Seminar

Bradley Greger Ph.D.

Assistant Professor
Bioengineering
University of Utah

Friday January 11, 2013
3:00pm
SCOB 228

Ira A. Fulton Schools of Engineering
ARIZONA STATE UNIVERSITY

Abstract

Decoding Information From, And Encoding Information Into, The Human Nervous System Using Micro-Electrode Arrays

We are developing neural prostheses that decode finite sets of categories or complex continuous movements from cortical signals. We are using micro-electrocorticography (micro-ECoG) grids to interface with the cerebral cortical in human patients. Micro-ECoG grids consist of an array of micro-scale, high-impedance electrodes which rest on the surface of the brain. Because of their non-penetrating nature, micro-ECoG grids can be safely placed over eloquent cortex. Micro-ECoG grids can record independent neural signals from multiple areas of the cerebral cortex and provide control signals for small complex movements such as speech and grasping. We are also testing the effectiveness of microelectrode arrays that penetrate into the nervous system. We examined several spatial and temporal characteristics of microstimulation using microelectrode arrays chronically implanted in V1 of a behaving macaque monkey. After two years of implantation we were able to evoke behavioral responses to electrical stimulation across the spatial extent of the array. Saccades to electrically-evoked targets showed that the animal could discriminate spatially distinct percepts having an average separation of 1.0 ± 0.2 degrees in visual space. Recently, we demonstrated both decoding and encoding using a micro-electrode array implanted in the residual peripheral nerve of patient with an amputation. During these experiments it was possible to provide real-time proportional control over finger position using decodes of action potential firing rate. Additionally, micro-stimulation using this array provided spatially and qualitatively distinct somatosensory perceptions. The results of these efforts will provide increased understanding of the spatial and temporal parameters of micro-scale electrophysiology and microstimulation, and will result in motor and sensory neural prostheses that improve patients' lives.