ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000372 - Seminars

DEGREE PROGRAMME

10AJ - Master Universitario En Inteligencia Artificial

ACADEMIC YEAR & SEMESTER

2018/19 - Semester 2

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	103000372 - Seminars
No of credits	10 ECTS
Type	Compulsory
Academic year ot the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AJ - Master universitario en inteligencia artificial
Centre	10 - Escuela Tecnica Superior de Ingenieros Informaticos
Academic year	2018-19

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Nikolaus Guyon Swoboda	2205	nik.swoboda@upm.es	Sin horario.
Antonio Jimenez Martin (Subject coordinator)	2110	antonio.jimenez@upm.es	Sin horario.
Miguel Garcia Remesal	2206	miguel.garcia.remesal@upm.es	Sin horario.
Pedro Maria Larrañaga Mugica	2208	pedro.larranaga@upm.es	Sin horario.

Daniel Manrique Gamo	2109	daniel.manrique@upm.es	Sin horario.
Javier Bajo Perez	2101	javier.bajo@upm.es	Sin horario.
Maria Concepcion Bielza Lozoya	2210	c.bielza@upm.es	Sin horario.
Jesus Cardeñosa Lera	2103	jesus.cardenosa@upm.es	Sin horario.
Oscar Corcho Garcia	2105	oscar.corcho@upm.es	Sin horario.
Victor Manuel Maojo Garcia	2102	victormanuel.maojo@upm.es	Sin horario.
Jacinto Gonzalez Pachon	2101	jacinto.gonzalez.pachon@upm.es	Sin horario.
Igor Boguslavskiy Margolin	2201	igor.boguslavskiy@upm.es	Sin horario.
Asuncion De Maria Gomez Perez	2209	asunciondemaria.gomez@upm.es	Sin horario.
Dario Maravall Gomez-Allende	2207	dario.maravall@upm.es	Sin horario.
Alfonso Vicente Rodriguez-Paton Aradas	2106	alfonso.rodriguez-paton@upm.es	Sin horario.
Alfonso Mateos Caballero	2110	alfonso.mateos@upm.es	Sin horario.
Luis Baumela Molina	2204	luis.baumela@upm.es	Sin horario.
Javier De Lope Asiain	4123	javier.delope@upm.es	Sin horario.
Martin Molina Gonzalez	2111	martin.molina@upm.es	Sin horario.
Josefa Zuleide Hernandez Diego	2205	josefaz.hernandez@upm.es	Sin horario.
Manuel De Hermenegildo Salinas	2212	manuel.hermenegildo@upm.es	Sin horario.
Francisco Bueno Carrillo	2206	francisco.bueno@upm.es	Sin horario.
Juan Antonio Fdez Del Pozo De Salamanca	2101	juan.fdezpozo.salamanca@upm.es	Sin horario.
M. Carmen Suarez De Figueroa Baonza	2101	mdelcarmen.suarezdefigueroa@upm.es	Sin horario.
David Perez Del Rey	2104	david.perez.rey@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.

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

CB8 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

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

CEIA1 - Capacidad de integrar tecnologías y sistemas propios de la Inteligencia Artificial, con carácter generalista, y en contextos más amplios y multidisciplinares

CEIA10 - Identificación de áreas de aplicación en las que se pueda utilizar las técnicas y métodos de la Inteligencia Artificial.

CEIA2 - Capacidad de conectar la tecnología puntera en Inteligencia Artificial con las necesidades de los clientes

CEIA3 - Conocimiento y aplicación de los modelos cuantitativos que dan soporte a los procesos de toma de decisiones en sus distintas variantes: determinístico-estocástico, individual-colectivo o estático-dinámico

CEIA4 - Capacidad de interpretar los modelos de clasificación supervisada y no supervisada obtenidos al aplicar las técnicas de Aprendizaje Automático para un conjunto de datos.

CEIA5 - Conocimiento las principales técnicas de computación natural, tanto a nivel simbólico como físico, e identificar su idoneidad para distintos tipos de problemas

CEIA6 - Formalización de especificaciones, demostración de propiedades de los programas y diseño de programas con razonamiento o la utilización de la lógica misma como lenguaje de programación

CEIA7 - Conocimiento de las técnicas de representación del conocimiento reutilizables y modelos de razonamiento en entornos centralizados y distribuidos a utilizar en la resolución de problemas que impliquen conducta

inteligente.

CEIA8 - Capacidad de analizar un problema de percepción relacionado con el guiado de un robot y determinar qué técnica es la más adecuada para su resolución, así como determinar las características del equipo de adquisición y llevar a la práctica un prototipo de dicho sistema

CEIA9 - Comprensión del mercado, sus hábitos y necesidades de productos o servicios en el ámbito de la Inteligencia Artificial.

CG10 - Capacidad de pensamiento creativo con el objetivo de desarrollar enfoques y métodos nuevos y originales.

CG11 - Integración del conocimiento a partir de disciplinas diferentes, así como el manejo de la complejidad.

CG12 - Comprensión amplia de las técnicas y métodos aplicables en una especialización concreta, así como de sus límites.

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente.

CG14 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos.

CG15 - Capacidad para contribuir al desarrollo futuro de la informática.

CG16 - Capacidad de trabajar de forma independiente en su campo profesional.

CG17 - Habilidades de gestión y capacidad de liderar un equipo que puede estar integrado por disciplinas y niveles distintos.

