Course guides  
270728 - PGM - Probabilistic Graphical Models

Unit in charge: Barcelona School of Informatics  
Teaching unit: 1004 - UB - (ENG)Universitat de Barcelona.

Degree: MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE (Syllabus 2017). (Optional subject).

Academic year: 2021  
ECTS Credits: 4.5  
Languages: English

LECTURER

Coordinating lecturer:

Others:

PRIOR SKILLS

The subject requires the student to have basic knowledge of linear algebra and calculus, and be familiar with basic probability concepts.

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.

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.

CEA3. Capability to understand the basic operation principles of Machine Learning main techniques, and to know how to use on the environment of an intelligent system or service.

CEA8. Capability to research in new techniques, methodologies, architectures, services or systems in the area of Artificial Intelligence.

CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.

CEP2. Capability to solve the decision making problems from different organizations, integrating intelligent tools.

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

CEP5. Capability to design new tools and new techniques of Artificial Intelligence in professional practice.

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.

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.

CT7. ANALISIS Y SINTESIS: Capability to analyze and solve complex technical problems.
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.
CB9. Possession of the learning skills that enable the students to continue studying in a way that will be mainly self-directed or autonomous.

TEACHING METHODOLOGY

Lectures dynamically combine master explanations and problem solving. The weekly schedule of in-person activities is distributed in three hours. Some slots may be exclusively dedicated to programming throughout directed activities or notebooks. The students will be required to present an application of PGMs (their own or other people's) to problems of their interest, or a recently proposed PGM technique.

LEARNING OBJECTIVES OF THE SUBJECT

1. Be able to use effectively Probabilistic Graphical Models in business and research scenarios.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes</td>
<td>15,0</td>
<td>13.33</td>
</tr>
<tr>
<td>Guided activities</td>
<td>3,0</td>
<td>2.67</td>
</tr>
<tr>
<td>Self study</td>
<td>72,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Practical classes</td>
<td>15,0</td>
<td>13.33</td>
</tr>
<tr>
<td>Laboratory classes</td>
<td>7,5</td>
<td>6.67</td>
</tr>
</tbody>
</table>

Total learning time: 112.5 h

CONTENTS

- **Representation**
  Description:
  Formal description of PGMs and different types

- **Inference**
  Description:
  Using PGMs to answer probabilistic queries (both exactly and approximately)

- **Learning**
  Description:
  Learning PGMs from data (both parameters and graph structure)

- **Modern trends, applications and tools**
  Description:
  PGMs state-of-the-art
## ACTIVITIES

### Development of the first subject's block: Representation

**Description:**
Collaborative style lectures

**Specific objectives:**
1

**Full-or-part-time:** 25h
- Theory classes: 4h
- Practical classes: 4h
- Laboratory classes: 2h
- Self study: 15h

### Development of the second subject's block: Inference

**Full-or-part-time:** 25h
- Theory classes: 4h
- Practical classes: 4h
- Laboratory classes: 2h
- Self study: 15h

### Development of the third subject's block: Learning

**Full-or-part-time:** 25h
- Theory classes: 4h
- Practical classes: 4h
- Laboratory classes: 2h
- Self study: 15h

### Test

**Specific objectives:**
1

**Full-or-part-time:** 17h 30m
- Guided activities: 2h 30m
- Self study: 15h

### Development of the fourth subject's block: Trends and applications

**Full-or-part-time:** 2h 30m
- Theory classes: 1h
- Practical classes: 1h
- Laboratory classes: 0h 30m
Students’ presentations

Specific objectives:

1

Full-or-part-time: 17h 30m
Guided activities: 2h 30m
Self study: 15h

GRADING SYSTEM

The subject is expected to be evaluated based on a final exam (40%), a presentation (30%) and in-class activities (30%).

BIBLIOGRAPHY

Basic:

RESOURCES

Hyperlink:
- https://www.coursera.org/