ECoG-Guided Evaluation of Scalp EEG Signatures of Spreading Depolarization

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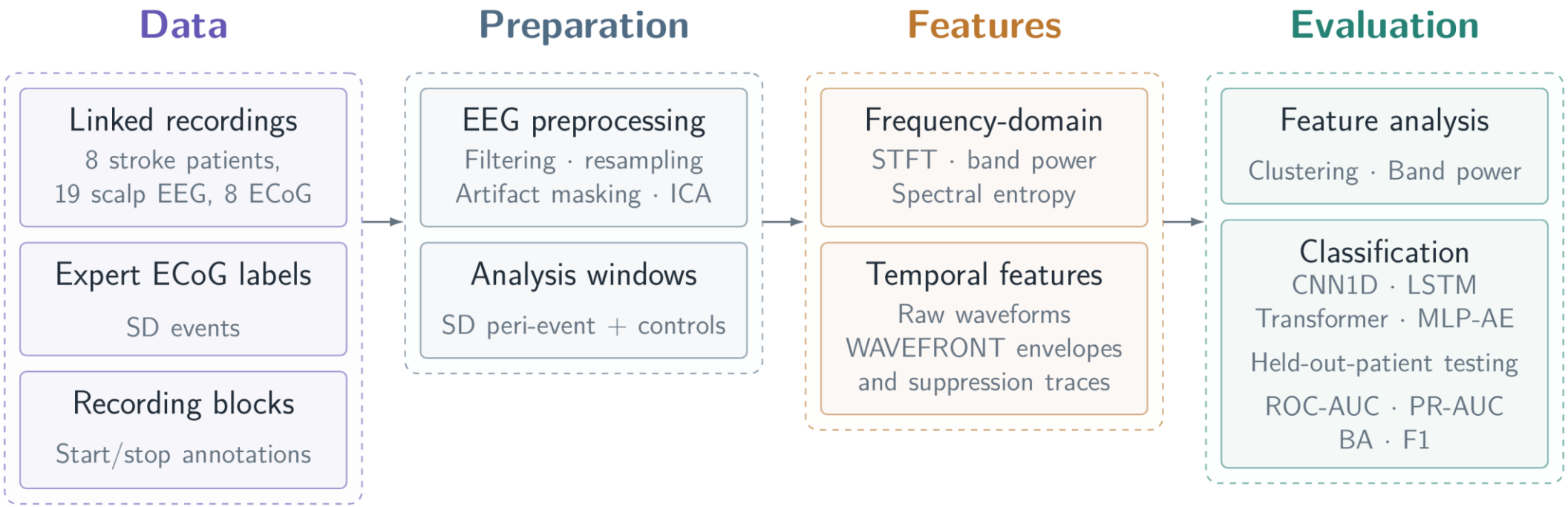
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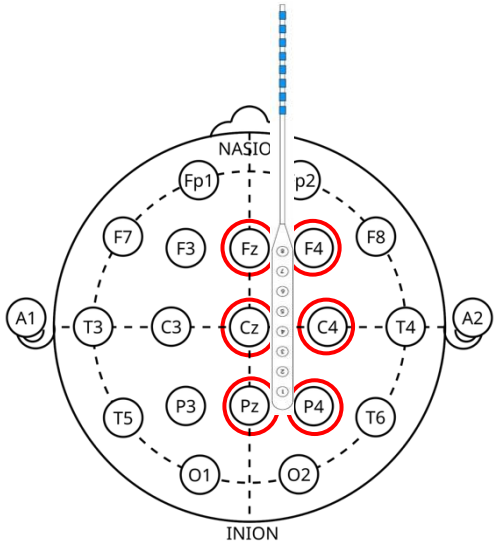
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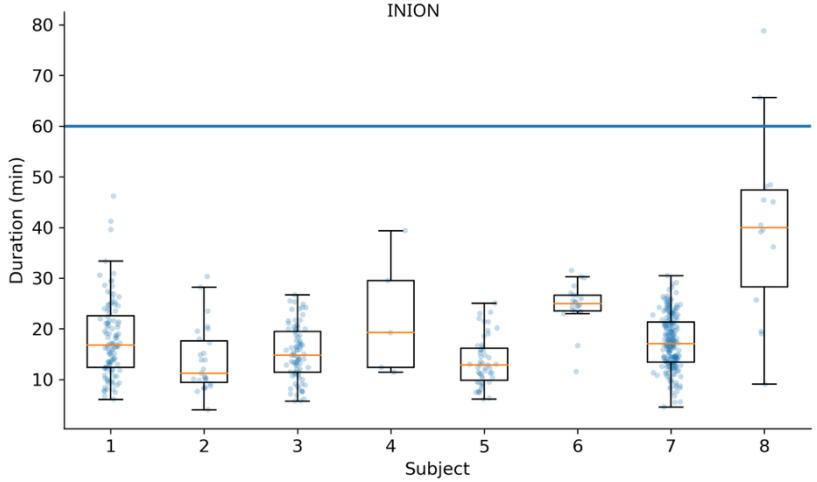