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG19 - Aproximación sistemática a la gestión de riesgos.

CG5 - Organización y planificación.

CG6 - Gestión de la información.

CG7 - Especificación y realización de tareas informáticas complejas, poco definidas o no familiares.

CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas.

CGI1 - Adquirir conocimientos científicos avanzados del campo de la informática que le permitan generar nuevas

ideas dentro de una línea de investigación.

CGI2 - Comprender el procedimiento, valor y límites del método científico en el campo de la Informática, siendo capaz de identificar, localizar y obtener datos requeridos en un trabajo de investigación, de diseñar y guiar investigaciones analíticas, de modelado y experimentales, así como de evaluar datos de una manera crítica y extraer conclusiones.

CGI3 - Capacidad para valorar la importancia de las fuentes documentales, manejarlas y buscar la información para el desarrollo de cualquier trabajo de investigación.

CGI4 - Capacidad de leer y comprender publicaciones dentro de su ámbito de estudio/investigación, así como su catalogación y valor científico.

CGI5 - Que el estudiante adquiera el conocimiento necesario sobre los mecanismos de financiación de la investigación y transferencia de la tecnología, y sobre la legislación vigente sobre protección de resultados

3.2. Learning outcomes

RA2 - Establecer un debate fundamentado sobre el conocimiento científico y las bases de la investigación

RA8 - Conocer el tipo de problemas que se pueden resolver con las disciplinas de la Inteligencia Artificial involucradas en las materias de las que forman parte dichos seminarios

RA4 - Valorar la importancia de las fuentes documentales y seleccionar aquéllas que sean más interesantes para publicar sus trabajos

RA6 - Ser capaz de elaborar documentos para difundir los resultados de la investigación de acuerdos con unas características específicas y dentro del estilo científico

RA7 - Capacidad de presentar en público los resultados de sus trabajos de investigación

RA5 - Buscar y recuperar la información documental para el desarrollo de cualquier trabajo de investigación

RA9 - Conocer las distintas técnicas de solución asociadas a los tipos de problemas que se pueden resolver con las disciplinas de la IA y sus límites

RA3 - Abordar los aspectos formales del proyecto inicial de una investigación

* 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 student must attend **five seminars**. The seminars offered in the Master's degree course are all optional, except S1: Research Methodology and S2: Project Management and Risk Control, which are mandatory. All seminars are organised into three categories:

- Seminars whose name match the subject to which they belong (S3, S4, S5, S7, S8 and S11). If the student decides not to be taught any module belonging to M2 to M7, then the student must take this seminar. In these seminars the student will acquire general knowledge about the respective subject.

- Seminars that complement modules (S6, S9, S10, S12, S13, S14 and S15). These are aimed at covering some disciplines of Artificial Intelligence which are not studied in the modules.

- Seminars by visiting professors, in which the student acquires advanced or specialised knowledge about any of the subjects taught within the course.

Note: seminars can be attended as distance learning via videoconferencing. (S6: Deep learning, S9: Fuzzy logic and S12: Principals of Robotic Locomotion cannot be attended by videoconference).

SEMINAR DESCRIPTIONS

S1: Research Methodology (offered in English). This seminar tries to inform and guide the students about techniques, most common standards and systems for the practice of scientific research and its methodological bases and documentaries. The topics are as follows: General Approach (scientific knowledge and its purpose, problems of scientific research, research works); Scientific Work (choice of subject, setting objectives, formulating hypotheses, choice of work method, choice of tools and resources. Phases of work); Information Search (sources, publications, bibliographical searches, access to scientific documentation, internet, etc.); Work Writing (rules, principles, tips, style, language, etc.) and Presentation and Defence of Work (legal aspects, formal aspects, personal aspects, visual aids to support the presentation).

S2: Project Management and Risk Control (offered in English). This seminar will cover fundamental aspects of project management and risk control. It will be possible for the student to understand the principles of project

management, risk and change management, as well as to acquire the ability to apply methodologies and processes for project management and risk mitigation.

S3: Decision Analysis (offered in English). The seminar provides students with a general knowledge on the topic of Decision Analysis, being itself an introduction to the different modules that are part of the subject: Decision Support Systems and Negotiation and Collective Decision-Making under Bounded Rationality.

S4: Data Mining (offered in English). The seminar provides students with general knowledge about the topic of Machine Learning, being itself an introduction to the various modules and seminars that are part of the subject: Bayesian Networks, Machine Learning and Neural Networks.

S5: Natural Computing (offered in english). The seminar provides students with general knowledge about the topic of Natural Computing, being itself an introduction to the different modules which are part of the subject: Intelligent Search based on Metaheuristics, Evolutionary Computation and Unconventional Computing (biomolecular computing and biocircuit engineering).

S6: Deep Learning (offered in Spanish). The discipline of machine learning in artificial intelligence provides useful solutions to be used, for example, in data science or in the development of autonomous systems (e.g., robots or unmanned vehicles). With the arrival of big data and the increase of computational power (e.g., parallelization using graphics processing units - GPUs), the approach of deep learning has emerged from the connectionist branch of machine learning with new architectures, algorithms and hybridations with other techniques such as evolutionary algorithms. Deep learning has proved to be significantly better than other approaches to solve problems that cope with large amounts of data as it is required, for example, in computer vision (image or video processing), in speech understanding, or in classification, besides other problems. This seminar presents a theoretical and practical view of deep learning. The seminar presents first the foundations of artificial neural networks with both supervised and unsupervised learning. Then, the seminar presents different types of deep architectures (e.g., convolutional neural networks, etc.) and application domains (e.g., computer vision). To complement the practical view, the seminar also presents specialized software tools for deep learning and describes how to use them in practical problems.

