MATP6960 • Stochastic Optimization Methods • Fall 2019

Time: 12:00-1:50pm TF   Location: JRSC 1W01

Instructor: Yangyang Xu
Email: xuy21@rpi.edu
Phone: 518-276-6902
Office: Amos Eaton 310
Office hours: TF 3:00pm – 4:00pm or By Appointment
Course page: https://xu-yangyang.github.io/MATH6960.html

Course Objective

This course is to introduce recent advancement of optimization methods in big data analysis. The focus will be given to randomized and stochastic optimization algorithms for very large-scale problems that arise from machine learning, statistics, signal and image processing, and data mining. Convergence and complexity analysis will also be covered. Topics include first-order methods, randomized block coordinate update, stochastic approximation, and parallel computing.

Prerequisites

MATP6600/ISYE6780 or MATP6610 or MATH6800

Textbooks

- *Optimization for Machine Learning* by Suvrit Sra, Sebastian Nowozin, Stephen Wright. (**recommended**)
- *Introductory Lectures on Stochastic Optimization* by John C. Duchi (**recommended**)
- *Lectures on Stochastic Programming* by Alexander Shapiro, Darinka Dentcheva, Andrzej Ruszczynski (**recommended**)
- *Convex Analysis* by Rockafellar (**recommended**)
- *Introductory Lectures on Convex Programming* by Yuri Nesterov (**recommended**)
- *Convex Optimization* by Stephen Boyd and Lieven Vandenberghe (**recommended**)
- *Numerical Optimization* by Jorge Nocedal and Stephen Wright (**recommended**)

Topics to cover

1. Measure of algorithm reliability and efficiency: convergence in different senses, convergence speed, iteration complexity
2. Gradient descent, proximal gradient, accelerated proximal gradient
3. Randomized coordinate descent, randomized dual coordinate ascent
4. Stochastic approximation method: stochastic (sub)gradient method, variance-reduction, accelerated stochastic gradient, adaptive stochastic (sub)gradient method
5. Augmented Lagrangian method, (adaptive) primal-dual stochastic method

Assignments and grading policy

- Assignments: 5 projects will be assigned
- Grades: 15% for each of the first 4 projects, 30% for the last project, 10% for the final presentation

Attendance

Attendance and participation in class is a vital part of the learning process. Regular class attendance is strongly encouraged. It is the students' responsibility to keep informed of any announcement, or policy changes made during scheduled classes.

Academic Integrity

Intellectual integrity and credibility are the foundation of all academic work. A violation of Academic Integrity policy is, by definition, considered a flagrant offense to the educational process. It is taken seriously by students, faculty, and Rensselaer and will be addressed in an effective manner.

If found responsible for committing academic dishonesty, a student may be subject to one or both types of penalties: an academic (grade) penalty administered by the professor and/or disciplinary action through the Rensselaer judicial process described in the Student Rights and Responsibilities Handbook.

Academic dishonesty is a violation of the Grounds for Disciplinary Action as described in the handbook. A student may be subject to any of the following types of disciplinary action should disciplinary action be pursued by the instructor: disciplinary warning; disciplinary probation; disciplinary suspension, expulsion and/or alternative actions as agreed on by the student and hearing officer. It should be noted that no student who allegedly commits academic dishonesty will be able to drop or change the grade option for the course in question and is not eligible to request an F examination for the course.

The academic integrity policy applies to all students, undergraduate and graduate, and to scholarly pursuits and research. Additionally, attempts to commit academic dishonesty or to assist in the commission or attempt of such an act are also violations of this policy.