Universitat Autònoma de Barcelona

2020/2021

Artificial intelligence

Code: 101764
ECTS Credits: 6

Degree	Type	Year	Semester
2501233 Aeronautical Management	OB	2	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

To be able to do the practical works of the subject it is necessary to have the adequate knowledge of programming in Python language that is provided in Fundamentals of Computer Science and Advanced Computing.

Therefore, IN CASE OF NOT HAVING PASSED THE SUBJECT OF FUNDAMENTALS OF COMPUTERS PREVIOUSLY AND/OR NOT HAVING REGISTERED FOR ADVANCED COMPUTING IN THE 2020-2021 YEAR, IT IS STRONGLY RECOMMENDED NOT TO REGISTER ON THIS SUBJECT.

For the theoretical part of the subject, some minimum knowledge of statistics (1st year) and algebra (2nd year) are also necessary.

Objectives and Contextualisation

The objectives of the subject can be summarized in:

- Describe the most important areas of artificial intelligence
- Describe the basic techniques of knowledge representation, learning and search for problem solving
- Recognize situations where the application of artificial intelligence may be adequate to solve a problem in the aeronautical sector
- Analyze the problem to solve and design the optimal solution applying the techniques learned
- Program the basic algorithms to solve the proposed problems
- Evaluate the results of the implemented solution and assess possible improvements
- Defend and argue the decisions taken in the solution of the proposed problems

Competences

- Apply specific software for solving problems in the aeronautical sector.
- Communication.
- Personal work habits.
- Thinking skills.

- Use knowledge of the fundamental principles of mathematics, economics, information technologies and psychology of organisations and work to understand, develop and evaluate the management processes of the different systems in the aeronautical sector.
- Work in teams.

Learning Outcomes

1. Accept and respect the role of the various team members and the different levels of dependence within the team.
2. Apply imperative programming efficiently.
3. Apply suitable expert systems to help in making decisions and solving problems in the aeronautical sector.
4. Communicate knowledge and findings efficiently, both orally and in writing, both in professional situations and with a non-expert audience.
5. Develop independent learning strategies.
6. Develop scientific thinking skills.
7. Make efficient use of ICT in communicating ideas and results.
8. Manage time and available resources. Work in an organised manner.
9. Understand the basic methods of representing information, learning and researching in order to solve problems.
10. Work cooperatively.
11. Work independently.

Content

UNIT 1: INTRODUCTION

- Basic concepts
- History of artificial intelligence
- Smart agents

UNIT 2: PROBLEM SOLVING AND SEARCH

- Uninformed search
- Informed search
- Local search
- Search for constraint satisfaction

UNIT 3: KNOWLEDGE REPRESENTATION

- Fundamentals of logic
- Rule based systems
- Reasoning with uncertainty

UNIT 4: LEARNING

- Feature selection and representation
- Supervised learning
- Unsupervised learning

UNIT 5: DISTRIBUTED ARTIFICIAL INTELLIGENCE AND MULTI-AGENT SYSTEMS

- Introduction to multi-agent systems

Methodology

The Caronte platform (http://caronte.uab.cat) will be the usual tool for exchanging information between teachers and students. All materials and information related to the development of the subject will be published on this platform.

The activities that will be carried out in the subject are organized as follows:

Theory classes

The main concepts and algorithms of each theme will be presented in participatory master class format, where examples and short exercises will also be proposed so that students will put into practice specific aspects of the exposed topics.

Before some lectures, students might be asked to do some preparatory tasks, such as watching a video, reading a document or answering a questionnaire. These taks will be needed to be able to do the tasks on the lecture in the classroom.

Problem classes

Short exercises will be proposed to be solved in small cooperative groups in order to consolidate the learning of the topics exposed to the theory classes. The problems will allow to illustrate how to apply the theoretical contents to the solution of real problems. The work done in the classroom must be delivered at the end of the class.

Practical project

At the beginning of the course, the problem will be solved in teams of 4 students and each team will define their own project. Throughout the semester, the teams will have to analyze the problem, design and implement the solution (program in Python language), analyze the results obtained and defend their work.

