270722 - KRE - Knowledge and Representation Engineering

Coordinating unit: 270 - FIB - Barcelona School of Informatics
Teaching unit: 1042 - URV - Universitat Rovira i Virgili
Academic year: 2019
Degree: MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE (Syllabus 2012). (Teaching unit Optional)
MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE (Syllabus 2009). (Teaching unit Optional)
MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE (Syllabus 2009). (Teaching unit Optional)
MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE (Syllabus 2017). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: English

Prior skills
Self-contained subject.

Degree competences to which the subject contributes

Basic:
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.

Specific:
CEA12. Capability to understand the advanced techniques of Knowledge Engineering, Machine Learning and Decision Support Systems, and to know how to design, implement and apply these techniques in the development of intelligent applications, services or systems.
CEA13. Capability to understand advanced techniques of Modeling, Reasoning and Problem Solving, and to know how to design, implement and apply these techniques in the development of intelligent applications, services or systems.
CEP2. Capability to solve the decision making problems from different organizations, integrating intelligent tools.

General:
CG3. Capacity for modeling, calculation, simulation, development and implementation in technology and company engineering centers, particularly in research, development and innovation in all areas related to Artificial Intelligence.

Transversal:
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
CT5. APPROPRIATE ATTITUDE TOWARDS WORK: Capability to be motivated for professional development, to meet new challenges and for continuous improvement. Capability to work in situations with lack of information.
CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..
Teaching methodology

Introductory Activities: Introduction of the lecturer, the objectives of the subject, the contents, the teaching methodology, evaluation process, and the supporting material.

Master Session: The lecturer will explain the basic contents of the subject with examples. (S)he will provide the student all the material required to prepare the subject.

Solving problems and exercises in ordinary class: In groups we’ll study a tool for knowledge management and we’ll do a practical work. Each group will present the results to the lecturer.

Learning objectives of the subject

1. Differentiate between the concepts data, information and knowledge, and their technologies.
2. Know and know how to use alternative knowledge representation formalisms.
3. Know how to apply knowledge engineering methods for concrete problems.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>20h</th>
<th>13.33%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>20h</td>
<td>13.33%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>10h</td>
<td>6.67%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>4h</td>
<td>2.67%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>96h</td>
<td>64.00%</td>
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</tbody>
</table>
# Content

## Introduction and Concepts

**Degree competences to which the content contributes:**

**Description:**
Data, Information and Knowledge; Knowledge Types and Uses; Knowledge Representation; Knowledge Engineering; Syntax and Semantics.

## Knowledge Representation

**Degree competences to which the content contributes:**

**Description:**
First order logic; Rules and production systems; Object-Oriented Representations; Network Representation; Ontologies

## Knowledge Engineering

**Degree competences to which the content contributes:**

**Description:**
Knowledge Life-Cycle; Knowledge Audit; Knowledge Acquisition; Detailed Case-Study.

## Knowledge Representation in the Web

**Degree competences to which the content contributes:**

**Description:**
Representing data with HTML; Formalization and representation of information with DTD, XMLSchema, XML; Tools for data and information management on the web with XPath and XSL; Formalization and representation of knowledge with RDF and OWL2.
# Planning of activities

<table>
<thead>
<tr>
<th><strong>Introduction</strong></th>
<th><strong>Hours:</strong> 1h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 0h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 0h</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
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<td>Self study: 0h</td>
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</tbody>
</table>

**Description:**
Academic description of the subject, contents, evaluation process, etc.

<table>
<thead>
<tr>
<th><strong>Regular master class</strong></th>
<th><strong>Hours:</strong> 64h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 49h</td>
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<tr>
<td></td>
<td>Practical classes: 0h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 0h</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
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<tr>
<td></td>
<td>Self study: 15h</td>
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**Description:**
Introduction of the important concepts of the course, the relevant technologies, and the promotion of assimilation with specific and clear examples.

**Specific objectives:**
1, 2, 3

<table>
<thead>
<tr>
<th><strong>Knowledge representation test</strong></th>
<th><strong>Hours:</strong> 12h</th>
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<tbody>
<tr>
<td></td>
<td>Guided activities: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study: 10h</td>
</tr>
</tbody>
</table>

**Description:**
Test with practical exercises and theoretical questions.

**Specific objectives:**
1, 2

<table>
<thead>
<tr>
<th><strong>Knowledge Engineering test</strong></th>
<th><strong>Hours:</strong> 12h</th>
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<td></td>
<td>Guided activities: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study: 10h</td>
</tr>
</tbody>
</table>

**Description:**
Test of practical exercises and theoretical questions on knowledge engineering.

**Specific objectives:**
3
Practical work of representation of knowledge

Description:
Work in a group where the construction of a knowledge base through software is exercised

Specific objectives:
2

Practical work of representation of knowledge on the Web

Description:
Work in a group where the construction of a web ontology is carried out through Protege.

Qualification system

(50%) Problems and exercises resolution in ordinary class: Thorough the course there will be several partial tests.

(50%) Objective tests with short questions: Objective tests with short questions every other week of 30 min each. We'll devote one of these tests (this one of 2h) to evaluate the total content of the subject.

The student who don't pass the evaluation, will have a reparatory exam on the full contents of the subject (100% of the final mark).

Bibliography

Basic:

Complementary:
