



THE UNIVERSITY OF
CHICAGO

DEPARTMENT OF STATISTICS

PhD Dissertation Presentation

Ziming Gan

Department of Statistics
The University of Chicago

“Statistical Methods for Structure Discovery in Genomic and Clinical Data”

July 8, 2026, at 10:00 AM
Zoom Meeting

Abstract

Statistical analysis of modern biomedical data requires methods capable of handling high dimensionality, complex dependence structures, and evolving biological systems. This dissertation develops statistical methodologies for two important classes of biomedical data: alternative polyadenylation (APA) measurements from transcriptomic studies and longitudinal discrete event data from electronic health records.

The first part of the dissertation focuses on transcript-aware analysis of APA, a widespread post-transcriptional regulatory mechanism. Existing approaches often struggle to accurately identify polyadenylation sites and to determine whether APA usage depends on biological variables after accounting for confounding factors. To address these challenges, I develop a unified framework that incorporates transcript structure into peak identification and polyadenylation-site annotation and formulates APA analysis as a conditional independence testing problem.

The second part of the dissertation develops H-DOGTOR, a framework for dynamic knowledge graph learning from longitudinal discrete event data. H-DOGTOR models event occurrences using multivariate Hawkes processes whose baseline intensities and interaction networks vary smoothly across external environments. To address high dimensionality, the framework incorporates both sparsity and low-rank structural constraints, enabling recovery of localized interactions and latent network structure.

Together, these methodologies provide statistically rigorous tools for learning biological structure and dependence from complex biomedical data. By integrating machine learning, high-

dimensional inference, and stochastic process modeling, this work advances both transcriptomic regulation analysis and dynamic clinical knowledge discovery.

For information about building access for persons with disabilities, please contact Keisha Prowoznik at 773.702-0541 or send an email to kprowoznik@uchicago.edu. If you wish to subscribe to our email list, please visit the following website: <https://lists.uchicago.edu/web/info/statseminars>.