

Course guide

270746 - DLMIA - Deep Learning for Medical Image Analysis

Last modified: 21/07/2022

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

Type	Hours	Percentage
Hours small group	12,0	16.00
Self study	48,0	64.00
Hours large group	12,0	16.00
Guided activities	3,0	4.00

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.

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

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.

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.

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.

CEP6. Capability to assimilate and integrate the changing economic, social and technological environment to the objectives and procedures of informatic work in intelligent systems.

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.

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.

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

CEP8. Capability to respect the surrounding environment and design and develop sustainable intelligent systems.

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

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.

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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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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: 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.

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

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.

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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:

$$FS = 0.4 * PR + 0.3 * PS + 0.3 * TS$$

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:

- Litjens, G.; Kooi, T.; Bejnordi, B.E. "A survey on deep learning in medical image analysis". Medical image analysis [on line]. 42, 60-88. (2017) [Consultation: 25/11/2021]. Available on: [HTTPS://DOI.ORG/10.1016/J.MEDIA.2017.07.005](https://doi.org/10.1016/j.media.2017.07.005).- Greenspan, H., Van Ginneken, B., & Summers, R. M. "Guest editorial deep learning in medical imaging: Overview and future promise of an exciting new technique". IEEE Transactions on Medical Imaging [on line]. (2016) 35(5), 1153-1159 [Consultation: 25/11/2021]. Available on: <https://ieeexplore.ieee.org/document/7463094>.