

BIOserenity EEG foundation models: a new paradigm for developing AI use cases in EEG

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Introduction

Challenge

Neurological disorders diagnostics face a critical challenge: a global shortage of neurologists causes delayed diagnosis and therapeutic wandering.

Approach

We develop diagnosis support tools performing EEG pre-analysis with AI-driven foundation models. Our approach achieves clinical precision and helps uncovering novel biomarkers to reduce diagnostic time.

Conclusion

By leveraging self-supervised learning, our technology deciphers the complex patterns inherent in EEG data, with the goal of creating an efficient ecosystem that accelerates the development of powerful and resource-efficient AI EEG analysis systems and biomarkers.

Next steps

Input flexible

- Current design limited to certain channels

Larger

- Scalable architecture & more data

New use cases

- Sleep stages, BCI, seizures/spikes

References



BioSerenity-E1, Bettinardi et al., ArXiv, 2025.



SleepFM, Thapa R. et al., Nature Medicine, 2025.

Methods

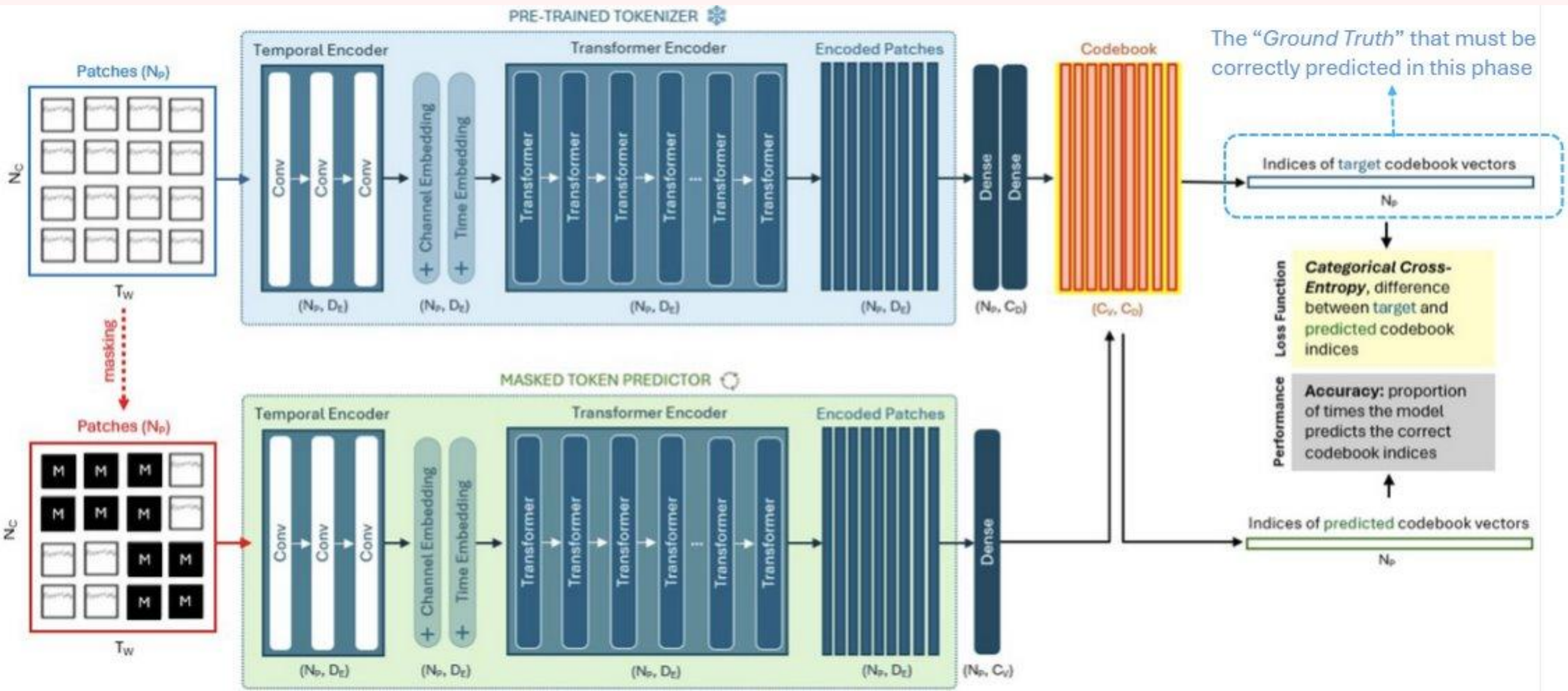


Classifier

Biomarker

1. Encoding/Decoding architecture

- Segment decomposition into patches
- Transformer architecture
- Quantized representation
- Spectral reconstruction



2. Self-supervised pretraining

Learns representation without labels

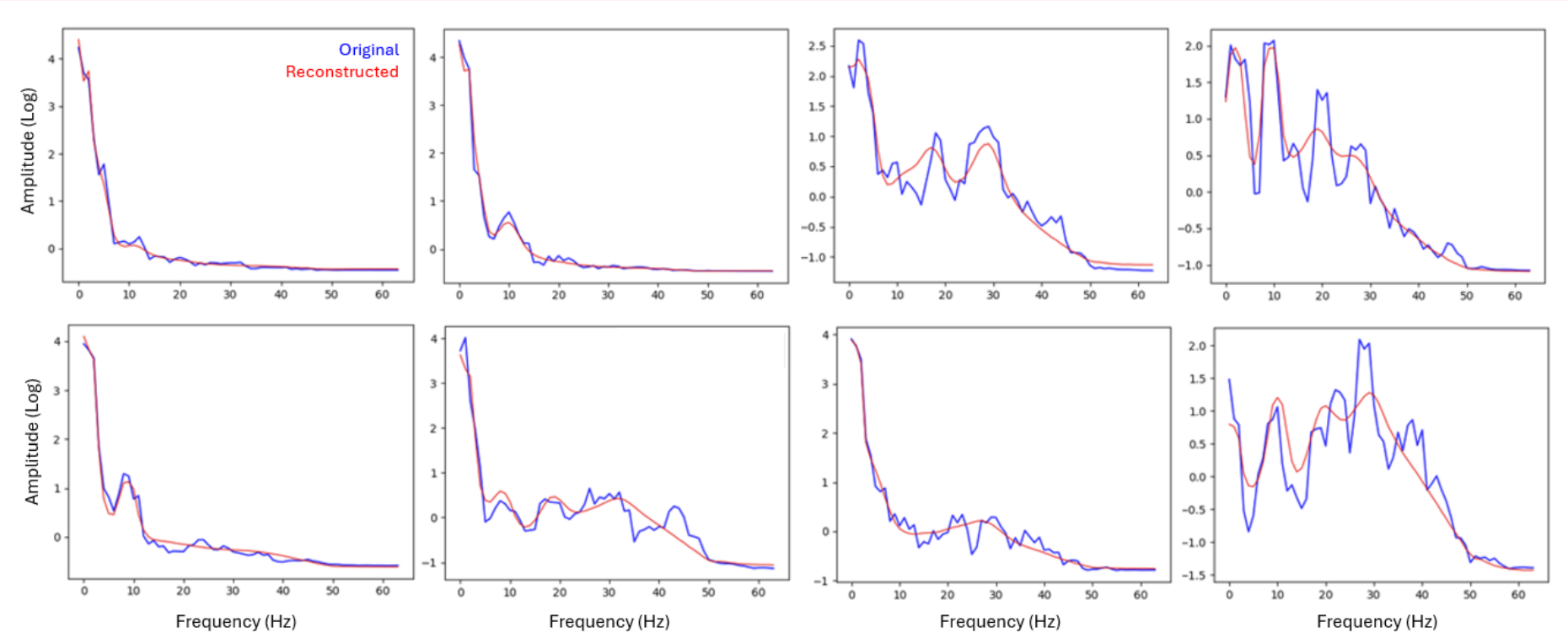
Dataset	EEG hours	Windows	Tokens	Percentage
Bioserenity-Neurophy-FR1	2,803	630,684	161.4M	70%
Bioserenity-US1	1,201	270,336	69.2M	20%
TUH-Seizure	200	45,056	11.5M	5%
TUH-Abnormal	160	36,044	9.2M	4%
TUH-Events	28	6,308	1.6M	0.7%
TUH-Artifacts	12	2,703	0.7M	0.3%
TOTAL	4,005	901,12	253.6M	100%

