



Universitat de Lleida

DEGREE CURRICULUM

ARTIFICIAL INTELLIGENCE

Coordination: ANSOTEGUI GIL, CARLOS JOSE

Academic year 2023-24

Subject's general information

| | | | |
|---|---|---------------|------------------------|
| Subject name | ARTIFICIAL INTELLIGENCE | | |
| Code | 102020 | | |
| Semester | 1st Q(SEMESTER) CONTINUED EVALUATION | | |
| Typology | Degree | Course | Character |
| | Bachelor's Degree in Computer Engineering | 3 | COMPULSORY |
| | Double bachelor's degree: Degree in Computer Engineering and Degree in Business Administration and Management | 4 | COMPULSORY |
| | Master's Degree in Informatics Engineering | | COMPLEMENTARY TRAINING |
| Modality | Attendance-based | | |
| Course number of credits (ECTS) | 6 | | |
| Type of activity, credits, and groups | Activity type | PRALAB | TEORIA |
| | Number of credits | 3 | 3 |
| | Number of groups | 2 | 1 |
| Coordination | ANSOTEGUI GIL, CARLOS JOSE | | |
| Department | COMPUTER ENGINEERING AND DIGITAL DESIGN | | |
| Teaching load distribution between lectures and independent student work | 6 ECTS = 25*6 = 150 working hours. 40% --> 60 in-class hours. 60% --> 90 autonomous work hours. | | |
| Important information on data processing | Consult this link for more information. | | |
| Language | Catalan / Spanish | | |

| Teaching staff | E-mail addresses | Credits taught by teacher | Office and hour of attention |
|----------------------------|--------------------------|---------------------------|------------------------------|
| ANSOTEGUI GIL, CARLOS JOSE | carlos.ansotegui@udl.cat | 0 | |
| GARRALDA BARRIO, MARIANO | | 3 | |
| GARRALDA BARRIO, MARIANO | | 1,5 | |
| PON FARRENY, JOSEP | josep.pon@udl.cat | 4,5 | |

Subject's extra information

For questions or related issues, it is recommended to send an email to the teachers of the subject.

Learning objectives

- Design, implement and evaluate uninformed and informed search algorithms describing space and time complexities.
- Select and implement heuristic and evaluation functions for search algorithms.
- Evaluate and implement algorithms for supervised and unsupervised learning.
- Select the most appropriate technique of supervised learning for a given domain.
- Abstract and represent search problems.
- Optimize implementations of search algorithms.
- Optimize implementations of supervised learning algorithms.
- Write documents describing the architecture, design and implementation of a component of an intelligent system.

Competences

Degree-specific competences

- GII-CRI15: Knowledge and application of the main principles and basic techniques of intelligent systems and their practical application.

Degree-transversal competences

- EPS12: Be motivated by quality and continual improvement.
- EPS6: Capacity of analysis and synthesis.

Subject contents

The course content is as follows:

1. Introduction to artificial intelligence
2. Search algorithms and basic schemes: uninformed and informed search
 - Uninformed search: DFS, BFS, IDS
 - Informed search: UCS, BestH, A*
3. Machine Learning: supervised and unsupervised
 - Supervised learning: Bayesian learning, decision trees
 - Unsupervised learning: hierarchical clustering, k-means.

Methodology

Every week the student attends to a 2-hour Large Group class and to a 2-hour Middle Group class.

Medium Group classes take place in a laboratory.

In Large Group classes we present the topics listed into the contents section. They incorporate illustrative examples and problems to be solved in the laboratory classes.

In Medium Group classes we present problems and the proposed solutions are discussed .

In Medium Group classes we also present and discuss the lab exercises to be done.

The theoretical classes In laboratory classes the proposed problems are resolved. The algorithms presented in the lecture are also implemented. In a first phase, the student watches the teacher how to implement an algorithm and how to evaluate its correctness and efficiency. In a second phase the student begins to solve the current laboratory activity.

The autonomous work of the student consists of solving the proposed problems and lab exercises.

The programming language is Python. Code quality is an important aspect .

Development plan

| Week | Description | Classroom Activity GG | Classroom Activity GM | Autonomous work activity |
|------|---|---|--|--|
| 1 | Introduction to artificial intelligence | T1- Introduction to artificial intelligence | Course introduction Tutorial python | Consult bibliography, program, and python tutorial |
| 2 | Uninformed search | T2- Search algorithms | Tutorial Python Presentation of Practice1 (P1) | Python tutorial |
| 3 | Uninformed search | HOLIDAY | Problems T2 | P1 Problems T2 |
| 4 | Uninformed search | T2- Search algorithms | P1 | P1 Problems T2 |

