DEGREE CURRICULUM

ARTIFICIAL INTELLIGENCE

Coordination: ANSOTEGUI GIL, CARLOS JOSE

Academic year 2020-21

ARTIFICIAL INTELLIGENCE 2020-21

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>Character</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>
</table>
</td></tr>
<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><td>PRALAB</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>3</td><td>3</td></tr>
<tr><th>Number of groups</th><td>2</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>Coordination</td><td>ANSOTEGUI GIL, CARLOS JOSE</td></tr>
<tr><td>Department</td><td>COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>6 ECTS = 25*6 = 150 working hours.
40% --> 60 in-class hours.
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>
</table>

ARTIFICIAL INTELLIGENCE 2020-21

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
ALÒS PASCUAL, JOSEP	josep.alos@udl.cat	4	
ANSOTEGUI GIL, CARLOS JOSE	carlos.ansotegui@udl.cat	3	
TORRES MONTIEL, EDUARD	eduard.torres@udl.cat	2	

Subject's extra information

Theory classes are held online.

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

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 online 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** Problems T2	P1 Problems T2
4	Informed search	T2- Search algorithms	P1	P1 Problems T2
5	Informed search	T2- Search algorithms	Problems T2	P1 Problems T2
6	Informed Search	T2- Search algorithms	P1	P1 Problems T2
7	Maximum Satisfiability	T3- Constraint Programming	**Presentation of Practice2 (P2)**	P2 Problems T3
8	Maximum Satisfiability	HOLIDAY	**Delivery P1** P2 Resolution of doubts T2-T3	P2 Problems T3
9		**1st Partial**		Study
10	Maximum Satisfiability	T3- Constraint Programming	P2 Problems T3	P2 Problems T3
11	Supervised Learning	T4- Automatic Learning	**Delivery P2** **Presentation of Practice3 (P3)**	P3 Problems T4
12	Supervised Learning	T4- Automatic Learning	P3 Problems T4	P3 Problems T4
13	Supervised Learning	HOLIDAY	**HOLIDAY GMA, GMB**	P3 Problems T4
14	Unsupervised Learning	T4- Automatic Learning	P3 Problems T4	P3 Problems T4
15	Unsupervised Learning	T4- Automatic Learning	**Delivery P3** **HOLIDAY GMB** Resolution of doubts T3-T4	Problems
16		**2nd Partial**		Study
17		**2nd Partial**		Study
18				
19		**Recovery**		Study

Evaluation

Table. Assesment Activities

ARTIFICIAL INTELLIGENCE 2020-21

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	NO
P2	*Practice2*	10%	-	YES (<=2)	YES	NO
P3	*Practice3*	20%	-	YES (<=2)	YES	NO
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.

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 10% **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 20% **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

- 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