Motivation

- It is difficult to provide a good balance between high seizure prediction accuracy (100%) in advance with low false prediction rate (FPR) calculated in hour time unit using all patients by a prediction algorithm.
- For a given seizure prediction horizon (SPH), it is also difficult to provide seizure prediction performance above the chance level for all patients by a particular method.

Therefore, more research should be conducted in this scope to achieve better accuracy for the advanced prediction with low FPR.

Proposed Method

- In this paper, an effective epileptic seizure prediction method is proposed which exploits undulated global and local features together with a regularization technique to predict the seizure onset in advanced.
- In general, pre-processing, features extraction, classification, regularization (i.e., post-processing) and decision function are the possible steps for predicting seizure in advance from Electroencephalogram (EEG) signals.

Fig. 1. Generic block diagram of a seizure prediction process.

- The proposed method is considered with a certain range of artifacts tolerance without filtering technique.
- Global feature is extracted using phase correlation between two consecutive epochs of a signal and local feature is extracted using a weighted cost function comprising fluctuation and deviation within an epoch.
- The popular support vector machine (SVM) classifier is used to classify the interictal, preictal, and ictal signals.
- To purify the classified output, a two-step post-processing regularization technique is also applied for the final output.

Fig. 2. Extracted global feature using phase correlation.

Experimental Results

The proposed method outperforms six existing relevant state-of-the-art methods considering the balance between the prediction accuracy (%) and FPR.

Fig. 4. Original EEG signals comprises interictal and preictal/ictal (prIc) periods.

Fig. 5. Mean energy concentration ratio (MECR) of interictal and preictal/ictal periods (prIc) using six channels.

Fig. 6. Energy of cost function of fluctuation and deviation (ECFD) of interictal and preictal/ictal (prIc) periods using six channels.

Fig. 7. Classified results of each epoch of interictal and preictal/ictal (prIc) periods.

Fig. 8. Decision on classified values after windowing of interictal and preictal/ictal (i.e., prIc) periods.

References


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