| | | | | |
|----|-----------------------|-------------------------------|---|-------------------|
| 5 | Informed search | T2- Search algorithms | HOLIDAY | P1 Problems T2 |
| 6 | Informed Search | T2- Search algorithms | P1 | P1 Problems T2 |
| 7 | Informed Search | T2- Search algorithms | Delivery P1 Resolution of doubts T2-T3 | Problems T2 |
| 8 | Informed Search | T2- Search algorithms | HOLIDAY | Problems T2 |
| 9 | | 1st Partial | | Study |
| 10 | Supervised Learning | T3- Aprentatge automàtic | Problems T3 | Problems T3 |
| 11 | Supervised Learning | T3- Automatic Learning | Presentation of Practice3 (P2) | P2 Problems T |
| 12 | Supervised Learning | T3- Automatic Learning | P2 Problems T3 | P2 Problems T3 |
| 13 | Supervised Learning | HOLIDAY | HOLIDAY | P2 Problems T3 |
| 14 | Unsupervised Learning | T3- Automatic Learning | P2 Problems T3 | P2 Problems T3 |
| 15 | Unsupervised Learning | T3- Automatic Learning | Delivery P2 Resolution of doubts T3 | Problems |
| 16 | | 2nd Partial | | Study |
| 17 | | 2nd Partial | | Study |

Evaluation

Table. Assessment Activities

| Acr. | Assessment activity | Weighting | Minimum Grade | In Group | Mandatory | Recoverable |
|------|------------------------------|------------|---------------|-----------|-----------|-------------|
| PE1 | 1 st Partial Exam | 25% | NO | NO | NO | NO |
| PE2 | 2 nd Partial Exam | 25% | NO | NO | NO | NO |
| P1 | Practice1 | 25% | NO | YES (<=2) | NO | NO |
| P2 | Practice2 | 25% | NO | YES (<=2) | NO | NO |
| PCL | Class Participation | 0.5 points | NO | NO | NO | NO |

$$\text{Final grade} = 0,25*PE1 + 0,25*PE2 + 0,25*P1 + 0,25*P2 + 0,2*P3 + 0,05*PCL$$

Activity Written exam

Week 9

Percentage 25% **Type** Compulsory / Individual

Evaluation:

The activity will be evaluated over 10 points.

Objectives

- Design, implement and evaluate uninformed and informed search algorithms describing space and time complexities.
- Select and implement heuristic and evaluation functions for search algorithms.
- Abstract and represent search problems.
- Evaluate uninformed and informed search algorithms describing their space and time complexities

Activity Written exam

Weeks 16-17

Percentage 25% **Type** Individual

Evaluation:

The activity will be evaluated over 10 points.

Objectives

- Apply and evaluate complete and incomplete solvers for the satisfiability and maximum satisfiability problems.
- Evaluate complete and incomplete solvers for the satisfiability and maximum satisfiability problems.
- Model decision and optimization problems with the language of propositional logic.
- Evaluate and implement algorithms for supervised and unsupervised learning.
- Select the most appropriate technique of supervised learning for a given domain

Activity Laboratory activity

Week 8

Percentage 20% **Type** Individual or Group

Evaluation:

The activity will be evaluated over 10 points.

Objectives

- Design, implement and evaluate uninformed and informed search algorithms describing space and time complexities.
- Select and implement heuristic and evaluation functions for search algorithms.
- Evaluate uninformed and informed search algorithms describing their space and time complexities
- Write documents describing the architecture, design, and implementation of a component of an intelligent system.

Activity Laboratory activity

Week 15

Percentage 20% **Type** Individual or Group

Evaluation:

The activity will be evaluated over 10 points.

Objectives

- Evaluate and implement algorithms for supervised and unsupervised learning.
- Select the most appropriate technique of supervised learning for a given domain
- Write documents describing the architecture, design, and implementation of a component of an intelligent system.

Alternative evaluation (students who waive continuous evaluation):

Students who have the approval to be evaluated by alternative evaluation (see requirements and procedure in the evaluation regulations) will have to do the following activities.

- **Single exam** (100%): It can be improved. Date of the exam: the date of the realization of the 2nd Midterm Exam, defined by the EPS. This exam consists of a written test of the entire subject matter.
- **Improvement of Single exam** (100%): Date of the exam: the date of the realization of the Improvement Exam, defined by the EPS. The realization of the improvement exam does not condition the maximum grade achieved in the subject.

Bibliography

- Artificial Intelligence: A Modern Approach

Stuart. J. Russell and Peter. Norvig

Prentice Hall, 2009

- Essentials of Artificial Intelligence

Matt Ginsberg

Morgan Kaufmann Pub, 1993

- Handbook of Satisfiability

Biere, Armin and Heule, Marijn J. H. and van Maaren, Hans and Walsh, Toby

IOS Press, 2009

- Data Mining: Practical Machine Learning Tools and Techniques

Ian H. Witten and Eibe Frank

Morgan Kaufmann, 2005