EPFL

CS-233	**Introduction to machine learning**

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Cursus	Sem.	Type
Communication systems	BA4	Obl.
Computer science	BA4	Opt.
Environmental Sciences and Engineering	BA6	Opt.
HES - IC	E	Opt.

Language of teaching	English
Credits	6
Session	Summer
Semester	Spring
Exam	Written
Workload	180h
Weeks	14
Hours	**6 weekly**
Lecture	2 weekly
Exercises	2 weekly
Project	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.

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 (derivatives 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-wolrd problems, and rigorously evaluate their performance using

cross-validation

Teaching methods

- Lectures
- Pen-and-paper exercise sessions
- Python lab with a mini project in groups of 3 students

Expected student activities

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

Assessment methods

- Self-assessment via the solutions of the pen-and-paper exercises and coding labs
- Two milestones for the mini-proejct (10% of the grade each)
- Final exam (80% of the grade)

Supervision

Office hours	No
Assistants	Yes
Forum	Yes

Resources

Moodle Link

- https://go.epfl.ch/CS-233