

Lecture: Tue and Thu at 01:00-02:30 pm in Louderman 458

Tutorials: Fri at 01:00-03:00 pm in Brown 118

Instructor:

Prof. Ulugbek Kamilov

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TA:

Mr. Yu Sun

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Mr. Hesam Mazidi

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Office: Tue 04:30-05:30 pm

Course Website: cigroup.wustl.edu/teaching/ese415

Prerequisites: ESE 318, Math 233, Math 309, and Math 429, or equivalents. Familiarity with MATLAB.

Textbooks

- “Mathematics of Nonlinear Programming” by A. L. Peressini
- “Linear and Nonlinear Programming” by D. G. Luenberger
 - ▶ Available online at web.stanford.edu/class/msande310/310trialtext.pdf
- “Convex Optimization” by S. Boyd and L. Vandenberghe
 - ▶ Available online at web.stanford.edu/~boyd/cvxbook
- “Nonlinear Programming” by D. P. Bertsekas

Course Description

Optimization is at the core of modern *signal processing*, *computational imaging*, *communications*, *control and robotics*, *operations research*, and *financial engineering*. Some of the biggest challenges in those disciplines are formulated and solved as optimization problems. Optimization is an essential topic that everyone in computational sciences and engineering must master. This course gives a rigorous introduction to the fundamentals of nonlinear optimization theory and methods. Topics include unconstrained and constrained optimization, convex optimization, computational optimization methods, optimality conditions, and duality theory. Algorithmic methods include the gradient and accelerated gradient methods, the Newton’s method, the conjugate gradient method, projected gradient method, as well as penalty and barrier methods.

Syllabus

- Introduction, motivation, and preliminaries
- Optimality conditions for unconstrained optimization
- Convex sets and functions
- Unconstrained minimization algorithms and applications
- Optimality conditions for constrained optimization
- Constrained minimization algorithms and applications

- Lagrangian duality and methods of multipliers
- Basic primal-dual methods (*if time permits*)
- Stochastic optimization (*if time permits*)

Grading Policy

The course grade in ESE 415 will be based on a weighted average of the following components:

- Homework (40%): In general, Assignments will be handed out on Thursdays and will be due on a subsequent Thursday before the beginning of class. Penalties for late submission will be 20% points a day. You are encouraged to discuss on homework problems with your classmates, but you must write your own solutions.
- Midterm (30%): One in-class closed-book midterm will be held on 03/08. No external assistance is allowed in the midterm.
- Final exam (30%): The final will be held on 05/08. No external assistance is allowed in the final.

Technology

In this course, we will be using iClicker technology. Each student must check out an iClicker from Olin Library in order to participate. Therefore, before the first lecture, please go to the Olin Library Help desk to check out an iClicker. All iClicker devices are available for checkout only for students registered in specific courses, so please be prepared to tell the circulation staff that you are registered for this course. Note that iClickers will not be used in grading, but as a tool for interaction during the lectures.

Disability

If you have any disability that you feel may affect your performance, please inform the instructor.