BUET ACM Chapter

presents

NeuroADDA: Active Discriminative Domain Adaptation in Connectomics

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Shashata Sawmya is a graduate student in Electrical Engineering and Computer Science at the Massachusetts Institute of Technology (MIT). Before joining MIT, he was a lecturer at the Bangladesh University of Engineering and Technology. His research interests encompass neural computation in both silicon and biological tissues, particularly in the field of connectomics—the study of the intricate wiring of the brain. Apart from his passion for research, he enjoys working out, cooking, and engaging in conversations about ideas. Like the father of neuroscience, Santiago Ramón y Cajal, Shashata believes that even the smallest of ideas can transform the world. His ultimate dream is a world where humanity understands its own delicate mind, and his life goal is to make the impossible possible by pushing the boundaries of neuroscience to new heights.

Abstract

Neuroscience aims to understand how neural systems function, from individual neurons to entire brain networks. Connectomics, a subfield of structural neuroscience, specifically seeks to map the intricate wiring of neural circuits using advanced high-resolution imaging techniques such as serial-section electron microscopy (SEM). Effective analysis of connectomic EM datasets relies critically on computer vision algorithms, particularly segmentation, which enable the identification and delineation of neurons and synapses. Even though understanding the structure and connectivity of neural tissue is fundamental, training segmentation models for new EM connectomics datasets remains data-intensive and computationally expensive. The lack of large annotated datasets makes it challenging to develop accurate segmentation models, necessitating efficient methods to achieve high performance in low ground-truth scenarios. In this project, we explore domain adaptation as a solution by leveraging pretrained models from existing datasets. We introduce NeuroADDA, a method that combines Maximum Mean Discrepancy (MMD)-based optimal domain selection with source-free active learning to efficiently adapt pretrained segmentation models to new domains. NeuroADDA significantly reduces annotation costs while improving performance, achieving a 45–63% reduction in Variation of Information with only n=4 fine-tuning samples. Beyond improving segmentation efficiency, we also investigate the underlying properties of neural tissue distribution distances and their potential connections to core biological hypotheses, such as evolutionary relationships and neural development.

When: Wednesday, April 16, 2025 (3:00 PM - 4:30 PM)

Where: Hybrid Mode

Graduate Seminar Room (ECE 503), Department of CSE

Zoom Meeting

Meeting ID: 633 8732 3392

Link: https://bdren.zoom.us/j/63387323392https://bdren.zoom.us/j/63387323392

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