Statistics 6207: Computational Methods in Statistics

Syllabus

Time: W, 6:10-8:40 PM; Room: Phil 108
Instructor: Rida Moustafa
E-mail address: shalash@gwu.edu
Office hours: By appointment.

Textbooks
- Required: None
- Recommended
  - Matrix Computations, Golub and VanLoan (Johns Hopkins University Press, 96).
  - Additional course material provided by the instructor.

Description
Computational methods play significant role in modern statistical data analysis due to the ever-increasing data sizes, complexity and various underlying assumptions of the given data that must be statistically validated. This course is an introduction to the modern, computationally intensive methods in statistics focusing on the aspects of the computational methods in data analysis and inference, and the development of statistical theory. In particular, the following general areas will be covered:

1. Introduction statistical programming using R: Reading data tables and frames, data aggregation, code factorization and optimization, and statistical libraries in R.
3. Linear Methods for Regression Analysis: multiple regression analysis, orthogonalization by Householder transformations (QR); singular value decomposition (SVD); linear dimension-reduction using principal component analysis (PCA).
4. Simulation of Random Variables: Random number generators, discrete and continuous random variables; inverse transform method, acceptance-rejection method, mixture methods.
7. Elementary Pattern Recognition:
   b. Classification: Bayesian classification, k-nearest neighbor classification.

Prerequisites
- A course in statistics and a course in numerical analysis or linear algebra.
Computer programming skills

Grading
- Homework (weekly, take home): 40%, work independently.
- Mid Term: 20%, work independently.
- Final exam/project/presentation: 40%, work independently.

Note
- No early or make-up homework or project.
  - Except under extraordinary circumstances, in which a written request and related documentations must be submitted as early as possible.
- Regular class attendance

LEARNING OUTCOMES:
As a result of completing this course, students will be familiar with:
- High level programming language
- Statistical models and data fitting
- Data and dimension reduction
- Computational inference

ACADEMIC INTEGRITY
I personally support the GW Code of Academic Integrity. It states: “Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information.” For the remainder of the code, see: http://www.gwu.edu/~ntegrity/code.html

SUPPORT FOR STUDENTS OUTSIDE THE CLASSROOM
DISABILITY SUPPORT SERVICES (DSS)
Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Marvin Center, Suite 242, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to: http://gwired.gwu.edu/dss/

UNIVERSITY COUNSELING CENTER (UCC) 202-994-5300
The University Counseling Center (UCC) offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include:
- crisis and emergency mental health consultations
- confidential assessment, counseling services (individual and small group), and referrals
http://gwired.gwu.edu/counsel/CounselingServices/AcademicSupportServices

SECURITY
In the case of an emergency, if at all possible, the class should shelter in place. If the building that the class is in is affected, follow the evacuation procedures for the building. After evacuation, seek shelter at a predetermined rendezvous location.