STAT 915: Nonparametric Inference

MW 9-10:30am @ F38 JMHH

Office hour: Wednesday 1-2pm @469 JMHH

This course aims to give a modern treatment of nonparametric function estimation. The focus is on wavelet methodologies and the Gaussian sequence model. We will discuss minimaxity, adaptive minimaxity, rate-optimal procedures, and lower bound techniques. Estimation of various functionals and nonparametric inference will also be covered. Here is an outline of the topics.

- Overview of nonparametric function estimation

    - Problems, models, and criteria.
    - Conventional methods for density estimation and nonparametric regression
    - Rates of convergence

- Lower bound techniques

    - Measures of distance: Affinity, L_1 distance, Chi-square distance, total variation
    - Le Cam's method
    - Brown-Low's constrained risk inequality
    - Other lower bound arguments

- Wavelet thresholding

    - Term-by-term thresholding
    - Block thresholding & information pooling
    - Oracle Inequality
    - Adaptive estimation

- Estimation of functionals

    - Linear functionals
    - Quadratic functionals
    - Nonsmooth functionals

- Robust nonparametric estimation & regression in exponential families

- Nonparametric inference

    - Hypothesis testing
    - Confidence intervals and confidence balls: Construction & lower bounds

Course Materials:

1. Johnstone, I. M. (2013). *Gaussian Estimation: Sequence And Wavelet Models.* Available at `www-stat.stanford.edu/~imj`.

2. Härdle, W., Kerkyacharian, G., Picard, D. and Tsybakov, A. (1998). *Wavelets, Approximation, and Statistical Applications*, Springer.

3. Daubechies, I. (1992). *Ten Lectures on Wavelets*, SIAM.

4. Wasserman, L. (2006). *All of Nonparametric Statistics*, Springer.

5. Lecture Notes.

Computing: You can use R or MATLAB in the course for simulation and implementation of the wavelet procedures. If you prefer, you may also use other software packages.

Homework: There will be occasional homework assignments.

Exam: There will be no exam.

Presentation: Students are expected to give a presentation near the end of the semester.