ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000606 - Intelligent Systems

DEGREE PROGRAMME

10AN - Master Universitario en Ingenieria Informatica

ACADEMIC YEAR & SEMESTER

2020/21 - Semester 1

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	103000606 - Intelligent Systems
No of credits	4.5 ECTS
Type	Compulsory
Academic year ot the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AN - Master Universitario en Ingenieria Informatica
Centre	10 - Escuela Tecnica Superior de Ingenieros Informaticos
Academic year	2020-21

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.

2.2. Research assistants

Name and surname	Email	Faculty member in charge
Navas Loro, Maria	m.navas@upm.es	Rico Almodovar, Mariano

3. Skills and learning outcomes *

3.1. Skills to be learned

CE12 - Capacidad para aplicar métodos matemáticos, estadísticos y de inteligencia artificial para modelar, diseñar y desarrollar aplicaciones, servicios, sistemas inteligentes y sistemas basados en el conocimiento.

3.2. Learning outcomes

RA63 - To be able to use and apply methods for knowledge acquisition to create manually and automatically knowledge bases using other sources of information (e.g., data sets or text documents).

RA64 - To be able to use and apply languages and software tools for knowledge representation and reasoning for building knowledge-based arquitectures of intelligent systems.

RA62 - To be able to identify areas of application where the techniques of intelligent systems can be used.

RA61 - To know the existing techniques about intelligent systems (knowledge acquisition, knowledge representation and reasoning) understanding their scope and limitations.

RA65 - To be able to search and manage bibliographic sources to analyse the state of the art in the area of intelligent systems.

RA60 - To know what are the main challenges and achievements in the area of 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 Lecture		**Course introduction** 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 2** Duration: 02:00 Lecture		**Lecture on Unit 2** Duration: 02:00 Lecture	
5				
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 3** Duration: 02:00 Lecture		**Lecture on Unit 3** Duration: 02:00 Lecture	
9	**Lecture on Unit 3** Duration: 02:00 Lecture		**Lecture on Unit 3** Duration: 02:00 Lecture	
10	**Lecture on Unit 4** Duration: 02:00 Lecture		**Lecture on Unit 4** Duration: 02:00 Lecture	**Assessment of Units 1-2-3** Written test Continuous assessment Not Presential Duration: 02:00
11	**Lecture on Unit 4** Duration: 02:00 Lecture		**Lecture on Unit 4** Duration: 02:00 Lecture	
12	**Lecture on Unit 4** Duration: 02:00 Laboratory assignments **Lecture on Unit 5** Duration: 02:00 Lecture		**Lecture on Unit 4** Duration: 02:00 Laboratory assignments **Lecture on Unit 5** Duration: 02:00 Lecture	

13	**Group tutoring session** Duration: 02:00 Additional activities		**Group tutoring session** Duration: 02:00 Additional activities	
14	**Lecture on Unit 5** Duration: 02:00 Lecture **Group tutoring session** Duration: 02:00 Additional activities		**Lecture on Unit 5** Duration: 02:00 Lecture **Group tutoring session** Duration: 02:00 Additional activities	
15	**Lecture on Unit 5** Duration: 02:00 Lecture **Group tutoring session** Duration: 02:00 Additional activities		**Lecture on Unit 5** Duration: 02:00 Lecture **Group tutoring session** Duration: 02:00 Additional activities	
16				**Assessment of Unit 4** Group work Continuous assessment Not Presential Duration: 00:00 **Assessment of Unit 5** Individual work Continuous assessment Not Presential Duration: 00:00
17				**Assessment of Units 1-2-3** Written test Final examination Not Presential Duration: 02:00 **Assessment of Unit 4** Group work Final examination Not Presential Duration: 00:00 **Assessment of Unit 5** Individual work 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	Written test	No Presential	02:00	50%	2 / 10	CE12
16	Assessment of Unit 4	Group work	No Presential	00:00	25%	2 / 10	CE12
16	Assessment of Unit 5	Individual work	No Presential	00:00	25%	2 / 10	CE12

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Assessment of Units 1-2-3	Written test	No Presential	02:00	50%	2 / 10	CE12
17	Assessment of Unit 4	Group work	No Presential	00:00	25%	2 / 10	CE12
17	Assessment of Unit 5	Individual work	No Presential	00:00	25%	2 / 10	CE12

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Assessment of Units 1-2-3	Written test	Face-to-face	02:00	50%	2 / 10	CE12
Assessment of Unit 4	Group work	Face-to-face	00:00	25%	2 / 10	CE12
Assessment of Unit 5	Individual work	Face-to-face	00:00	25%	2 / 10	CE12

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 have chosen "continuous" assessment may be affected during the course by problems related to Covid-19 or by the need to enter working life due to the socio-economic situation. In this case, students can apply for admission to the "final examination". This request must be sent to the coordinator (martin.molina@upm.es) and duly justified with the appropriate documentation.

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
Microsoft Teams	Others	Support to on-line education
Blackboard Collaborate	Others	Support to on-line education
Biblography	Bibliography	Selected bibliography (papers and text books)

8. Other information

8.1. Other information about the subject

Online education is planned to be performed in the following way:

- UPM Moodle will be used by instructors, for example, to communicate general messages to students, to provide course material (e.g. lecture slides), to propose assignments and to communicate grades. Students will use UPM Moodle, for example, to take online exams and to submit the results of assignments.
- Microsoft Teams or Blackboard Collaborate will be used for online lectures by instructors, student presentations, support to online exams and meetings with students.

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).