

DETECTION OF SEIZURE TYPES FROM THE WAVELET ENERGY OF SCALP EEG

Joseph Mathew, N. Sivakumaran, P.A. Karthick

National Institute of Technology, Tiruchirappalli, TamilNadu, India

Corresponding Author: Joseph Mathew

Email: jchackompally@gmail.com

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ABSTRACT

Epilepsy is a disabling and devastating neurological disorder, characterized by recurrent seizures. These seizures are caused by the abrupt disturbance of the brain and are categorized into various types based on the clinical manifestations and localization. Seizures with clinical manifestations require immediate medical attention. In this work, an attempt has been made to differentiate the seizures with and without clinical manifestations using wavelet energy of scalp EEG signals. For this purpose, scalp EEG records from the publically available Temple University Hospital (TUH) database are considered in this work. The first four seconds of scalp EEG during seizure is subjected to seven-level Daubechies (db4) wavelet decomposition and energy is extracted from the resultant coefficients. These features are used to develop *k-Nearest Neighbor (k-NN)* classification model for the detection. The results show that the energy associated with most of the sub-bands exhibits significant difference ($p < 0.05$) in these two types of seizures. It is found that the machine learning model based on *k-NN* achieves an accuracy of 87.6% and precision of 87.3%. Therefore, it appears that the proposed approach could aid in detecting life-threatening seizures in clinical settings.

Keywords: Epilepsy, EEG, seizure, wavelet

INTRODUCTION

Epilepsy is a neural disorder that affects about 50 millions of people worldwide [1]. Electroencephalography is a technique that records the electrical activity of the brain and it has significant

by contributions in the diagnosis of neurological diseases such as epilepsy [2]. Recurrent

seizures caused by epilepsy are due to the temporary electrical disturbance of the brain. These events are found to be in many variants and International League Against Epilepsy (ILAE) has categorized them based on the nature and localization of seizure onsets such as generalized, focal, unknown, motor, and non-motor [3]. Another classification based on the manifestation of seizure categorized as electro clinical and electrographic [4]. Electrographic Seizures (EGSZ) do not exhibit any clinical manifestations or symptoms, whereas electro clinical seizures have complex clinical symptoms. These manifestations may cause the patient to be physically injured and sometimes this lead to death if patient does not receive immediate medical attention [5].

Identification of the type of seizure has a greater importance in deciding the treatment strategies of epilepsy. Once patient is admitted into the hospital, the patient will be under observation and video EEG (VEEG) is recorded for the annotation and identification. Many hospitals follow intermittent reviewing and that takes lot of clinical time. Rapid identification of seizures (EGSZ) [6] is necessary for a patient in managing the electro clinical seizures, sometimes lead to a life threatening situation due to the convulsive and non-convulsive activities during the onset [7].