Module Description, available in: EN

Multi-agent systems

General Information

Number of ECTS Credits

3

Module code

FTP_MultiASys

Valid for academic year

2020-21

Last modification

2020-01-27

Coordinator of the module

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Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
Instruction				**X** E 100%			
Documentation				**X** E 100%			
Examination				**X** E 100%			

Module Category

FTP Fundamental theoretical principles

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

Basic knowledge of probability, algebra, calculus and differential equations. Basics of procedural programming and ability to implement small programs in an arbitrary language, e.g. Python, Matlab, R, Java, C#, C++, C, etc.

Brief course description of module objectives and content

Natural, social, and engineered complex systems can be modelled as being composed of agents interacting with one another and their environment. This course introduces students to the theory, tools and techniques for understanding and solving problems related to such systems.

The course is composed of two parts. In the first one, both cooperative and selfish agents and interactions between them will be discussed. The methodological support will be provided by game theory.

In the second part, the focus will be on the study and analysis of models of systems in the aim of understanding the conditions under which certain properties can emerge. Based on this, mechanisms to impede possible undesired behaviour of systems and to stir the desired dynamics will be developed.

Throughout the course, several application areas such as cooperation and competition, social networks, opinion dynamics and social influence will be discussed.

Aims, content, methods

Learning objectives and acquired competencies

A successful participant of this course is able to

- understand the rationale of multi-agent systems, modelling and simulation.
- model scenarios with multiple interacting agents in the language of game theory
- evaluate the feasibility of achieving goals with agents using game theory
- learn to choose the appropriate class of models with agents to characterise different complex systems
- implement in an efficient way a model of a system, then visualise, understand and analyse the corresponding outputs

Contents of module with emphasis on teaching content

- Multi-agent interaction: games in normal form, dominant strategies, Nash equilibria, Pareto optimality, partial observability, Bayesian games, cooperative and coalition games, repeated games, multi-agent learning.

- Population dynamics: evolutionarily stable strategies, Replicator's dynamics

- Network dynamics: Small world phenomenon, epidemics

- Multi-agent simulation: Cellular automata and the Game of life, demographic games, opinion dynamics and social influence.

Teaching and learning methods

- Lectures
- Exercises and homework
- Practical work with appropriate tools and group project
- Literature studies

Literature

- *A Concise Introduction to Multi-Agent Systems and Distributed Artificial Intelligence*. Nikos Vlassis. Morgan & Claypool Publishers, 2007.
- *Introduction to Multi-Agent Systems* - 2nd Edition. Michael Wooldridge. John Wiley & Sons, 2009.
- *Multi-Agent Systems*. Yoav Shoham and Kevin Leyton-Brown. Cambridge University Press, 2009.
- *Generative Social Science*. Joshua Epstein. Princeton University Press, 2006.

Assessment

Certification requirements

Module does not use certification requirements

Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

Calculator.

Other permissible aids

1 handwritten A4 sheet (both sides). The use of a paper-based dictionary is permitted.

Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

No electronic aids permitted

Other permissible aids

The use of a paper-based dictionary is permitted.