Machine learning and data analysis are becoming increasingly central in many sciences and applications. This course concentrates on the theoretical underpinnings of machine learning.

**Content**

- **Basics**: statistical learning framework, Probably Approximately Correct (PAC) learning, learning with a finite number of classes, Vapnik-Chervonenkis (VC) dimension, non-uniform learnability, complexity of learning.
- **Neural Nets**: representation power of neural nets, learning and stability, PAC Bayes bounds.
- **Graphical model learning**.
- **Non-negative matrix factorization, Tensor decompositions and factorization**.
- **Learning mixture models**.

**Learning Prerequisites**

**Recommended courses**

- Analysis I, II, III
- Linear Algebra
- Machine learning
- Probability
- Algorithms (CS-250)

**Learning Outcomes**

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

- Explain the framework of PAC learning
- Explain the importance basic concepts such as VC dimension and non-uniform learnability
- Describe basic facts about representation of functions by neural networks
- Describe recent results on specific topics e.g., graphical model learning, matrix and tensor factorization, learning mixture models
• Lectures
• Exercises

Expected student activities
• Attend lectures
• Attend exercises sessions and do the homework

Assessment methods
Final exam and graded homeworks

Supervision
Office hours: Yes
Assistants: Yes
Forum: Yes
Others: Course website

Resources
Moodle Link
• https://go.epfl.ch/CS-526