Proposed Research Area:

1. Features Importance according to the bands (alpha, beta, theta, delta, gamma or Slow wave/Fast wave)
2. Statistics property analysis for all bands.
3. Statistical Changes in REM and NREM.
4. Accuracy Performance Dependency.

Dataset Distribution

NREM	72631
REM	16480
TOTAL	89111

Data Set: ALL

	Precision	Recall	F1-Score	Support
NREM	0.91	0.96	0.93	23930
REM	0.75	0.57	0.64	5472
Accuracy			0.88	29402
Macro AVG	0.83	0.76	0.79	29402
Weighted AVG	0.88	0.88	0.88	29402

Data Set: Delta (Slow Wave)

	Precision	Recall	F1-Score	Support
NREM	0.87	0.92	0.89	23930
REM	0.52	0.38	0.44	5472
				29402
Accuracy			0.82	29402
Macro AVG	0.69	0.65	0.67	29402
Weighted AVG	0.80	0.82	0.81	29402

Data Set: Theta (Slow wave)

	Precision	Recall	F1-Score	Support
NREM	0.84	0.97	0.90	23930
REM	0.56	0.18	0.28	5472
Accuracy			0.82	29402
Macro AVG	0.70	0.58	0.59	29402
Weighted AVG	0.79	0.82	0.78	29402

Data Set: Alpha (Fast Wave)

	Precision	Recall	F1-Score	Support
NREM	0.85	0.96	0.90	23930
REM	0.60	0.27	0.37	5472
Accuracy			0.83	29402
Macro AVG	0.72	0.62	0.64	29402
Weighted AVG	0.80	0.83	0.80	29402

Data Set: Beta (Fast Wave)

	Precision	Recall	F1-Score	Support
NREM	0.88	0.93	0.90	23930
REM	0.59	0.44	0.5	5472
Accuracy			0.84	29402
Macro AVG	0.74	0.69	0.70	29402
Weighted AVG	0.83	0.84	0.83	29402

Data Set: Gamma (Ultra)

	Precision	Recall	F1-Score	Support
NREM	0.84	0.90	0.87	23930
REM	0.37	0.26	0.30	5472
Accuracy			0.78	29402
Macro AVG	0.61	0.58	0.59	29402
Weighted AVG	0.75	0.78	0.76	29402

Data Set: Slow Waves (Delta and Theta)

	Precision	Recall	F1-Score	Support
NREM	0.87	0.95	0.91	23930
REM	0.52	0.10	0.48	5472
Accuracy			0.85	29402
Macro AVG	0.76	0.67	0.69	29402
Weighted AVG	0.83	0.85	0.83	29402

Data Set: Fast Wave (Alpha and Beta)

	Precision	Recall	F1-Score	Support
NREM	0.88	0.95	0.92	23930
REM	0.68	0.45	0.54	5472
Accuracy			0.86	29402
Macro AVG	0.78	0.70	0.73	29402
Weighted AVG	0.84	0.86	0.85	29402

Significant Features:

Data Set: ALL

	Specs	Score
9	PeakF_Beta_C4	3802.124267
6	MedianF_Beta_C4	1178.303860
2	MeanF_Alpha_C4	966.498298
8	Spectral Edge_Beta_C4	923.028755
3	Spectral Edge_Alpha_C4	602.343125
7	MeanF_Beta_C4	513.436454
23	Spectral Edge_Gamma_C4	441.873372
24	PeakF_Gamma_C4	436.007872
22	MeanF_Gamma_C4	420.415097
18	Spectral Edge_Delta_C4	401.853100

Data Set: Alpha

	Specs	Score
2	MeanF_Alpha_C4	966.498298
3	Spectral Edge_Alpha_C4	602.343125
4	PeakF_Alpha_C4	77.671066
1	MedianF_Alpha_C4	18.048726
0	MeanP_Alpha_C4	5.225929

Data Set: Beta

	Specs	Score
4	PeakF_Beta_C4	3802.124267
1	MedianF_Beta_C4	1178.303860
3	Spectral Edge_Beta_C4	923.028755
2	MeanF_Beta_C4	513.436454
0	MeanP_Beta_C4	34.116501

Data Set: Delta

	Specs	Score
3	Spectral Edge_Delta_C4	401.853100
2	MeanF_Delta_C4	189.413357
4	PeakF_Delta_C4	147.339009
0	MeanP_Delta_C4	41.274128
1	MedianF_Delta_C4	7.200691

Data Set: Theta

	Specs	Score
3	Spectral Edge_Theta_C4	180.639050
2	MeanF_Theta_C4	128.553212
1	MedianF_Theta_C4	13.293698
0	MeanP_Theta_C4	9.941585
4	PeakF_Theta_C4	1.537337

Data Set: Gamma

	Specs	Score
3	Spectral Edge_Gamma_C4	441.873372
4	PeakF_Gamma_C4	436.007872
2	MeanF_Gamma_C4	420.415097
1	MedianF_Gamma_C4	135.189612
0	MeanP_Gamma_C4	121.430705

Heat Map:
https://github.com/RafsanJany-44/Research-NREM-REM/blob/main/Feature_Selection_Gamma_O2.ipynb

Data Set: Slow- Wave (Delta and Theta)

	Specs	Score
8	Spectral Edge_Delta_C4	401.853100
7	MeanF_Delta_C4	189.413357
3	Spectral Edge_Theta_C4	180.639050
9	PeakF_Delta_C4	147.339009
2	MeanF_Theta_C4	128.553212
5	MeanP_Delta_C4	41.274128
1	MedianF_Theta_C4	13.293698
0	MeanP_Theta_C4	9.941585
6	MedianF_Delta_C4	7.200691
4	PeakF_Theta_C4	1.537337

Data Set: Fast-Wave (Alpha and Beta)

	Specs	Score
9	PeakF_Beta_C4	3802.124267
6	MedianF_Beta_C4	1178.303860
2	MeanF_Alpha_C4	966.498298
8	Spectral Edge_Beta_C4	923.028755
3	Spectral Edge_Alpha_C4	602.343125
7	MeanF_Beta_C4	513.436454
4	PeakF_Alpha_C4	77.671066
5	MeanP_Beta_C4	34.116501
1	MedianF_Alpha_C4	18.048726
0	MeanP_Alpha_C4	5.225929

Sectors Of Improvement:

1. Process to make the data ratio stable
2. Visual Presentation
3. Neural Network Model
4. Explainable
5. Co Relation between the features
6. Convenient statistical analysis
7. Do machine learning with different significant value