ISE 444: OPTIMIZATION METHODS IN MACHINE LEARNING

Instructor: Luis Nunes Vicente
Email: lnv@lehigh.edu
Office: Mohler 421

Class Time: F 1:10-4:00 pm
Classroom: Mohler 453
Office Hours: F 4:00-5:00 pm
or by appointment

http://ise.lehigh.edu/content/luis-nunes-vicente

1 Course Description

(1) Introduction to convex optimization models in data science. Classical examples. (2) Convexity and nonsmooth calculus tools for optimization. Rates of convergence. (3) Subgradient methods. (4) Proximal gradient methods. (5) Accelarated gradient methods (momentum). Other relevant examples in data science. (6) Limits and errors of learning. Introduction to (nonconvex) optimization models in supervised machine learning. (7) Stochastic gradient methods. (8) Noise reduction methods. (9) Second-order methods.

2 Prerequisites

Basic understanding of linear algebra, vector calculus, numerical analysis, and probability.

3 Required Texts and Materials

A pdf document containing all slides presented in class will be made available, and no other material is required.

4 Assignments, Exams, and Grades

There will be four homework assignments (counting 10% each) and one mini project (counting 30%). The remaining 30% are for participation in class.

Some homework questions and the mini project may involve computer coding (which can be done in Matlab or Python). Source code must be turned in. All code and numerical results must be printed and handed in class (not sent by email).

Students may discuss the homework assignments among them but they are responsible for writing their own solutions and codes. Mathematical solutions to questions must be reported in hand writing.

The mini project will be on a topic not covered in class, and although it may be done in a team it will always include an individual presentation.

5 Other Issues

The course complies to all Lehigh University policies concerning Student Absences, Student Code of Conduct, Disability Support, and Syllabus, in particular with the following ones:

Accommodations for Students with Disabilities Lehigh University is committed to maintaining an equitable and inclusive community and welcomes students with disabilities into all of the Universitys educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact Disability Support Services (DSS), provide documentation, and participate in an interactive review process. If the documentation supports a request for reasonable accommodations, DSS will provide students with a Letter of Accommodations. Students who are approved for accommodations at Lehigh should share this letter and discuss their accommodations and learning needs with instructors as early in the semester as possible. For more information or to request services, please contact Disability Support Services in person in Williams Hall, Suite 301, via phone at 610-758-4152, via email at indss@lehigh.edu, or online at `https://studentaffairs.lehigh.edu/disabilities`.

The Principles of Our Equitable Community: Lehigh University endorses The Principles of Our Equitable Community [`http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity_Sheet_v2_032212.pdf`]. We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.