

230695 - ACO - Applied Convex Optimization

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
 Teaching unit: 739 - TSC - Department of Signal Theory and Communications
 Academic year: 2017
 Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)
 MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
 ECTS credits: 5 Teaching languages: Spanish, English

Teaching staff

Coordinator: Perez Neira, Ana Isabel
 Others: Perez Neira, Ana Isabel

Opening hours

Timetable: 9h to 18h (prior arrangement)

Prior skills

Basic Algebra

Teaching methodology

Classroom sessions

Learning objectives of the subject

The so-called optimization problems rise in very different fields and applications. In all of them the function to be optimize is the so-called cost or objective function and the variables that we control to carry out the optimization are many times confined, which it is called the constraints of the problem. Convex optimization arise frequently in engineering problems but often go unrecognized. This course shows that there is a substantial and useful theory for such problems. The course will give students the tools and training to recognize convex optimization problems that arise in wireless communications and networks. The basic theory of such problems is presented together with the required background to use the methods in their own research or engineering work.

Study load

Total learning time: 125h	Hours large group:	39h	31.20%
	Self study:	86h	68.80%

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Content

Introduction	Learning time: 2h Theory classes: 2h
Description: Modern optimization vs classical one: Efficient solvable programmes	
Convex Sets and functions	Learning time: 4h 20m Theory classes: 4h 20m
Description: Definitions and properties	
Convex programming and class of convex problems	Learning time: 8h 40m Theory classes: 4h 20m Practical classes: 4h 20m
Description: Formulation of a convex optimization problem Study of: LP, QP, SOCP, SDP, GP Problem relaxation Applications: norm minimization, filter design, low rank optimization problems (eg. Netflix, video security, image restoration) Convex software tool programming	
Duality	Learning time: 6h Theory classes: 4h Practical classes: 2h
Description: Lagrange Duality and KKT conditions Primal-Dual decomposition Applications: Radio resource management for satellite and wireless comm (power control, waterfilling, MIMO transceiver design), cloud computing	

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Algorithms	Learning time: 9h Theory classes: 9h
Description: Basic algorithms: interior point method Simple methods for extremely large problems Applications: compressed sensing, ML decoding and SDP relaxation, 5G beamforming	
Multi-Objective optimization	Learning time: 9h Theory classes: 9h
Description: Theory Applications: interference networks, portfolio optimization, SVM and classification	

Qualification system

Individual assessment 60%
Group assessment 40%

Bibliography

Basic:

Boyd, S.; Vandenberghe, L. Convex optimization. Cambridge: Cambridge University Press, 2004. ISBN 0521833787.
Ehrgott, M. Multi-criteria optimization. New York : Springer: Springer, 2005. ISBN 3540213988.

Others resources:

Class notes and problems