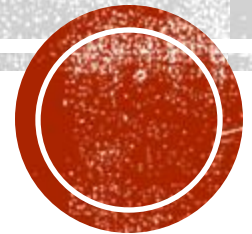


kaggle

**HMS**



# INTRODUCTION

- **Goal:** Develop an AI model to detect and classify seizures and harmful brain activity from EEG signals of critically ill hospital patients.
- **Data:**
  - Source: Hospital EEG recordings
  - Patient Status: Critically ill
  - Signal Type: Electroencephalography (EEG)
- **Evaluation:** Kullback-Leibler divergence between predicted probabilities and observed targets.
- **Impact:** Enable automated monitoring and early detection of critical neurological events.



# SUBMISSION FILE

	eeg_id	seizure_vote	lpd_vote	gpd_vote	lrda_vote	grda_vote	other_vote
0	3911565283	0.009433	0.024104	0.001578	0.30751	0.05186	0.605514



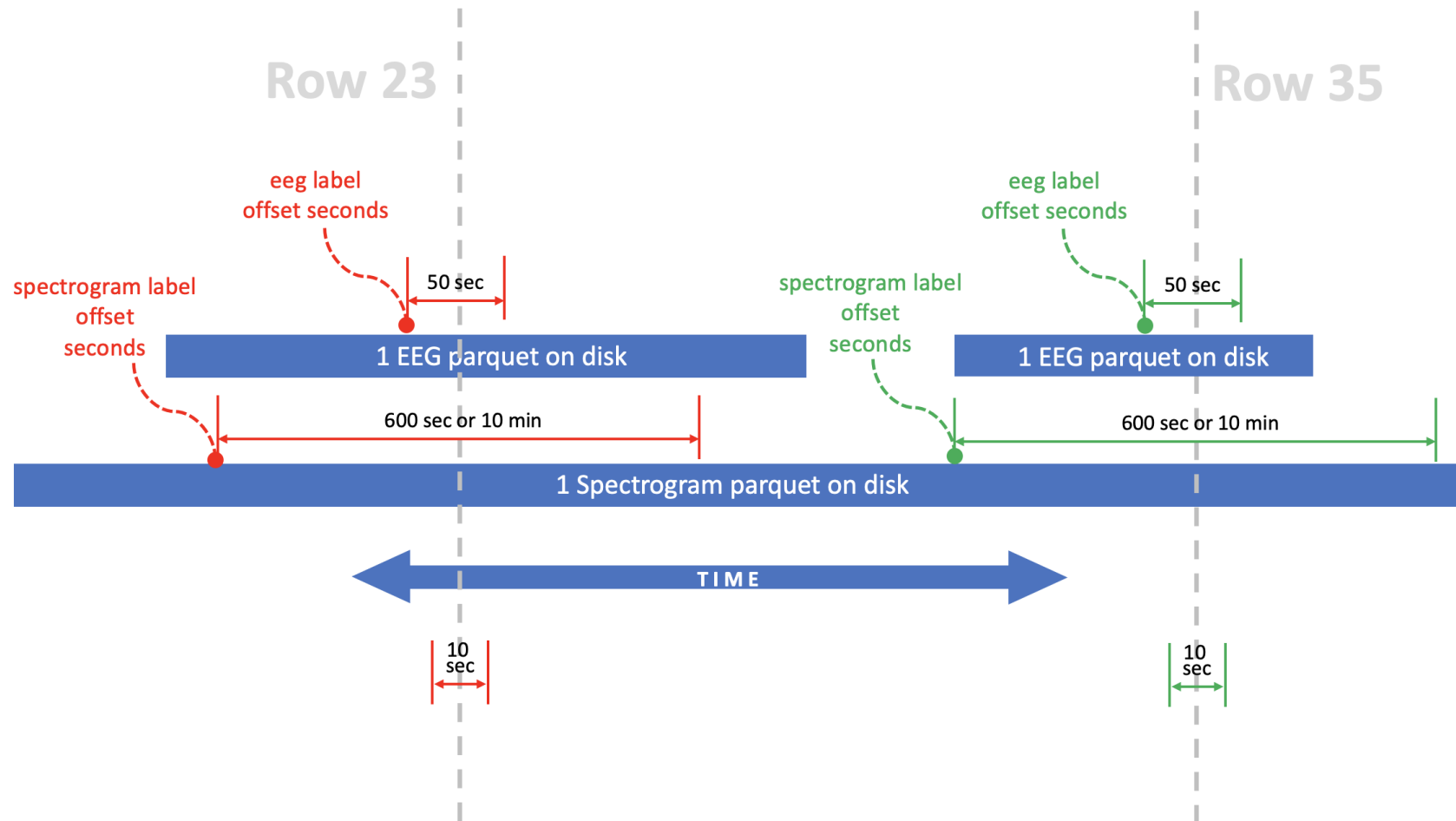
# DATASET OVERVIEW

## **train.csv**

- 106,800 total records
- 17,089 unique EEG IDs
- 11,138 unique spectrogram IDs



# DATA ANALYSIS

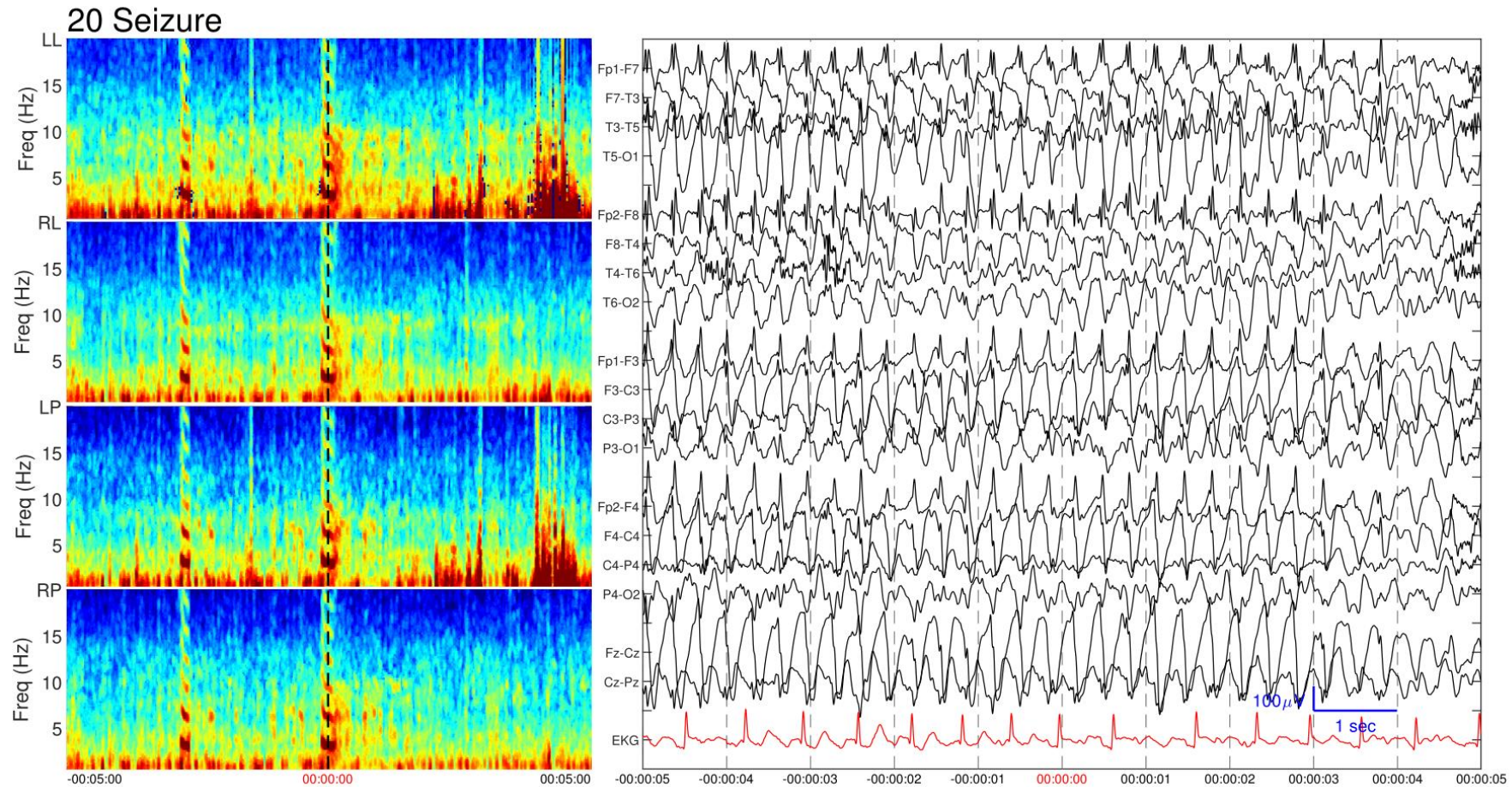


