STAT 991: High-Dimensional Statistical Inference

Monday & Wednesday 9:00-10:30am at F96 JMHH

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Office hours: Tuesday 9:15 - 11:00am at 469 JMHH.

The main focus of the course is to discuss current research problems on high dimensional statistical inference, which is one of the most active research areas in statistics at the moment. Topics include high-dimensional sparse signal recovery (compressed sensing, large p, small n regression), large-scale multiple testing, and estimation of large covariance matrices. Both theory and methods are covered in the course.

The following is a tentative list of main topics.

- Overview
- Gaussian Sequence Model & Nonparametric Function Estimation
  - Linear estimators & asymptotic minimaxity
  - Wavelet thresholding & Adaptive estimation
  - Oracle Inequalities
- Compressed sensing & High Dimensional Linear Regression
  - Methods of ℓ_1 penalty and constrained ℓ_1 minimization. RIP, MIP & RE conditions.
  - Analysis of Lasso and Dantzig Selector.
  - Shifting inequality & sparse signal recovery in three settings: noiseless, bounded noise and Gaussian noise.
- Johnson-Lindenstrass Lemma & Construction of Compressed Sensing Matrices
- Estimation of large covariance matrices
  - Methods
  - Rates of convergence
  - Lower bound techniques
- Additional topics will be covered if time permits.

Class Participation: Each participant is expected to read at least one research paper in depth and present to the class in a lecture.

Homework & Grade: Each registered student is required to write a report on a research topic based on leading research papers on the subject. There will be occasional homework assignments. Discussion among students are encouraged. There is no exams. Final grade will be based on the presentation, research report, and class participation.

Course Material:

1. *Introduction to Nonparametric Function Estimation*, by A. Tsybakov (Springer, 2009).
2. *Function Estimation and Gaussian Sequence Models*, by Iain Johnstone. Monograph. Available at `http://www-stat.stanford.edu/~imj` .
3. Lecture Notes.