3. Downstream tasks

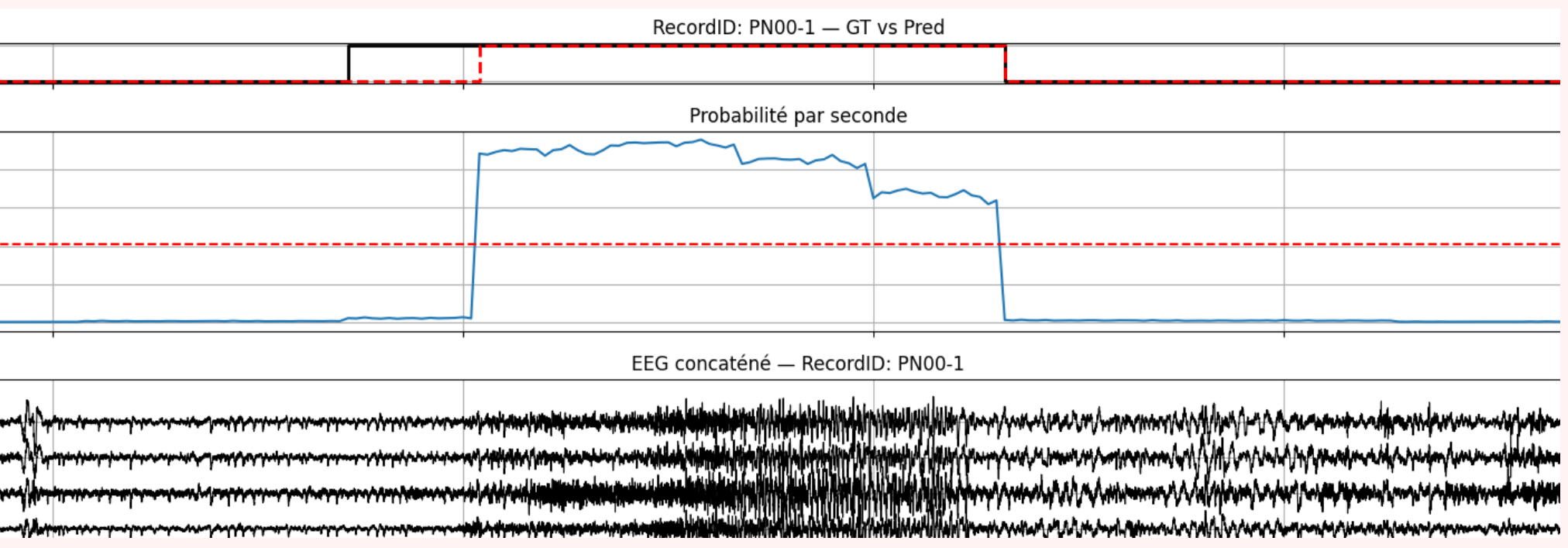
Evaluate model on clinical tasks

Dataset	Subset	EEG hours	Windows	Tokens	Classes
Neurophy-Abnormal	train	270	60,85	15.5M	Normal / Abnormal
Neurophy-Abnormal	test	68	15,285	3.9M	Normal / Abnormal
Neurophy-Multiclass	train	270	60,85	15.5M	Normal / Lesion / Status / Encephalopathy
Neurophy-Multiclass	test	68	15,285	3.9M	Normal / Lesion / Status / Encephalopathy
TUH-Abnormal	train	904	203,388	52M	Normal / Abnormal
TUH-Abnormal	test	102	23,04	5.8M	Normal / Abnormal
TUH-Seizure	train	106	23,84	6.1M	Background / Seizure
TUH-Seizure	test	32	7,152	1.8M	Background / Seizure