S7: Logic Computing (offered in English). The seminar provides students with general knowledge on the topic of Computational Logic, being itself an introduction to the different modules that are part of the subject: Logic Programming and Extensions of Logic Programming.

S8: Knowledge Representation and Reasoning Models (offered in English). The seminar provides students with general knowledge on the topic of Knowledge Representation and Reasoning Models, being itself an introduction to the several modules and seminars that are part of the subject: Intelligent Agents and Multi- agent Systems, Ontology Engineering, Commonsense Reasoning and Fuzzy Logics.

S9: Fuzzy Logic (offered in Spanish). This seminar is dedicated to the theoretical fundamentals of Fuzzy Logic and presents the main tools that are currently being used in applications. Students will acquire extensive knowledge of these tools for both the design of fuzzy systems and develop processes for approximate reasoning

S10: Cognitive Computing (offered in Spanish)**.** The aim of this seminar is to provide an introduction to Cognitive Science and Cognitive Systems, paying attention to architectures, key components, and revising the main systems and platforms that can be found in the literature.

S11: Robotics and Computational Perception (all the documentation is offered in English but lectures are given in a mixture of Spanish and English to guarantee the best communicative results). The seminar provides students with general knowledge on the topic of Robotics and Computational Perception, being itself an introduction to the several modules and seminars that are part of the subject: Computer Vision, Autonomous Robots and Evolutionary Robotics.

S12: Principals of Robotics Locomotion (offered in English). Very few living organisms do not have the capacity of locomotion, being able to move is fundamental to survival in the real world. Likewise, locomotion is one of the basic capacities expected of an intelligent robotic system. In this seminar we will discuss issues related to robot locomotion with a focus on navigation and mapping. Participants in the seminar will build a simple robot controller and will test that controller in a real robot.

S13: Applications of Artificial Intelligence (offered in English). The seminar is a compendium of Artificial Intelligence applications naturally taking full advantage of the research potential of professors at DIA and the experience of its members in numerous R&D projects undertaken in recent years. In order to do this, descriptions of all DIA modules (and particularly those who have an applied component and less than basic research) are considered and included in this seminar. In this seminar not only are the topics important to teach, but teaching the very development of Artificial Intelligence applications and projects in the area, exceeding the idea of mere exposition of a theoretical lectures without the applied aspect which is essential in Artificial Intelligence and particularly for industrial use.

S14: Language Engineering (offered in Spanish). The purpose of this seminar derives from the need to fill a gap in the teaching of subjects that are, generally speaking, on Language Engineering. On the one hand, when we talk about Engineering, then we talk about design, methodologies, techniques, systems, and components; on the other hand, when we talk about language then we talk about grammars, corpora, dictionaries, etc. Usually, the teaching of these subjects often has a tendency, perhaps excessive, to one side or another. This seminar aims to provide a unified view of both sides, from the fundamentals to applications. The area of Linguistic Engineering is considered to be one of the areas where most research and development efforts will lie in the next few years, if we are to achieve the goal of having machines that really make our lives easier in a simple way. The seminar is focused, in the first part, on the state of the art technologies, followed by a second part where we will explore in depth

technologies that allow supporting applications on the market. For practical reasons, the practice work will be focused in word processing technologies.

S15: Automated Planning (offered in English). Automated planning is a branch of Artificial intelligence aimed at obtaining plans (i.e. sequences of actions) for solving complex problems or for governing the behavior of intelligent agents, autonomous robots or unmanned vehicles. Planning techniques have been successfully applied in different domains, including industrial contexts, logistics, computer games, robotics or space exploration. In this seminar we will review the existing approaches for solving classical planning problems, such as state-space search, plan-space search, graph-based techniques or turning classical planning problems into propositional satisfiability problems. The course will then focus on the study of knowledge-based planning methods, such as control rule-based pruning or hierarchical task network-based planning techniques. These approaches exploit the domain knowledge provided by human experts to improve the performance of the planning algorithms. Finally, we will briefly introduce advanced planning algorithms, which are able to generate planning policies that take into account time constraints and/or partial observability conditions, which are common in real world applications.

4.2. Syllabus

1. S1: Research methodology
2. S2: Project management and risk control
3. S3: Decision analysis
4. S4: Data mining
5. S5: Natural computing
6. S6: Deep learning
7. S7: Logic computing
8. S8: Knowledge representation and reasoning
9. S9: Fuzzy logic
10. S10: Cognitive computing
11. S11: Robotics and computational perception
12. S12: Principals of robotics locomotion
13. S13: Applications of Artificial Intelligence

