Brain connectivity in health and disease

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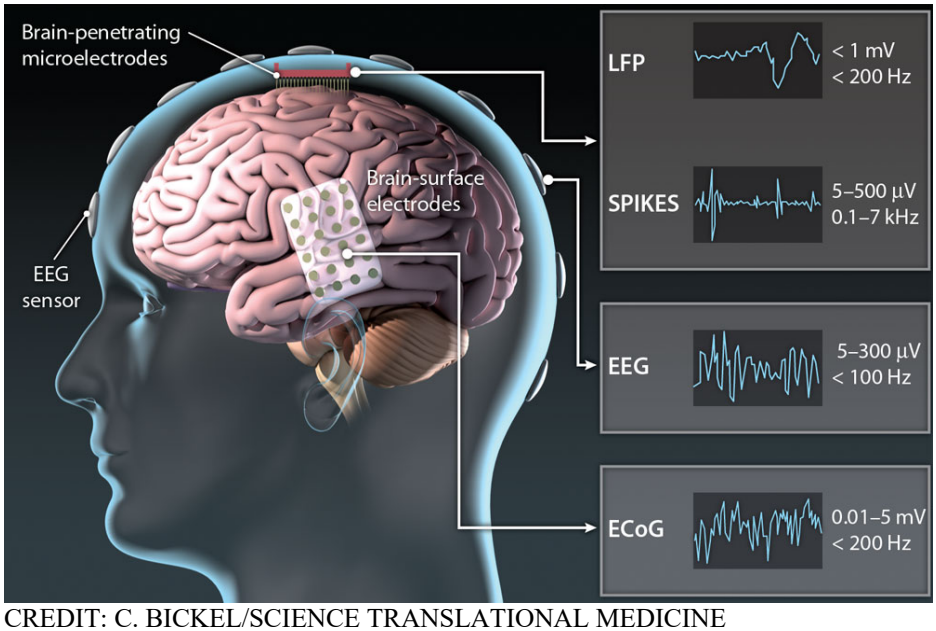
Signals recorded from the brain are now being used to control prosthetic devices, ushering a new era of brain machine interfaces (BMI). However, brain signals can be recorded using various techniques, such as microelectrodes implanted in the brain as well as electrodes placed on the scalp, called electroencephalogram (EEG). In these signals, oscillations are often seen at various frequencies such as alpha (8-12 Hz) and gamma (30-80 Hz) bands, which are tightly coupled to behavioral states and are abnormal in diseases such as Autism and Alzheimer's disease.

Because these signals are recorded from multiple electrodes that sample the activity of different brain regions, it is important to quantify the connectivity between these brain regions in the spectral domain. In this project, we will develop and use cutting-edge mathematical tools to study such connectivity patterns and causal interactions across brain areas in a variety of brain signals, including EEG collected from a large dataset of elderly subjects, some of whom have mild cognitive impairment (MCI) or at an early stages of Alzheimer's disease (AD).

Preferred background: Electrical engineering: signal processing, computer science, Mathematics, Neuroscience.



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