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Biomedical Engineering
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Seminar Series

A synergy-based brain-machine interface for dexterous control of prosthetic hands

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LECTURE: 9:00 AM - 10:00 AM

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Abstract: In the United States alone, there are over 259,000 people living with a chronic spinal cord injury (SCI). A recent survey of 681 people with tetraplegia shows that, for over 45% regaining arm and hand function would improve their quality of life significantly. While sophisticated Functional Electric Stimulation (FES) systems have been developed (e.g. Freehand), one of the main challenges is obtaining multiple independent control signals that allow stimulation of muscles in a coordinated fashion that generates continuous and natural hand movements.

Brain machine interface (BMI) provides a viable and powerful solution for this user-control problem by accessing and decoding the native motor control signals in the brain. One of the major challenges is extending this technology to control high-dimensional systems like controlling a human hand with above 27 degrees of freedom (DoF). Movement planning functions in the brain are hypothesized to happen in a low-dimensional subspace of movements called movement primitives often referred as synergies. Synergies enable control of multiple DoF of movement with fewer control signals. By combining the advantages of a synergy-based model for dimensionality reduction and good spatial and temporal resolution provided by an electrocorticography (ECoG) based BMI dexterous control of prosthetic hands can be achieved. Using the above method agile control of assistive devices including FES can be achieved.

Biography: Ramana Vinjamuri received his undergraduate degree in Electrical Engineering from Kakatiya University (India) in 2002. He received his MS in Electrical Engineering from Villanova University in 2004 specialized in Bioinstrumentation. He received his PhD in Electrical Engineering in 2008 specialized in Dimensionality Reduction in Control and Coordination of Human Hand from the University of Pittsburgh. He worked as a postdoctoral fellow (2008-2011) in the field of Brain Machine Interfaces (BMI) to control prosthesis in the School of Medicine, University of Pittsburgh. Since 2011, he is been working as a Research Associate there. In 2010, he was awarded Mary E. Switzer Merit Fellowship by National Institute on Disease and Rehabilitation Research (NIDRR) for his proposal, "A synergy based BMI to reanimate paralyzed hands". He has a pending patent as the lead inventor on related technology. In 2011, he was elevated to IEEE Senior Member. He has authored several publications in IEEE Transactions and conferences and other journals in the fields of biomedical engineering. He serves as reviewer for journals and conferences including IEEE Transactions in Neural Networks, IEEE Transactions on Intelligent Transport Systems, IEEE EMBC, Journal of Neural engineering, Sensors, International Journal of Nano Medicine, etc.

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