14. S14: Natural language processing

15. S15: Automated planning

16. S16: Seminars by visiting professors

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	**S1: Research methodology** Duration: 10:00 Lecture			**Evaluation of seminar S1** Individual work Continuous assessment and final examination Duration: 00:00
2	**S2: Project management and risk control** Duration: 10:00 Lecture			**Evaluation of Seminar 2** Individual work Continuous assessment and final examination Duration: 00:00
3	**S3: Decision analysis** Duration: 10:00 Lecture			**Evaluation of seminar S3** Individual work Continuous assessment and final examination Duration: 00:00
4	**S4: Data mining** Duration: 10:00 Lecture			**Evaluation of seminar S4** Individual work Continuous assessment and final examination Duration: 00:00
5	**S5: Natural computing** Duration: 10:00 Lecture			**Evaluation of seminar S5** Individual work Continuous assessment and final examination Duration: 00:00
6	**S6: Deep learning** Duration: 10:00 Lecture			**Evaluation of seminar S6** Written test Continuous assessment and final examination Duration: 00:00
7	**S7: Logic computing** Duration: 10:00 Lecture			**Evaluation of seminar S7** Group work Continuous assessment and final examination Duration: 00:00
8	**S8: Knowledge representation and reasoning** Duration: 10:00 Lecture			**Evaluation of seminar S8** Individual work Continuous assessment and final examination Duration: 00:00
9	**S9: Fuzzy logic** Duration: 08:00 Lecture			**Evaluation of seminar S9** Written test Continuous assessment and final examination Duration: 02:00

10	**S10: Cognitive Computing** Duration: 10:00 Lecture			**Evaluation of seminar S10** Individual work Continuous assessment and final examination Duration: 00:00
11	**S11: Robotics and computational perception** Duration: 10:00 Lecture			**Evaluation of seminar S11** Individual work Continuous assessment and final examination Duration: 00:00
12	**S12: Principals of robotics locomotion** Duration: 10:00 Lecture			**Evaluation of seminar S12** Individual work Continuous assessment and final examination Duration: 00:00
13	**S13: Applications of Artificial Intelligence** Duration: 10:00 Lecture			**Evaluation of seminar S13** Individual work Continuous assessment and final examination Duration: 00:00
14	**S14: Natural language processing** Duration: 10:00 Lecture			**Evaluation of seminar S14** Individual work Continuous assessment and final examination Duration: 00:00
15	**S15: Automated planning** Duration: 10:00 Lecture			**Evaluation of seminar S15** Individual work Continuous assessment and final examination Duration: 00:00
16	**S16: Seminar by visiting professor** Duration: 10:00 Lecture			**Evaluation of seminar S16** Individual work Continuous assessment and final examination Duration: 00:00
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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 theorical planning of the subject plan and might go to 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
1	Evaluation of seminar S1	Individual work	Face-to-face	00:00	20%	/ 10	CG18 CB10 CGI2 CB9 CG5 CG6 CG11 CG17 CG9 CGI4 CGI3 CGI5
2	Evaluation of Seminar 2	Individual work	Face-to-face	00:00	20%	/ 10	CG18 CB8 CGI2 CG5 CG7 CG8 CG17 CG19 CG16 CGI4 CGI3 CGI5
3	Evaluation of seminar S3	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CGI2 CEIA3 CG17 CG19 CG16 CGI4 CEIA10 CGI3

4	Evaluation of seminar S4	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CB10 CGI2 CEIA4 CB7 CEIA10 CGI3
5	Evaluation of seminar S5	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CB10 CGI2 CEIA5 CB7 CG8 CG9 CGI4 CEIA10 CGI3
6	Evaluation of seminar S6	Written test	Face-to-face	00:00	20%	/ 10	CG10 CB10 CG19 CEIA10
7	Evaluation of seminar S7	Group work	Face-to-face	00:00	20%	/ 10	CG13 CG10 CEIA6 CB7 CG7 CG15 CEIA10
8	Evaluation of seminar S8	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CG10 CB10 CGI2 CG9 CEIA7 CEIA10
9	Evaluation of seminar S9	Written test	Face-to-face	02:00	20%	/ 10	CG13 CG10 CB10 CGI2 CB7 CG11 CG12 CEIA7 CGI4 CEIA10
10	Evaluation of seminar S10	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CG10 CB10 CGI2 CG12 CG9 CEIA7 CGI4

							CEIA10
11	Evaluation of seminar S11	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CB8 CB10 CEIA8 CG14 CEIA10 CGI3
12	Evaluation of seminar S12	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CB8 CEIA1 CGI1 CG10 CB10 CEIA8 CB7 CB9 CG14 CGI4 CEIA10 CGI3
13	Evaluation of seminar S13	Individual work	Face-to-face	00:00	20%	/ 10	CEIA1 CGI1 CG10 CEIA2 CEIA9 CB7 CG8 CG11 CG12 CG9 CGI4 CEIA10 CGI3 CGI5
14	Evaluation of seminar S14	Individual work	Face-to-face	00:00	20%	/ 10	CEIA1 CGI1 CG10 CEIA2 CEIA9 CB7 CG6 CG8 CG11 CG12 CG9 CGI4 CEIA10 CGI3

15	Evaluation of seminar S15	Individual work	Face-to-face	00:00	20%	/ 10	CEIA1 CGI1 CEIA2 CEIA9 CB7 CG7 CG8 CG11 CG12 CG9 CGI4 CEIA10 CGI3
16	Evaluation of seminar S16	Individual work	Face-to-face	00:00	20%	/ 10	

