

Fondamentaux de l'apprentissage automatique

ECTS : 4.5

Volume horaire : 36

Description du contenu de l'enseignement :

The aim of this course is to provide the students with the fundamental concepts and tools for developing and analyzing machine learning algorithms.

The course will introduce the theoretical foundations of machine learning, review the most successful algorithms with their theoretical guarantees, and discuss their application in real world problems. The covered topics are:

- Introduction to the different paradigms of ML and applications
- Computational learning theory
 - PAC model
 - VC-dimension
 - Rademacher complexity,...
- Supervised learning
 - Logistic regression and beyond
 - Perceptron
 - SVM
 - Kernel methods
 - Decision trees and Random Forests
 - Ensemble methods: bagging and boosting
- Unsupervised learning
 - Dimensionality reduction: PCA, ICA, Random Projections, Kernel PCA, ISOMAP, LLE
 - Density estimation
 - EM
 - Spectral clustering
- Online learning
- Multiclass and ranking algorithms
- Practical sessions

Bibliographie, lectures recommandées :

References:

- Mohri, M., Rostamizadeh, A., & Talwalkar, A. (2012). Foundations of machine learning. MIT press.
- Shalev-Shwartz, S., & Ben-David, S. (2014). Understanding machine learning: From theory to algorithms. Cambridge university press.
- Vapnik, V. (2013). The nature of statistical learning theory. Springer science & business media.
- Bishop Ch. (2006). Pattern recognition and machine learning. Springer
- Friedman, J., Hastie, T., & Tibshirani, R. (2001). The elements of statistical learning (Vol. 1, No. 10). New York, NY, USA:: Springer series in statistics.
- James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An introduction to statistical

Document susceptible de mise à jour - 08/02/2026

Université Paris Dauphine - PSL - Place du Maréchal de Lattre de Tassigny - 75775 PARIS Cedex 16