# ABSTRACT

Approximately 50 million individuals worldwide suffer from epilepsy, a common neurological illness. Due to abnormally high levels of electrical activity in the brain, which may result in seizures, this disease is typically accompanied by momentary indications or symptoms. Our movement, thoughts, and memories are all controlled by electrical pulses that our brain continuously produces and transmits through neurons. Neurons typically fire individually or in small groups, but throughout an epileptic seizure, lots of neurons activate at once, 500 times faster than usual. The messages that the brain delivers to the rest of the body are jumbled by the large, abrupt discharges in neural brain activity that epileptic seizures cause. This might result in potentially fatal effects that include uncontrollable movements, feelings, emotions, as well as a brief loss of awareness and even death. Therefore, catching epileptic seizures early can greatly enhance the quality of life for those who are suffering from them. A neurologist evaluating scalp electroencephalogram (EEG) signals is the most frequent method used to identify seizures. The contamination of the recordings by physiological and non-physiological resources, as well as the resemblance of seizure spikes to regular EEG waveforms, make it time-consuming to visually inspect the recordings. As a result, a generalised, automatic system for detect seizures has been created.

Seizures in patients with epilepsy are detected from EEG signals classified automatically utilising signal processing methods. To reduce the risk of consequences linked to seizures, epilepsy must be accurately diagnosed. However, the sensitivity and accuracy of the currently accessible automatic signal recognition methods are poor.

In the first study, a method for automatically classifying seizure from EEG signals is offered to achieve improved classification results. The proposed method enhances detection performance by utilizing the Variable Gaussian filter (VGF) in conjunction with the social spider optimization algorithm (SSA) (SSA-VGF), the Empirical Wavelet Transform (EWT) for extracting features, K-Principal Component Analysis (K-PCA) for reducing features, and the Fuzzy logic embedded RBF kernel based ELM algorithm (FRBFELM) for signal classification. To remove noise artifacts from the provided EEG signals, the SSA-VGF method is used. EWT is utilised to extract features, and the K-PCA technique is used to condense the size of the extracted features. The FRBFELM classifier is then used to categorise the signals as either epileptic or normal. Peak Signal-to-Noise Ratio (PSNR), sensitivity, accuracy, and specificity metrics are used to assess the performance of the suggested approach. The proposed methods performance indicators are 98.44%, 98.48%, and 98.51%.

In this second investigation, time-frequency indicators could potentially predict patterns of termination by analyzing the temporal and spectral aspects of intracranial EEG (iEEG) during epileptic seizures. A deep learning model categorizes burst suppression and continuous bursting in multi-channel iEEG arrays during epileptic episodes. The 1-D representation of Morlet wavelet decomposition of EEG signals is precisely divided into time segments. The resulting coefficients are then evaluated for their median and variance after fitting them with a generalized Gaussian filter (GGF). The EEG signals provided are denoised and improved using the SSA-GGF approach. Feature extraction is performed using the Morlet Wavelet Transform (MWT), in which the raw time series data of seizure events broken down into time-frequency representations. Then the extracted feature sizes are reduced through K-PCA. To achieve accurate classification outcomes, an automated FRBFELM method of signal categorization for detection seizures from EEG signals is taken as per the previous study. Finally, the signals are classified as epileptic or normal using the scale parameter of the GGF and the FRBFELM classifier. The simulative analysis of the projected approach is estimated using metrics such as PSNR, sensitivity, accuracy, and specificity. The suggested approach achieves performance events of 98.84%, 98.8%, and 98.94%.

In the third study, the modification is implemented in the feature extraction module. The SSA function enables a distributed update of the spatial data used by the search agents. In order to uncover both global and local answers for the efficient optimised filtering process, deep search is used. The EWT features and histogram features are obtained by using a more sophisticated feature selection technique. An improved entropy K-PCA dimensionality function is then used to decrease the features, which improves the trade-off between exploration and exploitation. This has the potential to increase the final output's categorization accuracy. In relation to the datasets, the approach that is modified based on relative energy and mean frequency has helped with the identification of useful discriminative signal features. It is used to empirically identify the fundamental oscillatory components in a signal based on their unique time scales. The energy to entropy ratio of the reconstructed EEG signals following dimensionality reduction also automatically determines the number of major components for a particular individual. This type of enhancement is adapted in this module along with the FRBFELM performances.

As the final part of research, a different method termed to be EK-PCA (Entropy based K-PCA) that uses entropy calculation to reduce the dimensionality of EEG signals. The energy to entropy ratio of the reconstructed EEG signals allows for the automatic determination of the best number of main components for a particular subject. In extended type of K-

PCA, there is as the adaptation progress along with the fuzzy-based entropy clustering module (FECM). The proposed work is validated with the combination of MWT and the feature selections based on above-mentioned adaptation, which is combined further with the FRBFELM module as a final classifier for better implementation outcomes.