2CC3000 – Optimization

Instructors: Jean-Christophe Pesquet
Department: DÉPARTEMENT MATHÉMATIQUES
Language of instruction: FRANCAIS, ANGLAIS
Campus: CAMPUS DE METZ, CAMPUS DE RENNES, CAMPUS DE PARIS - SACLAY
Workload (HEE): 60
On-site hours (HPE): 36,00

Description

This course will explore various fundamental notions of both continuous and discrete optimization.

The following topics will be addressed and implemented: formulation of optimization problems, existence conditions for global and local minimizers, convexity, duality, Lagrange multipliers, first-order methods, linear programming, integer linear programming, branch and bound approaches, preliminary stochastic optimization concepts.

Quarter number
ST7

Prerequisites (in terms of CS courses)

Basics in functional analysis, differential calculus, and probability (convergence, integration and probability course), knowledge of a programming environment

Syllabus
1. Optimization basics

    1.1 Introductory notions
    1.2 Existence of minimizers
    1.3 Convexity
    1.4 Duality

2. Linear programming

3. Integer linear programming

4. More advanced notions in continuous optimization

4.1 Lagrange multipliers method
4.2 Some iterative algorithms

5. Stochastic Optimization

Class components (lecture, labs, etc.)
This course combines lectures and exercise/practical classes.
This represents 22,5 hours of lectures, 10.5 of exercise classes, and 1.5 hour of final exam.

Grading
The grading will be based on a continuous evaluation process and the final written exam. In case of a justified absence to intermediary examinations, the grades of the latters are replaced by the grade of the final examination.

Course support, bibliography

D. P. Bertsekas, Nonlinear Programming, 3rd Edition. Athena Scientific, 2016. ISBN:978-1-886529-05-2

H.H. Bauschke and P. L. Combettes, Convex Analysis and Monotone Operator Theory in Hilbert Spaces, 2nd Edition. Springer, 2017. ISBN: 978-3-319-48311-5

Resources
Software equired: MATLAB, Python,...

Learning outcomes covered on the course
Upon completion of this course, the students will be able to :
address a wide range of concrete optimization problems arising either in a scientific or industrial context.
Formulate the problem in a suitable manner, to handle it numerically by using existing methods,
validate and interpret the solution with regards to the initial problem.

Description of the skills acquired at the end of the course
Intermediary level skills in optimization