CSE291 Convex Optimization (CSE203B Pending)

CK Cheng

Dept. of Computer Science and Engineering

University of California, San Diego

Outlines

- Staff
  - Instructor: CK Cheng, TA: Po-Ya Hsu
- Logistics
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Information about the Instructor

- Instructor: CK Cheng
- Education: Ph.D. in EECS UC Berkeley
- Industrial Experiences: Engineer of AMD, Mentor Graphics, Bellcore; Consultant for technology companies
- Research: Design Automation, Brain Computer Interface
- Email: ckcheng+291@ucsd.edu
- Office: Room CSE2130
- Office hour will be posted on the course website
  - 2-250PM Th
- Websites
  - http://cseweb.ucsd.edu/~kuan
  - http://cseweb.ucsd.edu/classes/fa17/cse291-a

Staff

Teaching Assistant

- Po-Ya Hsu, p8hsu@ucsd.edu

Logistics: Textbooks

Required text:

- Convex Optimization, Stephen Boyd and Lieven Vandenberghe, Cambridge, 2004

References

- Numerical Recipes: The Art of Scientific Computing, Third Edition, W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Cambridge University Press, 2007.
- Functions of Matrices: Theory and Computation, N.J. Higham, SIAM, 2008.
- Fall 2016, Convex Optimization by R. Tibshirani, http://www.stat.cmu.edu/~ryantibs/convexopt/
- EE364a: Convex Optimization I, S. Boyd, http://stanford.edu/class/ee364a/

Logistics: Grading

Home Works (25%)

- Exercises (Grade by completion)
- Assignments (Grade by content)

Project (40%)

- Theory or applications of convex optimization
- Survey of the state of the art approaches
- Outlines, references (W4)
- Presentation (W9,10)
- Report (W11)

Exams

- Midterm (35%)

Classification: Brief history of convex optimization

theory (convex analysis): 1900–1970

algorithms

- 1947: simplex algorithm for linear programming (Dantzig)
- 1970s: ellipsoid method and other subgradient methods
- 1980s & 90s: polynomial-time interior-point methods for convex optimization (Karmarkar 1984, Nesterov & Nemirovski 1994)
- since 2000s: many methods for large-scale convex optimization

applications

- before 1990: mostly in operations research, a few in engineering
- since 1990: many applications in engineering (control, signal processing, communications, circuit design, . . .)
- since 2000s: machine learning and statistics

Classification

Tradition

Linear Programming	Nonlinear Programming	Discrete Integer Programming
Simplex	Lagrange multiplier	Trial and error
Primal/Dual	Gradient descent	Cutting plane
Interior point method	Newton's iteration	Relaxation

This class

Convex Optimization	Nonconvex, Discrete Problems
Primal/Dual, Lagrange multiplier	
Gradient descent	
Newton's iteration	
Interior point method	

Scope of Convex Optimization

For a convex problem, a local optimal solution is also a global optimum solution.

Scope

Problem Statement (Key word: convexity)

- Convex Sets (Ch2)
- Convex Functions (Ch3)
- Formulations (Ch4)

Tools (Key word: mechanism)

- Duality (Ch5)
- Optimal Conditions (Ch5)

Applications (Ch6,7,8) (Key words: complexity, optimality)

Algorithms (Key words: Taylor's expansion)

- Unconstrained (Ch9)
- Equality constraints (Ch10)
- Interior method (Ch11)