# TRAIN.CSV

eeg_id	eeg_label_offset_seconds	expert_consensus	seizure_vote	lpd_vote	gpd_vote	lrda_vote	grda_vote	other_vote
2578018731	0.0	Other	0	0	0	0	0	1
2578018731	20.0	GRDA	0	0	2	0	9	2
2578018731	26.0	GRDA	0	0	2	0	9	2
2578018731	32.0	GRDA	0	0	2	0	9	2



# DATA ANALYSIS





# OVERALL SOLUTION OVERVIEW

## **Model Architecture:**

- 8 models in ensemble

## **Data Sources:**

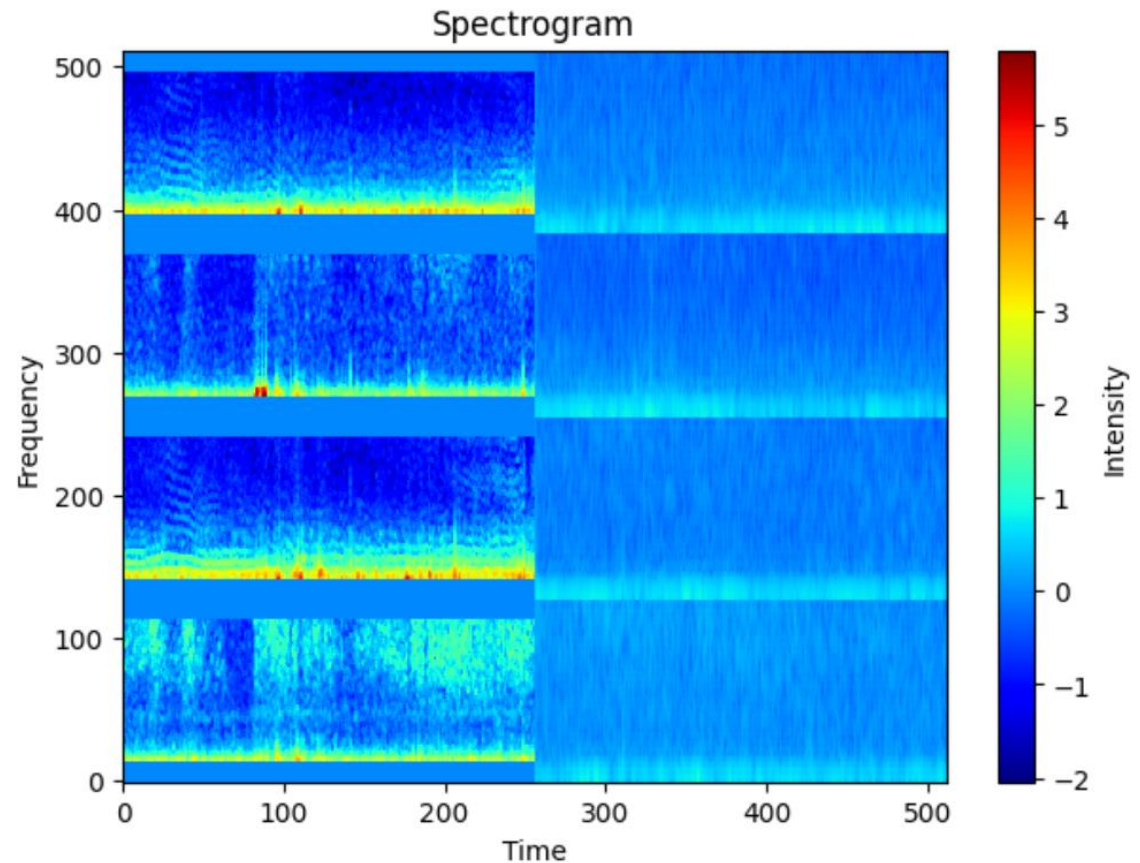
- Raw EEG signals
- Kaggle spectrograms
- EEG-derived spectrograms



