The IEEE Pittsburgh Section Signal Processing and Engineering in Medicine and Biology Society Chapters Present:

Bidirectional Neural Interfaces for Prosthesis

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Refreshments 11:30am – 12:00pm
Talk 12:00pm – 1:00pm

Over the last 2 decades, advances in microsystems engineering have enabled the development of neural prostheses that interface directly with neurons in the brain, spinal cord and peripheral nerves. These so-called “neural interfaces” serve as bi-directional communication channels, allowing information to be read-out by decoding signals recorded from neurons or written-in via patterned electrical stimulation of neurons. We are exploiting these technologies for two purposes: 1) to advance our understanding of how the nervous system senses and controls limb motion, and 2) to develop advanced prosthetic devices that interface directly with the nervous system for control. This talk will focus on work aimed at understanding how somatosensory neurons encode information about touch, force, limb position and motion. By recording and decoding the output of these neurons, we can provide limb-state feedback for controlling functional electrical stimulation (FES) systems to reanimate paralyzed limbs. Conversely, patterned stimulation of somatosensory neurons can be used to provide amputees with touch and proprioception for prosthetic limbs. Such feedback will be essential for users of the dexterous prosthetic limbs developed recently by the DARPA-funded Revolutionizing Prosthetics Program. Ultimately, these bidirectional neural interfaces will make the prosthesis feel and function like a native limb.

Robert Gaunt is a Research Assistant Professor in the department of Physical Medicine and Rehabilitation at the University of Pittsburgh. Robert completed an undergraduate in mechanical engineering in 2000 and his PhD in 2008 before coming to the University of Pittsburgh for postdoctoral training. His graduate work focused on the development of implantable devices for bladder control and currently works in the area of sensorimotor control and neuroprosthetic systems. His general research interests are in sensorimotor control, functional electrical stimulation and the development of advanced sensory and motor neuroprostheses. He has two patents and is a member of the Society for Neuroscience and the Biomedical Engineering Society.