CS-421  
Machine learning for behavioral data

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Cursus | Sem. | Type
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Computer science | MA2, MA4 | Opt.
Cybersecurity | MA2, MA4 | Opt.
Data Science | MA2, MA4 | Opt.
Data science minor | E | Opt.
Digital Humanities | MA2, MA4 | Opt.
Learning Sciences | | Opt.
Neuro-X | MA2, MA4 | Opt.
SC master EPFL | MA2, MA4 | Opt.
Statistics | MA2, MA4 | Opt.

Language of teaching | English
Credits | 6
Session | Summer
Semester | Spring
Exam | Written
Workload | 180h
Weeks | 14
Hours | 4 weekly
Lecture | 2 weekly
Project | 2 weekly
Number of positions | 6

Remark
Cours biennal

Summary
Computer environments such as educational games, interactive simulations, and web services provide large amounts of data, which can be analyzed and serve as a basis for adaptation. This course will cover the core methods of user modeling and personalization, with a focus on educational data.

Content
The users of computer environments such as intelligent tutoring systems, interactive games, and web services are often very heterogeneous and therefore it is important to adapt to their specific needs and preferences. This course will cover the core methods of adaptation and personalization, with a focus on educational data. Specifically we will discuss approaches to the task of accurately modeling and predicting human behavior within a computer environment. Furthermore, we will also discuss data mining techniques with the goal to gain insights into human behavior. We will cover the theories and methodologies underlying the current approaches and then also look into the most recent developments in the field.

1. Cycle of adaptation: representation, prediction, intervention (e.g. recommendation)
2. Data Processing and Interpretation (missing data, feature transformations, distribution fitting)
3. Performance evaluation (cross-validation, error measures, statistical significance, overfitting)
4. Representation & Prediction (probabilistic graphical models, recurrent neural networks, logistic models, clustering-classification approaches)
5. Recommendation (collaborative filtering, content-based recommendations, multi-armed bandits)
6. Stealth Assessment (seemless detection of user traits)
7. Multimodal analytics (represent & analyze data from non-traditional sources. i.e. sensors, classroom analytics, human-robot interaction)

Learning Prerequisites

Required courses
The student must have passed a course in probability and statistics and a course including a programming project

Recommended courses
- CS-433 Machine learning or
- CS-233 Introduction to machine learning

Important concepts to start the course
Learning Outcomes
By the end of the course, the student must be able to:
• Explain the main machine learning approaches to personalization, describe their advantages and disadvantages and explain the differences between them.
• Implement algorithms for these machine learning models
• Apply them to real-world data
• Assess / Evaluate their performance
• Explain and understand the fundamental theory underlying the presented machine learning models

Teaching methods
- Lectures
- Weekly lab sessions
- Course project

Expected student activities
- Attend the lectures
- Attend the lab sessions and work on the homework assignments
- Project work

Assessment methods
- Project work (50%)
- Final exam (50%)

Resources
Moodle Link
• https://go.epfl.ch/CS-421