THE UNIVERSITY OF CHICAGO

Department of Statistics

DISSERTATION PRESENTATION AND DEFENSE

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Statistical Learning and High-Dimensional Inference for Time Dependent Data

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ABSTRACT

This thesis considers statistical learning, testing and inference for time dependent data based on two papers. Following are abstracts for each of them:

Concentration Inequalities for Empirical Processes of Linear Time Series, joint with Wei Biao Wu, to appear in JMLR

The paper considers suprema of empirical processes for linear time series indexed by functional classes. We derive an upper bound for the tail probability of the suprema under conditions on the size of the function class, the sample size, temporal dependence and the moment conditions of the underlying time series. Due to the dependence and heavy-tailness, our tail probability bound is substantially different from those classical exponential bounds obtained under the independence assumption in that it involves an extra polynomial decaying term. We allow both short- and long-range dependent processes. For empirical processes indexed by half intervals, our tail probability inequality is sharp up to a multiplicative constant.

Testing for Trends in High-dimensional Time Series, joint with Wei Biao Wu, to appear in JASA

The paper considers statistical inference for trends of high-dimensional time series. Based on a modified L^2-distance between parametric and nonparametric trend estimators, we propose a de-diagonalized quadratic form test statistic for testing patterns on trends, such as linear, quadratic or parallel forms. We develop an asymptotic theory for the test statistic. A Gaussian multiplier testing procedure is proposed and it has an improved finite sample performance. Our testing procedure is applied to a spatial temporal temperature data gathered from various locations across America. A simulation study is also presented to illustrate the performance of our testing method.

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