CS-526 **Learning theory**

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Cursus	Sem.	Type
Computer science	MA2, MA4	Opt.
Cybersecurity	MA2, MA4	Opt.
Data Science	MA2, MA4	Opt.
SC master EPFL	MA2, MA4	Opt.

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

Summary

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 learing.
- 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

Teaching methods

- 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