Convex Optimization - Video course

COURSE OUTLINE

Basic facts of maxima & minima & convex optimization.
Important classes of convex optimization problems.
Convex sets & convex functions
Differentiable convex functions
Projection on a convex set and normal cone
Sub differential of a convex.
Saddle point Conditions.
Karush-kuhn-Tucker Conditions
Lagrangian duality and examples.
Strong duality & consequences.
Linear programming, basics & examples.
Basic results and the fundamental theorems of linear programming
Simplex method
Introduction to interior point methods
Short step path following method .
Semi definite programming
Approximate solutions.

COURSE DETAIL

Lecture/Module	Topics
1	Basics of Convex Optimization
2	Basic facts of Convex Optimization
3	Basic properties of convex sets
4	Introduction to Polyhedral sets
5	Separation theorems for convex sets
6	Theorems of the alternative
7	Continuity and differentiability properties of convex functions
8	Non differentiable convex functions
9	Calculus of Sub differentials

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Mathematics

Pre-requisites:

Knowledge in Linear Algebra & Real Analysis

Hyperlinks:

Stephen Byod lectures on Convex Optimization

Coordinators:

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10	Rockafeller-Pshenichny optimality condition
11	Properties of normals & projections
12	Computing the normal cone of inequality constraints.
13	Tangent cone
14	Fenchel conjugate continues.
15	Minimization of a convex function with convex inequality constraints is considered
16	Lagrangian Duality
17	Duality in connection with Linear Programming
18	Strong duality for convex problem
19	Pleasures of Linear Programming
20	Direction of descent
21	Extreme points of Linear Programming
22	Polyhedral sets & cones
23	Foundation of simplex methods
24	Fundamental theorem of Linear programming
25	Simplex methods
26	Simplex methods continued
27	Interior point methods
28	Interior point methods continued
29	Log barrier function

30	Primal-dual framework	
31	Overview of interior point algorithm	
32	Short step algorithm	
33	Predictor-corrector method	
34	Semi-definite programming	
35	Saddle point type conditions for SDP.	
36	Approximate solutions	
37	Descent direction for non-smooth functions	
38	Minimization of difference convex functions	
39	Minimization of difference convex functions continues.	
40	Concluding lecture.	

References:

1. Stories about Maxima & Minima By V.M. Tikhomirov Pub: American Mathematical Society.
2. Convex Optimization By S. Boyd Pub: Cambridge University Press
3. Convex Analysis and Minimization Algorithms By J.B.Hiriat-Uruty& Lemarechal Pub: Springer
4. Convex Analysis By R.T.Rockafellar, Pub: Princeton