Department of Electrical and Computer Engineering

TEXAS TECH UNIVERSITY
Edward E. Whitacre Jr.
College *of* Engineering

Spring 2025 Seminar Series

Seminar Title: ***Closed-Loop Brain-Computer Interfaces for Drug-Resistant Epilepsy: From Detection to Prediction and Control***

Time: 2:00-2:50 PM, Monday, Mar 10, 2025
Location: ECE 101

Speaker:
Erfan Nozari
University of California, Riverside

Abstract:
Over 3 million people in the United States and over 65 million people worldwide have active epilepsy, and about 30% of them are drug-resistant. A common treatment option for the latter group is invasive intracranial EEG (iEEG) monitoring followed by resecting or ablating the seizure onset zone. The highly invasive nature of this procedure has long motivated the development of chronically-implantable closed-loop brain-computer interfaces (BCIs) that aim to predict the likely occurrence of seizures ahead of time and apply intracranial electrical stimulation to suppress the impending seizure. The only existing clinical option, however, suffers from several limitations, including low efficacy and large variability. In this talk I will present an alternative approach for the design of such chronically-implantable closed-loop BCIs based on data-driven computational modeling. I will present our recent progress on improving the accuracy of advanced seizure prediction by an average of 50% (up to 300%) using multi-level predictive modeling of seizure dynamics. Then, I will present our results on accurate data-driven modeling of how intracranial electrical stimulation propagates through the brain and evokes iEEG response in near, mid-range, and distant electrodes. Together, these results form the foundation for model-based predictable close-loop seizure control—a transformative goal made possible only through cross-disciplinary collaboration among neuroscientists, engineers, and clinicians.

Speaker Bio:
Dr. Erfan Nozari is an Assistant Professor at the University of California, Riverside Department of Mechanical Engineering. He received a B.Sc. degree in Electrical Engineering-Control in 2013 from Isfahan University of Technology, Iran, and a Ph.D. in Mechanical Engineering and Cognitive Science in 2019 from University of California San Diego. He was subsequently a postdoctoral researcher at the University of Pennsylvania Department of Electrical and Systems Engineering. His main research interests lie at the intersection of computational neuroscience, dynamical systems, and machine learning and his lab's recent focus has been on understanding the neural code and its generative mechanisms across spatial and temporal scales using the unique perspective of dynamical systems and controls. He is a Hellman Fellow and has been the recipient of the NSF CAREER Award, the IEEE Transactions on Control of Network Systems Outstanding Paper Award, and Best Student Paper Awards from the IEEE Conference on Decision and Control and the American Control Conference.