Learning dynamics

Titulaire
Tom LENAERTS (Coordonnateur)

Mnémonique du cours
INFO-F409

Crédits ECTS
5 crédits

Langue(s) d'enseignement
Anglais

Période du cours
Premier quadrimestre

Contenu du cours

The 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.

Objectifs (et/ou acquis d'apprentissages spécifiques)

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.

Pré-requis et co-requis

Cours ayant celui-ci comme co-requis

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

Méthodes d'enseignement et activités d'apprentissages

Presentations + assignments

Références, bibliographie et lectures recommandées

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

Autres renseignements

Contact(s)

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Méthode(s) d'évaluation

Autre

Méthode(s) d'évaluation (complément)

Group project + presentation + assignements

Construction de la note (en ce compris, la pondération des notes partielles)

50% on the assignments

50% on the final project + presentation

Langue(s) d'évaluation principale(s)

Anglais

Programmes

Programmes proposant ce cours à la faculté des Sciences

MA-BINF | Master en bioinformatique et modélisation | finalité Approfondie/bloc 2, MA-INFO | Master en sciences informatiques | finalité Spécialisée/bloc 1 et finalité Spécialisée/bloc 2 et MA-SECU | Master en cybersécurité | finalité Erasmus Mundus joint master in Cybersecurity (CYBERUS)/bloc 2

Programmes proposant ce cours à l'école polytechnique de Bruxelles

MA-IRIF | Master : ingénieur civil en informatique | finalité Spécialisée/bloc 2