**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 appropriately and comparatively ML methods given a set of data
- Apply appropriately 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 parallel 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 theoretical material prior to applying it.

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

Supervision

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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.

Websites


Prerequisite for

Advanced Machine Learning, spring semester