MICRO-570

Advanced machine learning

Billard Aude

Cursus	Sem.	Type
Energy Management and Sustainability	MA2, MA4	Opt.
Financial engineering	MA2, MA4	Opt.
Microtechnics	MA2, MA4	Opt.
Robotics, Control and Intelligent Systems		Opt.
Robotics	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	**5 weekly**
Courses	3 weekly
Exercises	.5 weekly
Project	.5 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

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.

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