Department of Electrical and Computer Engineering

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

Fall 2023 Seminar Series

Seminar Title: ***Comprehensive In-situ Profiling of Pathological Brain Cellular Alterations using large-scale highly Multiplexed Immunofluorescence Imaging and Deep Neural Networks***

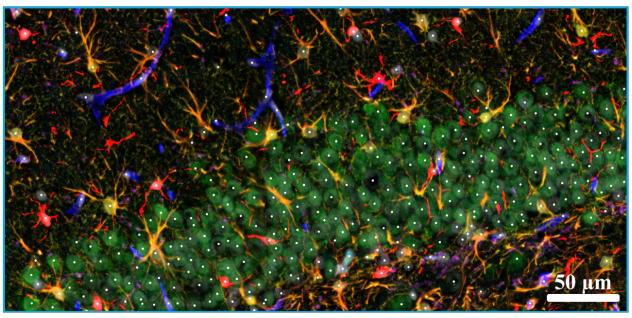
Time: 2:00-2:50 PM, Friday, Sept 29, 2023

Location: Biology 101

Speaker:
Badri Roysam
University of Houston

Abstract:

While international brain-mapping initiatives remain focused on revealing the structure and working of the healthy brain, the need to map the unhealthy brain is compelling and urgent, yet unmet. Especially important is the need to map the complex and multi-scale brain cellular alterations associated with pathological conditions like traumatic brain injury, ischemia, binge alcohol, tumor growth, and experimental drug treatments. For example, traumatic brain injury (TBI) initiates a complex web of pathological alterations in all types of brain cells at multiple scales, ranging from individual cells to multi-cellular niches to the layered brain cytoarchitecture. These alterations represent a mix of changes associated with the primary injury, secondary injuries, regenerative processes, inflammation, tissue remodeling, drug treatments, and drug side effects. Many of these alterations can be subtle and/or latent, only discernible by sensing changes in cell morphology, cyto- or myelo-architecture, or the expression patterns of molecular markers. Some alterations can be in brain regions that are distant from the injury/damage site. In this talk, we will discuss a comprehensive approach to pathological brain tissue mapping for driving rational therapeutics development. The idea is to replace the many low information content assays with a single comprehensive assay based on highly multiplexed imaging is brain sections employing 10 – 100 molecular markers, sufficient to analyze all the major brain cell types and their functional states over large brain regions. Such imaging generates terabyte-scale images. Analyzing these images is challenging due to their complexity, variability, and sheer size. To overcome these challenges, we describe a combination of signal reconstruction, neural-network-based cell detection and phenotyping, and high-dimensional data analysis approaches to generate quantitative readouts of cellular alterations at multiple scales ranging from individual cells to multi-cellular units, large cellular ensembles (e.g., cortical layers), and atlas-defined brain regions. These data can be used to explore the data interactively with a. custom search engine, and derive data for testing hypotheses, screening individual drugs and combination therapies, and formulate system-level studies.



Speaker Bio:

Dr. Badri Roysam, Fellow IEEE, Fellow AIMBE, is the Hugh Roy and Lillie Cranz Cullen University Professor, and Chairman of the Electrical and Computer Engineering Department at the University of Houston. From 1989 to 2010, he was a Professor at Rensselaer Polytechnic Institute in Troy, New York, USA, where he directed the Rensselaer unit of the NSF Engineering Research (ERC) Center for Subsurface Sensing and Imaging Systems (CenSSIS ERC), and co-directed the Rensselaer Center for Open Source Software (RCOS). He received the Doctor of Science degree from Washington University, St. Louis, USA, in 1989. Earlier, he received his Bachelor's degree from the Indian Institute of Technology, Madras, India in 1984.