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

Neural Prosthesis and Brain Machine Interfacing

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11:30 to 12:00 – Refreshments
12:00 to 1:00 - Presentation

For people with severe disabilities cause by various neurological disorders, such as spinal cord injury, cerebral palsy, and myodystrophy, they have a limited means to communicate and rely mainly on simple switch-activated devices to interact with their environment. Brain-computer interface (BCI) technology aims to establish a direct link between the brain and external devices, enabling faster and more intuitive communication and control. One of the major challenges in translating this technology from laboratory research into clinical practice is to develop a minimally invasive technique for obtaining reliable long-term neural recording with high spatial and temporal resolution.

Recent research has shown that electrocorticography (ECoG) is a promising modality that can potentially meet this requirement. ECoG is a technique similar to electroencephalography (EEG); however, it records brain activity with intracranial electrodes directly placed on top of the brain. ECoG has a much better signal-to-noise ratio and higher resolution than traditional EEG recorded with scalp electrodes, and it is less invasive compared to single-neuron recording technique, where arrays of microelectrodes are inserted into the cortex. Our goal is to translate knowledge and experience gained from previous basic animal and human BCI research into a clinical BCI device with micro-ECoG technology. A micro-ECoG electrode array is composed of miniature electrodes embedded in a silicon disc. It can be implanted with minimally invasive procedure that involves making a small burr hole in the skull. Another potential advantage of this approach is that it may be possible to place electrodes on the surface of the dura mater, leaving the brain's protective sheath intact, which significantly reduces the risk of infection. This BCI system will be even simpler and safer than deep brain stimulator, since its electrodes will not penetrate any brain structures and our device only records electrical activity and does not stimulate. With its simplicity, low clinical risk, and high performance, this system can benefit a large user population (both pediatric and adult) with various degrees of motor disabilities, including those with spinal cord injury and cerebral palsy.

Wei Wang received the Ph.D. degree in Biomedical Engineering from Washington University in St. Louis in 2006, M.Sc. degree in Biomedical Engineering from University of Tennessee Health Science Center, Memphis, TN in 2002, and the M.D. degree from Peking University Health Science Center (formerly Beijing Medical University), Beijing, China in 1999. Prior to joining the University of Pittsburgh in 2007, Dr. Wang served as a senior scientist at St. Jude Medical, Inc. in Sylmar, CA.

He is currently an assistant professor in the Department of Physical Medicine and Rehabilitation with a secondary appointment in the Department of Bioengineering and the Clinical and Translational Sciences Institute at the University of Pittsburgh. His current research interests include neural engineering, motor neuroprosthetics, brain-computer interface, rehabilitation of movement disorders, and motor system neurophysiology.