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Evaluation of seminar S1	Individual work	Face-to-face	00:00	20%	/ 10	CG18 CB10 CGI2 CB9 CG5 CG6 CG11 CG17 CG9 CGI4 CGI3 CGI5
2	Evaluation of Seminar 2	Individual work	Face-to-face	00:00	20%	/ 10	CG18 CB8 CGI2 CG5 CG7 CG8 CG17 CG19 CG16 CGI4 CGI3 CGI5
3	Evaluation of seminar S3	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CGI2 CEIA3 CG17 CG19 CG16 CGI4 CEIA10 CGI3

4	Evaluation of seminar S4	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CB10 CGI2 CEIA4 CB7 CEIA10 CGI3
5	Evaluation of seminar S5	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CB10 CGI2 CEIA5 CB7 CG8 CG9 CGI4 CEIA10 CGI3
6	Evaluation of seminar S6	Written test	Face-to-face	00:00	20%	/ 10	CG10 CB10 CG19 CEIA10
7	Evaluation of seminar S7	Group work	Face-to-face	00:00	20%	/ 10	CG13 CG10 CEIA6 CB7 CG7 CG15 CEIA10
8	Evaluation of seminar S8	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CG10 CB10 CGI2 CG9 CEIA7 CEIA10
9	Evaluation of seminar S9	Written test	Face-to-face	02:00	20%	/ 10	CG13 CG10 CB10 CGI2 CB7 CG11 CG12 CEIA7 CGI4 CEIA10
10	Evaluation of seminar S10	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CG10 CB10 CGI2 CG12 CG9 CEIA7 CGI4

							CEIA10
11	Evaluation of seminar S11	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CB8 CB10 CEIA8 CG14 CEIA10 CGI3
12	Evaluation of seminar S12	Individual work	Face-to-face	00:00	20%	/ 10	CG13 CB8 CEIA1 CGI1 CG10 CB10 CEIA8 CB7 CB9 CG14 CGI4 CEIA10 CGI3
13	Evaluation of seminar S13	Individual work	Face-to-face	00:00	20%	/ 10	CEIA1 CGI1 CG10 CEIA2 CEIA9 CB7 CG8 CG11 CG12 CG9 CGI4 CEIA10 CGI3 CGI5
14	Evaluation of seminar S14	Individual work	Face-to-face	00:00	20%	/ 10	CEIA1 CGI1 CG10 CEIA2 CEIA9 CB7 CG6 CG8 CG11 CG12 CG9 CGI4 CEIA10 CGI3

15	Evaluation of seminar S15	Individual work	Face-to-face	00:00	20%	/ 10	CEIA1 CGI1 CEIA2 CEIA9 CB7 CG7 CG8 CG11 CG12 CG9 CGI4 CEIA10 CGI3
16	Evaluation of seminar S16	Individual work	Face-to-face	00:00	20%	/ 10	

6.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

6.2. Assessment criteria

The grade of the subject is the average of the marks obtained in each of the 5 seminars taken. The evaluation activities in each one of them vary, being those indicated below:

- **S1: Research methodology:** Although the seminar is compulsory, attendance is not mandatory. The student will individually perform a work, consisting of:
  - Deepening one of the topics covered (50% of the grade)
  - Summarizing the most important points addressed in the seminar (50% of the grade)
- **S2: Project management and risk analysis:** The final grade is obtained as follows:
  - Grade of written summary of the most important points presented at the seminar (30%)
  - Grade of written summary and presentation of one of the topics presented in class (30%)
  - Grade of attendance and participation in class (40%). The student must attend at least the 80% of the classes.
- **S3: Decision Analysis:**
  - Regular attendance to class will be an essential condition.
  - Individual summary about the theoretical content of the course. It will be evaluated according to its completeness, clarity and coherence.
  - Collective work on the state of the art of the discipline through a specific wiki associated to the seminar. It will be evaluated according to the participation index, the ability to interconnect ideas, clarity and originality.
- **S4: Data mining:** Attendance will be mandatory. The student will individually perform a practical work

consisting of software management and oral presentation of an application case.

- **S5: Natural computing**:
  - Compulsory attendance at the seminars = 35% of the final grade.
  - Individual work summary report = 65% of the final grade.
- **S6: Deep learning:** Attendance (40%) and evaluation through a written test (60%).
- **S7: Logic computing:** Class attendance and short exercises (40%). Group practice (60%). Minimum attendance: 50%. Minimum grade in the group practice: 50/100.
- **S8: Knowledge representation and reasoning**: The final grade will be computed in the following way:
  - Attendance to class (attendance is mandatory at a minimum of 80%). Weight in the final grade of 40%.
  - Summary of the most important points discussed in the seminar. The clarity, coherence and correct use of the terminology will be evaluated. Weight in the final grade of 30%.
  - Individual work that delves into one of the topics covered in the seminar. The presentation, clarity and adequacy of the bibliographic references used will be evaluated. Weight in the final grade of 30%.
- **S9: Fuzzy logic:**
  - Attendance to the classes and the attitude shown in them will be valued with a weighting of 30% on the final grade.
  - There will be a written exam on the last day of the seminar, without the possibility of consulting notes, bibliography or any other type of documentation. It will be a necessary requirement to perform this test. Otherwise, the student will be evaluated as Not presented. The qualification of this exam will have a weight of 70% on the final grade.
- **S10: Cognitive computing**.
  - Attendance to class (a minimum of 80% attendance is mandatory). Weight in the final grade of 40%.
  - Summary of the most important points discussed in the seminar. The clarity, coherence and correct use of the terminology will be evaluated. Weight in the final grade of 30%.
  - Individual work that delves into one of the topics covered in the seminar. The presentation, clarity and adequacy of the bibliography will be evaluated. Weight in the final grade of 30%.
- **S11: Robotics and computational perception:** The evaluation is done through a work that can be exposed in the classes. They can be bibliographic works or of application of some of the methods and techniques studied. Attendance and participation in face-to-face classes and other activities that are proposed during the seminars are also valued.
- **S12: Principals of Robotics locomotion:** 25% of the evaluation will be computed based on the attendance and participation in classes during the seminar and 75% in a practical project.
- **S13: Application of Artificial Intelligence:** The attendance of the students to the seminar will be valued, on the one hand, and the development of a practical work on one of the topics of the seminar. The workload necessary for this practice will be adequate and proportional to the idea of a seminar and the number of

