

ME-429

Multiagent decision-making and control

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Cursus	Sem.	Type
Mechanical engineering minor	E	Opt.
Mechanical engineering	MA2, MA4	Opt.
Robotics, Control and Intelligent Systems		Obl.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	1 weekly
Project	1 weekly
Number of positions	

Summary

Students will be able to formulate a multi-agent decision-making problem in static and dynamic environments as a game and apply relevant mathematical theories and algorithms to analyze the interaction of the agents and predict the outcome of the decision-making problems.

Content

Elements of a non-cooperative game: Nash equilibrium, pure and mixed strategies, minimax theorem and saddle point equilibrium for zero-sum games, potential games, sequential games, feedback games, Bayesian games, auctions. Computing equilibria: convex games, best-response dynamics, gradient descent dynamics, learning equilibria, no-regret dynamics. Efficiency of equilibria and mechanism design.

Keywords

game theory, multi-agent decision-making, Nash equilibrium, independent learning.

Learning Prerequisites**Required courses**

The course is mathematical and assumes maturity in mathematical logic and experience with writing proofs, algebra, analysis, probability and optimization.

Learning Outcomes

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

- Formulate a multi-agent decision-making problem as a game
- Analyze the outcome of the game
- Identify the class of game (potential, sequential, one-shot, cooperative)
- Optimize each agent's decision based on her objective
- Formalize various equilibrium concepts
- Implement algorithms to compute Nash equilibria
- Assess / Evaluate applicability and value of multiagent analysis

Transversal skills

- Assess progress against the plan, and adapt the plan as appropriate.
- Communicate effectively, being understood, including across different languages and cultures.
- Give feedback (critique) in an appropriate fashion.
- Evaluate one's own performance in the team, receive and respond appropriately to feedback.
- Keep appropriate documentation for group meetings.
- Set objectives and design an action plan to reach those objectives.

Teaching methods

Lectures on blackboard and on slides. Exercise hours with problem sets. Group project.

Expected student activities

in-class lecture notes, and slides. the notes will be available on moodle after each class

Assessment methods

There will be a class project and two quizzes

Resources

Moodle Link

- <https://go.epfl.ch/ME-429>