

**Indiana University-Purdue University
Indianapolis**
Department of Mathematical Sciences

STATISTICS SEMINAR

12:15pm—1:15pm, Tuesday, October 23, 2018
LD 265

Speaker: **Dr. Yao Zheng** (Postdoc)
Department of Statistics, Purdue University

Title: **Finite Time Analysis of Vector Autoregressive Models
under Linear Restrictions**

Abstract:

We develop a unified finite-time theory for the OLS estimation of possibly unstable VAR models under linear restrictions, with the applicable region $\rho(A) \leq 1 + c/T$, where $\rho(A)$ is the spectral radius of the transition matrix in the VAR(1) representation, T is the time horizon and $c > 0$ is an arbitrary absolute constant. This linear restriction framework encompasses various existing models in the literature such as the banded VAR model and the network VAR model. We show that the restrictions reduce the error bounds not only through the reduced dimensionality, but also through a scale factor that resembles the asymptotic covariance matrix in the classical fixed-dimensional setup; as long as the model is correctly specified, this scale factor will decrease as more restrictions are incorporated. Our analysis reveals that a dichotomy between the slow and fast error rates is determined by the smallest singular value of the transition matrix, a measure of the least excitable mode of the system. We also derive minimax lower bounds for the linearly restricted models across different stability regimes. Compared to the usual asymptotic analysis, the finite-time theory not only bridges the theoretical gap between stable and unstable regimes, but precisely characterizes the effect of the restrictions and its interplay with other model parameters. Through simulations, our theoretical results are confirmed in small and large samples.