Georgia Tech | Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University | Emory University

Thesis Proposal & Defense Announcement Format

Please format your Proposal/Defense Announcement as follows:

Name
BME PhD (Proposal or Defense) Presentation

Date:
Time:
Location/Meeting Link:

Committee Members:
Faculty Name (Advisor)
Faculty Name
Faculty Name
Faculty Name
Faculty Name

Title:

Abstract:

Please send your announcement to the Academic Program Manager *at least* two (2) weeks prior to your presentation for distribution.

Please see the announcement example below and contact the APM with any questions!

Example:

Mark Connolly
BME PhD Defense Presentation

Date: Friday February 26, 2021
Time: 11:00 AM-1:00 PM
Location/ Meeting Link: UAW 1004

Committee Members:
Robert E. Gross, MD/PhD (Advisor)
Christopher J. Rozell, PhD
Annaelle Devergnas, PhD
Svjetlana Miocinovic, MD/PhD
Babak Mahmoudi, PhD

Title: A Framework for Designing Data-Driven Optimization Systems for Neural Modulation: With Applications in Optogenetic and Electrical Brain Stimulation

Abstract: Neural modulation has become fundamental tool for understanding and treating neurological and psychiatric diseases and disorders including Parkinson's disease and other movement disorders, epilepsy, depression, and a growing number of other indications. Neural modulation encompasses a range of technologies for stimulating the brain using an exogenous signal to modulate neural activity and ultimately, behavior. Electrical and magnetic stimulation are used therapeutically and have been used in research applications along with optogenetic, magnetic, and ultrasonic stimulation. The stimulation is typically defined by a set of parameters that can be adjusted to change the shape of the signal. However, delivering the desired therapy or intervention is dependent on using the correct stimulation parameters, which can be specific to the neural circuit being modulated, the disease being treated, and critically, the individual subject or patient. Researchers and medical device manufacturers are continually developing tools with unprecedented flexibility for precisely tailoring stimulation parameters for subject-specific interventions. As a consequence, this increased flexibility makes it exponentially more difficult to identify the optimal stimulation parameters for an individual. Data-driven optimization is a well-developed field of engineering that has recently emerged as a solution to the problem of selecting stimulation parameters for neural modulation. However, data-driven optimization systems must be carefully designed for each specific neural modulation problem or they risk failing to find optimal, or even reasonable, stimulation parameters. In this dissertation, I demonstrate the importance of and develop a framework for designing effective data-driven optimization solutions for specific neural modulation problems. I develop this framework in the context of maximizing an electrophysiological biomarker using optogenetic stimulation in a rodent model. I then extend the framework to neural modulation problems in rodents and humans with relevant design goals: optimization to a setpoint, optimization of a non-stationary response, safe optimization, and optimization of multiple objectives simultaneously. Through these examples, I demonstrate how this framework can improve neural modulation by allowing for more precise subject-specific therapies and interventions.