



POLITÉCNICA

INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros  
Informáticos

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000661 - Intelligent systems**

### DEGREE PROGRAMME

10AP - Eit Digital Master's Programme In Data Science

### ACADEMIC YEAR & SEMESTER

2018/19 - Semester 1

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## 1. Description

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### 1.1. Subject details

<b>Name of the subject</b>	103000661 - Intelligent systems
<b>No of credits</b>	4.5 ECTS
<b>Type</b>	Compulsory
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AP - Eit digital master's programme in data science
<b>Centre</b>	10 - Escuela Tecnica Superior de Ingenieros Informaticos
<b>Academic year</b>	2018-19

## 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>
M. Carmen Suarez De Figuroa Baonza	2101	mdelcarmen.suarezdefigueroa@upm.es	Sin horario.
Martin Molina Gonzalez (Subject coordinator)	2111	martin.molina@upm.es	Sin horario.
Asuncion De Maria Gomez Perez	2209	asunciondemaria.gomez@upm.es	Sin horario.

Daniel Manrique Gamo	2109	daniel.manrique@upm.es	Sin horario.
Raul Garcia Castro	2110	r.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 \*

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#### 3.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

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

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CE01 - Capacidad para la integración de tecnologías, aplicaciones, servicios y sistemas propios de la Ingeniería Informática, con carácter generalista, y en contextos más amplios y multidisciplinares.

CE04 - Capacidad para modelar, diseñar, definir la arquitectura, implantar, gestionar, operar, administrar y mantener aplicaciones, redes, sistemas, servicios y contenidos informáticos.

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.

CG03 - Especificación y realización de tareas informáticas complejas, poco definidas o no familiares

CG08 - Comprensión amplia de las técnicas y métodos aplicables en una especialización concreta, así como de sus límites

CG09 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente

### 3.2. Learning outcomes

RA73 - To know what are the main challenges and achievements in the area of intelligent systems

RA74 - 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).

RA75 - To be able to identify areas of application where the techniques of intelligent systems can be used.

RA77 - To know the existing techniques about intelligent systems (knowledge acquisition, knowledge representation and reasoning) understanding their scope and limitations.

\* 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

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### 4.1. Brief description of the subject

In a wide sense, intelligent systems can be considered as a type of computer systems that implement and integrate artificial intelligence methods to acquire and use knowledge for solving problems with limited resources. This course starts presenting machine learning techniques with a general overview followed by a detailed description of machine learning algorithms for symbolic representations (e.g., decision trees and rules). Then, the course explains basic concepts of knowledge representation and reasoning together with specific methods (e.g., representations for ontologies). Next, the course presents language technologies, including solutions for natural language understanding and natural language generation. Finally, the course presents a unit related to ethics for artificial intelligence. The course combines both a theoretical and a practical presentation and the students have to develop practical exercises related to the main presented concepts and techniques.

## 4.2. Syllabus

1. Introduction
  - 1.1. Introduction to the course
2. Machine learning
  - 2.1. Overview of machine learning
  - 2.2. Evaluating learned models
  - 2.3. Learning decision trees
  - 2.4. Learning classification rules: Prism, Ripper
  - 2.5. Learning association rules: Apriori
  - 2.6. Learning rules from relational data
  - 2.7. Learning rules with evolutionary algorithms
3. Knowledge representation
  - 3.1. Overview of knowledge representation
  - 3.2. Ontologies
4. Language technologies
  - 4.1. Natural language understanding
  - 4.2. Natural language generation
  - 4.3. Linguistic resources
5. Ethics for artificial intelligence

## 5. Schedule

### 5.1. Subject schedule\*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Other face-to-face activities	Assessment activities
1	Lecture on Unit 1 Duration: 02:00 Lecture			
2	Lecture on Unit 2 Duration: 02:00 Lecture			
3	Lecture on Unit 2 Duration: 02:00 Lecture			
4	Lecture on Unit 2 Duration: 02:00 Lecture			
5	Lecture on Unit 2 Duration: 02:00 Lecture			
6	Lecture on Unit 2 Duration: 02:00 Lecture			
7	Lecture on Unit 2 Duration: 02:00 Lecture			
8	Lecture on Unit 2 Duration: 02:00 Lecture			
9	Lecture on Unit 3 Duration: 02:00 Lecture			Assessment of Unit 2 Written test Continuous assessment Duration: 02:00
10	Lecture on Unit 3 Duration: 02:00 Lecture			
11	Lecture on Unit 3 Duration: 02:00 Lecture			
12	Lecture on Unit 3 Duration: 02:00 Lecture			
13	Lecture on Unit 4 Duration: 02:00 Lecture			Assessment of Unit 3 Individual work Continuous assessment Duration: 00:00

14	Lecture on Unit 4 Duration: 02:00 Lecture			
15	Lecture on Unit 4 Duration: 02:00 Lecture		Lecture on Unit 4 Duration: 02:00 Lecture	
16	Lecture on Unit 5 Duration: 02:00 Lecture			<b>Assessment of Unit 4</b> Individual work Continuous assessment Duration: 00:00  <b>Assessment of Unit 5</b> Other assessment Continuous assessment Duration: 00:00
17				<b>Assessment of Unit 2</b> Written test Final examination Duration: 02:00  <b>Assessment of Unit 3</b> Individual work Final examination Duration: 00:00  <b>Assessment of Unit 4</b> Individual work Final examination Duration: 00:00  <b>Assessment of Unit 5</b> Other assessment Final examination Duration: 00:00

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.



## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
9	Assessment of Unit 2	Written test	Face-to-face	02:00	35%	2 / 10	CG08 CG09 CB06 CB10 CE12
13	Assessment of Unit 3	Individual work	No Presential	00:00	30%	2 / 10	CG08 CG09 CB06 CE01 CB10 CE12
16	Assessment of Unit 4	Individual work	No Presential	00:00	30%	2 / 10	CG08 CG09 CB06 CB10 CE12
16	Assessment of Unit 5	Other assessment	Face-to-face	00:00	5%	/ 10	CG08 CG09 CE12

#### 6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Assessment of Unit 2	Written test	Face-to-face	02:00	35%	2 / 10	CG08 CG09 CB06 CB10 CE12
17	Assessment of Unit 3	Individual work	No Presential	00:00	30%	2 / 10	CG09 CB06 CE01 CB10 CE12 CG08

17	Assessment of Unit 4	Individual work	No Presential	00:00	30%	2 / 10	CG08 CG09 CB06 CB10 CE12
17	Assessment of Unit 5	Other assessment	Face-to-face	00:00	5%	/ 10	CG08 CG09 CE12

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

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Assessment of Unit 2	Written test	Face-to-face	02:00	35%	2 / 10	CG08 CG09 CB06 CB10 CE12
Assessment of Unit 3	Individual work	Face-to-face	00:00	30%	2 / 10	CG08 CG09 CB06 CE01 CB10 CE12
Assessment of Unit 4	Individual work	Face-to-face	00:00	30%	2 / 10	CG08 CG09 CB06 CB10 CE12
Assessment of Unit 5	Other assessment	Face-to-face	00:00	5%	/ 10	CG08 CG09 CE12

## 6.2. Assessment criteria

Partial and global grades are in 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 "only final" assessment are mutually exclusive. Students who want to follow "only final" assessment must inform the coordinator ([martin.molina@upm.es](mailto: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 want to follow the "extraordinary" assessment must submit to the coordinator ([martin.molina@upm.es](mailto: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 presented in advance the practical projects.

## 7. Teaching resources

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### 7.1. Teaching resources for the subject

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