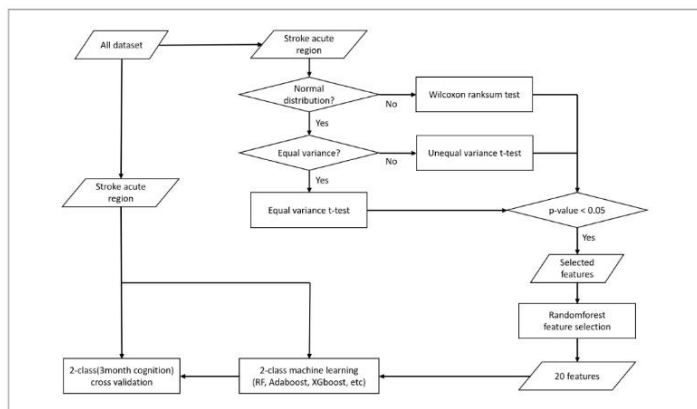


Fig. 1. The subjects clustered into 2 groups according to the laterality of delta wave dominance and then statistical analysis and feature selection were applied prior to machine learning classification.

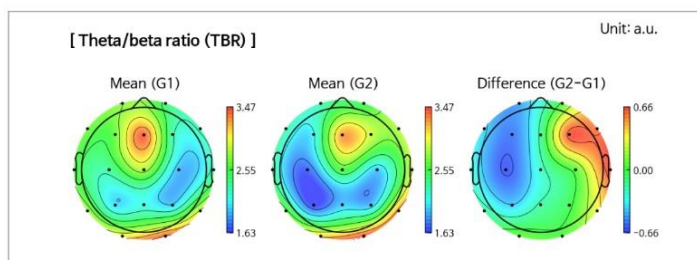


Fig. 2. Topographic map which shows ratio between theta and beta(TBR) of left delta dominance group(G1), right delta dominance group(G2) and difference between two groups.

Results

- Among 96 data, 11 were exclude because of bad signal quality, pre-stroke cognitive decline and unclear infarct region.
- 49 subjects were clustered as left delta dominance and 36 as right delta dominance.
- Prediction accuracy of 3-month cognition level was 85.71% and 88.89% for left and right group.

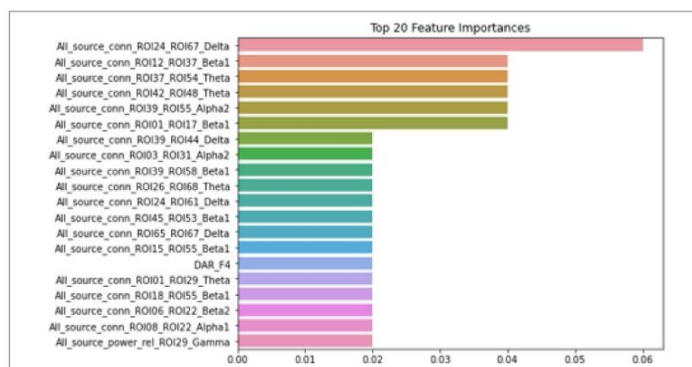


Fig. 3. Top 20 important features of left delta dominance group to predict subjects' 3-month cognition level

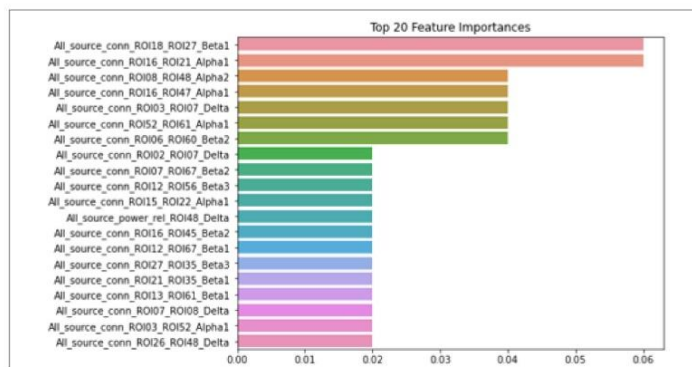


Fig. 4. Top 20 important features of right delta dominance group to predict subjects' 3-month cognition level

Conclusions

- At this study, we clustered into 2 group according to the laterality of delta wave dominance.
- When we trained independent 2 ML model for each group, we could get superior model validation score to single ML model for total subjects.
- In the next study, we will have to get more data and stratify the group more specifically according to the lesion of infarct to increase the predictive accuracy and differentiate the domain of cognitive impairment.

Acknowledgement

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