
DEGREE CURRICULUM

# ARTIFICIAL INTELLIGENCE

Coordination: ANSOTEGUI GIL, CARLOS JOSE

Academic year 2017-18

# ARTIFICIAL INTELLIGENCE 2017-18

## Subject's general information

<table>
<tr><td>Subject name</td><td>ARTIFICIAL INTELLIGENCE</td></tr>
<tr><td>Code</td><td>102020</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Typology</th><th>Modality</th></tr>
<tr><td>Double bachelor's degree: Degree in Computer Engineering and Degree in Business Administration and Management</td><td>4</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Bachelor's Degree in Computer Engineering</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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</td></tr>
<tr><td>ECTS credits</td><td>6</td></tr>
<tr><td>Groups</td><td>1GG,2GM</td></tr>
<tr><td>Theoretical credits</td><td>3</td></tr>
<tr><td>Practical credits</td><td>3</td></tr>
<tr><td>Coordination</td><td>ANSOTEGUI GIL, CARLOS JOSE</td></tr>
<tr><td>Department</td><td>INFORMATICA I ENGINYERIA INDUSTRIAL</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>6 ECTS = 25*6 = 150 working hours.<br>40% --> 60 in-class hours.<br>60% --> 90 autonomous work hours.</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Spanish</td></tr>
<tr><td>Office and hour of attention</td><td>Contact me to arrange a mutually suitable time</td></tr>
</table>

# ARTIFICIAL INTELLIGENCE 2017-18

| Teaching staff | E-mail addresses | Credits taught by teacher | Office and hour of attention |
|---|---|---|---|
| ANSOTEGUI GIL, CARLOS JOSE | carlos@diei.udl.cat | 9 | Office 2.16 at EPS, contact by email. |

## 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.
- Apply and evaluate complete and incomplete solvers for the satisfiability and maximum satisfiability problems.
- Evaluate and implement algorithms for supervised learning.
- Select the most appropriate technique of supervised learning for a given domain: decision trees, Bayesian networks or neural networks.
- Model decision and optimization problems with the language of propositional logic.
- Abstract and represent search problems.
- Evaluate complete and incomplete solvers for the satisfiability and maximum satisfiability problems.
- Evaluate uninformed and informed search algorithms describing their space and time complexities
- Evaluate supervised learning algorithms.
- Optimize implementations of search algorithms.
- Optimize encodings into the SAT and MaxSAT formalisms.
- 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

This course teaches the basic techniques that intelligent systems use for solving problems of very diverse nature.

Examples of these problems are; optimization of energy resources in smart homes, enterprises resource planning, schedules for sporting events such as a football league or the Olympics, decision making in complex environments

by autonomous agents in video games, or even the system that allows a car to be fully controlled by a computer, taking the best action to reach destination, or even take alternative routes when unexpectedly comes to a dead end.

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, ID
- Informed search: UCS, BestH, A*

