

Machine learning for optimization

**ECTS** : 3

**Volume horaire** : 15

**Description du contenu de l'enseignement :**

Optimization is a useful paradigm for modeling data science problems and solving them using advanced algorithms. On the other hand, data science has brought new paradigms to various areas of computational science, such as linear algebra and partial differential equations. This course is concerned with the latest results on exploiting learning techniques as a tool for solving difficult optimization problems. Rather than aiming for a necessarily incomplete review of existing approaches, the course will focus on selected topics where learning techniques (regression/classification, neural networks) can be integrated into an optimization framework. Topics of interest include graph neural networks and differentiable programming, while applications will range between combinatorial and continuous optimization.

**Compétence à acquérir :**

- Understand the main principles behind the learning tools used in conjunction with optimization solvers.
- Adopt a critical view of results as presented in research papers.

**Mode de contrôle des connaissances :**

Written exam.

**Bibliographie, lectures recommandées :**

- B. Amos. Tutorial on amortized optimization, Foundations and Trends in Machine Learning (2023)
- S. Jegelka. Theory of Graph Neural Networks: Representation and Learning, ICM (2022)
- L. Scavuzzo, K. Aardal, A. Lodi, N. Yorke-Smith. Machine learning augmented branch and bound for mixed integer linear programming, Mathematical Programming (2024)

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