Artificial Intelligence Initiative (Aii)

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Invited Speaker

Dr. Xinyu Chen, MIT

"Machine Learning and Optimization for Understanding Spatiotemporal Systems"

Thursday, May 22, 2025 • 1:30PM • R1 101 • Zoom

Abstract:
In spatiotemporal systems, large amounts of time series data—such as urban mobility and climate variables—are readily available for implementing downstream machine learning tasks and supporting decision-making. Since these data are characterized by spatiotemporal dimensions and reflect underlying system patterns, it is essential to reformulate time series problems using machine learning approaches. In this talk, we address two key scientific challenges: 1) Imputing missing values from partially observed time series data; 2) Quantifying time series periodicity in spatially- and time-varying systems. To tackle the first problem, we introduce a time series convolution framework that efficiently imputes missing data while maintaining scalability through the Fast Fourier Transform (FFT). For the second problem, we propose a mathematical framework based on sparse autoregression and mixed-integer programming to quantify periodicity in multidimensional mobility data and climate variables. Our models would lay an insightful foundation for understanding complicated spatiotemporal data in real-world systems.

Bio:
Dr. Xinyu Chen is now a Postdoctoral Associate at MIT, working with Prof. Jinhua Zhao to tackel data-driven machine learning challenges in computational engineering. He contributes to the Mens, Manus, and Machina (M3S) initiative and Department of Energy (DOE) projects. Prior to joining MIT, he received his Ph.D. from the University of Montreal in Canada where he was honored to receive the IVADO PhD Excellence Scholarship from the Montreal Institute for Data Valorization (IVADO). Currently, his research focuses on developing theoretical and interpretable machine learning methods for modeling spatiotemporal data and computational social science data. His work in model development of machine learning can be categorized into two key themes: tensor computations for machine learning (Tensor4ML) and optimization for interpretable machine learning (Opt4IML). His research has been published in the top-tier scientific journals across Data Science, Machine Learning, Optimization, and Transportation, including IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Knowledge and Data Engineering, INFORMS Journal on Computing, and Transportation Science.