credits.

- **S14: Natural Language processing:** The seminar will be based on attendance in at least 80% of the classes as well as a work done individually or in a group on a topic to be defined related to the exploration of information on some type of system in the market, its analysis and conclusions. It is not intended with this work more than to accustom the student to search existing solutions in the market and learn to develop an idea of how to solve them. The qualification in the July session will be governed by the same rules as in June. Attendance 80% of the classes is required as well as to delivery an individual or group work. The work will be qualified.
- **S15: Automated planning:** Half of the grade will come from the attendance to the classes and short practices carried out during the seminar, and the other half will be computed based on a project that will be carried out by the students.
- **S16: Seminar by visiting professors:** The evaluation activities of this seminar will be established by the invited professor in the corresponding academic course.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Videoconference system	Equipment	Videoconference system based on WebEx tool
Moodle	Web resource	Course available at UPM moodle including timetabling, documentation... https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=6732
K. Belhajjame, J. Zhao, D. Garijo, M. Gamble, K. Hettne, R. Palma, E. Mina, O. Corcho et al. (2015) Using a suite of ontologies for preserving workflow-centric research objects. Web Semantics: Science, Services and Agents on the World Wide Web 3,16-42	Bibliography	Seminar S1

A Guide to the Project Management Body of Knowledge (Pmbok(r) Guide). Project Mgmt Inst; Edición: Sixth Edition. 2017.	Bibliography	Seminar S2
A guide to the Project Management Body of Knowledge (PMBOK guide) & Agile practice guide bundle. Project Mgmt Inst. 2017	Bibliography	Seminar S2
Project Risk Management: Processes, Techniques and Insights, 2nd Edition. Chris Chapman, Stephen Ward. 2013.	Bibliography	Seminar S2
Clemen, R.T. (1996) Making Hard Decisions, Duxbury Press	Bibliography	Seminar S3
French, S. (1989) Decision Theory. Ellis Horwood, Cichester	Bibliography	Seminar S3
French, S., Maule, J., Papamichail, N. (2009) Decision Behavior, Analysis and Support, Cambridge University Press	Bibliography	Seminar S3
Hwang, C-H.; Lin, M-J. (1987). Group decision making under multiple criteria. Springer-Verlag, Berlín	Bibliography	Seminar S3
Law, A. M. (2007) Simulation Modeling and Analysis, McGraw-Hill, New York.	Bibliography	Seminar S3
Raiffa, H.; Richardson, J.; Metcalfe, D. (2002). Negotiation Analysis. Belknap Harvard, Cambridge, MA.	Bibliography	Seminar S3
Ríos Insua, S., Bielza, C., Mateos, A. (2002). Fundamentos de los Sistemas de Ayuda a la Decisión. RA-MA, Madrid.	Bibliography	Seminar S3

Ríos Insua, D., Ríos Insua, S., Martín, J., Jiménez, A. (2008). Simulación: Métodos y Aplicaciones. RA-MA, Madrid.	Bibliography	Seminar S3
Romero, C. (1991). Handbook of Critical Issues in Goal Programming. Pergamon Press	Bibliography	Seminar S3
Koller, D, Friedman, N. (2009) Probabilistic Graphical Models. Principles and Techniques. The MIT Press.	Bibliography	Seminar S4
Castillo, E., Gutiérrez, J.M., Hadi, A.S. (1997) Expert Systems and Probabilistic Network Models. Springer, New York. Versión en español, disponible en la red: Sistemas Expertos y Modelos de Redes Probabilísticas, Academia de Ingeniería, Madrid	Bibliography	Seminar S4
Koski, T., Noble, J. (2009) Bayesian Networks: An Introduction, Wiley	Bibliography	Seminar S4
Neapolitan, R., (2004) Learning Bayesian Networks, Prentice Hall	Bibliography	
Pourret, O., Naïm, P., Marcot, B. (2008) Bayesian Networks: A Practical Guide to Applications, Wiley	Bibliography	Seminar S4
Alpaydin, E. (2004) Introduction to Machine Learning. MIT Press	Bibliography	Seminar S4
Duda, R., Hart, P.E., Stork, D.G. (2001) Pattern Classification. Wiley	Bibliography	Seminar S4
Hernández-Orlalo, J., Ramírez, M.J., Ferri, C. (2004) Introducción a la Minería de Datos. Pearson Educación	Bibliography	Seminar S4

