

Graduate Course: Convex Analysis and Variational Problems

Proposed by: Bin Dong

1. Course Description

This is a graduate level introductory course on optimization with an emphasis on the theoretical aspects of convex analysis and variational problems. This course considers general convex optimization problems on Banach or Hilbert spaces and will provide a comprehensive survey on duality and its applications in calculus of variations. It also covers general numerical algorithms based on duality, such as Uzawa's algorithm and the augmented Lagrangian method. Recent applications of these algorithms in some nonsmooth optimizations, such as matrix completion and ℓ_1 minimizations, will also be discussed.

2. Prerequisites

This is a 2nd year graduate course. Good mathematical background in linear algebra and calculus is required. Knowledge in functional analysis is not a must, but is preferred.

3. Text Books

- Ivar Ekeland and Roger Témam, *Convex Analysis and Variational Problems*, Classics in Applied Mathematics, SIAM, 1999. (main textbook)
- R. Tyrrell Rockafellar and Roger J.-B. Wets, *Variational Analysis*, A Series of Comprehensive Studies in Mathematics, Vol. 317, Springer Verlag, 1998. (suggested reading)