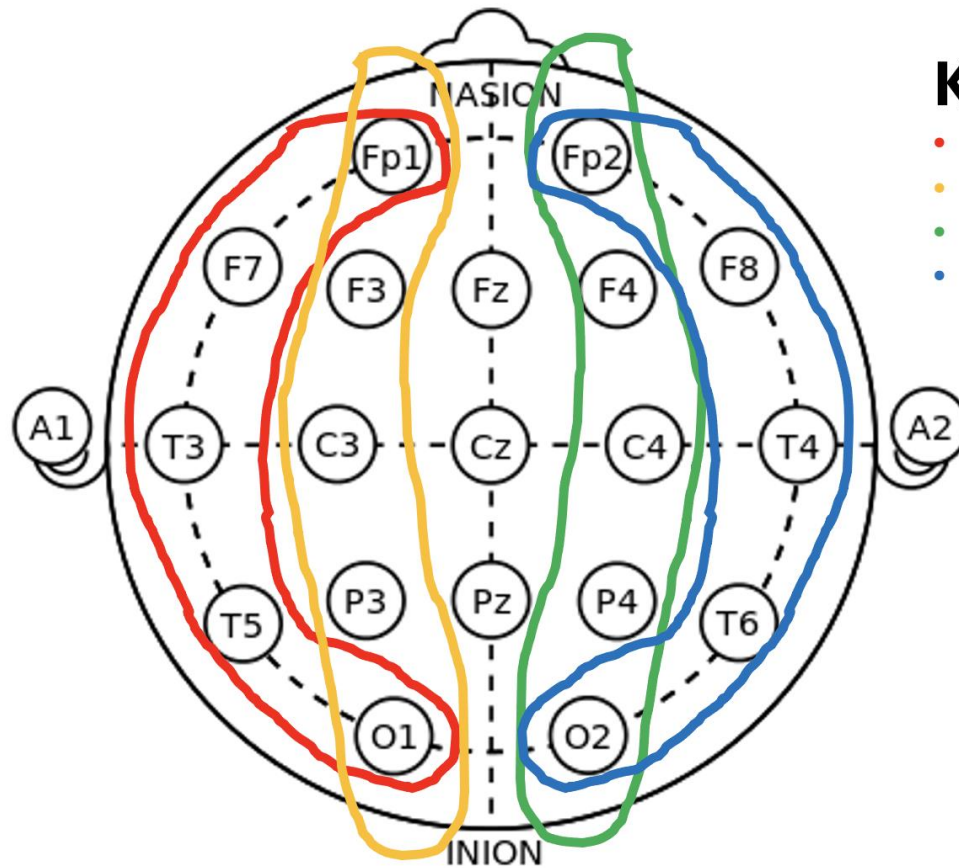


# MODEL1+MODEL2 :

- Kaggle spec :10 min
- EGG to spec :50s



# MODEL1+MODEL2:



## KEY

- LL - Left Temporal Chain
- LP - Left Parasagittal Chain
- RP - Right Parasagittal Chain
- RL - Right Temporal Chain