The work teams will have to train the first week of the course and will have to be maintained until the end of the course. Teams should be self-managed: role play, job planning, assignment of tasks, management of available resources, conflicts, etc. Although the teaching staff will guide and supervise the learning process, the teams will work autonomously and the intervention of the teaching staff in group management will beminimal.

In the practical sessions, each team will be assigned a time to carry out a follow-up meeting with the teaching staff, where the work done so far will be monitored. The rest of the session will serve to advance the developmentof the project according to the work plan provided. Each member of the team must take responsibility for the tasks entrusted to him, as well as the integration of the different parties to obtain the final result. Attendance at these meetings is mandatory. Non-attendance to a session will involve being evaluated with a zero from the part of the project corresponding to that session.

In the fifth practice session, the evaluation of the developed program will be carried out. Each team must demonstrate that their program works correctly and solves the problem posed at the beginning of the course. In addition, the team members will have to answer an individual questionnaire to evaluate the global knowledge of the presented program and the active participation in its development.

In the last practice session, the groups will give an oral presentation explaining to the rest of the team the project developed and the result obtained. In this presentation each component of the team will have to do a part of the presentation.

Transversal competences

Throughout the course the following transversal competences will be worked:

T01. Thinking skills

In the classes of theory and problems, aspects of scientific thinking will be worked out, such as the observation and acquisition of relevant data of a problem, evaluation of different possibilities of solution to a problem, evaluation of the performance of a solution, elaboration of proposals of improvement, etc.

Assessment: The problems proposed in the classes of problems and the written tests of the theoretical part will include specific sections in which theachievement of this competence will be evaluated.

T02. Personal work habits

In the classes of problems, students will have to develop the capacity to take the initiative to analyze the case and look for the necessary information to propose a solution adapted to the problem. They will also have to take responsibility for their work since when working in cooperative groups, the final solution depends on the individual work of each one of the components of the group.

In the development of the practical project, the teams will have to work autonomously, self-managing and taking their own decisions about the work. This way they will have to define the subject and scope of the work, to plan and to distribute the tasks, to explore different sources of information to acquire the programming knowledge that lacks them, to raise improvements on the basic work plan proposed, etc.

Evaluation: In the evaluation of the practical project, this competence is assessed through:

- the improvements implemented on the basic program proposed in the project work plans
- questions in the individual questionnaire of evaluation of the practical project
- co-assessment questionnaire among the members of the project teams
- oral presentation of the project (time management)

T03. Work in teams

Problems classes will be worked on in cooperative groups where their members will solve parts of a complex problem and the final solution can only be obtained from the combination of the different parts.

In carrying out the practical project, this competence is worked in different ways:

- readings on how to work in a team in a cooperative and conflict management
- assignment of roles as responsible for one of the areas of work
- assignment of tasks to the members of the team from which they will be responsible for completing the project
- use of team managementtools (code repositories, cloud spaces, communication tools)

Assessment: The degree of achievement of this competence willbe assessed through:

- the solutions to problems given to problem classes
- group evaluation of the program developed in the practical project
- assessment of the oral presentation of the project (global coherence of the presentation)
- co-assessment questionnaire among the components of the team

T04. Communication

The sessions of the practical project will work on the preparation of a type of written document in particular: the minutes of meetings. The sessions are in the form of a follow-up meeting and at the end of each meeting, one of the members of the team will have to take a minutes of the meeting following the directions of the teachers and the guide provided.

After the last practice session, each team will present an oral presentation to defend their work in front of the rest of the class. This presentation will be supervised by the teaching staff and a guide will be provided on how to make oral presentations.

Assessment: Both the oral presentation and the minutes of the meeting will be evaluated through specific rubrics for oral and written communication, where some aspects of the use of ICT in communication will be also considered.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory classes	12	0.48	2, 3, 5, 10, 11
Problems classes	12	0.48	3, 9, 4, 6, 5, 10, 11
Theory classes	24	0.96	9, 6
Type: Supervised			
Preparation and discussion of topics related to the practical project	5	0.2	3, 1, 9, 4, 5, 7, 8, 10, 11
Preparation of theory lectures	10	0.4	9, 5, 11
Type: Autonomous			
Personal work	19	0.76	5, 8, 11
Project programming	60	2.4	2, 3, 1, 5, 8, 10, 11

Assessment

Evaluation process and activities planned

The subject consists of the following evaluation activities:

1 - Written exam of Block 1: Partial examination of theory and problems of topics 1 and 2, with a weight of 20% on the final grade.

