Math 867: High-Dimensional Data Analysis and Statistical Inference
Spring 2015

Lectures: Wednesdays 3:10–5:50 pm, 402 Teaching Building 4

Instructor: Wei Lin (weilin@math.pku.edu.cn)
Office hours: Wednesdays 6:00–7:00 pm, No. 39 Xiaolou, Yandongyuan

Description:
This is a graduate and advanced undergraduate level course in high-dimensional statistics, introducing the fundamental principles for the statistical modeling, analysis, and inference of high-dimensional and big data. High-dimensional regression, large covariance estimation, and large-scale hypothesis testing will be covered, along with necessary mathematical tools such as concentration inequalities and random matrix theory, as well as optimization algorithms such as coordinate descent and the alternating direction method of multipliers. Large data sets of various types will be presented and analyzed.

Primary Texts:
The course will not follow a textbook, but the following books may be useful for reference.

1. P. Bühlmann and S. van de Geer, *Statistics for High-Dimensional Data: Methods, Theory and Applications*, Springer, 2011
2. M. Pourahmadi, *High-Dimensional Covariance Estimation*, Wiley, 2013
3. B. Efron, *Large-Scale Inference: Empirical Bayes Methods for Estimation, Testing, and Prediction*, Cambridge University Press, 2010

Supplementary Texts:

1. S. Boucheron, G. Lugosi and P. Massart, *Concentration Inequalities: A Nonasymptotic Theory of Independence*, Oxford University Press, 2013
2. Z. Bai and J. W. Silverstein, *Spectral Analysis of Large Dimensional Random Matrices* (2nd ed.), Springer, 2010

Course Schedules and Materials:
Course schedules and materials will be posted on the course websites at www.math.pku.edu.cn/teachers/linw/867s15.html and course.pku.edu.cn. Please check for updates throughout the semester.

Homework and Projects:
There will be three homework assignments, approximately corresponding to the three parts of contents (regression, covariance estimation, and testing). Collaboration on homework assignments is allowed but should be acknowledged in your submission by listing the names of the students with whom you collaborated with. You must, however, work on your own submission and *not* share it with others.

You are expected to complete a course project and present it in both written and oral forms. A list of project topics will be distributed in the middle of the semester. You should choose one topic from the list or elsewhere as permitted by the instructor, and work in groups of one to three.

Grading:
The course grade breaks down to 60% homework and 40% project (25% written report plus 15% oral presentation).