International Conference on Engineering, Trends in Engineering, Science, Humanities and Management (ICETESHM – 2024)
31st March, 2024, Karol Bagh, New Delhi, India.

CERTIFICATE NO: ICETESHM /2024/ C0324334

Wavelet-Based Feature Extraction of Epileptic EEG Signals Using Haar, Db4, and Sym8 Wavelets

Hude Tejaswi Kiran
Research Scholar, Department of Computer Science Engineering, Vikrant University, Gwalior, M.P.

ABSTRACT

Electroencephalography (EEG) is a widely used non-invasive technique for monitoring the electrical activity of the brain and plays a significant role in the diagnosis of neurological disorders, particularly epilepsy. Accurate detection of epileptic seizures depends largely on the extraction of meaningful features from EEG signals, which are inherently nonlinear, non-stationary, and often affected by noise and artifacts. Conventional time-domain analysis is inadequate for capturing the complex characteristics of EEG signals; therefore, advanced signal processing techniques are required. This study focuses on wavelet-based feature extraction of epileptic EEG signals using the Discrete Wavelet Transform (DWT) with three widely used wavelet families: Haar, Daubechies-4 (db4), and Symlet-8 (Sym8). Initially, EEG signals are preprocessed to remove noise and artifacts, improving signal quality for analysis. The DWT is then employed to decompose the EEG signals into multiple frequency sub-bands, enabling simultaneous analysis in both the time and frequency domains. Statistical and energy-based features, including mean, standard deviation, variance, energy, entropy, root mean square (RMS), skewness, and kurtosis, are extracted from the wavelet coefficients to characterize normal and epileptic brain activity effectively. A comparative analysis of Haar, db4, and Sym8 wavelets is conducted to evaluate their ability to represent epileptic EEG signals and extract discriminative features. The study aims to determine the most suitable wavelet for feature extraction based on its capability to preserve important signal characteristics and improve the quality of the extracted features. The proposed wavelet-based feature extraction framework provides a reliable foundation for subsequent machine learning and deep learning classification models used in automated epileptic seizure detection. The findings of this study are expected to contribute to the development of efficient computer-aided diagnostic systems, enhancing the accuracy of epilepsy diagnosis, reducing the workload of neurologists, and supporting intelligent healthcare applications through improved EEG signal analysis.

Keywords: *Electroencephalography (EEG), Discrete Wavelet Transform (DWT), Haar, Db4, and Sym8 Wavelets, Feature Extraction, Epileptic Seizure Detection.*