Indiana University-Purdue University Indianapolis

Department of Mathematical Sciences

Statistics Seminar

12:15pm—1:15pm, Tuesday, February 07, 2023
Zoom Meeting: Meeting ID: 845 0989 4694

Speaker: **Fangzheng Xie**
Department of Statistics,
Indiana University Bloomington

Title: **An Eigenvector-Assisted Estimation Framework for Signal-Plus-Noise Matrix Models**

Abstract:

Signal-plus-noise matrix models, also known as low-rank random matrix models, are ubiquitous in statistics, machine learning, applied mathematics, and signal processing, among other fields. In this talk, I will introduce an eigenvector-assisted estimation framework for a collection of signal-plus-noise matrix models arising in high-dimensional statistics and many applications. The framework is built upon a novel asymptotically unbiased estimating equation using the leading eigenvectors of the data matrix. However, the estimator obtained by directly solving the estimating equation could be numerically unstable in practice and lacks robustness against the model misspecification. We propose to use the quasi-posterior distribution by exponentiating a criterion function whose maximizer coincides with the estimating equation estimator. The proposed framework can incorporate the potentially heteroskedastic variance information but does not require the complete specification of the sampling distribution, and is also robust to the potential misspecification of the distribution of the noise matrix. Computationally, the quasi-posterior distribution can be obtained via a Markov Chain Monte Carlo sampler, which exhibits superior numerical stability than some of the existing optimization-based estimators and is straightforward for uncertainty quantification. Under mild regularity conditions, we establish the large sample properties of the quasi-posterior distributions. In particular, the quasi-posterior credible sets have the correct frequentist nominal coverage probability provided that the criterion function is carefully selected. The validity and usefulness of the proposed framework are demonstrated through the analysis of synthetic datasets and the real-world ENZYMES network datasets.

Bio:
Dr. Fangzheng Xie is an assistant professor in The Department of

Statistics at Indiana University. His research interest includes network analysis, high-dimensional statistics, Bayesian nonparametrics, and Bayesian methods for computer experiments and uncertainty quantification. He received his Ph.D. from The Department of Applied Mathematics and Statistics at Johns Hopkins University.