Indiana University Indianapolis Department of Mathematical Sciences

STATISTICS SEMINAR

12:15pm—1:15pm, Tuesday, April 15, 2025 Zoom Meeting: Meeting ID: 845 0989 4694

Speaker: Yuexuan Wu Department of Statistics, University of South Carolina

Title: Spatiotemporal Shape Analysis of Longitudinal Brain Imaging Data

Abstract:

Over the past 30 years, magnetic resonance imaging (MRI) has become a ubiquitous tool for visualizing brain structures. Understanding how brain morphology evolves over time is essential for studying brain aging and neurodegenerative diseases. However, modeling longitudinal 3D brain shape remains challenging due to high dimensionality, irregular temporal sampling, and variability across both spatial and temporal domains. In this talk, I will introduce statistical frameworks based on elastic shape analysis for aligning and modeling 3D surfaces over time. The approach leverages lowdimensional representations of 3D shape trajectories to efficiently quantify spatiotemporal deformation patterns while preserving biologically meaningful variability. We develop a set of tools to quantify longitudinal shape changes of brain structures directly from raw structural MRI data, enabling systematic comparisons across individuals and populations. Applications to multiple longitudinal neuroimaging datasets demonstrate the wide utility of the framework in estimating individual shape trajectories from sparse longitudinal data, identifying group-level differences related to aging, and detecting subtle patterns of morphological change. I will conclude by discussing ongoing work and related open questions.

Bio:

Dr. Yuexuan Wu is an Assistant Professor in the Department of Statistics at the University of South Carolina. Prior to that, he was a postdoc in Biostatistics at the University of Washington. He received his Ph.D. in Statistics from Florida State University in 2022. His research focuses on developing statistical and machine learning methods for high-dimensional and complex data, with applications in neuroimaging, brain aging, and Alzheimer's disease. His research interests include medical image analysis, shape and functional data analysis, causal inference, and deep learning.