molecules to communities

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ICTR ENRICHMENT SERIES Tuesday, June 10, 2025, 12:00 pm – 1:00 pm

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"Synergy-Based Brain-Machine Interfaces in Human-Robot Interaction"

Dr. Ramana Kumar Vinjamuri

Presented by

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Human-machine interfaces (HMIs) have emerged as promising technologies to restore lost limb function. They involve two key design elements: decoding human intent and controlling a machine to execute it. Despite decades of research, challenges such as complexity, adaptability, and variability remain. Overcoming these requires a computational understanding of human sensorimotor control.

Recent advances in HMIs rely on bioinspired models that are experimentally validated and used in adaptive, intuitive control. The human hand, with its high dimensionality, exemplifies these challenges and offers an ideal validation platform. How the central nervous system (CNS) manages this complexity remains an open question.

One promising model suggests the CNS uses synergies—coordinated groups of motor units—instead of individual control. Yet, key questions remain: Where are synergies located in the CNS, and what roles do they play in motor control and learning?

This research aims to combine human motor control, computational neuroscience, and machine learning with noninvasive experiments to answer these questions and enable seamless, natural HMIs based on biomimetic principles.



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