BCL5

5th Workshop on Brain, Computation, and Learning

भारतीय विज्ञान संस्थान

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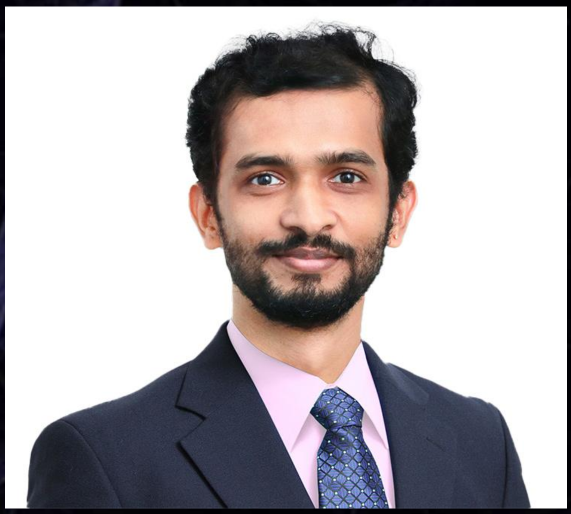

2 July | 14:00 - 15:30
Faculty Hall

Artificial Intelligence in Clinical Settings: Enhancing Epilepsy Treatment Outcomes

Abstract: Epilepsy, a neurological disorder, affects over 10–12 million individuals in India. While 70% achieve seizure control with medication, the remaining 30% with drug-resistant epilepsy (DRE) often require surgery. Localizing epileptic foci in these patients is challenging and demands comprehensive pre-surgical assessment. The Epileptogenic Zone (EZ) is the cortical region critical for seizure generation, whose removal can result in seizure freedom. In 50% of DRE cases, MRI fails to reveal lesions matching EEG findings. In such scenarios, advanced modalities—PET, SPECT, Magnetoencephalography (MEG), Electric Source Imaging (ESI), Video EEG (VEEG), and MRI—are combined to develop an EZ hypothesis, which is confirmed by Stereo-EEG (SEEG). SEEG involves implanting electrodes in key brain regions to record neural activity and precisely define surgical boundaries. Visual interpretation alone has limitations that can be overcome by artificial intelligence (AI)-based tools. In imaging, AI methods such as voxel-based morphometry, texture analysis, and MELD help detect lesions like focal cortical dysplasia (FCD) on MRI. PET asymmetry analysis using PASCOM quantifies hypometabolism. SISCOM (Subtraction Ictal SPECT coregistered to MRI) maps ictal networks, while PISCOM (PET interictal subtracted ictal SPECT) integrates PET and SPECT data to localize the EZ more accurately. For SEEG signal analysis, the Epileptogenicity Rank (ER), derived from the Epileptogenicity Index (EI), offers refined quantification by leveraging spatio-temporal dynamics. Training machine learning models on SEEG data, high-frequency oscillations (HFOs) from EZ and non-EZ regions, and region-specific HFO rates has yielded approximately 90% accuracy in EZ delineation. Combining these AI and computational post-processing tools within a multimodal framework enhances the identification of seizure onset zones. The latest advancement—the "virtual epileptic patient"—provides personalized predictions of seizure propagation and epileptogenicity, promising improved outcomes in complex epilepsy cases