



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

103000606 - Intelligent systems

DEGREE PROGRAMME

10AN - Master Universitario en Ingenieria Informatica

ACADEMIC YEAR & SEMESTER

2017/18 - Semester 1

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Learning guide

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1. Description

1.1. Subject details

| | |
|---------------------------------------|---|
| Name of the subject | 103000606 - Intelligent systems |
| No of credits | 4.5 ECTS |
| Type | Compulsory |
| Academic year of 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 | Escuela Tecnica Superior de Ingenieros Informaticos |
| Academic year | 2017-18 |

2. Faculty

2.1. Faculty members with subject teaching role

| Name and surname | Office/Room | Email | Tutoring hours * |
|---|--------------------|------------------------------------|-------------------------|
| Martin Molina Gonzalez (Subject coordinator) | 2111 | martin.molina@upm.es | Sin horario. |
| Asuncion De Maria Gomez Perez | 2209 | asunciondemaria.gomez@upm.es | Sin horario. |
| M. Carmen Suarez De Figueroa Baonza | 2101 | mdelcarmen.suarezdefigueroa@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 *

3.1. Skills to be learned

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.

CB6 - 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

CB7 - 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

CB9 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

CE1 - 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.

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.

CE4 - Capacidad para modelar, diseñar, definir la arquitectura, implantar, gestionar, operar, administrar y mantener aplicaciones, redes, sistemas, servicios y contenidos informáticos.

CG3 - Especificación y realización de tareas informáticas complejas, poco definidas o no familiares

CG6 - Capacidad de pensamiento creativo con el objetivo de desarrollar enfoques y métodos nuevos y originales

CG8 - Comprensión amplia de las técnicas y métodos aplicables en una especialización concreta, así como de sus límites

CG9 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente

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 architectures of intelligent systems.

RA60 - To know what are the main challenges and achievements in the area 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.

* 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 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 presents a general view of this type of systems describing first a review of basic concepts and techniques in knowledge representation and reasoning. Then, the course presents the problem of knowledge acquisition describing both automatic solutions (for example, using symbolic machine learning) and manual solutions. Then, the course explains semantic technologies describing specific knowledge representation techniques (frame-based systems and patterns) and how to build ontologies following a metodological approach. Finally, the course presents language technologies, including solutions for natural language understanding and natural language generation. The course combines both a teoretical and a practical presentation and the students have to develop practical exercices related to the main presented concepts and techniques.

4.2. Syllabus

1. Knowledge representation and reasoning
 - 1.1. Artificial intelligence systems
 - 1.2. Knowledge representation
 - 1.3. Reasoning
2. Knowledge acquisition
 - 2.1. Symbolic machine learning
 - 2.2. Evolutionary algorithms for knowledge acquisition
 - 2.3. Manual knowledge acquisition
3. Semantic technologies
 - 3.1. Frame-based systems
 - 3.2. Patterns in knowledge representation
 - 3.3. Ontologies
4. Language technologies
 - 4.1. Natural language understanding
 - 4.2. Natural language generation

4.3. Linguistic resources

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: 03:00 Lecture | | | |
| 2 | Lecture on Unit 1 Duration: 03:00 Lecture | | | |
| 3 | Lecture on Unit 2 Duration: 03:00 Lecture | | | |
| 4 | Lecture on Unit 2 Duration: 03:00 Lecture | | | |
| 5 | Lecture on Unit 2 Duration: 03:00 Lecture | | | |
| 6 | Lecture on Unit 2 Duration: 03:00 Lecture | | | |
| 7 | Lecture on Unit 2 Duration: 03:00 Lecture | | | |
| 8 | Lecture on Unit 2 Duration: 03:00 Lecture | | | Assessment of Unit 2: Written examination of knowledge acquisition Written test Continuous assessment Duration: 01:00 |
| 9 | Lecture on Unit 3 Duration: 03:00 Lecture | | | |
| 10 | Lecture on Unit 3 Duration: 03:00 Lecture | | | |
| 11 | Lecture on Unit 3 Duration: 03:00 Lecture | | | |
| 12 | Lecture on Unit 3 Duration: 03:00 Lecture | | | Assessment of Unit 3: Practical project of semantic technologies Individual work Continuous assessment and final examination Duration: 00:00 |

| | | | | |
|----|---|--|--|---|
| 13 | Lecture on Unit 4 Duration: 03:00 Lecture | | | |
| 14 | Lecture on Unit 4 Duration: 03:00 Lecture | | | |
| 15 | Lecture on Unit 4 Duration: 03:00 Lecture | | | |
| 16 | Lecture on Unit 4 Duration: 03:00 Lecture | | | Assessment of Unit 4: Practical exercises of language technologies Individual work Continuous assessment and final examination Duration: 02:00 |
| 17 | | | | Assessment of Unit 2: Written examination of knowledge acquisition Written test Final examination Duration: 01:00 |