2 - Written exam of Block 2: Partial examination of theory and problems of subjects 3, 4 and 5, with a weight of 20% on the final grade.

3 - Theory tests: Multiple choice tests about the theoretical contents of each unit of the course, with a weight of 10 % on the final grade.

4 - Problems assignments: The activities carried out in the classes of problems will be delivered at the end of each session. The note of the delivery of problems will be obtained from the average of all the work of the course. Unsolved issues will count as zero in the calculation of the average. This activity has a weight of 10% on the final grade.

The evaluation of the practical project will include a part of group evaluation and a part of individual evaluation. The activities of evaluation of the practical project, with a total weight of 40% on the final qualification of the subject, are:

5 - Program (group note): A single assessment for the entire work team that will assess the overall result of the implemented program, with a weight of 10% on the final grade.

6 - Program (individual note): Individual assessment on the part of the program implemented by each component of the work team and other individual projects made throughout the project. Non-justification assistance to a practice session implies a zero in the work part corresponding to that session. This activity has a weight of 10% on the final grade.

7 - Individual questionnaire: Written test of short questions about issues related to the program implemented in the practical project, with a weight of 10% on the final grade.

8 - Oral presentation: Oral presentation in class about the final result of thepractical project, with a weight of 3% of the final grade.

9 - Minutes of a meeting: Written document corresponding to the minutes of one ofthe follow-up meetings of the practical project, with a weight of 2% on the final grade

10 - Co-evaluation of the project: Evaluation questionnaire in which each component of the team will evaluate the contribution of the rest of the team's components to the development of the project, as well as aspects of personal work and teamwork . The mark of each member of the team will be obtained from the average of the evaluations received from the rest of the team. This activity will have a 5% weight on the final grade.

To pass the subject, by means of the continuous evaluation, it will be necessary to remove a minimum of 5 in the activities 1, 2, 5, 6 and 7.

Programming of evaluation activities

The scheduling of the assessment activities will be given on the first day of the course and will be made public through the Caronte platform (http://caronte.uab.cat) and on the website of the School of Engineering, at the exam section. The following calendar is scheduled:

1. Written exam of Part 1 - week 8 of the course
2. Written exam of Part 2 - exams period
3. Theory tests - along all the course
4. Problem assignments - each class of problems
5. Program (group mark) - week 13 of the course
6. Program (individual mark) - week 13 of the course
7. Individual questionnaire - week 13 of the course
8. Oral presentation - week 14 of the course
9. Minute of a meeting - every practice session (one person from the team each session)
10. Project co-assessment - week 15 of the course

This calendar can be subject to changes due to adaptation to possible incidents. Charon will always be informed about these changes.

Recovery process

In accordance with the coordination of the Degree and the direction of the School of Engineering the following activities can not be recovered:
4. Delivery of problems resolved in cooperative groups
6. Program (individual note)
8. Oral presentation
9. Minute of a meeting
10. Co-evaluation of the project

For the rest of the activities (Written exams of parts 1 and 2, and individual questionnaires of practical works) students can take the recovery whenever they have participated in a set of activities that represent a minimum of two thirds of the total grade of the subject.

Students can teke the recovery exams of parts 1 and 2 to improve grades, except in the case that they have committed irregularities in an evaluation activity of the course. If the mark obtained in the examination of recovery of any of the parts is lower than the mark of that part in the first exam, the mark of the first exam will be maintained.

If a team has not been able to finish the project on the date set at the beginning of the course, a second delivery date will be agreed which may not be after the date of the oral presentation of the project. The works delivered in this second delivery date will have a penalty in the mark.