Does scalp EEG reflect ECoG-confirmed signatures of spreading depolarization?



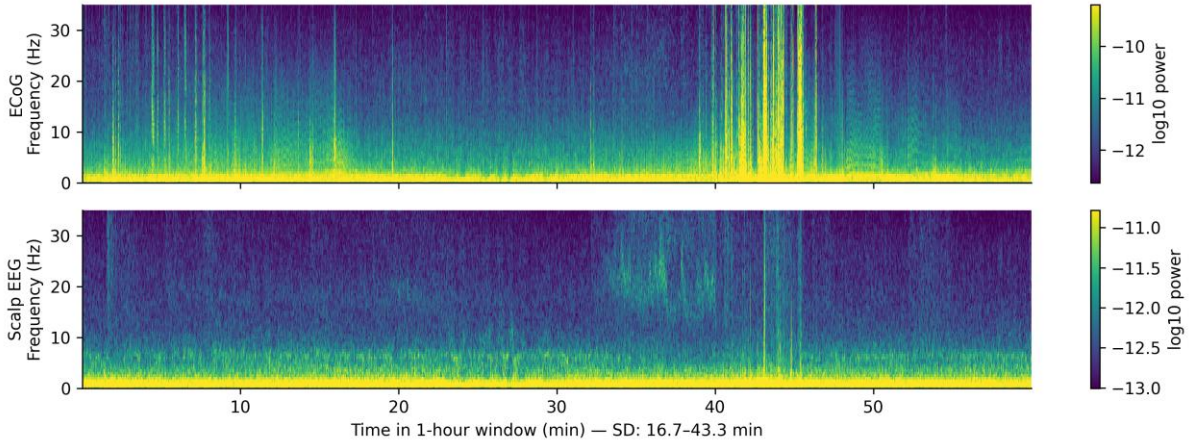
Data & Features



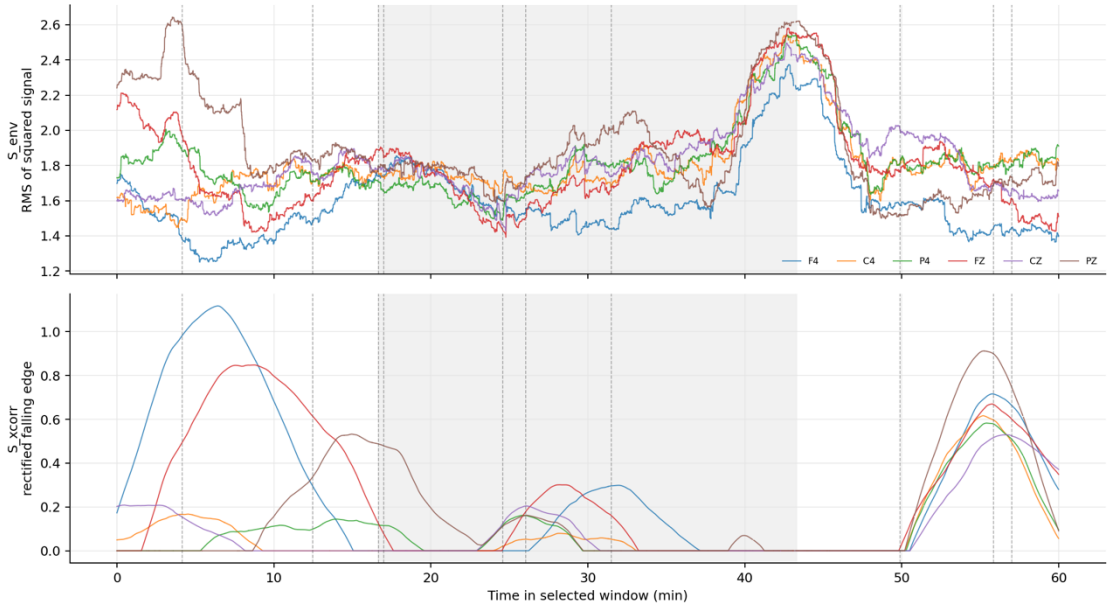


1hr SD event windows; 760 recording hours,
522 SD events, 925 windows

ECoG-placement informed EEG Feature Extraction



