Detection and Prediction of Epileptic Seizures Using Machine Learning Model

Nouf AlFouzn, Arwa Almutairi(✉), Sara Alwadyy, Shatha Almutairi, and Noore Zahra

College of Computer and Information Sciences, Princess Noura Bint Abdulrahman University, Riyadh, Saudi Arabia
arwa.ba00@gmail.com, nsmahamidrasool@pnu.edu.sa

Abstract. Epileptic seizures are caused by abnormal electrical activity in the brain manifesting in a variety of ways and can affect the patient's health. The seizure peak is reached after a sequence of stages. Using the Electroencephalogram (EEG) output, this work aims at predicting the next seizure by detecting the onset of the preictal state, which is the state immediately before the epileptic seizure. In this project, the EEG measurements of electrical activity in the brain are collected from CHB-MIT database. Wavelet analysis is carried out to separate the brain's signals by decomposing the signals into different frequency bands, namely, low-pass and high-pass sub bands. This helps in capturing the signals of interest with few large magnitudes. Noise is then removed from the collected EEG signals by removing the artifacts that deteriorated the original recordings. Most artifacts are caused by body movements, such as the electrical activity of muscle tissue recorded by Electromyography (EMG), the electrical signals in the heart recorded by Electrocardiogram (ECG), and blinking eyes. The energy signals are computed as needed for the feature extraction step. Finally, the machine learning classifiers; K-Nearest Neighbor (KNN), Support Vector Machine (SVM), and Random Forest (RF) algorithms are employed to classify the signals into seizures or non-seizures.

The three classifying techniques, KNN, SVM, and RF are evaluated using an accuracy score function. The classifiers' performance evaluation yields the accuracies of 88%, 84%, and 94% for KNN, SVM, and RF respectively. Therefore, Random Forest (RF) proved to have the highest accuracy among the classifiers tested based on the accuracy method used.

Keywords: Epileptic seizure · Wavelet analysis · Electroencephalogram · Support vector machines · Random Forest (RF)

.

K. Daimi and A. Al Sadoon (Eds.): ACR 2023, LNNS 700, p. 656, 2023.
https://doi.org/10.1007/978-3-031-33743-7_53