Kuncheva, L. (2004) Combining Pattern Classifiers. Wiley	Bibliography	Seminar S4
Webb, A. (2002) Statistical Pattern Recognition. Wiley	Bibliography	Seminar S4
Witten, I., Frank, E. (2005) Data Mining. Morgan Kaufmann. 2ª ed	Bibliography	Seminar S4
Andrew Ng (2010). "Part IV: Learning Feature Hierarchies and Deep Learning". ECCV-2010 Tutorial: Feature Learning for Image Classification.	Bibliography	Seminar S6
D. C. Ciresan, U. Meier, L. M. Gambardella, J. & Schmidhuber. (2010). Deep big simple neural nets for handwritten digit recogntion. Neural Computation, 22(12), 3207?3220.	Bibliography	Seminar S6
Deng, L. and Yu, D. (2014). Deep Learning: Methods and Applications. NOW Publishers.	Bibliography	Seminar S6
Goodfellow, I., Bengio, I., Courville, A. (2016): Deep Learning. MIT Press. Available online: http://www.deeplearningbook.org	Bibliography	Seminar S6
Hinton, G. E., Osindero, S., & Teh, Y.-W. (2006). A fast learning algorithm for deep belief nets. Neural Computation, 18(7), 1527?1554.	Bibliography	Seminar S6
K. Lang, A. Waibel & G. E. Hinton. (1990). A time-delay neural network architecture for isolated word recognition. Neural Networks, 3, 23?43.	Bibliography	Seminar S6

LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. Nature, 521(7553), 436-444.	Bibliography	Seminar S6
D. E. Rumelhart, G. E. Hinton & R. J. Williams. (1986). Learning internal representations by error propagation. In D. E. Rumelhart, & J. L. McClelland (Eds.), Parallel distributed processing, vol. 1 (pp. 318?362). MIT Press.	Bibliography	Seminar S6
Schmidhuber, J. (2015). Review. Deep learning in neural networks: an overview. Neural Networks, 61, 85-17.	Bibliography	Seminar S6
Sterling & Shapiro (1994) The Art of Prolog. MIT Press, Second ed.	Bibliography	Seminar S7
Apt, K. (1997) From Logic Programming to Prolog. Prentice-Hall	Bibliography	Seminar S7
Bratko, I. (2003) Prolog Programming for Artificial Intelligence. Addison-Wesley Ltd.	Bibliography	Seminar S7
Clocksin & Mellish (1981) Programming in Prolog. Springer-Verlag.	Bibliography	Seminar S7
Allier, J.H. (1997) Logic for Computer Science: Foundations of Automatic Theorem Proving. John Wiley and Sons	Bibliography	Seminar S7
Hogger, C. (1990) Essentials of Logic Programming. Clarendon Press, Oxford.	Bibliography	Seminar S7
Mueller, E. (2006) Commonsense Reasoning. Morgan Kaufmann	Bibliography	Seminar S8

Wooldridge, M. (2009) An Introduction to Multiagent Systems. 2nd edition, John Wiley and Son	Bibliography	Seminar S8
Gomez-Pérez, A., Fernández, M., Corcho, O. (2003) Ontological Engineering. Springer	Bibliography	Seminar S8
Stefan, M. (1995) Introduction to Knowledge Systems. Morgan Kaufmann.	Bibliography	Seminar S8
Davis, E. (1990) Representations of Commonsense Knowledge. Morgan Kaufmann.	Bibliography	Seminar S8
Daniel S. Weld, Johan de Kleer (1990) Qualitative Reasoning about Physical Systems. Morgan Kaufmann.	Bibliography	Seminar S8
Kolodner, J. (1993) Case-based Reasoning. Morgan Kaufmann series on Representation & Reasoning.	Bibliography	Seminar S8
Cuena, J. (1997) Sistemas Inteligentes. Conceptos, técnicas y métodos de construcción. Facultad de Informática. Fundación General de la UPM. Madrid	Bibliography	Seminar S9
Nguyen, H.T., Walker, E.A. (2000) A First Course in Fuzzy Logic, Chapman & Hall.	Bibliography	Seminar S9
Klir, G., Yuan, B. (1995) Fuzzy Sets and Fuzzy Logic, Prentice Hall.	Bibliography	Seminar S9
Wang, X., Ruan, D., Kerre, E.E. (2009) Mathematics of Fuzziness-Basic Issues, Springer.	Bibliography	Seminar S9

Daniel Manrique, María del Carmen Suárez de Figueroa (2017). Razonamiento con imprecisión: lógica borrosa. Apuntes y ejercicios. Archivo Digital UPM. http://http://oa.upm.es/46795/.	Bibliography	Seminario S9
Smart Machines. IBM's Watson and the Era of Cognitive Computing. John E. Kelly III and Steve Hamm. Columbia University Press. 2013.	Bibliography	Seminar S10
Learning IBM Watson Analytics. James Miller. Packt Publishing. 2016	Bibliography	Seminar S10
Bluemix: Deployment and Administration. Gerard Blokdyk. Createspace Independent Publishing Platform. 2017	Bibliography	Seminar S10
Learning IBM Bluemix. Sreelatha Sankaranarayanan. Packt Publishing. 2016.	Bibliography	Seminar S10
De Lope, J. (2001) Robots Móviles: Evolución Histórica y Técnicas de Programación, Fundación General de la UPM.	Bibliography	Seminar S11
Dudek, G., Jenkin, M. (2000) Computational principles of mobile robotics, Cambridge University Press.	Bibliography	Seminar S11
Mataric, M. (2007) The Robotics Primer, MIT Press, Cambridge, Massachussetts.	Bibliography	Seminar S11
Murphy, R. (2000) An Introduction to AI Robotics, MIT Press, Cambridge, Massachussetts.	Bibliography	Seminar S11

