Abstract

In this thesis, we present the design of a system, able to identify epilepsy seizures using EEG signals as inputs. A new neural network model called Multidimensional Radial Wavelon Feed-Forward Wavelet Neural Network (MRW-FFWNN) is proposed for classification of three classes of EEG related to epilepsy conditions: Ictal, Interictal and Healthy. The Discrete Wavelet Transform (DWT) and the Maximal Overlap Discrete Wavelet Transform (MODWT) are used to decompose the EEG signals into delta (δ), theta (θ), alpha (α), beta (β), and gamma (γ) sub-bands. Each EEG signal is represented by a feature vector of six components, built using the mean, absolute median and variance of delta (δ) and alpha (α) sub-bands, because the rhythmic activity associated with the onset of seizure activity is composed of strong frequency components of these sub-bands. We have used binary-tree and one-vs-one (OVO) decomposition strategies with two aggregation methods (Voting strategy and Weighted voting strategy) to obtain the predicted class of EEG signals. In this research, cross correlation coefficient was used to evaluate the degree of similarity between possible mother wavelets and EEG signals representing ictal, interictal and healthy states, and then the most appropriate mother wavelet was chosen. We compare the classification results of the proposed model with other wavelet-based neural networks. The best result of classification of three classes of EEG signals was of 96.67 % of accuracy using a binary-tree strategy based on our proposed model (MRW-FFWNN). Our assessment metrics were calculated using 3-fold validation in order to measure the generalization ability of the proposed classifier in the accuracy of classification.