Optimization for large-scale data

Academic Year: (2021 / 2022)   **Review date: 08-06-2021**

Department assigned to the subject: Statistics Department

Coordinating teacher: RUIZ MORA, CARLOS

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

OBJECTIVES

The goal of this course is to become familiar with the modeling and the application of optimization methods in complex decision-making processes. In this way, we provide the necessary tools and modern techniques of optimization for the efficient solution of many decision-making problems arising in diverse areas like
Business, Marketing, Finance and Engineering.

In particular, the objectives are:

1. Modeling and application of optimization methods for a series of general problems (linear models, discrete models, nonlinear models and also optimization under uncertainty)

2. Learn about the basic (mathematical) foundations that support the development of solution algorithms for the optimization problems mentioned above

3. Use Python to apply tools of modern optimization techniques in an efficient way.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Linear Models
1.1 Examples
1.2 Properties
1.3 Algorithms

2. Discrete Models
2.1 Introduction
2.2 Logic conditions
2.3 Networks
2.4 Algorithms

3. Nonlinear Models
3.1 Examples, least squares
3.2 Optimality conditions
3.3 Algorithms

4. Uncertainty Models
4.1 Introduction and properties
4.2 Stochastic Optimization

LEARNING ACTIVITIES AND METHODOLOGY

½ lectures with supporting materials available on the Web
½ practical sessions (computer labs with Python)

ASSESSMENT SYSTEM

90% continuous evaluation along the course + 10% attendance/participation in class

% end-of-term-examination: 0

% of continuous assessment (assigments, laboratory, practicals…):   100

BASIC BIBLIOGRAPHY

- Bertsimas, Dimitris, and John Tsitsiklis Introduction to Linear Optimization, Belmont, MA: Athena Scientific, 1997

- D Bertsimas, R Weismantel Optimization over integers, Belmont: Dynamic Ideas, 2005

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

BASIC ELECTRONIC RESOURCES

- GLPK . GLPK solver: https://www.gnu.org/software/glpk/

- Jupyter . Jupyter Notebook: https://jupyter-notebook.readthedocs.io/en/stable/

- Pyomo . Pyomo Documentation: https://software.sandia.gov/downloads/pub/pyomo/PyomoOnlineDocs.html

- Python . Python Tutorial: https://docs.python.org/3/tutorial/index.html