

CS-233(b) **Introduction to machine learning (BA4)**

Fua Pascal

Cursus	Sem.	Type
Communication systems	BA4	Opt.
Computer science	BA4	Opt.
Environmental Sciences and Engineering	BA6	Opt.

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

Summary

Machine learning and data analysis are becoming increasingly central in many sciences and applications. In this course, fundamental principles and methods of machine learning will be introduced, analyzed and practically implemented.

Content

- Introduction : K nearest neighbors, data representation, basic optimization.
- Linear models : Linear regression, least-square classification, logistic regression, linear SVMs.
- Nonlinear method : Polynomial regression, kernel methods.
- Deep learning : Multi-layer perceptron, CNNs.
- Unsupervised learning : Dimensionality reduction, clustering.

Keywords

Machine learning, classification, regression, algorithms

Learning Prerequisites**Required courses**

Linear algebra

Important concepts to start the course

- Basic linear algebra (matrix/vector multiplications, systems of linear equations, SVD).
- Multivariate calculus (derivative w.r.t. vector and matrix variables).
- Basic programming skills (labs will use Python).

Learning Outcomes

By the end of the course, the student must be able to:

- Define the following basic machine learning problems : regression, classification, clustering, dimensionality reduction
- Explain the main differences between them
- Implement algorithms for these machine learning models
- Optimize the main trade-offs such as overfitting, and computational cost vs accuracy

- Implement machine-learning methods to real-world problems, and rigorously evaluate their performance using cross-validation. Experience common pitfalls and how to overcome them.

Teaching methods

- Lectures
- Lab sessions

Expected student activities

- Attend lectures
- Attend lab sessions and work on the weekly theory and coding exercises

Assessment methods

- Continuous control (graded labs)
- Written final exam

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes
Others	Course website