Real-Time Control of Neural Dynamics in Parkinson’s Disease: From Data-Driven Circuit Analysis to Closed-Loop Deep Brain Stimulation

David Escobar
Assistant Professor; Department of Neurology – University of Minnesota

Elevated neural oscillatory activity and synchronization in brain circuits responsible for movement control are hypothesized to be involved in the development of rigidity and slowness of movement in Parkinson’s disease (PD). Circuit-level alterations in neural dynamics underlying changes in oscillatory activity and the causal relationship between these dynamics and PD motor signs are, however, not well understood. Understanding these causal relations is pivotal to developing personalized deep brain stimulation (DBS) therapies that control neural activity causally linked to the manifestation of Parkinson’s signs. In this talk, I will present our research program focused on characterizing circuit-level neural dynamics in PD, developing closed-loop DBS technologies that control neural activity in real-time, and untangling causal relations between neural dynamics and PD motor signs.

Bio: Dr. David Escobar is an assistant professor in the Department of Neurology at the University of Minnesota Medical School. His research is aimed to advance the development of patient-specific brain modulation therapies that control neural activity underlying dysfunction in brain conditions such as Parkinson’s disease and epilepsy. Dr. Escobar leverages the fields of neurophysiology, dynamical systems, and feedback (closed-loop) control to identify circuit-level neural dynamics causally linked to the manifestation of brain conditions and to develop brain stimulation techniques that control these neural dynamics in real-time. He received an M.S. and a Ph.D. in aerospace engineering and mechanics from the University of Minnesota in 2012 and 2015, respectively. His graduate research was on data-driven modeling of dynamical systems and robust feedback control. In 2015, he joined the Department of Neurology at the University of Minnesota as a postdoctoral fellow where he conducted preclinical and clinical research on neurophysiology, the pathophysiology of Parkinson’s disease, and closed-loop deep brain stimulation (DBS) therapies.