CS-233(a) **Introduction to machine learning (BA3)**

Salzmann Mathieu

Cursus	Sem.	Type
Communication systems	BA3	Opt.
Computer science	BA3	Opt.
Environmental Sciences and Engineering	BA5	Opt.
HES -SC	H	Obl.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
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: General concepts, data representation, basic optimization.
- Linear methods: Linear regression, least-square classification, logistic regression, linear SVMs.
- Nonlinear methods: Polynomial regression, kernel methods, K nearest neighbors
- 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
- Derive the formulation of these machine learning models
- Assess / Evaluate the main trade-offs such as overfitting, and computational cost vs accuracy

• Implement machine learning methods on real-world problems, and rigorously evaluate their performance using cross-validation.

Transversal skills

• Assess one's own level of skill acquisition, and plan their on-going learning goals.
• Continue to work through difficulties or initial failure to find optimal solutions.

Teaching methods

• Lectures
• Lab sessions

Expected student activities

• Attend lectures
• Attend lab sessions
• Work on the weekly theory and coding exercises

Assessment methods

• Two graded exercise sessions (10% each).
• Final exam (80%)

Supervision

Office hours	No
Assistants	Yes
Forum	Yes
Others	Course website