Universitat Autònoma de Barcelona

2023/2024

Autonomous Agents

Code: 106587
ECTS Credits: 6

Degree	Type	Year	Semester
2504392 Artificial Intelligence	OB	3	2

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Teachers

Dave De Jonge

Jordi Sabater Mir

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.
- 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 and solve problems effectively, generating innovative and creative proposals to achieve objectives.
2. Analyse the ethical implications of autonomous decisions.
3. Apply knowledge representation techniques (such as ontologies and logics) to decision models for autonomous agents.
4. Apply techniques of game theory, social choice and agreement technologies to the design of autonomous agent strategies.
5. Design and develop autonomous agents for artificial intelligence projects.
6. Develop critical thinking to analyse alternatives and proposals, both one's own and those of others, in a well-founded and argued manner.
7. Incorporate ethical constraints and social values into the design of inter-agent interaction strategies.
8. 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.
9. Work cooperatively to achieve common objectives, assuming own responsibility and respecting the role of the different members of the team.

Content

1. Intelligent agents:
    1. Introduction and Applications.
    2. Bratman's theory of human practical reasoning (BDI model) and criticisms.
    3. Foundations on philosophy of language, speech act theory (Austin, Searle). Agentspeak and FIPA-ACL.
3. Agent behaviour:
    1. Finite State Machines
    2. Utility theory
    3. Behaviour trees
    4. Agent planning (STRIPS, GOAP, HTN)
    5. Intentional systems (DBI, PRS)
    6. Reinforcement learning
5. Agent architectures:
    1. Logic-based
    2. Reactive
    3. Deliberative / BDI
    4. Layered/Hybrid
    5. Cognitive

7. Ethical implications of autonomous agents' decisions.

Methodology

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classroom lectures	40	1.6	2, 3, 4, 6, 7, 8
Classroom practices	5	0.2	1, 3, 5, 8
Type: Supervised			
Scheduled group tutorials	50	2	1, 5, 8, 9
Type: Autonomous			
Individual preparation of written tests	13	0.52	1, 2, 3, 6, 7, 8
Teamwork	30	1.2	1, 3, 5, 8, 9
Text readings	10	0.4	1, 2, 4, 6, 7, 8

Assessment

The evaluation of the level of achievement for the course by each student takes into account the individual and team work done in problem seminars and practical sessions, as well as the scientific and technical knowledge of the subject gained by the students. The final grade reflects this by combining the marks of the various assessment items as follows:

(a) Realization of different follow-up activities (class exercises) 20%
(b) Project teamwork submission 40%
(c) Teamwork project test 10%
(d) Individual theory test 30%

To pass the course in the first call, it is mandatory to obtain at least a mark of 5 in each of the assessment items (b), (c), and (d). The final grade will be computed as a weighted mean from all the assessment items.

In the second call it is possible to recover marks under 5 corresponding to (b), (c) and (d) assessment items. In order to successfully pass the course during the second call, it is necessary to achieve a minimum mark of 5 in the recovered items. Additionally, it's important to note that the mark for the recovered assessment item will be 5 (even if the final score is higher than that).

Non-Assessment: The final grade of the student will be 'ABSENT' as long as the student has not been assessed for the written tests (c) and (d).

Honors: Awarding an honors degree is the decision of the teaching staff responsible for the subject. UAB regulations dictate that Honors can only be granted to students who have obtained a final grade equal to or greater than 9, and that only up to 5% of the total number of students enrolled can be awarded an Honors degree.

Plagiarism: Without prejudice to others that are deemed appropriate and in accordance with current academic legislation, irregularities committed by a student during an assessment activity can lead to a change of any mark to 0. Assessment activities marked in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activitiesto pass the course, the student will not pass the course, with no opportunity to recover it in a second call in the same academic year. These irregularities include, among others:

- the total or partial copy of a practice, report, or any other evaluation activity;
- let others copy your exercises/exam/work;
- present a team work that has not been entirely done by the members of the team;
- present as own those materials produced by a third party, even if they are translations or adaptations, and in general works with non-original and exclusive elements of the student;
- use communication devices (such as mobile phones, smartwatches, tablets, etc.) during assessment activities, individual or in teams.

In case the student has committed irregularities in any assessment activity (and therefore it will not be possible to pass the course in a second call), the final grade of the course will be the lowest of the value 3 and the weighted average of the marks. In summary: copying, let others copy your work or plagiarising in any of the assessment activities is equivalent to a failure with a grade lower than or equal to 3.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Course attendance and realization of different follow-up activities of the subject	20%	0	0	1, 3, 4, 8, 9
Project related written test	10%	0	0	1, 8, 9
Project teamwork	40%	0	0	1, 3, 5, 8, 9
Theory related written test	30%	2	0.08	1, 2, 3, 4, 6, 7, 8

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 other IDE), JASON, PYTHON, UNITY, NETLOGO.