STFT[1]: 2s segments, 50% overlap, channel-averaged power at 80Hz sampling

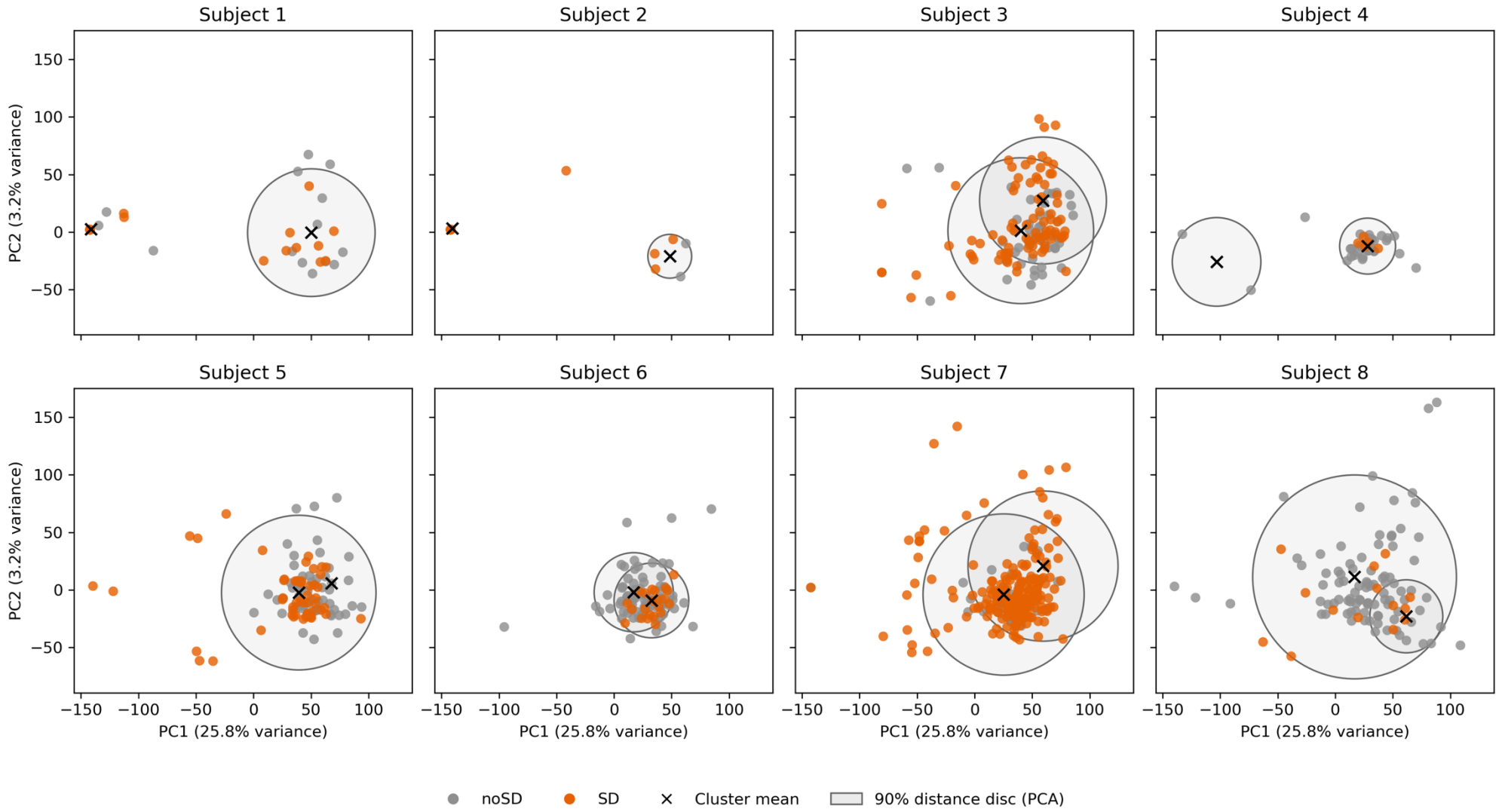


WAVEFRONT[2]: 6 EEG channels x 5 bands x 2 features;
60 traces, sampled every 10s

[1] Wu, Y, et al. IEEE JBHI 28.10 (2024).
[2] Chamanzar, A., et al. *Comm. Medicine* 3.1 (2023)

