



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
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COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros de
Telecomunicacion

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

93001324 - Inteligencia Artificial En Neurotecnología

DEGREE PROGRAMME

09BQ - Master In Science In Neurotechnology

ACADEMIC YEAR & SEMESTER

2024/25 - Semester 1

Index

Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	4
6. Activities and assessment criteria.....	6
7. Teaching resources.....	8

1. Description

1.1. Subject details

Name of the subject	93001324 - Inteligencia Artificial en Neurotecnología
No of credits	6 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	09BQ - Master In Science In Neurotechnology
Centre	09 - Escuela Tecnica Superior De Ingenieros De Telecomunicacion
Academic year	2024-25

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Javier Bajo Perez (Subject coordinator)		javier.bajo@upm.es	--
Bojan Mihaljevic		b.mihaljevic@upm.es	Sin horario.
Laura Melgar Garcia		laura.melgar@upm.es	Sin horario.
Emilio Serrano Fernandez		emilio.serrano@upm.es	Sin horario.
Esteban Garcia Cuesta		esteban.garcia@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. Skills and learning outcomes *

3.1. Skills to be learned

C4 - Resolver problemas de neurodispositivos, neuroseñales e inteligencia artificial, integrando conocimiento en aspectos nuevos o escasamente definidos y en entornos multidisciplinares. Competencias

C5 - Aplicar metodologías, procedimientos, herramientas y normas del estado del arte para la creación de nuevos componentes tecnológicos, y construir nuevas hipótesis y modelos, evaluarlos y aplicarlos a la resolución de problemas en el área de la neurotecnología. Competencias

K2 - Conocer los aspectos teóricos y prácticos de técnicas de inteligencia artificial avanzadas que se pueden emplear para resolver problemas multidisciplinares en neurotecnología. Conocimientos

S2 - Adquirir, procesar, analizar y modelar datos de la actividad del sistema nervioso e interpretar resultados, implementando algoritmos usando lenguajes de programación adecuados, software de distribución libre y plataformas de inteligencia artificial especializadas. Habilidades

S3 - Seleccionar y aplicar técnicas avanzadas para el procesamiento de señales neuroelectrofisiológicas e imágenes cerebrales para diseño, implementación y evaluación de interfaces cerebro-máquina, y dispositivos de neurorehabilitación que permitan diagnosticar y tratar enfermedades neurológicas y neuropsiquiátricas. Habilidades

S4 - Comunicar trabajos y conclusiones a comunidades de iguales o a públicos generales de una manera razonada, clara y sin ambigüedades, elaborar artículos o memorias técnicas, y transmitir de un modo claro los avances científicos y tecnológicos o de la innovación más avanzada a audiencias especializadas y no especializadas. Habilidades

S5 - Utilizar las tecnologías de la información y la comunicación para la búsqueda de información y datos bibliográficos, y para la adquisición de nuevo conocimiento para la formación permanente y el trabajo autónomo. Habilidades

3.2. Learning outcomes

RA4 - RA-K4,S1,S3,C3,C4,C5

RA3 - S4

* 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.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

The objective of this course is to introduce the student to the fundamental concepts of artificial intelligence, as well as its application to the field of neurotechnology. The student will be introduced to the main aspects of artificial intelligence, as well as to each of its areas. Special attention will be paid to cognitive architectures, data science, machine learning or artificial neural networks, among others. In addition, the application of these techniques to neurotechnology will be reviewed, trying to achieve a double objective: that the student can acquire skills on the principles and application of AI to neurotechnology, and that the student can apply neurotechnology (oriented to the knowledge of the human brain) to the knowledge and development of AI (more specifically, AI oriented to the imitation of the human brain).

4.2. Syllabus

1. Introduction to AI and Neurotechnology
2. Principals of Machine Learning
3. AI for analyzing temporal data and Heterogenous data
4. AI for Natural Language Processing
5. AI and Explainability

5. Schedule

5.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Introduction to AI and Neurotechnology Duration: 04:00			
2	Introduction to AI and Neurotechnology - Information Fusion Duration: 02:00			Presentation of Group Work Progressive assessment Presential Duration: 02:00
3	Principals of Machine Learning Duration: 04:00			
4	Principals of machine learning Duration: 04:00			
5	Principals of Machine Learning Duration: 04:00			
6	Principals of machine learning Duration: 04:00			
7				Individual work Progressive assessment Presential Duration: 02:00
8	AI for analyzing temporal data and heterogeneous data Duration: 04:00			
9	AI for analyzing temporal data and heterogeneous data Duration: 04:00			
10	AI for analyzing temporal data and heterogeneous data Duration: 04:00			
11	AI for analyzing temporal data and heterogeneous data Duration: 04:00			

12				<p>Individual work</p> <p>Progressive assessment Presential Duration: 02:00</p>
13	<p>AI for natural language processing Duration: 04:00</p>			
14	<p>AI for natural language processing Duration: 02:00</p>			<p>Group work</p> <p>Progressive assessment Presential Duration: 02:00</p>
15	<p>AI and explainability Duration: 04:00</p>			
16	<p>AI and Explainability Duration: 02:00</p>			<p>Group work</p> <p>Progressive assessment Presential Duration: 02:00</p>
17				<p>Individual Exam</p> <p>Global examination Not Presential Duration: 02:00</p> <p>Practical work</p> <p>Global examination Not Presential Duration: 02:00</p>

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.

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Presentation of Group Work		Face-to-face	02:00	10%	0 / 10	S5 S4 K2
7	Individual work		Face-to-face	02:00	35%	/ 10	S2 S4 K2
12	Individual work		Face-to-face	02:00	35%	/ 10	C4 S2 S4 C5 S3
14	Group work		Face-to-face	02:00	10%	/ 10	S5 S4 K2 S3
16	Group work		Face-to-face	02:00	10%	/ 10	S5 S4 C5 K2 S3

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Individual Exam		No Presential	02:00	40%	/ 10	S5 C4 K2 S3
17	Practical work		No Presential	02:00	60%	/ 10	S2 S4 C5 S3

6.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

6.2. Assessment criteria

Continuous Evaluation

Research work: Individual and group research works about one of the topics presented in class will be evaluated in the different sections of the subject

Introduction to AI and Neurotechnology - 10%

Principals of ML - 10%

AI for temporal data and heterogeneous data - 10%

AI and NLP - 10%

AI and explainability - 10%

Practical work

Practical works about different topics of the subject.

Principals of ML 25% of the grade of the subject

AI for temporal data and heterogeneous data 25% of the grade of the subject

Final Exam Only

Research work:

Individual and group research works about one of the topics presented in class will be evaluated in the different sections of the subject

Introduction to AI and Neurotechnology - 10%

Principals of ML - 10%

AI for temporal data and heterogeneous data - 10%

AI and NLP - 10%

AI and explainability - 10%

Practical work

Practical works about different topics of the subject.

Principals of ML 25% of the grade of the subject

AI for temporal data and heterogenous data 25% of the grade of the subject

Extraordinary Exams.

Individual research work (50%)

Practical work (50%)

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Slides	Web resource	
References	Bibliography	References provided by profs.
Software resources	Others	Software resources provided by profs.