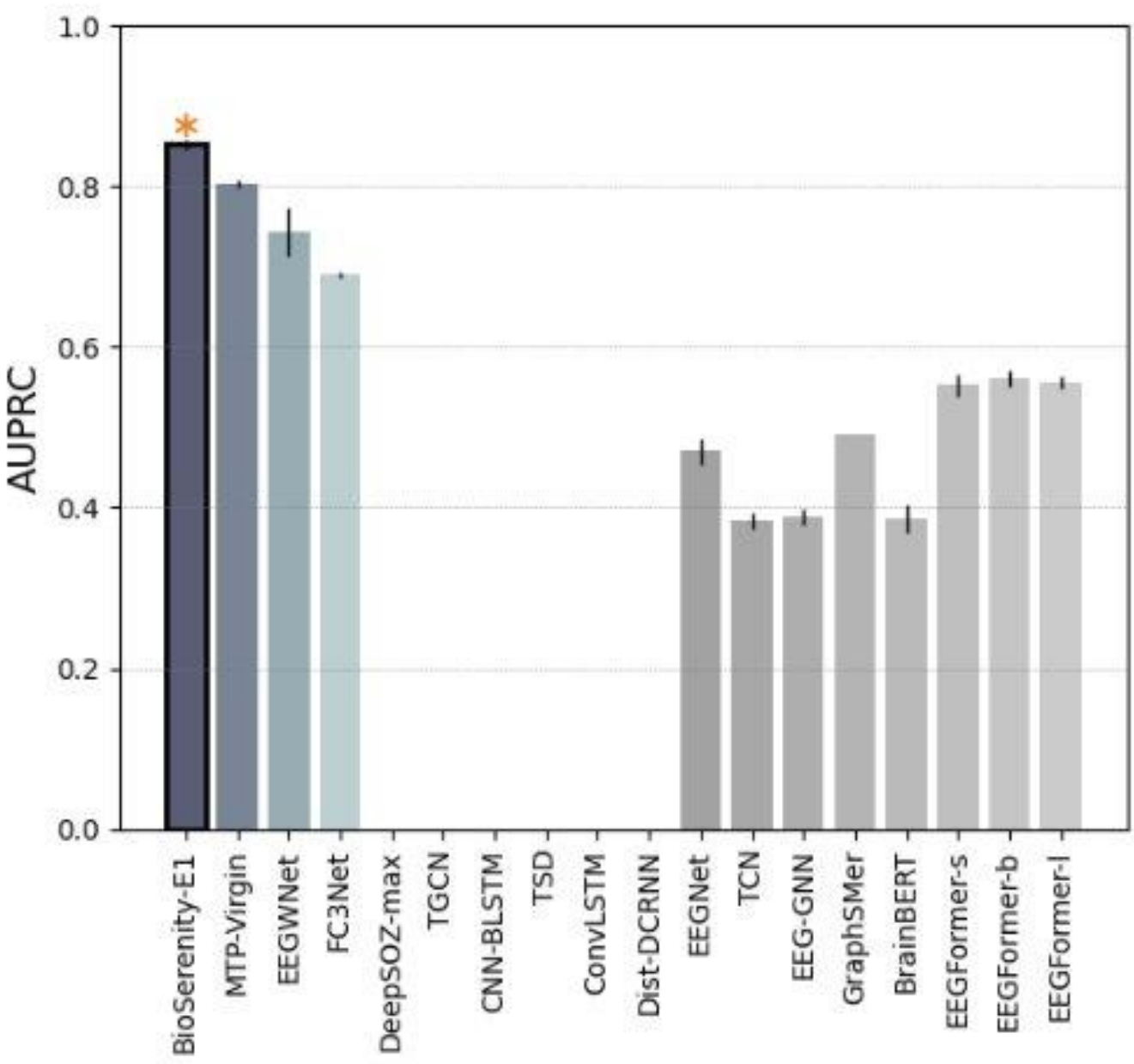
Results



Spectral reconstruction

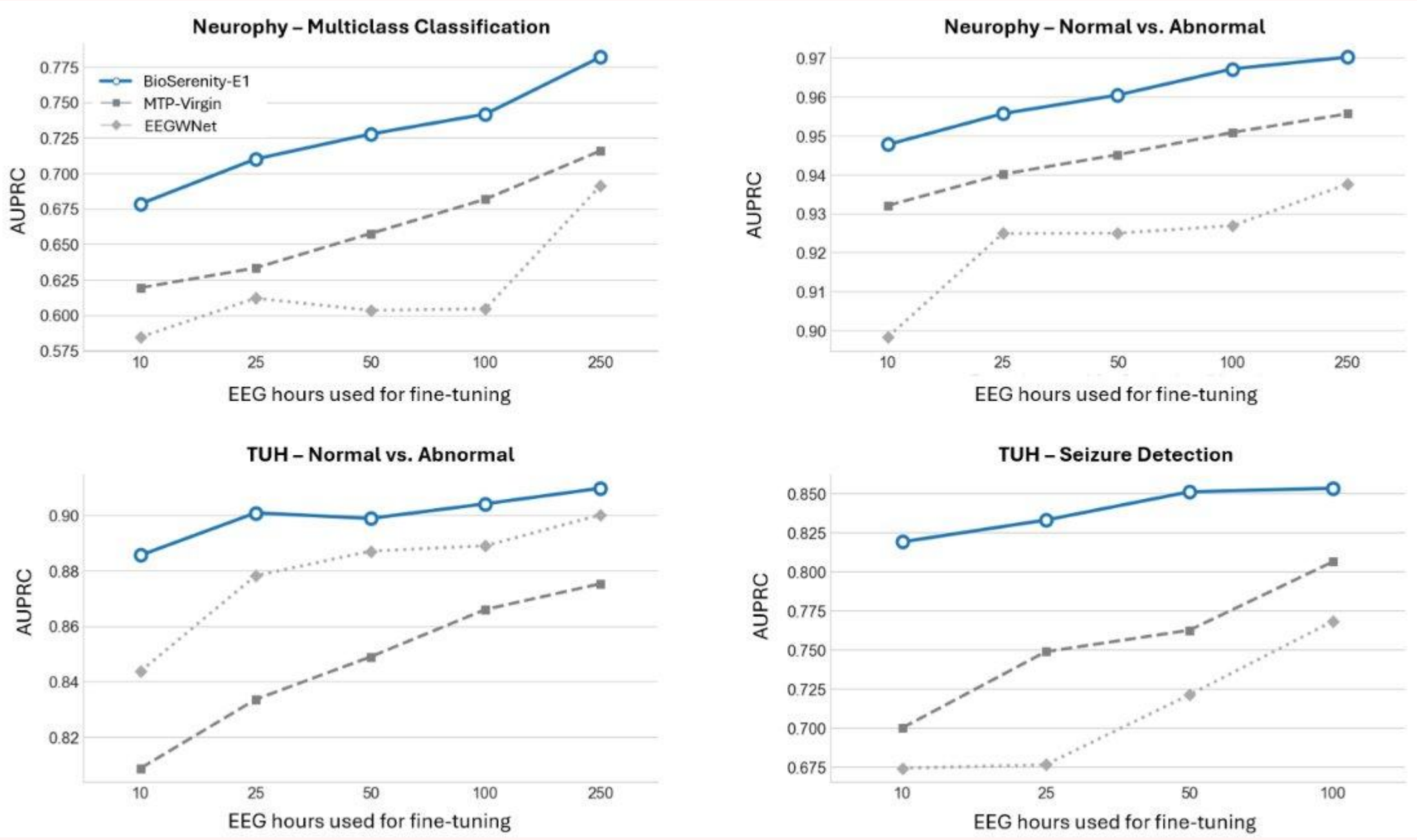


Example seizure detection



Seizure detection benchmark

- Competitive with SOTA
- Pretraining improves over training only on labels



Pre-training in low data regime

- Reduce the constraint for large labeled datasets