270729 - PMCDSS - Personalized Multi-Criteria Decision Support Systems

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 2017). (Teaching unit Optional)
ECTS credits: 4,5

Prior skills
None

Degree competences to which the subject contributes

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.
- CEP3. Capacity for applying Artificial Intelligence techniques in technological and industrial environments to improve quality and productivity.

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:
- 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.
- CT7. ANALISIS Y SINTESIS: Capability to analyze and solve complex technical problems.

Teaching methodology
Oral exposition of the teacher
Oral presentations of the students
Practical exercices with software tools
Solving exercices in class

Learning objectives of the subject
1. Recognize the main components of a decision making problem and decide the most appropriate modelization method.
2. Build a preference model according to the heterogeneous data types.
3. Make an appropriate selection and use of aggregation operators.
4. Study and apply methods based on the Multi-Attribute Utility Theory.
5. Study and apply methods based on Outranking models for MCDA.
6. Identify the relations between MCDA (Multi-criteria Decision Aiding) and AI (Artificial Intelligence)
## 1 Introduction

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

**Description:**
Multicriteria Decision Aiding is a research field that is growing in importance recently. The use of AI techniques in this field is quite new and opens many interesting research lines. The first topic introduces the basic concepts and notation.

1.1 The decision making problem. Formalization.
1.2 MCDA applications

## 2 Preference representation models for user profiles

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

**Description:**
To build personalized decision support systems we need to know and store the preferences of the users in an appropriate model. In this chapter, we study different representation models that take into account several data formats.

2.1 Data types
2.2 Family of criteria
2.3 User profile construction and update

## 3 Multi-Attribute Utility Theory

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

**Description:**
The course addresses two main approaches. The first is based on merging the utility of different criteria into a single overall score. Many fusion methods for aggregation will be presented and compared.

3.1 Introduction
3.2 Steps: aggregation and exploitation.
3.3 Aggregation operators. Properties.

## 4 Models based on outranking relations

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

**Description:**
The second approximation is more qualitative than quantitative. It is based on building a decision model with preference relations among a set of options.

4.1 Introduction
4.2 Outranking relations
4.3 ELECTRE
## 5 MCDA and AI

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

**Description:**
Use of MCDA in combination with other intelligent techniques can be applied in many different fields. Each course we study different lines according to the interests of the students. For example, MCDA in intelligent recommender systems, or in geographic information systems, or in web searchers, or electronic commerce, among others.
# Planning of activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
<th>Description</th>
<th>Specific objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exam</strong></td>
<td>2h</td>
<td>Final exam with questions and exercises</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td><strong>Research report with an oral presentation</strong></td>
<td>22h</td>
<td>The student will make a survey on some topic, in group. The report is delivered to the teacher. An oral presentation will be done at class.</td>
<td>1, 4, 5, 6</td>
</tr>
<tr>
<td><strong>Solving practical exercises with software tools</strong></td>
<td>11h</td>
<td>The student will use a free software to solve some exercises. Some of them will be reported in a short document delivered to the teacher.</td>
<td>1, 2, 3, 4, 5, 6</td>
</tr>
<tr>
<td><strong>Lectures</strong></td>
<td>53h</td>
<td>The lecturer explains the theoretical concepts of the subject with examples. Some complementary materials will be given to the students.</td>
<td>1, 2, 6</td>
</tr>
</tbody>
</table>

| Theory classes: 27h | Practical classes: 0h | Laboratory classes: 0h | Guided activities: 0h | Self study: 26h |
## Practical exercises at the computer lab

<table>
<thead>
<tr>
<th>Hours: 24h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 0h</td>
</tr>
<tr>
<td>Practical classes: 0h</td>
</tr>
<tr>
<td>Laboratory classes: 12h</td>
</tr>
<tr>
<td>Guided activities: 0h</td>
</tr>
<tr>
<td>Self study: 12h</td>
</tr>
</tbody>
</table>

### Description:
The student will use a free software to solve some exercises. Some of them will be reported in a short document delivered to the teacher.

### Specific objectives:
2, 3, 4, 5

## Qualification system

Student must solve practical exercises with software tools 30%
Student must prepare a research report and make an oral presentation 30%
There is a final exam with short questions and exercises 40%
Bibliography

Basic:


Others resources:

Hyperlink

http://www.mcdmsociety.org

http://www.mcdmsociety.org

http://www.informs.org/Community/MCDM

http://www.decision-deck.org