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Feature Analysis – Clustering



Most patients don’t show clean separation between SD & non-SD clusters

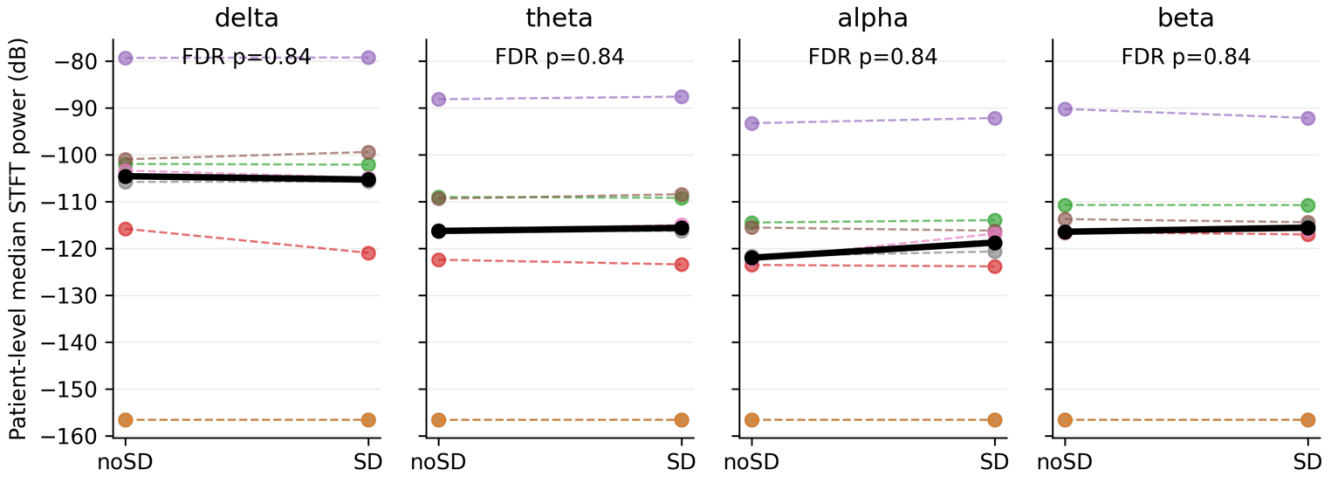
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Feature Analysis – Band Power Difference

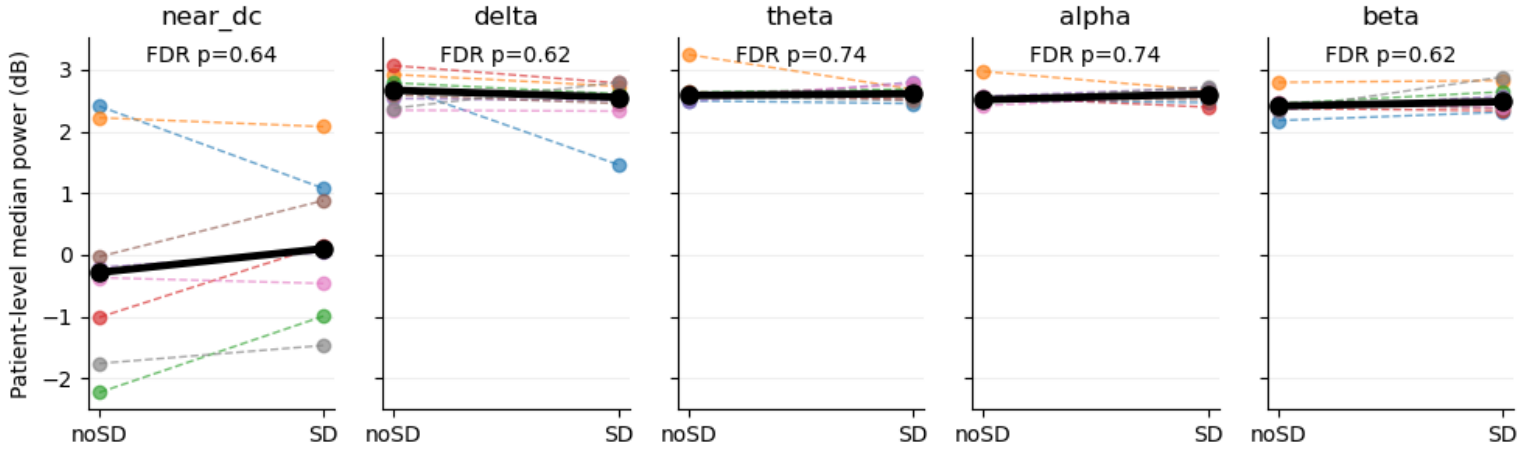
Does band power differ systematically between SD and non-SD periods within patients?

No statistically significant differences in patient-level SD and no-SD band power (both features)

STFT band power features



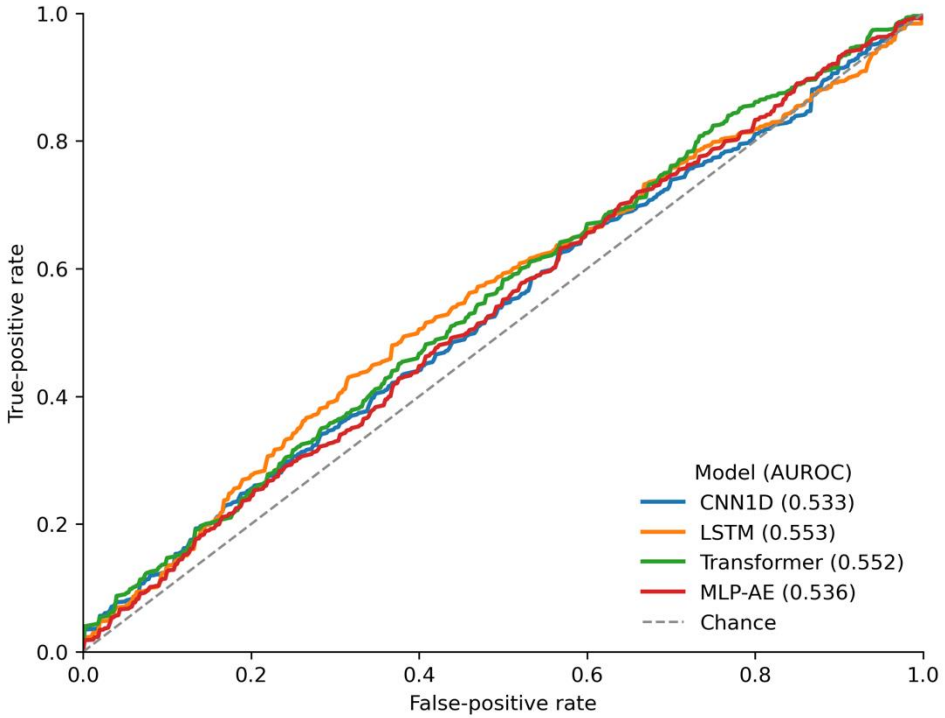
WAVEFRONT band power features



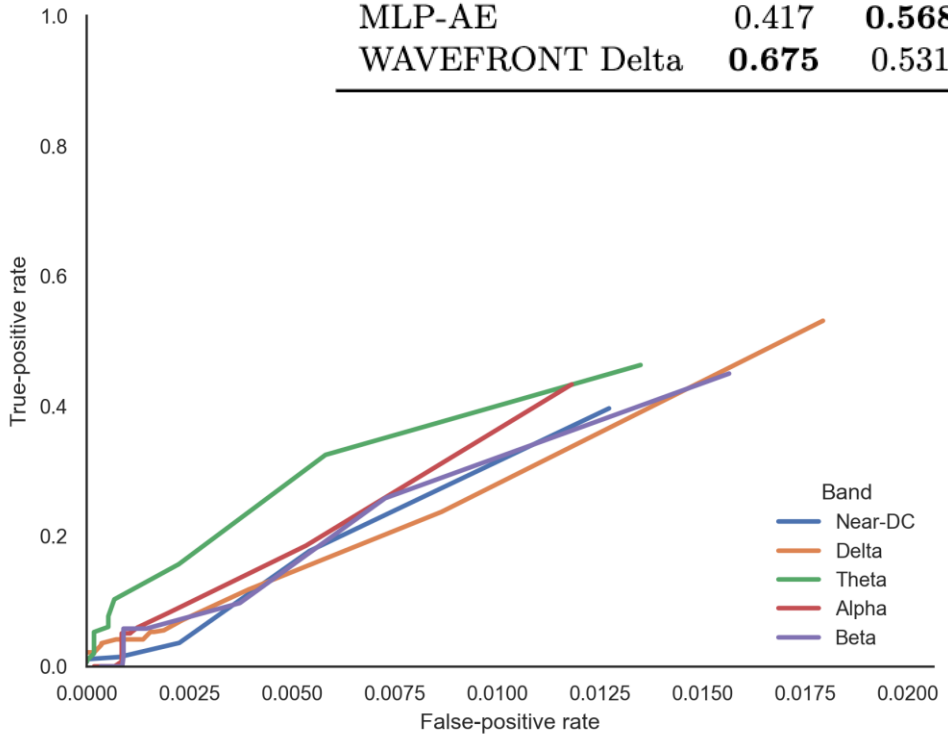
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Classifier Performance

Method	F1	TPR	FPR
CNN1D	0.338	0.418	0.410
LSTM	0.347	0.417	0.367
Transformer	0.382	0.477	0.416
MLP-AE	0.417	**0.568**	0.526
WAVEFRONT Delta	**0.675**	0.531	**0.018**



ML Classifiers



WAVEFRONT Algorithm

Classifiers performed near chance; WAVEFRONT reduced false positives, but sensitivity remained limited.

Does scalp EEG reflect ECoG-confirmed signatures of spreading depolarization?

No conclusive evidence for our patient cohort
Using the features tested

Future work

Build synthetic models to better understand SD dynamics
Incorporate mechanism-informed feature extraction for SD detection

Thank you!

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