



Department of Data Science

香港城市大學
City University of Hong Kong

DS SEMINAR

Trans-Glasso: A Transfer Learning Approach to Precision Matrix Estimation

Date: 30 April 2025 (Wednesday)

Time: 4:00pm - 5:00pm

Venue: Rm 6-209, Lau Ming Wai Academic Building

Zoom: <https://cityu.zoom.us/j/82146002845>



ABSTRACT

Many real-world systems—ranging from gene regulatory interactions in biology to financial asset dependencies—can be represented by networks, whose edges correspond to conditional relationships among variables. These relationships are succinctly captured by the precision matrix of a multivariate distribution. Estimating the precision matrix is thus fundamental to uncovering the underlying network structure. However, this task can be challenging when the available data for the target domain are limited, undermining accurate inference.

In this talk, I will present Trans-Glasso, a novel two-step transfer learning framework for precision matrix estimation that leverages data from source studies to improve estimates in the target study. First, Trans-Glasso identifies shared and unique features across studies via a multi-task learning objective. Then, it refines these initial estimates through differential network estimation to account for structural differences between the target and source precision matrices. Assuming that most entries of the target precision matrix are shared with at least one source matrix, we derive non-asymptotic error bounds and show that Trans-Glasso achieves minimax optimality under certain conditions.

Through extensive simulations, Trans-Glasso demonstrates improved performance over standard methods, especially in small-sample settings. Applications to gene regulatory networks across multiple brain tissues and protein networks in various cancer subtypes confirm its practical effectiveness in biological contexts, where understanding network structures can provide insights into disease mechanisms and potential interventions. Beyond biology, these techniques are broadly applicable wherever precision matrix estimation and network inference play a crucial role, including neuroscience, finance, and social science.

This is joint work with Boxin Zhao and Cong Ma.



Prof. Mladen Kolar

GUEST SPEAKER'S PROFILE

Mladen Kolar is a professor in the Department of Data Sciences and Operations at the USC Marshall School of Business. Mladen earned his PhD in Machine Learning from Carnegie Mellon University in 2013. His research focuses on high-dimensional statistical methods, probabilistic graphical models, and scalable optimization methods, driven by the need to uncover interesting and scientifically meaningful structures from observational data. Mladen was selected as a recipient of the 2024 Junior Leo Breiman Award for his outstanding contributions to these areas. He currently serves as an associate editor for the Journal of Machine Learning Research, the Annals of Statistics, the Journal of Computational and Graphical Statistics, and the New England Journal of Statistics in Data Science.

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All are welcome