Stanford University
Department of Statistics

Departmental Seminar

4:30pm, Tuesday, December 4, 2018
Sloan Mathematics Center Room 380C

Refreshments served at 4pm in Sequoia Lounge.

Speaker: Yingying Fan, *USC*

Title: Asymptotic Theory of Eigenvectors for Large Random Matrices with Applications to Network Inference

Abstract:

Characterizing the exact asymptotic distributions of high-dimensional eigenvectors for large structured random matrices poses important challenges yet can provide useful insights into a range of applications. To this end, in this paper we introduce a general framework of asymptotic theory of eigenvectors (ATE) for large structured symmetric random matrices with heterogeneous variances, and establish the asymptotic properties of the spiked eigenvectors and eigenvalues for the scenario of the generalized Wigner matrix noise, where the mean matrix is assumed to have the low-rank structure.

Under some mild regularity conditions, we provide the asymptotic expansions for the spiked eigenvalues and show that they are asymptotically normal after some normalization. For the spiked eigenvectors, we establish novel asymptotic expansions for the general linear combination and further show that it is asymptotically normal after some normalization, where the weight vector can be arbitrary. We also provide a more general asymptotic theory for the spiked eigenvectors using the bilinear form.

Simulation studies verify the validity of our new theoretical results. Our family of models encompasses many popularly used ones such as the stochastic block models with or without overlapping communities for network analysis and the topic models for text analysis, and our general theory can be exploited for statistical inference in these large-scale applications.

This talk is based on joint works with Jianqing Fan, Xiao Han, and Jinchi Lv.