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 |
|------|--|-----------------|---------------|----------|--------|---------------|---|
| 8 | Assessment of Unit 2: Written examination of knowledge acquisition | Written test | Face-to-face | 01:00 | 40% | 2 / 10 | CB6 CG9 CB10 CG8 CE12 |
| 12 | Assessment of Unit 3: Practical project of semantic technologies | Individual work | No Presential | 00:00 | 30% | 2 / 10 | CB6 CG9 CB9 CB10 CG8 CE12 CE1 |
| 16 | Assessment of Unit 4: Practical exercises of language technologies | Individual work | Face-to-face | 02:00 | 30% | 2 / 10 | CB6 CG9 CB9 CB10 CG8 |

6.1.2. Final examination

| Week | Description | Modality | Type | Duration | Weight | Minimum grade | Evaluated skills |
|------|--|-----------------|---------------|----------|--------|---------------|---|
| 12 | Assessment of Unit 3: Practical project of semantic technologies | Individual work | No Presential | 00:00 | 30% | 2 / 10 | CB6 CG9 CB9 CB10 CG8 CE12 CE1 |
| 16 | Assessment of Unit 4: Practical exercises of language technologies | Individual work | Face-to-face | 02:00 | 30% | 2 / 10 | CB6 CG9 CB9 CB10 CG8 |

| | | | | | | | |
|----|--|--------------|--------------|-------|-----|--------|-----------------------------------|
| 17 | Assessment of Unit 2: Written examination of knowledge acquisition | Written test | Face-to-face | 01:00 | 40% | 2 / 10 | CB6 CG9 CB10 CG8 CE12 |
|----|--|--------------|--------------|-------|-----|--------|-----------------------------------|

6.1.3. Referred (re-sit) examination

| Description | Modality | Type | Duration | Weight | Minimum grade | Evaluated skills |
|--|--------------|--------------|----------|--------|---------------|-----------------------------------|
| Assessment of Unit 2: Written examination of knowledge acquisition | Written test | Face-to-face | 01:00 | 40% | 2 / 10 | CB6 CG9 CB10 CG8 CE12 |

6.2. Assessment criteria

CONTINUOUS ASSESSMENT

The following partial qualifications are obtained during continuous assessment (grades from 0 to 10): X: Assessment for Unit 2, Y: Assessment for Unit 3, Z: Assessment for Unit 4. The final grade is obtained as follows: $N = 0.40 \times X + 0.30 \times Y + 0.30 \times Z$. To pass the course it is required that the global qualification N must satisfy $N \geq 5$ and the partial qualifications must satisfy $X \geq 2$, $Y \geq 2$, and $Z \geq 2$.

"ONLY FINAL" ASSESSMENT

"Only final" assessment and continuous assessment are mutually exclusive. Students who want to follow "only final" assessment 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.

The following partial qualifications are obtained in the "only final" assessment (grades from 0 to 10): X: Assessment for Unit 2, Y: Assessment for Unit 3, Z: Assessment for Unit 4. The final grade is obtained as follows: $N = 0.40 \times X + 0.30 \times Y + 0.30 \times Z$. To pass the course it is required that the global qualification N must satisfy $N \geq 5$ and the

partial qualifications must satisfy $X \geq 2$, $Y \geq 2$, and $Z \geq 2$.

EXTRAORDINARY ASSESSMENT

Students who want to follow the extraordinary assessment must submit to the coordinator (martin.molina@upm.es) the practical projects for Unit 3 and Unit 4 at least one week before the day established for the written examination. The student will be allowed to take the written examination for Unit 2 only if the student has presented in advance the practical projects for Unit 3 and Unit 4.

The following partial qualifications are obtained in the extraordinary assessment (grades from 0 to 10): X: Assessment for Unit 2, Y: Assessment for Unit 3, Z: Assessment for Unit 4. The final grade is obtained as follows: $N = 0.40 \times X + 0.30 \times Y + 0.30 \times Z$. To pass the course it is required that the global qualification N must satisfy $N \geq 5$ and the partial qualifications must satisfy $X \geq 2$, $Y \geq 2$, and $Z \geq 2$.

7. Teaching resources

7.1. Teaching resources for the subject

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