Course guide

270746 - DLMIA - Deep Learning for Medical Image Analysis

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: 2022  ECTS Credits: 3.0  Languages: English

LECTURER

Coordinating lecturer: SIMONE BALOCCO

Others: Primer quadrimestre:
SIMONE BALOCCO - 10

PRIOR SKILLS

The previous knowledge recommended for this course are:
- Good understanding of basic concepts and methods of Deep Learning.
- Familiarity with basic concepts and methods of Computer Vision.
- Good programming skills

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
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.
CEA14. Capability to understand the advanced techniques of Vision, Perception and Robotics, 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.
CEA4. Capability to understand the basic operation principles of Computational Intelligence main techniques, and to know how to use in the environment of an intelligent system or service.
CEA6. Capability to understand the basic operation principles of Computational Vision main techniques, and to know how to use in 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.
CEP3. Capacity for applying Artificial Intelligence techniques in technological and industrial environments to improve quality and productivity.
CEP6. Capability to assimilate and integrate the changing economic, social and technological environment to the objectives and procedures of informatic work in intelligent systems.
CEP8. Capability to respect the surrounding environment and design and develop sustainable intelligent systems.

Generical:
CG2. Capability to lead, plan and supervise multidisciplinary teams.

Transversal:
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.

Basic:
CB7. Ability to integrate knowledges and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.
TEACHING METHODOLOGY

T - Each week it will be a 1h theoretical topic exposition class.
P - Each week it will be a 1h practical session.
The rest of the course are devoted to autonomous lectures, programming, and studying.

LEARNING OBJECTIVES OF THE SUBJECT

1. Introduction to clinical imaging modalities.
   Data analysis techniques.
   Neural network for medical imaging
   Databases and challenges

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>12.0</td>
<td>16.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>3.0</td>
<td>4.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>12.0</td>
<td>16.00</td>
</tr>
<tr>
<td>Self study</td>
<td>48.0</td>
<td>64.00</td>
</tr>
</tbody>
</table>

Total learning time: 75 h

CONTENTS

- **Introduction to the clinical image modalities**
  **Description:**
  Introduction to the clinical image modalities

- **Techniques for data analysis**
  **Description:**
  Techniques for data analysis

- **Neural network for medical imaging**
  **Description:**
  Neural network for medical imaging

- **Data bases and challenges**
  **Description:**
  Data bases and challenges
ACTIVITIES

**Theory**

**Description:**
Theory

**Specific objectives:**
1

**Related competencies:**
CG2. Capability to lead, plan and supervise multidisciplinary teams.
CEP8. Capability to respect the surrounding environment and design and develop sustainable intelligent systems.
CEP3. Capacity for applying Artificial Intelligence techniques in technological and industrial environments to improve quality and productivity.
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CEA4. Capability to understand the basic operation principles of Computational Intelligence main techniques, and to know how to use in the environment of an intelligent system or service.
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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.
CB7. Ability to integrate knowledges and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.

**Full-or-part-time:** 25h
Theory classes: 12h
Self study: 13h
practicum

Description: practicum

Specific objectives:
1

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Full-or-part-time: 45h
Laboratory classes: 12h
Self study: 33h
**Student presentations**

**Description:**
Student presentations

**Specific objectives:**
1

**Related competencies:**
- CG2. Capability to lead, plan and supervise multidisciplinary teams.
- CEP8. Capability to respect the surrounding environment and design and develop sustainable intelligent systems.
- CEP3. Capacity for applying Artificial Intelligence techniques in technological and industrial environments to improve quality and productivity.
- 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.
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- CTS. 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.
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**Full-or-part-time:** 5h
- Theory classes: 1h
- Laboratory classes: 1h
- Self study: 3h

**GRADING SYSTEM**

The course will follow a continuous evaluation consisting in practical reports (PR) and in-class presentations (PS). A test (or multiple mini-tests) about the theory will be performed (TS). The final score (FS) will be computed as follows:

$$FS = 0.4 \times PR + 0.3 \times PS + 0.3 \times TS$$

A minimum score of 3 over 10 points is required for each part PR, PS, and TS in order to compute the final score FS.

**BIBLIOGRAPHY**

**Basic:**