Dr. Raviraj Nataraj

Assistant Professor
Department of Biomedical
Engineering,
Stevens Institute of Technology

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Personalizing Sensory-driven Computerized Interfaces for Motor Rehabilitation

Abstract:

A significant challenge with motor rehabilitation is the time and effort persons must commit to physical therapy to regain movement function. Computerized technologies, such as virtual reality and robotics, are increasingly used to motivate users and better monitor their progress. However, such interfaces are highly customizable and could be further personalized for greater functional gains and better experiences. Furthermore, interface parameters specifying the training are readily adaptable to maximize a broad array of user outcomes. These outcomes can include not only performance (i.e., how the user is "doing") but also perceptional and physiological measures (i.e., how the user is "feeling"). Identifying and leveraging synergies between performance and critical supporting measures may be the key to unlocking the full potential of computerized methods to accelerate motor learning while preserving user well- being. In this talk, I will present our lab's work demonstrating how performance, perceptions, and physiological indicators during motor tasks are related and influenced by sensory-driven guidance. We have examined the effects of varying guidance parameters (e.g., frequency, intensity, and type of sensory cue: visual, audio, haptic) with neurotypical and clinical populations. I will conclude the talk by suggesting how such findings can optimize performance and well-being outcomes using advanced rehabilitation platforms with "adaptive" interfaces.

About the Speaker

Dr. Raviraj (Ravi) Nataraj is an Assistant Professor in the Department of Biomedical Engineering at Stevens Institute of Technology. He received his Ph.D. in Biomedical Engineering at Case Western Reserve University and his Master's in Mechanical Engineering at Stanford University. His postdoctoral work involved motor restoration (e.g., neuroprostheses, exoskeletons) and sensorimotor assessment of persons having spinal cord injury (SCI), amputation, or carpal tunnel syndrome. As an independent investigator, his research focus is motor training with computerized interfaces that rehabilitate upper-extremity function after SCI or traumatic brain injury. His lab examines how virtual reality and instrumented wearables used for motor training can leverage changes in perception and physiological responses to maximize functional outcomes. The lab's ongoing work is done in partnership with the Bronx VA Medical Center and the Kessler Foundation, with funding from the Department of Veterans Affairs, the New Jersey Health Foundation, and the NSF (Disability and Rehabilitation Engineering CAREER award). Dr. Nataraj recently received the Stevens' Harvey Davis Distinguished Teaching Award and has served on grant review panels for NIDILRR, NSF, and NIH.