

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000856 - Deep Learning

DEGREE PROGRAMME

10AZ - Master Universitario En Innovación Digital

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	103000856 - Deep Learning
No of credits	3 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AZ - Master Universitario en Innovación Digital
Centre	10 - Escuela Técnica Superior De Ingenieros Informáticos
Academic year	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Martin Molina Gonzalez (Subject coordinator)	2111	martin.molina@upm.es	Sin horario.
Luis Baumela Molina	2112	luis.baumela@upm.es	Sin horario.
Daniel Manrique Gamo	2109	daniel.manrique@upm.es	Sin horario.
Roberto Valle Fernandez	3205	roberto.valle@upm.es	Sin horario.

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

- Intelligent Systems

3.2. Other recommended learning outcomes

- Basic foundations of artificial neural networks (e.g., shallow neural networks and backpropagation algorithm)
- Computer languages (e.g., Python)

4. Skills and learning outcomes *

4.1. Skills to be learned

CB07 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

CE-CD08 - Capacidad para utilizar y seleccionar las herramientas más adecuadas para deep learning

CG03 - La capacidad de usar la lengua inglesa de manera competente, es decir, con capacitación para tareas complejas de trabajo y estudio.

4.2. Learning outcomes

RA64 - Apply machine learning software tools for practical problems related to deep learning

RA63 - Identify areas of application where deep learning techniques can be used

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Deep learning has emerged from the connectionist branch of machine learning, aided by the arrival of big data and increased computational power (e. g., parallelization using graphics processing units - GPUs). Deep learning has shown better performance than other approaches to solve problems that cope with large amounts of data as it is required, for example, in computer vision (image or video processing) or speech understanding.

This course presents a theoretical and practical view of deep learning. It is assumed that students are familiar with the basic foundations of neural networks (e.g., shallow artificial neural networks and backpropagation algorithm). The course describes general methods to train deep neural networks (e.g., optimization algorithms, regularization methods, normalization methods, etc.) and presents neural models for specific domains (e.g., computer vision) together with software tools to train neural networks.

5.2. Syllabus

1. Training methods for deep neural networks
 - 1.1. Deep neural networks
 - 1.2. Training methods
2. Deep learning for computer vision
 - 2.1. Foundations of computer vision
 - 2.2. Convolutional neural networks

6. Schedule

6.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	Course introduction Duration: 02:00 Lecture Lecture on Unit 1 Duration: 02:00 Lecture			
2	Lecture on Unit 1 Duration: 02:00 Lecture Lecture on Unit 1 Duration: 02:00 Lecture			
3	Lecture on Unit 1 Duration: 02:00 Lecture Lecture on Unit 1 Duration: 02:00 Lecture			
4	Lecture on Unit 1 Duration: 02:00 Lecture Lecture on Unit 1 Duration: 02:00 Lecture			
5	Lecture on Unit 2 Duration: 02:00 Lecture			Assessment of Unit 1 Written test Continuous assessment Presential Duration: 02:00
6	Lecture on Unit 2 Duration: 02:00 Lecture Lecture on Unit 2 Duration: 02:00 Lecture			
7	Lecture on Unit 2 Duration: 02:00 Lecture Lecture on Unit 2 Duration: 02:00 Lecture			

8	Lecture on Unit 2 Duration: 02:00 Lecture Lecture on Unit 2 Duration: 02:00 Lecture			
9				
10				Assessment of Unit 1 Written test Final examination Presential Duration: 02:00 Assessment of Unit 2 Group work Continuous assessment and final examination Presential Duration: 00:00
11				
12				
13				
14				
15				
16				
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Assessment of Unit 1	Written test	Face-to-face	02:00	50%	4 / 10	CE-CD08 CB07 CG03
10	Assessment of Unit 2	Group work	Face-to-face	00:00	50%	3 / 10	CB07 CG03 CE-CD08

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
10	Assessment of Unit 1	Written test	Face-to-face	02:00	50%	4 / 10	CB07 CG03 CE-CD08
10	Assessment of Unit 2	Group work	Face-to-face	00:00	50%	3 / 10	CB07 CG03 CE-CD08

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Assessment of Unit 1	Written test	Face-to-face	02:00	50%	4 / 10	CB07 CG03 CE-CD08
Assessment of Unit 2	Group work	Face-to-face	00:00	50%	3 / 10	CB07 CG03 CE-CD08

7.2. Assessment criteria

Partial and final grades are on the scale of 0 to 10. To pass the course it is required that the final grade G must be $G \geq 5$.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
UPM Moodle	Web resource	
Bibliography	Bibliography	Selected bibliography (papers and text books)

9. Other information

9.1. Other information about the subject

The course "Deep Learning" is related to the "Sustainable Development Goal 9" (Build resilient infrastructure, promote sustainable industrialization and foster innovation), defined by the United Nations Development Programme (www.undp.org) in terms of innovation and scientific research in information technologies.