Yingying Fan (Keynote speaker, Saturday 2/13 1:00PM ET)

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Title: "**Large-scale Network Inference**"

Abstract:

Network data is prevalent in many contemporary big data applications in which a common interest is to unveil important latent links between different pairs of nodes. Yet a simple fundamental question of how to precisely quantify the statistical uncertainty associated with the identification of latent links still remains largely unexplored. In this paper, we propose the method of statistical inference on membership profiles in large networks (SIMPLE) in the setting of degree-corrected mixed membership model, where the null hypothesis assumes that the pair of nodes share the same profile of community memberships. In the simpler case of no degree heterogeneity, the model reduces to the mixed membership model for which an alternative more robust test is also proposed. Both tests are of the Hotelling-type statistics based on the rows of empirical eigenvectors or their ratios, whose asymptotic covariance matrices are very challenging to derive and estimate. Nevertheless, their analytical expressions are unveiled and the unknown covariance matrices are consistently estimated. Under some mild regularity conditions, we establish the exact limiting distributions of the two forms of SIMPLE test statistics under the null hypothesis and contiguous alternative hypothesis. They are the chi-square distributions and the noncentral chi-square distributions, respectively, with degrees of freedom depending on whether the degrees are corrected or not. We also address the important issue of estimating the unknown number of communities and establish the asymptotic properties of the associated test statistics. The advantages and practical utility of our new procedures in terms of both size and power are demonstrated through several simulation examples and real network applications. This talk is based on joint works with Jianqing Fan, Xiao Han and Jinchi Lv.