Autonomous Agents

Code: 106587
ECTS Credits: 6

2024/2025

Degree	Type	Year
2504392 Artificial Intelligence	OB	3

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Conceptual knowledge or Basics of programming, Computational logic, machine learning, neural networks and deep learning.

Objectives and Contextualisation

This subject introduces the basics of autonomous agents, gives a detailed vision of the design of these agents and provides the foundations for programming them in industrial or service production environments, integrating different elements learned throughout the degree.

Competences

- Analyse and solve problems effectively, generating innovative and creative proposals to achieve objectives.
- Conceive, design, analyse and implement autonomous cyber-physical agents and systems capable of interacting with other agents and/or people in open environments, taking into account collective demands and needs.
- Conceptualize and model alternatives of complex solutions to problems of application of artificial intelligence in different fields and create prototypes that demonstrate the validity of the proposed system.

- Develop critical thinking to analyse alternatives and proposals, both one's own and those of others, in a well-founded and argued manner.
- Identify, analyse and evaluate the ethical and social impact, the human and cultural context, and the legal implications of the development of artificial intelligence and data manipulation applications in different fields.
- Identify, understand and apply the fundamental concepts and techniques of knowledge representation, reasoning and computational learning for the solution of artificial intelligence problems.
- Introduce changes to methods and processes in the field of knowledge in order to provide innovative responses to society's needs and demands.
- Students can apply the knowledge to their own work or vocation in a professional manner and have the powers generally demonstrated by preparing and defending arguments and solving problems within their area of study.
- Work cooperatively to achieve common objectives, assuming own responsibility and respecting the role of the different members of the team.

Learning Outcomes

1. Analyse a situation and identify areas for improvement.
2. Analyse and solve problems effectively, generating innovative and creative proposals to achieve objectives.
3. Analyse the ethical implications of autonomous decisions.
4. Apply knowledge representation techniques (such as ontologies and logics) to decision models for autonomous agents.
5. Apply techniques of game theory, social choice and agreement technologies to the design of autonomous agent strategies.
6. Design and develop autonomous agents for artificial intelligence projects.
7. Design and develop platforms for multi-agent systems.
8. Design learning models for distributed and multi-agent systems.
9. Develop critical thinking to analyse alternatives and proposals, both one's own and those of others, in a well-founded and argued manner.
10. Incorporate ethical constraints and social values into the design of inter-agent interaction strategies.
11. Propose new methods or informed alternative solutions.
12. Students can apply the knowledge to their own work or vocation in a professional manner and have the powers generally demonstrated by preparing and defending arguments and solving problems within their area of study.
13. Weigh up the risks and opportunities of both your own and others' proposals for improvement.
14. Work cooperatively to achieve common objectives, assuming own responsibility and respecting the role of the different members of the team.

Content

1. Intelligent Agents: Introduction.
2. BDI, AgentSpeak, Jason.
3. Behavior Trees
4. Agent Planning (STRIPS, GOAP, HTN)
5. Reinforcement Learning
6. Introduction to Multi-Agent Systems.
7. Utility Theory
8. Game Theory
9. Communication. Fundamentals of Philosophy of Language, Speech Act Theory (Austin, Searle). FIPA-ACL.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classroom lectures	30	1.2	3, 4, 5, 9, 10, 12
Classroom practices	15	0.6	2, 4, 6, 12
Type: Supervised			
Scheduled group tutorials	50	2	2, 6, 12, 14
Type: Autonomous			
Individual preparation of written tests	13	0.52	2, 3, 4, 9, 10, 12
Teamwork	30	1.2	2, 4, 6, 12, 14
Text readings	10	0.4	2, 3, 5, 9, 10, 12

Since the subject is mainly oriented to the learning of the basic techniques of designing and building software authonomous agents, the teaching methodology and the formative activities of the subject will combine: expositive lecture sessions (to guide and clarify doubts about compulsory readings), face-to-face practices (in classroom, in seminars, or in computer rooms), and applied teamwork. This teaching format allows to apply the concepts acquired and techniques explained, and will be combined throughout the course with tutorials of follow-up and autonomous work.

As the core of a challenge-based learning process, an Agents' Challenge Arena (ACA) will be organised to test the performance of the different teamwork projects.

Following are the different activities, with their specific weight within the distribution of the total time that the student has to dedicate to the subject.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practical works	50%	0	0	1, 2, 4, 6, 7, 8, 9, 11, 12, 13, 14
Theory related written test 1st part	25%	1	0.04	2, 3, 4, 5, 9, 10, 12
Theory related written test 2nd part	25%	1	0.04	2, 3, 4, 5, 9, 10, 12

The assessment of each student's level of achievement in the course takes into account the practical work, as well as the scientific and technical knowledge of the course. The final grade reflects this by combining the scores from the practical and theoretical parts as follows:

(a) Theory test (1st exam) (25%)

(b) Theory test (2nd exam) (25%)

(c) Practical exercises (50%)

To pass the course in the first examination period, it is mandatory to obtain at least a grade of 5 in each of the evaluation items (a), (b), and (c). The final grade will be calculated as a weighted average of all the evaluation items.

In the second examination period, it is possible to retake evaluation items (a), (b), and (c) where the grades were below 5. To successfully pass the course in the second examination period, a minimum grade of 5 must be achieved in the retaken items. Additionally, it is important to note that the grade assigned to the retaken evaluation item will be 5 (even if the final score is higher).

Not Evaluated: The student's final grade will be "Not Presented" if the student has not been evaluated in the written tests (a) and (b).

Honors: The award of an "Honors" title (MH) is at the discretion of the course faculty. The UAB regulations state that the honors title can only be awarded to students who have obtained a final grade equal to or greater than 9, and only up to 5% of the total enrolled students can be awarded an honors title.

Plagiarism: Without prejudice to other measures deemed appropriate and in accordance with current academic legislation, irregularities committed by a student during an assessment activity may result in the grade being changed to 0. Evaluation activities thus graded by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities to pass the course, the student will not pass the course, without the possibility of retaking it in the second examination period of the same academicyear. These irregularities include, among others:

- Copying all or part of a practical, report, or any other assessment activity;
- Allowing others to copy your exercises/exam/work;
- Submitting a team project that has not been entirely done by the team members;
- Presenting as your own materials produced by a third party, even if they are translations or adaptations, and generally works with non-original and exclusive elements of the student;
- Using communication devices (such as mobile phones, smartwatches, tablets, etc.) during assessment activities, whether individual or in teams.

In the event that the student has committed irregularities in any assessment activity (and therefore will not be able to pass the course even in the second examination period), the final grade for the course will be the lower of either 3 or the weighted average of the grades. In summary: copying, allowing others to copy your work, or plagiarizing in any of the assessment activities equates to failing with a grade of 3 or lower.

Bibliography

Bordini R. H. Hübner Jomi Fred & Wooldridge M. J. (2007). Programming multi-agent systems in agentspeak using jason. Wiley Series in Agent Technology. J. Wiley.

Russell S. J. Norvig P. Chang M.-W. Devlin J. Dragan A. Forsyth D. Goodfellow I. Malik J. Mansinghka V. & Pearl J. (2022). Artificial intelligence: a modern approach (Fourth edition. Global). Pearson.

Wooldridge M. J. (2009). An introduction to multiagent systems (2. ed.). John Wiley & Sons.

Software

PyCharm (or another IDE), JASON, PYTHON, UNITY, NETLOGO.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	English	second semester	afternoon
(PLAB) Practical laboratories	1	English	second semester	afternoon
(PLAB) Practical laboratories	2	English	second semester	afternoon
(TE) Theory	1	English	second semester	afternoon