# Forecasting Epileptic Seizures Using EEG Signals Wavelet Transform and Artificial Neural Networks

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***Abstract*** **– Electroencephalograms EEG are signal records of electrical activity of brain neurons EEG which is a compulsive tool used for diagnosing neurological diseases such as epilepsy besides of techniques such as magnetic resonance and brain tomography BT that are used for diagnosing structural brain disorders This paper describes a novel approach for forecasting epileptic seizure activity by classifying these EEG signals The decision making consists of two stages initially the signal features are extracted by applying wavelet transform WT and then an artificial neural network ANN model which is a supervised learning based algorithm classifier used for signal classification Wavelet transform is an effective tool for analysis of transient events in non stationary signals such as EEGs The performance of the ANN classifier is evaluated in terms of sensitivity specificity and classification accuracy The obtained classification accuracy confirms that the proposed scheme has potential in classifying EEG signals**

***Keywords*** **– Electroencephalogram EEG Discrete Wavelet Transform DWT Artificial Neural Networks ANNs Epilepsy Seizure forecasting Seizure Prediction**

## I INTRODUCTION

The human brain being a complex system exhibits rich spatiotemporal dynamics and bio medical signals are the observations of neurological activities forming inside the brain Among numerous techniques used for probing human brain dynamics electroencephalography EEG is an important bio medical signal which provides a direct measure of cortical activity with millisecond temporal resolution Especially it is useful in diagnosing neurological disorders such as epilepsy []

Epilepsy is a chronic illness that affects approximately to of the world's population [] and epileptic seizures are the results of the transient and unexpected electrical agitations of the brain which involves uncontrolled neuron firings including brief transient discharges spikes or combinations such as spike wave discharges But the occurrence of an epileptic seizure is unpredictable and also its process has not yet been understood completely Sometimes seizures may remain unnoticed depending on their presentation and it can also get confused with other events such as a stroke []

This research focuses on developing a system for forecasting epileptic seizures using digital EEG signals Wavelet Transform which is a digital signal processing technique for time frequency analysis of the signal and Artificial Neural Network models for the classification using Wavelet coefficients Signal processing has also been made use of to deal with miscellaneous issues in EEG analysis such as data compression detection and classification noise reduction signal separation and feature extraction [] During the process of forecasting epileptic seizures these raw EEG signals are processed in the purpose of extracting certain features for classification in the second step

## II RELATED WORK

Analysis of the electroencephalogram EEG records provides valuable means for detecting widespread brain disorders Therefore EEGs have become the most utilized bio medical signal to clinically assess brain activities According to the current context the detection of epilepti form discharges in the EEG record is an important component in the diagnosis of epilepsy EEG systems usually generate large amount of data Although early on EEG analysis was restricted to visual inspection of the EEG signal it became impossible to analyse large amount of data efficiently and effectively since there is no definite criterion evaluated by the experts Along with that visual inspection is insufficient when alpha activity is dominant The EEG spectrum contains some characteristic waveforms that fall primarily within four frequency bands—delta – Hz theta – Hz alpha – Hz and beta – Hz [] Therefore when alpha activity is dominant delta and theta activities get unnoticed

The results of the studies in the literature have demonstrated many techniques for feature extraction of discrete EEG time signals Fast Fourier Transform FFT [] Wavelet Transform WT or Discrete Wavelet transform DWT [] Independent Component Analysis ICA [] and AutoRegression AR are some of the reported technologies by other researchers

According to Jahankhani Kodogiannis and Revett [] representations based on a Fourier transform have been applied since the early days of automatic EEG processing Although such methods have proved to be beneficial for various EEG characterizations Fast Fourier transform FFT suffers from having large noise sensitivity [] FFT also requires longer duration data records for efficient extraction of EEG features coefficients and it has a single set of basis functions which utilizes just the sine and cosine functions [] According to Babuji Vidhya and Sumesh [] FFT gives a global representation of the EEG signal and is band limited making it less productive in analysis of non–stationary signals and transient detection

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