CS-303

Principles of online decision-making

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Cursus	Sem.	Type
Communication systems	BA5	Opt.
Computer science minor	H	Opt.
Computer science	BA5	Opt.
Data science minor	H	Opt.

Language of teaching	English
Credits	6
Session	Winter
Semester	Fall
Exam	Written
Workload	180h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	1 weekly
Lab	1 weekly
Number of positions	

Summary

This course provides a mathematical treatment of online decision-making. It covers bandits (multi-armed, contextual, structured), Markov Decision Processes (MDPs), and related topics. Key concepts include exploration-exploitation, UCB, Thompson sampling, and tools to derive regret bounds.

Content

- Decision-making problems in active and reinforcement learning
- Online learning and prediction
- Multi-armed bandits model
- Upper-confidence bound (UCB) and Thompson sampling
- Contextual bandits
- Reinforcement learning model
- Markov Decision Processes (MDP)
- General decision-making and regret bounds
- Large state space and function approximation

Learning Prerequisites

Required courses

CS-233 Introduction to machine learning

Recommended courses

COM-102 Advanced information, computation, communication II
COM-300 Modèles stochastiques pour les communications or equivalent

Important concepts to start the course

- Probability and random processes
- Data structures and algorithms
- Information theory

Learning Outcomes

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

- Create mathematical models of real-world sequential decision-making scenarios
- Develop algorithms, reason about efficiency and performance

Teaching methods

- Ex-cathedra lectures
- Homework series
- Labs to develop, simulate, and analyze algorithms

Assessment methods

- Lab reports
- Final exam

Supervision

Office hours	No
Assistant.e.s	Yes

Resources

Moodle Link

- https://go.epfl.ch/CS-303