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Neural Prosthesis Seminar

"Learning and Plasticity Associated With Long-Term Exposure of a Brain-Machine Interface"

Friday, February 20th, 2015 • 8:30 AM

Biomedical Research Building 105
Case Western Reserve University

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Abstract

Learning to control a device using a cortically-controlled brain machine interface (BMI) may be viewed as a form of motor skill acquisition such as playing tennis. Psychophysical evidence indicates that motor skill acquisition in contrast to other forms of motor learning requires extended exposure time and repetition. In particular, motor skill acquisition is often characterized by a power law that relates the time to perform a task versus the number of repetitions. Non-human primates with medically-related amputations of the hand and arm controlled a BMI from clusters of motor cortical neurons contralateral to the amputation in order to drive a multiple degree of freedom robotic arm and hand. We developed a non-biomimetic, unsupervised decoding algorithm which was held fixed throughout months of exposure to the system. Preliminary data showed a similar power law relationship in learning to control the robotic device to reach and grasp an object. To examine neural plasticity, we applied generalized linear models to predict the current spiking responses of each neuron based on the past responses of other neurons. We found that the number of directed connections within the neural clusters increased with long term exposure to the BMI although excitatory connections substantially outnumbered inhibitory connections. These results suggest that a BMI may provide a useful test bed for examining skill learning and plasticity.

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