Computational statistics is an interface between statistics and computing. We will cover classic algorithms arising from solving statistical problems, optimization tools for developing new algorithms, and briefly talk about new methods to quantify uncertainty for machine learning algorithms. List of topics may include:

- Analysis of simple algorithms: bisection and functional iteration
- Gradient descent and newton’s method and application in statistics
- Discriminant analysis and classification
- Clustering
- EM algorithm
- Gaussian mixture and hidden Markov models (HMM)
- Principle component analysis (PCA)
- Model selection and cross validation
- Lasso and its statistical properties
- Bootstrap
- Splines
- Introduction to Monte Carlo methods
- Other selected topics

Instructor: Prof. Yao Xie, Groseclose #339, email: yao.xie@isye.gatech.edu

Class Time and Location: Tues and Thurs, 8:05-9:25am, Instruction Center (IC) 213

Instructor Office Hour: Tuesday at noon, Groseclose 339

Class TA: Yang Cao, caoyang@gatech.edu

TA Office Hour: Thursday 1:30-3:30pm, Main Building 417

Class Website: T-square
Class material available on our website includes
- Announcements
- Course syllabus
- Homework assignments and solutions
- Slides and other lecture material
- Practical exams
- Your course grades on exams and homework
- Any important announcements

Make sure the scores in T-square are consistent with what you got. We will not make any change in grading for works older than 2 weeks.

Class Mailing List: Registered students are automatically subscribed to the class mailing list.
Textbook: the course material will be based on lectures and slides posted on T-square.

References:
Numerical Analysis for Statisticians, Kenneth Lange.
An introduction to statistical learning: with applications in R, G. James, D. Witten, T. Hastie, R. Tibshirani.
Computational Statistics handbook with MATLAB, W. L. Martinez and A. R. Martinez.
Elements of Computational Statistics, J. E. Gentle.
Numerical linear algebra, Lloyd N. Trefethen and David Bau III.
The elements of Statistical Learning: Data Mining, Inference, and Predictions, 2nd edition, Trevor Hastie, Robert Tibshirani, and Jerome Friedman.

Prerequisites: undergraduate level basic probability, linear algebra, and statistics.

Honor Code: For any question involving Academic Honor Code issues, please consult www.honor.gatech.edu

Software: MATLAB and/or R. You will use this software for homework assignment.

Grading Policy: Class Participation 8%, Submitting Teaching Evaluation - 2%, Homework - 20%, Midterm 1 - 20%, Midterm 2 - 20%, Final Project - 30%

Homework: The homework should be handed in before the end of the class on the due date. The lowest homework-score will be dropped. Late Homework will NOT be accepted. Assignments will include both exercises and computer problems; the computer problems will ask you to carry out statistical analysis using computer statistical software. Keep in mind that you should not hand in raw computer output. Conclusions and interpretation of results are more important than good printouts. You are allowed to work together with other students on homework, as long as you write up and turn in your own solutions. You are also allowed (and encouraged) to ask me questions, although you should try to think about the problems before asking. Request for re-grading the Homework/Exams/Quizzes should be made within a week of returning Homework/Exams/Quizzes.

Midterms: There will be two in-class midterm exams during the class. The midterms are close notes (including assignment solutions) and close textbook but two and respectively, four two-sided pages with formulas will be allowed. Do not write homework solutions on the formula sheet. You are not allowed to use your cell phone. The notes have to be self-made. No make-ups.

Midterm 1: Feb. 23, Tuesday
Midterm 2: March 17, Thursday
Project: details TBA.