CSC466H1/CSC2305H: Numerical Methods for Optimization Problems, Spring 2023
University of Toronto
Syllabus

Lectures: Tuesdays 3pm–5pm, Thursdays 3pm-4pm in VC 101

Instructor: Kirill Serkh
Email: kserkh@math.toronto.edu
Office Hours: TBD

Grading: 75% homework, 25% final project

Textbooks: *Numerical Optimization*, 2nd ed., J. Nocedal and S.J. Wright.

Course contents:

1. Types of optimization problems and optimization algorithms
2. Line search methods, Steepest descent, Newton, Quasi-Newton methods
3. Convergence of line search methods, Step length selection
4. Trust-region methods, Cauchy point algorithms, Dogleg methods
5. Convergence of trust-region methods
6. Conjugate gradient methods, Nonlinear conjugate gradient methods
7. BFGS and DFP methods, Broyden methods
8. Inexact (iterative) Newton methods
9. Derivative-free optimization methods, the Nelder-Mead method
10. Least squares, Gauss-Newton, Levenberg-Marquardt
11. Constrained optimization, Optimality conditions, Lagrange multipliers
12. Linear programming, the Simplex method, Interior-point methods, Primal-dual methods
13. Constrained nonlinear optimization, Quadratic programming, Penalty methods, SQP methods
14. Optimization methods for training deep neural networks
15. Stochastic gradient descent, Momentum, Adam

Assignments:

There will be 5 homework assignments, each worth 15% of your grade, with the due dates Jan. 27, Feb. 10, Mar. 6, Mar. 20, and Apr. 3. The homeworks will involve a combination of mathematics and programming.

Final project:

For the final project, you will have the option of choosing between a project that I will assign, or proposing your own. If you would like to choose your own project, please discuss it with me to make sure that it is suitable.

Academic integrity:

The following helpful webpage answers many questions on this topic: https://www.academicintegrity.utoronto.ca/perils-and-pitfalls/.

Accessibility:

If you have any accessibility-related concerns, please let me know. More information can be found here: https://studentlife.utoronto.ca/department/accessibility-services/.

Student resources:

The academic calendar is available here: https://fas.calendar.utoronto.ca/sessional-dates. Some general information about the current academic year is available here: https://www.utoronto.ca/utogether. The University offers online "study with me" sessions where you can study together here: https://sidneysmithcommons.artsci.utoronto.ca/meet-to-complete/. You can also form or join study groups with your classmates here: https://sidneysmithcommons.artsci.utoronto.ca/recognized-study-groups/.

Absence declarations:

For Spring 2023, the Verification of Illness (or "doctor's note") is not required. Students who are absent from academic participation for any reason (e.g., COVID, cold, flu and other illness or injury, family situation) and who require consideration for missed academic work have been asked to record their absence through the ACORN online absence declaration. Students should also advise their instructor of their absence. Instructors will not be automatically alerted when a student declares an absence. Note that the maximum period for which you can declare an absence using the ACORN declaration has changed from 14 days to seven days as of Jan. 2.