Project Synopsis: Improving Efficiency and Accuracy of Epileptic Seizure Diagnosis with Machine Learning

We have developed a Machine Learning (ML) App to significantly reduce the time taken by neurologists to accurately identify and characterize epilepsy types, based on Electro-Encephalography (EEG) readings.

Epilepsy is the second most prevalent neurological condition in India, with its incidence leading to osteoporosis, fractures and poor health among afflicted individuals. Early and accurate detection and classification of epilepsy by neurologists using EEG readings goes a long way in mitigating the impact of epilepsy by 70% on patient health, by focusing on treatment pathways aligned to classified epilepsy.

We collated publicly available EEG data from sources such as Temple University Hospital (TUH) and Massachusetts Institute of Technology (MIT) hospital using bandpass filtering to eliminate EEG data noise arising out of eye movement, muscle activity and electrical interference.

Post data-cleansing, we built the ML algorithm to capture time-domain and frequency-domain features from EEG data such as mean, variance, skewness, kurtosis, standard deviation towards developing wavelet coefficients using Discrete Wavelet Transform (DWT). We trained the ML algorithm, using the Long Short-Term Memory (LSTM) network model and Synthetic Minority Over-Sampling Technique (SMOTE), on the cleansed data sets and diagnosis outcomes for the same to ensure the Model learns well from all data types to identify seizures and efficiently classify seizure types.

We ran the Epilepsy Diagnosis Efficacy (EDE) app on 29,000 EEG data-sets and observed an 85% reduction in diagnosis time and 92% accuracy in the classification of epilepsy.

The EDE app has the potential to significantly improve diagnosis and treatment pathways for epilepsy patients improving their forward health. Going forward, our focus will be on handing multiple EEG configuration types, improving classification accuracy-at-speed and superimposing multi-test instance EEG datasets towards assessing treatment efficacy over time.