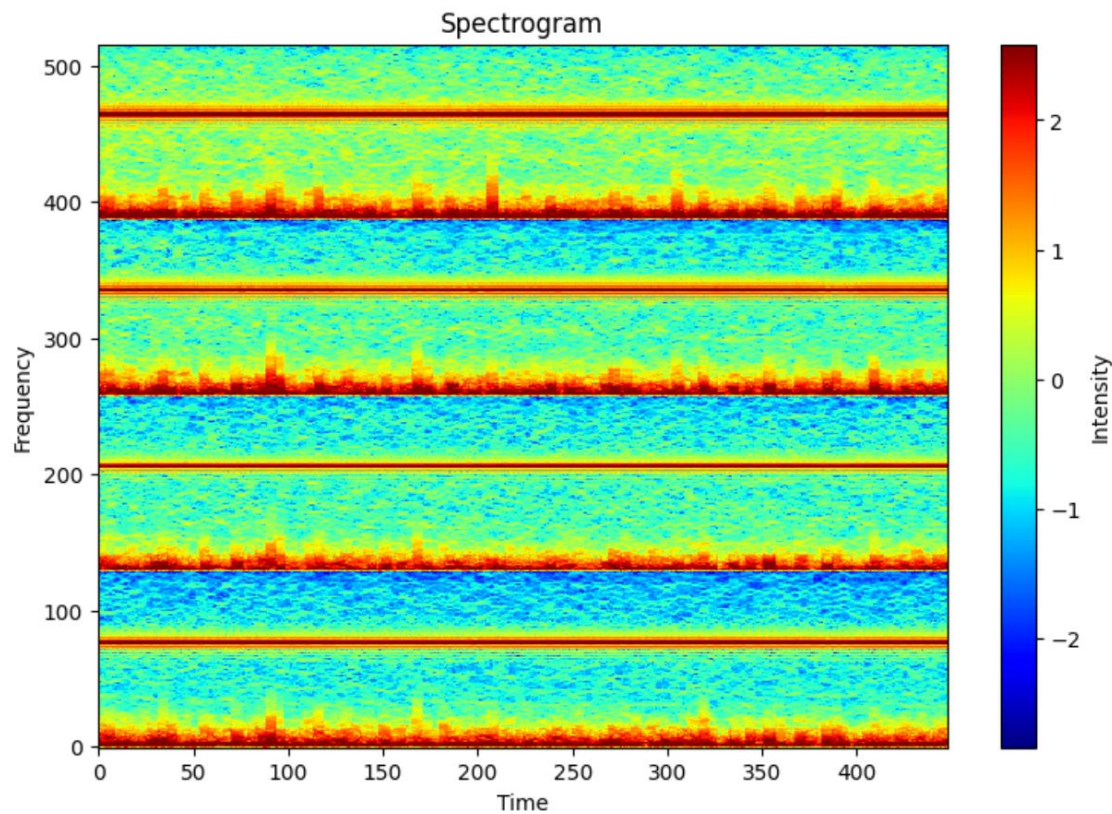
# MODEL1+MODEL2 :

## **Training Strategy:**

- Select unique rows by EEG ID and consensus voting from training set
- 10-fold cross-validation training approach
- Model: TF-EfficientNetV2-S
- Augmentation: Time and frequency masking
- KL Loss function
- 2-stage training process



# MODEL3+MODEL4+MODEL5+MODEL6 :



## ■ EEG to spec: 50s

LL Spec = ( spec(Fp1 - F7) + spec(F7 - T3) + spec(T3 - T5) + spec(T5 - O1) )/4

LP Spec = ( spec(Fp1 - F3) + spec(F3 - C3) + spec(C3 - P3) + spec(P3 - O1) )/4

RP Spec = ( spec(Fp2 - F4) + spec(F4 - C4) + spec(C4 - P4) + spec(P4 - O2) )/4

RL Spec = ( spec(Fp2 - F8) + spec(F8 - T4) + spec(T4 - T6) + spec(T6 - O2) )/4

## ■ EEG to spec: 50s+10s



# MODEL7 :

## ■ Raw EEG

```
map_features = [  
    ("Fp1", "F3"),  
    ("Fp2", "F4"),  
    ("F3", "C3"),  
    ("F4", "C4"),  
    ("C3", "P3"),  
    ("C4", "P4"),  
    ("P3", "O1"),  
    ("P4", "O2"),  
    ("Fp1", "F7"),  
    ("Fp2", "F8"),  
    ("F7", "F3"),  
    ("F8", "T4"),  
    ("T3", "T5"),  
    ("T4", "T6"),  
    ("T5", "O1"),  
    ("T6", "O2"),  
    ('Fz', 'Cz'),  
    ('Cz', 'Pz'),  
]
```



# MODEL8 :

- EEG to spec: 50s
- EEG to spec: 10s
- Kaggle spec: 10m



# PERFORMANCE ENHANCEMENT STRATEGY:

- Data: Optimized filtering and diverse data types
- Validation: Robust cross-validation methodology
- Models: Strategic selection and ensemble approach
- Training: Multi-stage learning process





# UNSUCCESSFUL ATTEMPTS:

- Transformer architecture implementation
- Limiting training to 10-second data segments
- Testing various EfficientNet models on identical datasets