Choset, H.; Lynch, K.; Hutchinson, S.; et al. (2005) Principles of Robot Motion Theory, Algorithms, and Implementations, MIT.	Bibliography	Seminar S12
Murphy, R. (2000) Introduction to AI Robotics, MIT.	Bibliography	Seminar S12
Nourbakhsh, I; Siegwart, R. (2004) Introduction to Autonomous Mobile Robots, MIT.	Bibliography	Seminar S12
Greenes, R.A. (ed.) (2014) Clinical Decision Support: The Road Ahead. Academic Press, 2nd edition	Bibliography	Seminar S13
Mittal, A. (2007) Bayesian Network Technologies: Applications and Graphical Models. IGI Publishing Hershey, PA, USA.	Bibliography	Seminar S13
Garrote, L. Molina, M., Medico. L. Probabilistic Forecasts Using Bayesian Networks Calibrated with Deterministic Rainfall-Runoff Models In Extreme Hydrological Events: New Concepts for Security. Springer	Bibliography	Seminar S13
Molina, M., Flores, V. (2006) A Knowledge-based Approach for Automatic Generation of Summaries of Behavior. In Artificial Intelligence: Methodology, Systems, and Applications, 12th International Conference AIMSA, LNAI, Springer Verlag	Bibliography	Seminar S13
Molina, M. (2005) An Intelligent Assistant for Public Transport Management. International Conference on Intelligent Computing, ICIC 05. Lecture Notes in Computer Science, nº 3645, Springer Verlag. Hefei, China.	Bibliography	Seminar S13

Molina, M., Blasco, G. (2003) A Multi-agent system for Emergency Decision Support. 4th International Conference of Intelligent Data Engineering and Automated Learning (IDEAL 2003) In "Intelligent Data Engineering and Automated Learning" LNCS, 2690	Bibliography	Seminar S13
Virile, G.B., Zampolli, A. Survey of the state of the art in Human Language Technology, in Linguistica Compaqzionale XII-XIII. Cambridge Univ. Press. ISBN 0-521-59277-1.	Bibliography	Seminar S13
Jiménez, A., Ríos-Insua, S., Mateos, A. (2006) A Generic Multi-Attribute Analysis System, Computers & Operations Research 33 (4): 1081-1101	Bibliography	Seminar S13
Cole, R., Mariani, J., Uszkoreit, H., Battista Virile, G., Zaenen, A., Zampolli, A. (eds.) (2010) Survey of the State of the Art in Human Language Technology (Studies in Natural Language Processing). Cambridge University Press.	Bibliography	Seminar S14
Ghallab, M., Nau, D., Traverso, P. (2004) Automated Task Planning. Theory & Practice. Morgan Kaufmann	Bibliography	Seminar S15
Allen, J.F., Hendler, J., Tate, A. (eds.) (1990) Readings in planning. Morgan Kaufmann	Bibliography	Seminar S15
Russell, S., Norvig, P. (1996) Inteligencia Artificial. Un enfoque moderno. Prentice Hall	Bibliography	Seminar S15

8. Other information

8.1. Other information about the subject

Teaching staff:

S1: Research methodology

Asunción Gómez Pérez (coord.), Óscar Corcho García

S2: Project management and risk control

Javier Bajo Pérez (coord.), Asunción Gómez Pérez

S3: Decision analysis

Jacinto González Pachón (coord.), Concha Bielza Lozoya, Juan Antonio Fernández del Pozo, Antonio Jiménez Martín

S4: Data mining

Pedro Larrañaga Múgica (coord.), Concha Bielza Lozoya

S5: Natural Computing

Alfonso Rodríguez Patón (coord.), Pedro Larrañaga Múgica, Alfonso Mateos Caballero

S6: Deep learning

Martín Molina González (coord.), Luis Baumela Molina, Daniel Manrique Gamo

S7: Logic computing

Miguel García Remesal (coord.)

S8: Knowledge representation and reasoning

Martín Molina González (coord.), Asunción Gómez Pérez, Óscar Corcho García, Pepa Hernández Diego, Javier Bajo Pérez, Nik Swoboda

S9: Fuzzy logic

Daniel Manrique Gamo (coord.)

S10: Cognitive computing

Javier Bajo Pérez (coord.), Asunción Gómez Pérez, Óscar Corcho García, Martín Molina González, Josefa Z. Hernández Diego, Nik Swoboda

S11: Robots and computacional perception

Darío Maravall Gómez-Allende (coord.), Luis Baumela Molina, Javier de Lope Asiaín, Nik Swoboda

S12: Principals of robotics locomotion

Nik Swoboda (coord.)

S13: Applications of Artificial Intelligence

Víctor Maojo García (coord.), Pedro Larrañaga Múgica, Asunción Gómez Pérez, Martín Molina González, Jesús Cardeñosa Lera, Antonio Jiménez Martín, David Pérez del Rey, María del Carmen Suárez de Figueroa

S14: Natural language processing

Jesús Cardeñosa Lera (coord.), Igor Boguslavski

S15: Automated planning

Miguel García Remesal (coord.)

S16: Seminar by visiting professors