Procedure for reviewing qualifications

For each assessment activity, a place, date and time of revision will be indicated in which the student will be able to review the activity with the responsible teaching staff. In this context, claims can be made about the activity note that will be evaluated by the teachers responsible for the subject. If the student does not submit to this review, this activity will not be reviewed later.

Qualifications

In the event that the subject is failed for not having reached the minimum mark in any of the parts, the numerical mark of thecourse will be the lowest value between 4.5 and the weighted average ofthe marks.

In the event that the subject is failed for having committed irregularities in an evaluation activity, the numerical mark of the course will be the lowest value between 3.0 and the weighted average of the marks.

Granting a qualification of excellent with honours (MH) is a decision of the faculty responsible for the subject. The regulations of the UAB indicate that MH can only be awarded to students who have obtained a final grade of 9.0 or more. It can be granted up to 5% of MH of the total number of students enrolled. In the case that there are more students with a mark equal to or greater than 9.0 than the number of MH allowed, priority will be given according to the following rules (in order):

1. Students who have done less recovery activities (either because they have failed the activity or because they have gone taken the exam to improve marks).
2. Students with more grades over 9 in activities 1, 2, 6 and 7.
3. Students with the best overall grade.

The non-evaluable grade (NA) will be assigned if the student does not make at least 10% of the subject's assessment activities.

Irregularities by the student, copy and plagiarism

Without prejudice to other disciplinary measures that may be considered appropriate, the irregularities committed by the student that can lead to a variation in the evaluation grade will be assessed with zero. Therefore, copying, plagiarism, cheating, allow others to copy, etc. in any assessment activities will imply failing it with a zero. Assessment activities qualified in this way and by this procedure, will not be recoverable. If it is necessary to pass any ofthese assessment activities to pass the subject, the subject willbe failed directly, without opportunity to recover it in the same course. In this case, the numerical mark of the coursewill be the lowest value between 3.0 and the weighted average of the notes.

In future editions of this subject, the student who has committed irregularities in an evaluation act will not be validated any of the assessment activities carried out.

Evaluation of repeating students

Evaluation activities of previous courses will not be validated.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
01 - Written exam of Part 1	20%	2	0.08	9, 6
02 - Written exam of Part 2	20%	2	0.08	3, 9, 6
03 - Tests	10%	1	0.04	9, 5, 11
04 - Problems assignments	10%	0	0	3, 9, 6, 10
05 - Practical project: program (group mark)	10%	0.5	0.02	2, 3, 5, 10, 11
06 - Practical project: program (individual mark)	10%	0	0	2, 3, 5, 11
07 - Individual text about the practical project	10%	0.5	0.02	2, 3, 5, 10, 11
08 - Oral presentation about the practical project	3%	0.5	0.02	4, 7, 8, 10

09 - Minute of a project's meeting	2%	1	0.04	4, 7
10 - Co-assessment of the practical project	5%	0.5	0.02	1, 5, 8, 10, 11

Bibliography

Web links

- Caronte: http://caronte.uab.cat
- Artificial Intelligence: A Modern Approach. http://aima.cs.berkeley.edu/
- Course bibliography at UAB library. http://cataleg.uab.cat/

Basic bibliography

- S. Russell, P. Norvig. Artificial Intelligence: A Modern Approach. Ed. Prentice Hall, Third Edition, 2010.

Supplementary bibliography

- P.H. Winston. Inteligencia Artificial, Addison-Wesley, 1992.
- V. Torra. Fonaments d'Intel·ligència Artificial, Fundació UOC, 2007.
- D.R. Tveter. The Pattern Recognition basis of Artificial Intelligence. IEEE Computer Society, 1998.
- M. Friedman, A. Kandel. Introduction to Pattern Recognition, World Scientific, 1999.
- R.O. Duda, P.E. Hart, D.G. Stork. Pattern Classification, Wiley, 2nd Edition, 2001.
- G. Klir, B. Yan. Fuzzy Sets and Fuzzy Logic: Theory and Applications. Prentice Hall, 1995.
- J. Ferber. Multi-Agent Systems: An Introduction to Distributed Artificial Intelligence. Addison-Wesley, 1999.
- M. Wooldridge, An Introduction to MultiAgent Systems. Wiley, 2002.