DEGREE CURRICULUM

AUTOMATIC LEARNING AND REASONING

Coordination: BEJAR TORRES, RAMON

Academic year 2017-18

AUTOMATIC LEARNING AND REASONING 2017-18

Subject's general information

Subject name	AUTOMATIC LEARNING AND REASONING
Code	102040
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION
Typology	<table><tr><th>Degree</th><th>Course</th><th>Typology</th><th>Modality</th></tr><tr><td>Bachelor's Degree in Computer Engineering</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr></table>
ECTS credits	6
Groups	1GG
Theoretical credits	3
Practical credits	3
Coordination	BEJAR TORRES, RAMON
Department	INFORMATICA I ENGINYERIA INDUSTRIAL
Teaching load distribution between lectures and independent student work	6 ECTS = 25x6 = 150 - 60 hours of on-class activities - 90 hours of autonomous activities
Important information on data processing	Consult this link for more information.
Language	Lectures at the classrom in Spanish, but learning material is provided always in English. Lectures can also be given in English if requested by students.
Distribution of credits	Ramon Bejar Torres 6
Office and hour of attention	To arrange with the teacher

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Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BEJAR TORRES, RAMON	ramon@diei.udl.cat	6	by appointment via email

Subject's extra information

To successfully address the subject, it is advisable to have taken before, or attend during the same course, subjects about:

- Computational Logic (compulsory at this level Computer).
- Artificial intelligence (compulsory at this level Computer).

But the most important requirement is the computacional logic subject, although minimal knowledge about heuristic search in AI is also highly recommended.

Learning objectives

Expected learning outcomes linked to UdL strategic and cross-disciplinary competences :

- Knows how to prepare technical documents with different presentation tools for digital documents (CT3).
- Knows how to work with technical and scientific documents written in English (CT2).
- Understands the main problems encountered in the design of intelligent systems capable of reasoning and learning and knows how to analize the requirements in the design of these systems (EPS6).

Expected learning outcomes linked to specific competences :

- Knows the basics of using formal logic for knowledge representation in intelligent agents (GII-C5).
- Knows how to design a basic intelligent agent that is capable of acting in response to their environment and their internal knowledge (GII-C4).
- Understands the basics of representation, inference and learning under knowledge models based on Bayesian networks (GII C4-C5 and GII GII-C7).

Competences

Strategic:

CT2. Mastering a foreign language, especially English.

CT3. Training Experience in the use of the new technologies and the information and communication technologies.

Cross-disciplinary:

EPS6. Capacity of analysis and synthesis.

Specific:

GII-C4. Capacity to understand the basics, paradigms and techniques of the intelligent systems and analyse, design and build systems, services and computer applications that use these techniques in any field of application.

GII-C5. Capacity to acquire, obtain, formalise and represent the human knowledge in a computable form to solve problems by means of a computer system in any field of application, particularly in the ones related with computation, perception and performance in environments or intelligent surroundings.

GII-C7. Capacity to know and develop techniques of computational learning and design and implement applications and systems that use them, including the ones devoted to automatic extraction of information and knowledge from big volumes of data.

Subject contents

In this course, starting from basic knowledge of IA presented in the first semester, we will present different ways of representing knowledge and reasoning processes carried out on this knowledge as well as machine learning.

Knowledge representation, and obtaining answers to questions through automated reasoning, allows us to create systems for solving various problems such as resolving conflicts in resource allocations in business environments or intelligent systems for searching on web systems, where a question as "give me websites where they talk about mammals," can get back as response pages where they talk about whales, even if these pages do not mention explicitly the relationship between mammals and whales.

Finally, we reinforce the basic knowledge on learning initiated also on the first semester, covering a learning system widely used in real applications of artificial intelligence: Bayesian networks learning. They are used in systems such as automatic recommenders for online shopping sites such as Amazon that can be used to Recomending buying a book based on a profile that is learned for each user, or spam filters for email tools like Thunderbird mail, where the decision to classify emails as spam depends on a model that is refined according to the experience of previously obtained spam messages.

The syllabus of the course will be the next one:

1. Knowledge Representation and Reasoning with First Order Logic
2. Integration of knowledge representation formalisms and efficient reasoning
3. Representation of Ontologies with Description Logics
4. Probabilistic models for knowledge representation and inference under incomplete information
5. Model learning from incomplete information: Bayesian networks.

Methodology

There will be three types of activities:

1) Lectures

2) Laboratory classes

3) Independent work outside the classroom to finish exercises and to do the mandatory assignments for this subject.

Development plan

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Week	Description	Face-to-Face Activity	Autonomous Activity	Hours (F and A)
1	Presentation and introduction to the goals of the subject	Lectures		**4**
2	Basic CP0 Reasoning remainder	Lectures and solving exercises	**Solve Exercises**	4 5
3	Reasoning in Agents with CP0	Lectures and solving exercises	**Study**	4 3
4	Reasoning in Agents with CP0	Lectures and solving exercises	**Study and Solve Exercises**	4 6
5	Reasoning in Agents with CP0	Lectures and programming laboratory	**Study and Solve Exercises**	**4 6**
6	Reasoning with CP1	Lectures and programming laboratory	**Study and Solve Exercises**	4 6
7	Reasoning with CP1	Lectures and programming laboratory	Work on 1st programming assignment **Solve Exercises**	4 8
8	Ontology Representation and reasoning	Lectures and programming laboratory	Work on 1st programming assignment **Solve Exercises**	4 8
9	Partial evaluation	**Written exam about CP0 based agents and CP0/CP1 theory**	Study Work on 1st programming assignment	2 8
10	Introduction to inference and learning under uncertainty	Lectures	**Study**	4 4
11	Inference with probablistic models	Lectures and programming laboratory	**Solve Exercises**	4 6
12	Inference with probablistic models	Lectures and programming laboratory	**Solve Exercises**	4 6
13	Inference and learning with probablistic models	Lectures and programming laboratory	**Solve Exercises**	4 10
14	Learning probablistic models	Lectures and programming laboratory	**Solve Exercises** **Work on 2nd programming assignment**	4 8
15	Learning probablistic models	Lectures and programming laboratory	Study **Work on 2nd programming assignment**	4 8
16			Study **Work on 2nd programming assignment**	- 6
17	Partial evaluation	**Written exam about machine learning**	Study **Work on 2nd programming assignment**	2 8
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Evaluation

Evaluation activities

Acr.	Evaluation activity	Weight	Minimum grade	In group	Mandatory	
P1	*Programming assignment (1)*	30%	NO	YES	YES	
P2	*Programming assignment (2)*	30%	NO	YES	YES	
PR	*Exercises*	20%	NO	NO	NO	
E1	*Written exam (1)*	18%	NO	NO	YES	
E2	*Written exam (2)*	18%	NO	NO	YES	

FinalGrade = 0,3*P1 + 0,3*P2 + 0.18*E1+ 0.18*E2+ 0,2*PR
Observe that the total weight is 116%, meaning that the maximum possible grade is 11.6

Bibliography

All learning material will be provided during the course in the form of slides, lectures notes and manuals of the different programs to be used. However, some part of the contents can be complemented with some chapters from the book:

- Artificial Intelligence, a modern approach (3rd edition). Stuart Russel and Peter Norvig. Publisher: Pearson.