Learning dynamics

Lecturer
Tom LENAERTS (Coordinator)

Course mnemonic
INFO-F409

ECTS credits
5 credits

Language(s) of instruction
English

Course period
First term

Course content

he course addresses two general areas of research : individual-based learning and social learning in populations.

The first part focusses on learning through experience, of which reinforcement learning is the standard example. We start from a single agent setting and introduce reinforcement learning as a model free approach to dynamic programming. Then we have a look at the interplay of multiple learning agents in the same environment. For this purpose and for the following part on evolutionary dynamics, basic concepts of Game Theory are introduced.

The second part provides an introduction to the principles of learning by imitation, modelled through evolutionary dynamics. It will explain what evolution is and how games can be used to model interactions between individuals in a population. It will show how these models can be used to study the evolution of cooperation in social dilemmas, the evolution of conventions like language or even the dynamics of cancer.

The course concludes with a project which can include, for those who are interested, experiments using the Khepera robots

Objectives (and/or specific learning outcomes)

The aim of the course is to introduce the students to the field of learning in individual agents and learning in populations of agents and to prepare them for a Master thesis in these research areas.

He or she will learn the basic principles of both domains, the mathematical and computational methods and the typical problems they are trying to solve.

The students will also obtain a basic understanding of (evolutionary) game theory which will allow them to understand the standard literature in that field and the relevance of this domain to learning in general.

The students will obtain the skills to address independently problems within these fields. In addition, they will be capable of presenting their work to an audience of specialists and non-specialists.

Pre-requisits and co-requisits

Courses having this one as co-requisit

INFO-F439 | Advanced Methods in Bioinformatics | 5 crédits and
INFO-Y099 | Multicore programming | 6 crédits

Teaching method and learning activities

Lectures and practical assignments.

References, bibliography and recommended reading

M.J. Osborne, An introduction to Game Theory

R.S. Sutton and A.G. Barto, Reinforcement learning: an introduction

M. Nowak, Evolutionary dynamics; exploring the equations of life

Other information

Contact(s)

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Evaluation method(s)

Other

Evaluation method(s) (additional information)

Group project + presentation + assignements

Determination of the mark (including the weighting of partial marks)

50% on the assignments

50% on the final project + presentation

Main language(s) of evaluation

English

Programmes

Programmes proposing this course at the faculty of Sciences

MA-BINF | Master in Bio-informatics and Modelling | finalité Research/unit 2, MA-INFO | Master in Computer science | finalité Professional/unit 1 and finalité Professional/unit 2 and MA-SECU | Master in cybersecurity | finalité Erasmus Mundus joint master in Cybersecurity (CYBERUS)/unit 2

Programmes proposing this course at the Brussels School of Engineering

MA-IRIF | Master of science in Computer Science and Engineering | finalité Professional/unit 2