MICRO-570 **Advanced machine learning**

Billard Aude

Cursus	Sem.	Type
Energy Management and Sustainability	MA2, MA4	Opt.
Microtechnics	MA2, MA4	Opt.
Systems Engineering minor	E	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Oral
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	1 weekly
Project	1 weekly
Number of positions	

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