EPFL

MICRO-455	**Applied machine learning**
	Billard Aude

Cursus	Sem.	Type
Electrical and Electronical Engineering	MA1, MA3	Obl.
Microtechnics	MA1, MA3	Obl.
Microtechnics	MA1, MA3	Opt.
Systems Engineering minor	H	Obl.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	4 weekly
Number of positions	

Summary

Real-world engineering applications must cope with a large dataset of dynamic variables, which cannot be well approximated by classical or deterministic models. This course gives an overview of methods from Machine Learning for the analysis of non-linear, highly noisy and multi dimensional data.

Content

Because machine Learning can only be understood through practice, by using the algorithms, the course is accompanied with practicals during which students test a variety of machine learning algorithm with *real world data* . The courses uses matlab libraries for machine learning, as well as the MLDEMOS TOOLBOX that entails a large variety of Machine Learning algorithms.

- Binary and multi-class classifiers: LDA, GMM with Bayes, SVM, Boosting, etc.
- Pattern recognition and clustering
- Non-linear Regression
- Markov-Based Techniques for Time Series Analysis

Keywords

Machine Learning, Statistics

Learning Prerequisites

Required courses

Linear Algebra, Probability & Statistics

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 ML method for a given problem
- Assess / Evaluate appropriatedly and comparatively ML methods given a set of data
- Apply appropriatedly ML methods

Transversal skills

- Use a work methodology appropriate to the task.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Write a scientific or technical report.
- Make an oral presentation.

Teaching methods

Ex-cathedra, exercises, computer-based practical sessions

Expected student activities

Students who are no longer up to date with the pre-requisites should work on these in parralel to taking the class. Students are expected to attend the exercise sessions and the computer-based practice sessions. They should revise the class notes prior to going to practical session to be on top of the the theoretical material prior to applying it.

Assessment methods

Final written exam (75% grade), in-class assessment (25% grade).

Resources

Ressources en bibliothèque

- Machine Learning Techniques / Billard

Notes/Handbook

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

Prerequisite for

Advanced Machine Learning, spring semester