Abstract

Advancing Neural Prosthetics: From Brain-Machine toward Brain-Muscle Interfaces

The field of Brain-Machine Interfaces (BMIs) has advanced greatly in the past few decades, evolving from simple control of a one-dimensional computer cursor to high-dimensional control of a robotic arm using one’s brain signals. While advancements in electrode designs and decoding algorithms have played a large role in this evolution, many untapped opportunities remain to utilize BMIs not just for their therapeutic potential but for scientific inquiries as well. In the first portion of this talk, I will discuss my work examining how the brain adapts different scales of activity to control a BMI task, how these signals may change with learning, and practical approaches to how we may train naïve subjects to learn to use a prosthetic device.

In addition, much of BMI research has used artificial devices (i.e. computer cursor, robot) as the brain-controlled effector. However, the ultimate goal for many target end-users of this technology would be to restore volitional control of their paralyzed limbs. Toward this goal, functional electrical stimulation of muscle activity has been integrated with BMI systems to achieve this goal with some success. More recently, the introduction of optogenetics in the peripheral nervous system has demonstrated potential benefits over traditional electrical stimulation in producing functional movements useful for BMI applications. In the second part of this talk, I will discuss some of the inherent difficulties involved with using viral gene therapy for prosthetic applications in the peripheral nervous system, my ongoing work to address these obstacles in rodent and non-human primate models, and functional considerations for how optical stimulation paradigms may differ from standard electrical stimulation approaches.

Medical College of Wisconsin is located on 1101 N. 87th St., Milwaukee, WI 53226. Parking is available across the street in visitor parking. Refreshments will be served.