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## Feature selection method of EEG biomarkers for unipolar Major Depressive Disorder (MDD)

Aamir Saeed Malik, Wajid Mumtaz and Syed Saad Azhar Ali Universiti Teknologi Petronas, Malaysia

ajor Depressive Disorder (MDD), a leading cause of functional disability worldwide, is a mental illness. The clinical management of MDD patients has been challenging that includes an early diagnosis. The Electroencephalography (EEG)based studies for diagnosis have shown less clear clinical utilities and warrant further investigations. This research advocates the use of EEG as a biomarker for early diagnosis for unipolar MDD patients. More specifically, an improved feature selection and classification system involving pre-treatment EEG data termed as Intelligent Treatment Management System (ITMS) has been presented. The ITMS involved an integration of the most significant EEG features as input data. The study hypothesized that the MDD patients and healthy controls could be discriminated based on integrating the EEG alpha asymmetry and synchronization likelihood (the EEG measure to quantify the brain functional connectivity). The method helped during diagnosis of MDD patients and was termed as ITMS for diagnosis (ITMS-diagnosis). The proposed ITMS for depression includes a general Machine Learning (ML) framework for EEG feature extraction, the selection of most noteworthy features that could give highperformance classification models such as the Logistic Regression (LR), Support Vector Machine (SVM) and Naive Bayesian (NB) classifiers. Moreover, the proposed methods have been validated with EEG data involving 34 MDD patients (medicationfree) with a confirmed diagnosis of depression and a group of 30 age-matched healthy controls. In addition, the proposed method was validated with 10-fold cross validation (10-CV). Consequently, the EEG features for diagnosis such as the power of alpha band, alpha interhemispheric asymmetry and synchronization likelihood were extracted from the frontal and temporal regions. The features were found significant for both the MDD diagnosis. Furthermore, the proposed SVM method exhibited diagnosis accuracy=98.8%, sensitivity=98.6%, specificity=99.4% and F1-score=0.98. In conclusion, the classification results have proven the proposed ITMS useful for diagnosis of unipolar MDD patients.

aamir\_saeed@utp.edu.my