University of Houston - Biomedical Engineering Seminar

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Neural Interfaces for Controlling Finger Movements

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Abstract

To surpass the current state of the art in assistive technology the next step is to control more complex movements at the level of individual fingers. For people with upper limb amputation, we acquire signals from individual peripheral nerve branches using small muscle grafts to amplify the signal. Human study participants have recently been able to control individual fingers online using indwelling EMG electrodes within these grafts. For spinal cord injury, we implant Utah arrays into finger areas of motor cortex, and have successfully decoded flexion and extension in multiple fingers. Decoding "spiking band" activity at much lower sampling rates, we recently showed that power consumption of an implantable device could be reduced by an order of magnitude compared to existing broadband approaches. Finally, finger control is ultimately limited by the number of independent electrodes that can be placed within cortex or the nerves, and this is in turn limited by the extent of glial scarring surrounding an electrode. We developed an electrode array based on 8 um carbon fibers, no bigger than the neurons for chronic recording of single units with minimal scarring. Our long-term goal is to make neural interfaces for the restoration of hand movement a clinical reality.

Biosketch

Cynthia A. Chestek received the B.S. and M.S. degrees in electrical engineering from Case Western Reserve University in 2005 and the Ph.D. degree in electrical engineering from Stanford University in 2010. She was a postdoc at the Stanford Department of Neurosurgery with the Braingate 2 clinical trial. She is now an Associate Professor of Biomedical Engineering at the University of Michigan, Ann Arbor, MI, where she joined the faculty in 2012. She runs the Cortical Neural Prosthetics Lab, which focuses on brain and nerve control of finger movements as well as to high-density carbon fiber electrode arrays. She is the author of 49 full-length scientific articles. Her research interests include high-density interfaces to the nervous system for the control of multiple degree of freedom hand and finger movements.