Deep reinforcement learning for epileptic seizure prediction and closed-loop control

PIs: Sridharan Devarajan (CNS) & Gugan Thoppe (CSA)

Abstract: Such warnings can help the patient or the caregiver take preventative measures to avoid catastrophic injury.

We will employ deep reinforcement learning to analyze high-density data streams from brain implanted intracranial EEG electrodes (iEEG). Analysis of these data at high resolution is computationally expensive and access to clinically annotated data is limited.

We combine deep learning generative models -- including transformers for time-series modeling -- to detect and predict seizures well before they onset. Importantly, with a novel combination of reinforcement learning we will develop sparse, intelligent sampling strategies that enable such predictions without having to monitor all channels at high resolution. Once the seizure is predicted, we will explore deep learning-based control theory models to provide closed loop electrical stimulation to arrest seizures even before they occur.

This is a joint project between Prof. Sridharan Devarajan of CNS and Prof. Gugan Thoppe of CSA that is part of the Brain Co-processors neural implants project at IISc.

Preferred background:

Coding proficiency, some familiarly with machine learning and deep learning (preferred)

For more information, see:

i) Moonshot Project link: https://brain-computation.iisc.ac.in/moonshot-project/

ii) Recent publication at Neurips: https://arxiv.org/abs/2507.05077