BCL5

5th Workshop on Brain, Computation, and Learning

Arjun Ramakrishnan

Assistant Professor
Indian Institute of Technology, Kanpur

1st July | 9:45 – 10:30
Biological Sciences Auditorium

Neuroengineering for Mental Health: Understanding Suboptimal Decision-Making in Anxious Individuals

Abstract: Depression and anxiety impair cognitive and decision-making abilities, yet the neural mechanisms underlying these effects remain unclear. Addressing this gap is essential for developing targeted interventions. To investigate, we designed experimental assays to study patch foraging behavior—a decision-making process where individuals decide whether to stay in a resource patch or move to a new one. Guided by the Marginal Value Theorem (MVT), foraging reflects trade-offs between rewards and costs. While generally optimal, this behavior varies between individuals, with stress and anxiety likely influencing these differences. Our research focuses on the anterior cingulate cortex (ACC), involved in reward-effort trade-offs, and the locus coeruleus (LC), a hub for norepinephrine, a stress-related neuromodulator. Using a patch-foraging game, we monitored participants' stress responses through cortisol, norepinephrine, pupil dilation (arousal), and EEG frontal theta-beta ratios (cognitive control). Individuals with higher trait anxiety showed suboptimal foraging, leaving patches prematurely, with these deviations correlating with stress biomarkers. Collaborating with Cogwear, we are developing AI models to predict and monitor anxiety trends from EEG data. This innovative, non-invasive approach offers real-time anxiety assessment, enabling early diagnosis and personalized treatment strategies. By integrating computational modelling, neurophysiology, and AI, our work advances understanding of anxiety and decision-making..