Determining the Level of Anxiety and Depression with Brain Signal Processing

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According to the researches, it turns out that human's activities are the results of the internal-neural activities of their brain. The reflection of such activities which are propagated throughout the scalp can then be acquired and processed. In this regard, EEG (Electroencephalography) is one of approaches to acquire and record brain waves. Recording brain signals, one can analyze them based on several various steps of the brain signal processing; generally including the data acquisition, pre-processing, feature extraction, on demand dimension reduction, and ed features classification. In terms of interesting research areas, researchers have employed different procedures to process such signals in various areas. Based on the recent investigations, it turned out that the majority of researches have been done in the applied medical science and BCI (Brain-Computer Interface). Particularly in the applied medical science for the epilepsy detection, level detection of the pain, anesthesia, and hypnotism, anxiety and depression, and etc too many researches have already been done among which the epileptic signal acquisition and analysis are considered significantly. Concerning the anxiety and depression disorder epidemic in societies and their dependency on the therapist's recognition, we became to step up in this way in order to give the therapist assistance through the improvement of the validity of the therapy. The purpose of the current study is to extract features patient and control individuals and then to classify them into two specific targets for assigning them to two levels of normal (healthy) and severe patient. In this respect, five controls and five patients were indexed by two levels of normal and severe patient based on their results of the DSM-IV psychology tests. Furthermore, their brain waves are recorded according to the 12-channel standard under an equal condition. In the Pre-process step, inevitable EOG artifacts are eliminated the raw signal and signals are segmented in specific time series. Based on the discrete

Wavelet Time-Frequency transform, with the Mother Wavelet SYM2, each segment is considered in one level of decomposition (partitioning) in the feature extraction phase. According to the knowledge of an expert, two representatives are ed each prototype by averaging the approximated coefficients of the Frontal area channels and the rest of areas separately. Afterwards, statistical features such as absolute average, variance, minimum, and maximum of the approximated coefficients are considered as four features both representatives of each prototype. Because of the strong dependency between them, the applied Decision Tree to extracted features for the classification of the two normal and patient classes is followed by the dimension reduction which is done based on LDA approach and the aforementioned extracted features reduced four to two dimensions. Subsequently, the resulted features are given to the SVM classifier with RBF core and the Gaussian function. Eventually, for the Machine Learning evaluation, k-fold cross algorithm with k = 10 is employed. In this project 25 wavelets are discussed categories of Coiflet, Symlet, and Daubechies in three decomposition levels for each prototype and then for every single wavelet in each level 50 parameters of sigma in the range of 0.1 to 5 are considered. Ultimately, the value of MSE for each branch regarding k = 10 times of classifier learning are computed. In conclusion, the whole process of the discrete wavelet of sym2 with the statistical extracted features in the first level of the decomposition, dimension reduction with LDA, and usage of the SVM classifier with the core RBF of the Gaussian function based on parameter 0.3

Keywords : Anxiety and Depression, Brain Waves, Feature Extraction, Feature Reduction, Classifier