3. Constraint Programming: Satisfiability and Maximum Satisfiability

- Modelling problemas as MaxSAT instances
- Solvers for MaxSAT instances

4. 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 solvd 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 | Atunomous work activity |
|---|---|---|---|---|
| 1 | Introduction to artificial intelligence | T1- Introduction to artificial intelligence | 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 | T2- Search algorithms | **HOLIDAY GMA**<br>Problems T2 | P1<br>Problems T2 |
| 4 | Informed search | T2- Search algorithms | P1 | P1<br>Problems T2 |
| 5 | Informed search | T2- Search algorithms | Problems T2 | P1<br>Problems T2 |
| 6 | Informed Search | T2- Search algorithms | P1 | P1<br>Problems T2 |
| 7 | Maximum Satisfiability | T3- Constraint Programming | **Presentation of Practice2 (P2)** | P2<br>Problems T3 |
| 8 | Maximum Satisfiability | HOLIDAY | **Delivery P1**<br>P2<br>Resolution of doubts T2-T3 | P2<br>Problems T3 |
| 9 | | **1st Partial** | | Study |
| 10 | Maximum Satisfiability | T3- Constraint Programming | P2<br>Problems T3 | P2<br>Problems T3 |
| 11 | Supervised Learning | T4- Automatic Learning | **Delivery P2**<br>**Presentation of Practice3 (P3)** | P3<br>Problems T4 |
| 12 | Supervised Learning | T4- Automatic Learning | P3<br>Problems T4 | P3<br>Problems T4 |
| 13 | Supervised Learning | HOLIDAY | **HOLIDAY GMA, GMB** | P3<br>Problems T4 |
| 14 | Unsupervised Learning | T4- Automatic Learning | P3<br>Problems T4 | P3<br>Problems T4 |
| 15 | Unsupervised Learning | T4- Automatic Learning | **Delivery P3**<br>**HOLIDAY GMB**<br>Resolution of doubts T3-T4 | Problems |
| 16 | | **2nd Partial** | | Study |
| 17 | | **2nd Partial** | | Study |
| 18 | | | | |
| 19 | | **Recovery** | | Study |

## Evaluation

Table. Assesment Activities

| Acr. | Assesment activity | Weighting | Minimm Grade | In Group | Obligatoria | Mandatory |
|---|---|---|---|---|---|---|
| *PE1* | *1st Partial Exam* | 25% | 3 | NO | YES | YES |

| | | | | | | |
|---|---|---|---|---|---|---|
| *PE2* | *2nd Partial Exam* | 25% | 3 | NO | YES | YES |
| *P1* | *Practice1* | 20% | - | YES (<=2) | YES | Only one pract |
| *P2* | *Practice2* | 10% | - | YES (<=2) | YES | Only one pract |
| *P3* | *Practice3* | 20% | - | YES (<=2) | YES | Only one pract |
| *PCL* | *Class Participation* | 0.5 points | NO | NO | NO | NO |
| | | | | | | |
| **Final grade** = 0,25*PE1 + 0,25*PE2 + 0,2*P1 + 0,1*P2 + 0.2*P3 + 0,05*PCL | | | | | | |

**Recovery of written exams:**

**Evaluation**

If the final grade in the course is < 5, then the student can decide to recover the 50% represetend by the written exams. In this case, the student must have completed the three laboratory activities with a mark each >= 3, and he/she must have presented the two written exams. The recovery exam will be evaluated over 10 points. To pass the subject the mark obtained in the written test must be > = 3 . The weight of this recovery exam in the final grade is 50 %.

**Activity** Written exam

Week 9

**Percentatge** 25% **Type** Compulsory / Individual

**Evaluation:**

The activity will be evaluated over 10 punts . To approve the subject the mark obtained in this written test must be > = 3 .

**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

**Percetatge** 25% **Type** Compulsory / Individual

**Evaluation:**

The activity will be evaluated over 10 punts . To approve the subject the mark obtained in this written test must be > = 3 .

**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 an unsupervised learning.
- Select the most appropriate technique of supervised learning for a given domain

**Activity** Laboratory activity

Week 8

**Percentatge** 20% **Type** Compulsory / Group

**Evaluation:**

The activity will be evaluated over 10 punts . This activity can not be recovered.

**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 11

**Percentatge 1**0% **Type** Compulsory / Group

**Evaluation:**

The activity will be evaluated over 10 punts . This activity can not be recovered.

**Objectives**

- Apply and evaluate complete and incomplete solvers for the satisfiability and maximum satisfiability problems.
- Model decision and optimization problems with the language of propositional logic.
- Write documents describing the architecture, design and implementation of a component of an intelligent system.

**Activity** Laboratory activity

Week 15

**Percentatge 2**0% **Type** Compulsory / Group

**Evaluation:**

The activity will be evaluated over 10 punts . This activity can not be recovered.

**Objectives**

- Evaluate and implement algorithms for supervised an 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.

## Bibliography

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- Essentials of Artificial Intelligence

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- Handbook of Satisfiability

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Ian H. Witten and Eibe Frank

Morgan Kaufmann, 2005