



POLITÉCNICA

INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informaticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000898 - Deep Learning**

### DEGREE PROGRAMME

10BA - Master Universitario en Ciencia de Datos

### ACADEMIC YEAR & SEMESTER

2019/20 - Semester 2

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## 1. Description

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### 1.1. Subject details

<b>Name of the subject</b>	103000898 - Deep Learning
<b>No of credits</b>	3 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10BA - Master Universitario en Ciencia de Datos
<b>Centre</b>	10 - Escuela Tecnica Superior de Ingenieros Informaticos
<b>Academic year</b>	2019-20

## 2. Faculty

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### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Martin Molina Gonzalez (Subject coordinator)	2111	martin.molina@upm.es	Sin horario.
Luis Baumela Molina	2204	luis.baumela@upm.es	Sin horario.
Daniel Manrique Gamo	2109	daniel.manrique@upm.es	Sin horario.
Emilio Serrano Fernandez	2201	emilio.serrano@upm.es	Sin horario.

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

## 2.2. Research assistants

Name and surname	Email	Faculty member in charge
Amador Dominguez, Elvira	elvira.amador@upm.es	Molina Gonzalez, Martin

## 3. Prior knowledge recommended to take the subject

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### 3.1. Recommended (passed) subjects

- Sistemas Inteligentes

### 3.2. Other recommended learning outcomes

- Basic foundations of neural networks
- Computer languages (e.g., Python)

## 4. Skills and learning outcomes \*

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### 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

CECD06 - Conocer y tener capacidad para aplicar métodos de minería de datos para clasificación, modelado, segmentación y predicción a partir de un conjunto de datos

## 4.2. Learning outcomes

RA35 - Identify areas of application where deep learning techniques can be used

RA36 - Apply machine learning software tools for practical problems related to deep learning

\* 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

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### 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 showed 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). First, the course presents learning techniques to train deep neural networks. The course also presents neural models for problem classes and application domains (e.g., computer vision and natural language processing). To complement the practical view, the student will use specialized software tools to train neural networks in practical problems.

## 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
3. Deep learning for natural language processing

## 6. Schedule

### 6.1. Subject schedule\*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Other face-to-face activities	Assessment activities
1	<b>Lecture on Unit 1</b> Duration: 02:00  <b>Lecture on Unit 1</b> Duration: 02:00			
2	<b>Lecture on Unit 1</b> Duration: 02:00  <b>Lecture on Unit 1</b> Duration: 02:00			
3	<b>Lecture on Unit 1</b> Duration: 02:00  <b>Lecture on Unit 2</b> Duration: 02:00			<b>Assessment activity for Unit 1</b>  Continuous assessment Duration: 00:00
4	<b>Lecture on Unit 2</b> Duration: 02:00  <b>Lecture on Unit 2</b> Duration: 02:00			
5	<b>Lecture on Unit 2</b> Duration: 02:00  <b>Lecture on Unit 2</b> Duration: 02:00			
6	<b>Lecture on Unit 2</b> Duration: 02:00  <b>Lecture on Unit 3</b> Duration: 02:00			<b>Assessment activity for Unit 2</b>  Continuous assessment Duration: 00:00

7	<b>Lecture on Unit 3</b> Duration: 02:00  <b>Lecture on Unit 3</b> Duration: 02:00			
8	<b>Lecture on Unit 3</b> Duration: 02:00  <b>Lecture on Unit 3</b> Duration: 02:00			<b>Assessment activity for Unit 3</b>  Continuous assessment Duration: 02:00
9				
10				
11				
12				
13				
14				
15				
16				
17				<b>Assessment activity for Unit 1</b>  Final examination Duration: 00:00  <b>Assessment activity for Unit 2</b>  Final examination Duration: 00:00  <b>Assessment activity for Unit 3</b>  Final examination Duration: 02:00

The independent study hours are training activities during which students should spend time on individual study or individual assignments.

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 subject schedule is based on a previous theoretical planning of the subject plan and might go through experience some unexpected changes along throughout the academic year.

## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Assessment activity for Unit 1		No Presential	00:00	30%	2 / 10	CB07 CECD06
6	Assessment activity for Unit 2		No Presential	00:00	50%	2 / 10	CB07 CECD06
8	Assessment activity for Unit 3		Face-to-face	02:00	20%	/ 10	CB07 CECD06

#### 7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Assessment activity for Unit 1		No Presential	00:00	30%	2 / 10	CB07 CECD06
17	Assessment activity for Unit 2		No Presential	00:00	50%	2 / 10	CB07 CECD06
17	Assessment activity for Unit 3		Face-to-face	02:00	20%	/ 10	CB07 CECD06

#### 7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Assessment activity for Unit 1		Face-to-face	00:00	30%	2 / 10	CB07 CECD06
Assessment activity for Unit 2		Face-to-face	00:00	50%	2 / 10	CB07 CECD06
Assessment activity for Unit 3		Face-to-face	02:00	20%	/ 10	CB07 CECD06

## 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  $G \geq 5$ .

"Continuous assessment" and "final examination" are mutually exclusive. Students who want to follow "final examination" must inform the coordinator (martin.molina@upm.es) at the beginning of the course (in the first two weeks of the course). Otherwise, continuous assessment is followed.

## 8. Teaching resources

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### 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

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### 9.1. Other information about the subject