Course Outline: SEEM5121 Numerical Optimization
Spring Semester 2015

Instructor: Prof. MA, Shiqian
Office: 508, M.W. Mong Engineering Building, phone 3943-8240
Email: sqma@se.cuhk.edu.hk
Class Meetings: Friday 9:30am-12:15pm, Venue: ERB 406
Office Hours: Friday 2:00pm-3:00pm, and by appointment
Course website: http://www1.se.cuhk.edu.hk/~sqma/SEEM5121

• Objectives:

1. To familiarize with optimization algorithms for solving large scale optimization problems
2. To understand the convergence behaviors of different algorithms
3. To understand the capability of different algorithms
4. To be able to use learned algorithms to solve practical problems

• Textbook

The following books are (optional) reference books for this course:

– S. Boyd and L. Vandenberghe, Convex Optimization, Cambridge University Press, 2004 (has electronic version from the author’s website)

• Course Description

This course is to teach students modern numerical optimization methods for large scale systems. Topics covered in this course include gradient method, subgradient method, proximal gradient method, Nesterov’s acceleration technique, alternating direction method of multipliers, coordinate descent method, and stochastic/randomized algorithms. Applications of these optimization methods for solving problems in contemporary applications arising from big data analytics, machine learning, statistics, signal processing etc. will also be discussed.

• Prerequisites

You should have working knowledge on calculus, linear algebra and probability. It is preferable (but not required) if you already took ENGG5501: Foundations of Optimization or an equivalent course.

• Workload and gradings
– Homework (6 sets): 60%
– Final: 40%

• Teaching Plan (tentative)

1. Introduction of structured optimization
2. Convex set and convex function
3. Gradient method
4. Quasi-Newton method
5. Subgradient and subgradient method
6. Proximal gradient method
7. Accelerated gradient method
8. Augmented Lagrangian method
9. Alternating direction method
10. Coordinate descent method
11. Stochastic algorithms
12. Interior point method

• Academic Integrity

As a part of the University, this course upholds and enforces the general university policies on academic honesty and plagiarism. All examinations and written homework assignments are subject to the usual standards of academic honesty. In particular, you should submit your own work only, and you are required to acknowledge any book or person you have consulted.

For more information, see http://www.cuhk.edu.hk/policy/academichonesty/p01.htm