DS-GA 1014: Extended Syllabus Lecture 10

Optimization and Computational Linear Algebra for Data Science (Fall 2018)

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- Convexity, convex functions, conditions for convex differentiable functions, and optimization problems – Notes "Convex optimization" of [2].
- Duality – Section 6.1. of [1]
- Lagrangian (and duality) – Notes "Convex optimization" of [2].
- Gradient Descent – Notes "Optimization Methods" of [2].
- Newton's Method – See Page 484 in [3] or page 44 in [5]. You can also take a look at [4], and at Quasi Newton methods such as BFGS (see, e.g. Page 136 in [5]) or L-BFGS (Limited Memory BFGS; see Page 177 in [5]).

References

[1] Afonso S. Bandeira, *Ten Lectures and Forty-Two Open Problems in the Mathematics of Data Science*, available at http://www.cims.nyu.edu/~bandeira/TenLecturesFortyTwoProblems.pdf

[2] Carlos Fernandez-Granda, *Lecture Notes of "Optimization-based Data Analysis"*, available at http://www.cims.nyu.edu/~cfgranda/pages/OBDA_spring16/notes.html, 2015

[3] S. Boyd and L. Vandenberghe, *Convex Optimization*, Cambridge University Press, 2004.

[4] Carlos Fernandez-Granda, *Lecture Notes of DSGA1002*, available at http://www.cims.nyu.edu/~cfgranda/pages/DSGA1002_fall15/notes.html, 2015.

[5] J. Nocedal and S. Wright, *Numerical Optimization*, Springer 2006.