Stats 102B Computation and Optimazation for Statistics

Course moodle site: `https://ccle.ucla.edu/course/view.php?name=12W-STATS102B-1`.
Instructor: Qing Zhou (zhou@stat.ucla.edu), OH: Tuesday 2:20–3pm, and 5–6pm, MS 8979.
Prerequisite: Stats 100B (Mathematical Statistics) and Math 33A (Linear Algebra). Programming skills (R or Matlab or C).

Grading

Your final grade of this course will be composed of three parts:

1. Homework assignments (20%). We will have biweekly assignments. Some problems need computer programming.
2. Midterm exam (40%, in-class). 1-2:20pm, Thursday (2/9).
3. Final exam (40%, in-class). 1-2:20pm, Thursday (3/15).

Letter grades: top 30% (A), 30% – 80% (B), below 80% (C or below C).

Topics

Introduction to computational methods and optimization useful for statisticians. Use of computer programming to solve statistical problems. The topics are grouped into six chapters:

1. Introduction and Examples: motivations of the course with examples, relation to other statistical courses.
2. Matrix Algebra: vector and matrix computation, connections to statistics, eigenvalue decomposition.
3. Principal Component Analysis (PCA): multivariate normal distribution, principal components, dimension reduction, PC regression.
4. Optimization: gradient and Hessian, Newton's method, coordinate descent, constrained optimization, applications in linear regression and penalized least squares.
5. EM and MM Algorithms: missing data, the EM algorithm, Majorization, MM algorithm.

References

- Lecture notes: Will be posted on the Moodle site weekly.
- (Optional) Bryan Manly, Multivariate Statistical Methods: A Primer, Third Edition, Chapman & Hall/CRC: for chapters 2 and 3.
- (Optional) Fletcher, R., Practical Methods of Optimization, Second edition, Wiley: for chapters 4 and 5.