**Review on Graph neural networks for improved Electroencephalographic (EEG) Seizure Analysis**

Automated seizure detection and classification:

Challenges –

1. Representing non-Euclidean data Structure in EEG.
2. Accurately classifying rare seizure types.
3. Lacking quantitative interpretability approach to measure model ability.

This can be achieved by-

1. Proposing EEG graph structure to capture brain connectivity.
2. Proposing self-supervised pretraining method that predicts preprocessed signals to improve model performance.
3. Proposing quantitative model interpretability approach to assess model’s ability to localize seizures within EEG.

Workflow:

EEG electrode placement ----- > Distance based EEG graph ------> Correlation EEG graph  
 ---- >Model & Predictions

1.

Creating EEG graph structure (1) the natural geometry of EEG sensors or (2) dynamic connectivity in the brain.

2.

A self-supervised pre-training strategy to further improve the recurrent GNN model performance.

3.

A quantitative model interpretability analysis that can be used to assess a model’s ability to localize seizures.

4.

Providing valuable insights

Why Graphs?

* Several studies have done on automated seizure detection or classification. However, several challenges remained unaddressed.
* Most recent studies use CNN but it ignores natural geometry of EEG electrodes & connectivity in brain network.
* Graphs are a data structure that can represent complex non-Euclidean data.

Why Self Supervised learning?

* Training ML models that perform well on these rarer seizure classes using traditional supervised learning is challenging.
* An alternative, self-supervised training strategy improves model performance on data with imbalanced labels.
* Self-supervised pre training can help improve graph model performance on rare seizure types.

Seizure detection & Classification-

* Previous works were qualitative visualization for model interpretability. This study proposes the quantitative model interpretability analysis that can be used to access a model ability to localize seizures

O/P-

Displaying the identified seizure regions on raw EEG signals & EEG Graphs.