Project Title:

Human-Centered Multi-Source Data Learning on Ageing Neuroscience (Computer vision/Image processing field)

Supervisor: Prof. Mark Chignell

Application: Please submit CV, unofficial transcript, and a single paragraph describing your interest in the project in one file in a single email to Prof. Mark Chignell at chignel@mie.utoronto.ca and Dr. Lu Wang at lwang71@central.uh.edu. We will decide the acceptance based on your interest and completion in doing a small real data work within our projects instead of your interview performance.

Project Background and Description: The global population is rapidly aging, bringing significant challenges to healthcare systems, particularly in understanding and addressing age-related neurological conditions such as Alzheimer's disease, Parkinson's disease, and other forms of cognitive decline. As the prevalence of these conditions rises, there is a critical need for advanced methods to analyze and interpret complex datasets that can provide insights into the aging brain.

This project focuses on leveraging human-centered multi-source data learning approaches in the field of aging neuroscience, particularly through the application of computer vision and image processing techniques. Aging neuroscience research increasingly involves the integration of diverse data sources from CAM-CAN (https://camcan-archive.mrc-cbu.cam.ac.uk/dataaccess/), including neuroimaging (MRI, fMRI, PET), behavioral data, medical history, and cognitive assessments. The challenge lies in developing robust computational models that can effectively combine these heterogeneous data types to yield meaningful insights into the aging process and its impact on brain function.

By adopting a human-centered approach, this project emphasizes the importance of creating models that are not only accurate but also interpretable and accessible to clinicians and researchers. The ultimate goal is to develop tools that can assist in early diagnosis, personalized treatment planning, and monitoring of age-related neurological conditions, thus improving the quality of life for the aging population.

The project will explore state-of-the-art techniques in computer vision and image processing, including deep learning models for pattern recognition and anomaly detection, multi-modal data fusion, and explainable AI. These techniques will be applied to large-scale datasets from aging studies, aiming to uncover new biomarkers and predictive models that can advance our understanding of the aging brain.

By integrating multi-source data and focusing on human-centered design, this project has the potential to revolutionize how aging neuroscience is studied and how care is delivered to older adults with neurological conditions.

The project will involve the following key components: **Multi-Source Data Integration**, **Computer Vision and Image Processing Techniques**, **Human-Centered Model Design**, **Application to Aging-Related Conditions**, **Validation and Clinical Collaboration**

By focusing on human-centered multi-source data learning, this project aims to advance the field of aging neuroscience and improve the understanding, diagnosis, and treatment of aging-related neurological conditions. The integration of computer vision and image processing techniques with a human-centered approach will lead to the development of tools that are both scientifically rigorous and practically valuable in clinical settings.

In this project, you will have opportunities working with real healthcare and medical data including EHRs/EMRs for multiple cognitive disorders and chronic diseases collaborating with physicians, clinicians and psychiatrists, etc.

Start date: Summer/Fall 2025
Research area: Data science, machine learning, artificial intelligence, healthcare, medical research.