ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000851 - Intelligent Systems

DEGREE PROGRAMME

10AZ - Master Universitario En Innovación Digital

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 1

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	103000851 - Intelligent Systems
No of credits	4.5 ECTS
Type	Optional
Academic year ot the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AZ - Master Universitario en Innovación Digital
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Asuncion De Maria Gomez Perez	2209	asunciondemaria.gomez@upm.es	Sin horario.
M. Carmen Suarez De Figueroa Baonza	2201	mdelcarmen.suarezdefigueroa@upm.es	Sin horario.
Martin Molina Gonzalez (Subject coordinator)	2111	martin.molina@upm.es	Sin horario.

Daniel Manrique Gamo	2109	daniel.manrique@upm.es	Sin horario.
Mariano Rico Almodovar		mariano.rico@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

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-CD04 - Capacidad para aplicar métodos avanzados para clasificación, modelado, segmentación y predicción a partir de un conjunto de datos

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.

3.2. Learning outcomes

RA68 - Identify areas of application where techniques of intelligent systems can be used

RA66 - Apply methods for knowledge acquisition to create knowledge bases using other sources of information

RA67 - Use computer languages or software tools for knowledge representation and reasoning for building intelligent systems

* 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

In a broad sense, intelligent systems can be considered as a type of computer system that integrates artificial intelligence algorithms to solve problems in complex environments using limited resources. Intelligent systems are capable of acquiring and using knowledge by integrating methods based on machine learning, knowledge representation and reasoning.

This course presents AI techniques that are applicable to the design and construction of intelligent systems. The course starts with a general characterization of intelligent systems and an overview of the main approaches and basic concepts. Then, the course presents methods of artificial intelligence that can be used to develop different cognitive abilities of intelligent systems. These methods are presented following a formal theoretical approach together with practical exercises.

In particular, the course explains: (1) the foundations of neural networks, which have been used with great success, for example, in problems related to perception or classification, (2) how an intelligent system can learn to act using reinforcement learning techniques, (3) ontologies that are useful, for example, for symbolic knowledge representation and knowledge integration, and (4) natural language processing methods that are useful to facilitate the communication between systems and humans.

4.2. Syllabus

1. Intelligent systems
    1.1. General characterization of intelligent systems
    1.2. Knowledge representation and reasoning
2. Neural networks
    2.1. Representing neural networks
    2.2. Training neural networks
3. Reinforcement learning
    3.1. Sequential decision problems
    3.2. Reinforcement learning algorithms
4. Ontology engineering
    4.1. Ontologies and ontology design patterns
    4.2. How to develop ontologies
5. Natural language processing
    5.1. Morphology
    5.2. Syntax and semantics

5. Schedule

5.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	**Course introduction** Duration: 02:00		**Course introduction** Duration: 02:00	
2	**Lecture on Unit 1** Duration: 02:00		**Lecture on Unit 1** Duration: 02:00	
3	**Lecture on Unit 1** Duration: 02:00		**Lecture on Unit 1** Duration: 02:00	
4	**Lecture on Unit 2** Duration: 02:00		**Lecture on Unit 2** Duration: 02:00	
5	**Lecture on Unit 2** Duration: 02:00		**Lecture on Unit 2** Duration: 02:00	
6	**Lecture on Unit 2** Duration: 02:00		**Lecture on Unit 2** Duration: 02:00	
7	**Lecture on Unit 3** Duration: 02:00		**Lecture on Unit 3** Duration: 02:00	
8	**Lecture on Unit 3** Duration: 02:00		**Lecture on Unit 3** Duration: 02:00	
9	**Lecture on Unit 3** Duration: 02:00		**Lecture on Unit 3** Duration: 02:00	
10	**Lecture on Unit 4** Duration: 02:00		**Lecture on Unit 4** Duration: 02:00	**Assessment of Units 1-2-3** Continuous assessment Not Presential Duration: 02:00
11	**Lecture on Unit 4** Duration: 02:00		**Lecture on Unit 4** Duration: 02:00	
12	**Lecture on Unit 4** Duration: 02:00 **Lecture on Unit 2** Duration: 02:00		**Lecture on Unit 4** Duration: 02:00 **Lecture on Unit 2** Duration: 02:00	

13	**Lecture on Unit 5** Duration: 02:00 **Group tutoring session** Duration: 02:00		**Lecture on Unit 5** Duration: 02:00 **Group tutoring session** Duration: 02:00	
14	**Lecture on Unit 5** Duration: 02:00 **Group tutoring session** Duration: 02:00		**Lecture on Unit 5** Duration: 02:00 **Group tutoring session** Duration: 02:00	
15	**Lecture on Unit 5** Duration: 02:00 **Group tutoring session** Duration: 02:00		**Lecture on Unit 5** Duration: 02:00 **Group tutoring session** Duration: 02:00	
16				**Assessment of Unit 4** Continuous assessment Not Presential Duration: 00:00 **Assessment of Unit 5** Continuous assessment Not Presential Duration: 00:00
17				**Assessment of Units 1-2-3** Final examination Presential Duration: 02:00 **Assessment of Unit 4** Final examination Not Presential Duration: 00:00 **Assessment of Unit 5** Final examination Not Presential Duration: 00:00

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.

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
10	Assessment of Units 1-2-3		No Presential	02:00	50%	2 / 10	CB07 CG03 CE-CD08 CE-CD04
16	Assessment of Unit 4		No Presential	00:00	25%	2 / 10	CB07 CG03 CE-CD04
16	Assessment of Unit 5		No Presential	00:00	25%	2 / 10	CG03 CB07 CE-CD04

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Assessment of Units 1-2-3		Face-to-face	02:00	50%	2 / 10	CB07 CG03 CE-CD08 CE-CD04
17	Assessment of Unit 4		No Presential	00:00	25%	2 / 10	CB07 CG03 CE-CD04
17	Assessment of Unit 5		No Presential	00:00	25%	2 / 10	CE-CD04 CB07 CG03

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills

Assessment of Units 1-2-3		Face-to-face	02:00	50%	2 / 10	CE-CD08 CE-CD04 CB07 CG03
Assessment of Unit 4		Face-to-face	00:00	25%	2 / 10	CB07 CG03 CE-CD04
Assessment of Unit 5		Face-to-face	00:00	25%	2 / 10	CB07 CG03 CE-CD04

6.2. 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 >= 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.

Students who follow "final examination" or "referred (re-sit) examination" must submit to the coordinator (martin.molina@upm.es) the practical projects at least one week before the day established for the written examination. The student will be allowed to take the written examination if the student has submitted in advance the practical projects.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
UPM Moodle	Web resource	Support to on-line education
Biblography	Bibliography	Selected bibliography (papers and text books)

8. Other information

8.1. Other information about the subject

The health situation caused by the COVID-19 pandemic forces to restrict the capacity of the classrooms and therefore it has been decided that the teaching of this semester will be of mixed attendance. Shifts will be established within the groups, so that each week one shift will attend class in the classroom (column "face-to-face classroom activity" of the schedule), while the rest of the shifts will connect to the class remotely (column "distant / on-line"). And each week a different shift will come to the classroom.

If health conditions improve and face-to-face classes can be held normally, all students will go to the classrooms to receive the classes indicated in the "face-to-face classroom activity" column. On the other hand, if health conditions worsen, all students will be connected to the remote classes in the "distant / on-line" column.

This course 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.