UNIVERSITY of HOUSTON | ENGINEERING

Department of Biomedical Engineering

Tuesday, May 5th, 2020

2:30 PM

Defense held online via Zoom

Thomas B. Potter
PhD Dissertation Defense
Dr. Yingchun Zhang, Faculty Advisor

"Navigating a Strange World: the Use of Unimodal and Novel Multimodal Neuroimaging to Investigate of Brain-Environment Interactions"

Abstract

The cortical mechanisms that support perception, cognition, and behavior are challenging to study. The subject-specific nature of responses and the need to construct contextually-flexible actions complicate even simple behaviors. Further, observing the cortical activity as an individual coordinates a response can pose a prohibitive challenge due to the inherent risks of direct, invasive signal acquisition. The advent of non-invasive neuroimaging approaches as sought to resolve this problem, with electroencephalography (EEG) and functional Magnetic Resonance Imaging (fMRI) emerging as the predominant methods thanks to their respective advantages in temporal and spatial resolution. Unimodal and multimodal source localization techniques that combine these methods have been further developed to capitalize on these respective advantages. Applying these techniques, we have investigated the cortical processes of audition and motor actuation, revealing electrophysiological dynamics that support effective stimulus response. Building upon EEG and fMRI, a novel form of multimodal source localization, known as the Dynamic Brain Transition Network approach, has been developed. This integration method applies temporally variant fMRI priors to direct EEG source localization, producing results that are resilient to depth-bias and noise. The heightened spatiotemporal detection of this method have then formed a basis for investigating the communication between brain regions that supports complex emotional perception and regulation, showing differential patterns of activity.

Zoom link: https://uofh.zoom.us/j/7065078826