



(*)Escola Superior de Enxeñaría Informática

Presentation

In 1991, the University School of Technical Engineering in Computer Management of the University of Vigo was created in the Campus of Ourense together with the degree of Technical Engineering in Computer Management, in order to respond to the needs of graduates in Computer Science demanded by the Galician society. In 1999, after the concession to this Centre of the second cycle of the degree in Computer Engineering, it changed its name to Escuela Superior de Enxeñaría Informática (ESEI).

Currently, the Centre offers the following degrees:

- **Degree in Computer Engineering:** A degree adapted to the EEES that incorporates two different professional profiles that are highly attractive in the Galician socio-economic environment:
 - Software Engineering
 - Information Technologies
- **Degree in Artificial Intelligence:** provides the broad, in-depth and multidisciplinary training required by professionals in this field and which is essential to successfully build the intelligent services and applications that are having such an important impact on our lives at all levels.

This is an inter-university degree in the Galician University System, of four courses (240 ECTS), in which the subjects of the first two courses are common to the three universities (A Coruña, Santiago and Vigo). In the third and fourth years, the University of Vigo develops the orientation in Intelligent Information Systems (SII).

- **University Master's Degree in Computer Engineering:** a degree linked to the profession of Computer Engineering, with 90 ECTS and one and a half years adapted to the EHEA. Its objective is to provide the graduate student with in-depth training in management and administration in the area of information technology, as well as solid knowledge in specific technologies associated with different professional profiles in this field. Graduates acquire technical, communication and leadership skills that enable them to start up their own business or to join management positions in the ICT area in companies and organisations.
- **University Master's Degree in Artificial Intelligence:** an inter-university degree, offered by the Universities of A Coruña, Santiago de Compostela and Vigo, which is a complete programme for the training of professionals and entrepreneurs in this branch of knowledge. It has a workload of 90 ECTS credits and a duration of one and a half academic years.

All the information about the Centre and its degrees is available on the website esei.uvigo.es.

Organization chart

Management Team Director:

Arno Formella

- He is responsible for the running of the School, implementing the agreements of the collegiate bodies, executing the budget and representing the Centre both within the University and before institutions and society in general.
- Email: [formella\(at\)uvigo.es](mailto:formella(at)uvigo.es)
- Telephone: +34 988 387 002

Deputy Director of Planning:

Francisco Javier Rodríguez Martínez

- He is responsible for the planning, definition, implementation, evaluation and monitoring of the procedures and processes of the ESEI.
- Email: franjrm(at)uvigo.es
- Telephone: +34 988 387 022

Deputy Director of Academic Organisation:

Adrián Seara Vieira

- She is responsible for the organisation of teaching at the School: timetables, exam calendars, teaching control, control of tutorials...
- Email: adrseara(at)uvigo.es
- Telephone: +34 988 387 019

Deputy Director of Quality:

Eva Lorenzo Iglesias

- She is in charge of ensuring compliance with the Internal Quality Assurance System.
- Email: eva(at)uvigo.es
- Telephone: +34 988 387 019

Deputy Director of Internacionalization and Innovation: Alma Gómez Rodríguez

- She is responsible for promoting mobility within and outside Europe, fostering international cooperation with foreign institutions, improving multilingualism, and managing teachers' continuing professional development and Educational Innovation.
- Email: alma@uvigo.gal
- Teléfono: +34 988 387 008

Secretary of the Centre:

María Encarnación González Rufino

- She is in charge of taking the minutes of the School's collegiate bodies, as well as certifying the agreements taken in them.
- Email: secretaria.esei(at)uvigo.es
- Telephone: +34 988 387 016

Within the management team, the secretary of the school, María Encarnación González Rufino, is the **Equality Liaison Officer**, and is responsible for the dynamisation and implementation of equality policies. This person is the liaison with the **Equality Unit** of the University of Vigo to contribute to the application and monitoring of the measures proposed in the Plan for Equality between women and men of the University of Vigo, with a view to achieving a more balanced participation of women and men in our University.

