ABSTRACT

Epilepsy is caused by abnormal brain tissue activity and effecting parts of the cerebral cortex to experience excessive synchronization. The main symptom of epilepsy is seizure that attacks suddenly and occurs several times. Unpredictable seizures allow the sufferer to not survive. Patients with epilepsy are still doing the traditional and troublesome manual seizure prediction. Therefore, automatic seizure prediction would help patients prepare for upcoming seizures in a short period of time.

Seizures can be predicted by analyzing the recordings of electroencephalogram (EEG) signals. The epileptic EEG recordings consists of three kinds of condition, namely pre-ictal, ictal, and interictal. Seizure prediction is performed by detecting the pre-ictal condition. Machine learning (ML) algorithms have the potential to predict seizures as early and accurately as possible. In this study, the EEG signals were extracted using the multiscale empirical wavelet transform (EWT) and fluctuation-based dispersion entropy (FDispEn) methods. The dataset used is Temple University Hospital EEG Seizure Corpus (TUSZ). The multiscale method plays a role in the decomposition stage using EWT. Then, the features are extracted from the decomposed signal using FDispEn. This research also compares the use of EWT with empirical mode decomposition (EMD), and FDispEn with permutation entropy (PE). Then, the features are classified with support vector machine (SVM) to obtain the seizure prediction results.

The type of seizure studied was Generalized Non-specific Seizure (GNSZ) with 28 training data and 9 testing data. Performance of the methods was evaluated by seizure prediction horizon (SPH), average false prediction rate (FPR), and sensitivity (SE). The lowest mean FPR, highest SE, and longest SPH were obtained by the EMD–FDispEn method, which were 0.54 h^{-1}, 100%, and 2 minutes, respectively. FDispEn is able to produce features that are more discriminatory and have the potential for real-time applications. EWT is able to predict seizure effectively, yet could not be more reliable than EMD.

Keyword: *Epilepsy, seizure prediction, EEG, EWT, FDispEn, SVM.*