UAB
Universitat Autònoma de Barcelona

Autonomous Agents

Code: 106587
ECTS Credits: 6

2025/2026

Degree	Type	Year
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 and fundamentals of programming, computational logic, and machine learning.

Objectives and Contextualisation

This course introduces the fundamentals of autonomous agents and multi-agent systems, provides a detailed overview of their design, and offers the foundation for programming them in industrial or service-oriented production environments, integrating various concepts 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 (Belief-Desire-Intention)
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)
10. Automated Negotiation
11. LLM-based Agents

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 Autonomous Agent Competition (AAC) will be organised to test the performance of the different teamwork projects.

In this course, the use of Artificial Intelligence (AI) technologies is permitted as an integral part of work development, provided that the final result reflects a significant contribution from the student in terms of analysis and personal reflection. The student must clearly identify which parts were generated using this technology, specify the tools used, and include a critical reflection on how these tools influenced the process and final outcome of the activity. Lack of transparency regarding AI use will be considered academic dishonesty and may result in a penalty on the activity grade or more severe sanctions in serious cases.

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	2, 1, 4, 9, 6, 7, 8, 13, 11, 12, 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

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

(a) Theory test (1st exam) (25%)
(b) Theory test (2nd exam) (25%)
(c) Practical work (50%)

This course does not include the single assessment system.

To pass the course in the first sitting, it is mandatory to obtain at least a grade of 5 in the theoretical part (average of points (a) and (b)) and a 5 in the practical part (point (c)). The final grade will be calculated as the weighted average of the theoretical part (points (a) and (b)) and the practical part (point (c)).

In the second sitting, it is possible to retake any components (a), (b), or (c) with grades below 5. To successfully pass the course in the second sitting, the same criteria as the first sitting will apply. Additionally, it is important to note that the grade assigned to a retaken component will be capped at 5 (even if the final score is higher).

No Evaluation: The student's final grade will be "Not Submitted" if the student has not been evaluated in both written tests (a) and (b).

Honors: The awarding of an "Honors Distinction" (MH) is at the discretion of the course instructor. UAB regulations stipulate that an Honors Distinction can only be awarded to students who have obtained a final grade of 9 or higher and that no more than 5% of the total enrolled students may receive this distinction.

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 a grade of 0. Assessment activities penalized in this manner cannot be retaken. If passing any of these assessment activities is required to pass the course, the student will fail the course without the possibility of retaking it in a second sitting within the same academic year. These irregularities include, but are not limited to:

- Copying, in whole or in part, a practical assignment, report, or any other assessment activity;
- Allowing others to copy your exercises/exam/work;
- Submitting a team assignment that was not entirely completed by the team members;
- Presenting materials produced by a third party as one's own, even if they are translations or adaptations, and generally any work containing non-original elements exclusive to the student;
- Using communication devices (such as mobile phones, smartwatches, tablets, etc.) during individual or team assessment activities.

If a student has committed irregularities in any assessment activity (and thus cannot pass the course, even in the second sitting), the final grade for the course will be the lower value between 3 and the weighted average of the grades. In summary: copying, allowing others to copy your work, or plagiarizing in any assessment activity results in a failing grade of 3 or lower.

Bibliography

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.

Introduction to Automated Negotiation. Dave de Jonge.

Software

PyCharm,Visual Studio (or another IDE), PYTHON, UNITY.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	711	English	second semester	morning-mixed
(PLAB) Practical laboratories	711	English	second semester	morning-mixed
(TE) Theory	71	English	second semester	morning-mixed