

# **Using different ML and SP techniques to predict epileptic seizures and diagnose epilepsy from EEG signals.**

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## ***Project Description:***

Epilepsy is a disorder that causes repeated and unprovoked seizures, and it is the fourth most common neurological disorder affecting about 3.4 million people in the US alone.

Electroencephalograms (EEGs) are the most common test used to diagnose epilepsy as they record the electrical activity in one's brain. Those with epilepsy often have changes in their brain waves even when they are not actively having a seizure, so by analyzing the EEG recordings of those with epilepsy before a seizure, the goal would be to create an efficient and effective algorithm to predict seizures using various ML and SP techniques. Also, with the knowledge that even without having a seizure, a person with epilepsy still may have abnormal brain wave patterns, a secondary goal would be to develop an algorithm to help determine if a patient has epilepsy.

## ***Dataset:***

The dataset I plan to use is the Epileptic Seizure Recognition dataset available on Kaggle. It consists of 2300 with epilepsy and 9200 that do not have epilepsy. This dataset should allow me to complete both tasks of predicting epileptic seizures and diagnosing epilepsy.

## ***Machine Learning and Signal Processing Methods:***

The first method I would like to employ is by first taking the EEG recordings and applying both a Fourier Transform and Wavelet Transform to the original time-domain signals. I believe that working with the signal in the frequency domain or in the time-frequency domain will allow my ML model to perform better.

The next method would be implementing feature selection. Since the EEGs have multiple channels per recording, it would be useful to not only determine which EEG channels are more useful, but also which features or measures within the channels would be most useful.

Finally, the last method would be choosing which classification technique would yield the best results. The ML algorithms to be tested are SVM and multilevel perceptron (MLP).

## ***Overview of Steps:***

First, I will take the Fourier Transform and Wavelet Transform to the EEG dataset. Second, I will implement feature selection for each domain (Time, Frequency, Time-Frequency). Third, I will test the feature selected time domain, frequency domain, and time-frequency domain data in each of the three ML classification techniques (SVM and multilevel perceptron). These would be done for both seizure prediction and epilepsy diagnosis, so I will implement it for seizure prediction first, then, if time permits, will implement it for epilepsy detection as well.

***Expected Results:***

I expect that using the data in the frequency domain or in the time-frequency domain will outperform the data in the time domain. I also believe that a MLP would outperform the SVM classification.