

Biology Seminar

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Optical Imaging of Brain Activities using Functional Near-Infrared Spectroscopy (fNIRS)

Functional near-infrared spectroscopy (fNIRS) is a state-of-the-art optical imaging technology to record brain activities. It is a noninvasively imaging technology to detect the hemodynamic response in real-time. fNIRS is superior to the traditional fMRI (functional magnetic resonance imaging) because it can record with time resolution in msec compared to the time resolution of sec for fMRI recordings. It can also record both oxy-hemoglobin and deoxy-hemoglobin levels, whereas fMRI can only record the deoxy- but not oxy-hemoglobin level. Thus, optical imaging provides additional measures of brain signals that magnetic imaging cannot provide.

The neuro-prosthetics project involves decoding the brain signals to drive a wheelchair for paralyzed patients to execute hands-free navigation. By imaging the motor cortex using fNIRS recordings optically, the activation/deactivation patterns of the motor cortical neurons were decoded to extract the intentional movements in human subjects. We are able to decode the movement direction signals based on the recorded optical signals.

These brain-derived command signals are then sent to a mini-robot for navigational control, which is used as a test-bed for wheelchair navigation.



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