**Advanced machine learning**

**Cursus**

- Energie et durabilité
- Ing. finance
- Microtechnique
- Mineur en Systems Engineering
- Robotique

**Sem.**

- MA2, MA4
- MA2, MA4
- MA2, MA4
- E
- MA2

**Type**

- Opt.
- Opt.
- Opt.
- Opt.
- Opt.

**Language**

- English

**Credits**

- 4

**Session**

- Summer

**Semester**

- Spring

**Exam**

- Oral

**Workload**

- 120h

**Weeks**

- 14

**Hours**

- 4 weekly

- 2 weekly

- 1 weekly

**Number of positions**

- Remarque

pas donné en 2018-19

**Summary**

This course will present some of the core advanced methods in the field for structure discovery, classification and non-linear regression. This is an advanced class in Machine Learning; hence, students are expected to have some background in the field.

**Content**

The class will be accompanied by practical session on computer, using the mldemos software (http://mldemos.epfl.ch) that encompasses more than 30 state of the art algorithms.

- Introduction to the major mathematical principles of Machine Learning
- Structure Discovery: spectral and kernel methods, kernel PCA.CCA, X-means
- Advanced Nonlinear Regression Methods
- Stochastic Modeling: Particle Filters, Reinforcement Learning and Gradient Methods

**Keywords**

- Machine learning, statistics

**Learning Prerequisites**

**Required courses**

- Probability & Statistics, Linear Algebra

**Recommended courses**

- Machine Learning, Pattern Recognition

**Important concepts to start the course**

- Linear Algebra: Eigenvalue and singular value decomposition
- Statistics: Definitions of probability density function, marginal, likelihood, covariance, correlation
- Optimization: Lagrange multipliers, gradient descent, local and global optima

**Learning Outcomes**
By the end of the course, the student must be able to:
• Choose an appropriate method
• Apply the method properly

Transversal skills
• Use a work methodology appropriate to the task.
• Write a scientific or technical report.

Teaching methods
Ex-cathedra lectures, exercises, computer-based practical sessions

Expected student activities
Each week, students should read the selected chapters of the Lecture Notes prior to class. Students must attend the computer-based practice session and prepare regular reports that are graded.

Assessment methods
50% personal work during semester, 50% oral exam

Supervision
Office hours No
Assistants Yes
Forum No

Resources
Ressources en bibliothèque
• Machine Learning Technique / Billard

Notes/Handbook
Machine Learning Techniques, available at the Librairie Polytechnique. To be purchased before the class starts.

Websites
• http://lasa.epfl.ch/teaching/lectures/ML_MSc_Advanced/

Moodle Link
• http://moodle.epfl.ch/course/view.php?id=14885#section-0

Prerequisite for
Students must be knowledgeable about machine learning and have taken a course in the area either at EPFL or elsewhere. Relevant courses at EPFL are:
Applied Machine Learning - MICRO-455
Pattern Classification and Machine Learning: CS-433
Data Analysis and Model Classification - EE-516