In addition to the management team, there are several professors in charge of coordinating the degree courses:

Coordinator of the Degree in Computer Engineering:

Eva Lorenzo Iglesias

Email: eva(at)uvigo.es

Phone: +34 988 387 019

Coordinator of the Degree in Artificial Intelligence:

Lourdes Borrajo Diz

Email: lborrajo(at)uvigo.es

Phone: +34 988 387 028

Coordinator of the Master's Degree in Computer Engineering:

Analia María García Lourenço

Email: analia(at)uvigo.es

Phone: +34 988 387 029

Coordinator of the Master's Degree in Artificial Intelligence:

Alma Gómez Rodríguez

Email: alma(at)uvigo.es

Phone: +34 988 387 008

Location

Escola Superior de Enxeñería Informática.

Campus de Ourense - Universidad de Vigo

Edificio Politécnico. As Lagoas s/n

32004 - Ourense (Spain)

Teléfonos: +34 988 387000, +34 988 387002

Web: esei.uvigo.es

Regulations and legislation

Available on the Centre's website (esei.uvigo.es)

Center services

teaching equipment

14 computer laboratories with 24 individual workstations and different operating systems

1 Electronics Technology laboratory

1 Computer Architecture laboratory

1 end-of-degree project laboratory

6 theory classrooms

6 seminars for group tutorials

added values

Classes in English in various subjects

Guidance teacher in the first year.

E-mail for students.

Storage directory for students, accessible from the Internet.

E-learning platform.

Wireless Internet access from all over campus.

Campus library with 120,000 volumes.

Alumni Delegation.

Premises for student associations.

University residence.

Hall of Degrees and Assembly Hall.

Cafeteria.

Máster universitario en Inteligencia artificial

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
006M193V01101	AI Fundamentals	1st	3
006M193V01102	Data engineering	1st	3
006M193V01103	Reasoning and planning	1st	6
006M193V01104	Natural language understanding	1st	6
006M193V01105	Machine learning I	1st	6
006M193V01106	Computer vision I	1st	3
006M193V01107	Intelligent robotics I	1st	3
006M193V01201	Explainable and Trustworthy AI	2nd	3
006M193V01202	Multiagent systems	2nd	6
006M193V01203	Knowledge and reasoning under uncertainty	2nd	3
006M193V01204	Language modelling	2nd	3
006M193V01205	Web intelligence and semantic technologies	2nd	6
006M193V01206	Deep learning	2nd	6
006M193V01207	Machine learning II	2nd	3
006M193V01208	Evolutionary computation	2nd	3
006M193V01209	Computer vision II	2nd	6
006M193V01210	Intelligent robotics II	2nd	6
006M193V01211	AI project management	2nd	3
006M193V01212	Process Mining	2nd	3
006M193V01213	Intelligent real-time systems	2nd	3

Year 2nd

Code	Name	Quadmester	Total Cr.
006M193V01214	Internships	1st	6
006M193V01301	Computational aspects of cognitive science	1st	3
006M193V01302	Text mining	1st	3
006M193V01303	AI in big data environments	1st	6
006M193V01304	AI in health	1st	3

O06M193V01305	Intelligent IoT	1st	3
O06M193V01306	Intelligent cibersecurity	1st	3
O06M193V01307	Emergent and entrepreneurial aspects in IA	1st	3
O06M193V01309	Master Thesis	1st	12

IDENTIFYING DATA				
AI Fundamentals				
Subject	AI Fundamentals			
Code	O06M193V01101			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	English			
Department				
Coordinator	Candal Ventureira, David			
Lecturers	Candal Ventureira, David			
E-mail	dcandal@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA				
Data engineering				
Subject	Data engineering			
Code	006M193V01102			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	English			
Department				
Coordinator	Garcia Lourenço, Anália Maria			
Lecturers	Garcia Lourenço, Anália Maria			
E-mail	analía@uvigo.es			
Web	http://http://moovi.uvigo.gal			
General description	The aim of this course is to introduce the basics of data engineering, notably in the scope of Big Data. The acquired skills will allow the analysis and the efficient management of heterogeneous information, both structured and non structured, within the development of AI applications, whenever traditional methods show insufficiency.			

Training and Learning Results				
Code				
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context			
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.			
A3	CB8 - the complexity of making judgments based on information that, while incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.			
B2	Successfully address all stages of an Artificial Intelligence project.			
B3	Search and select useful information needed to solve complex problems, handling with fluency the bibliographic sources of the field.			
B4	Elaborate adequately and with certain originality written compositions or motivated arguments, write plans, work projects, scientific articles and formulate reasonable hypotheses in the field.			
B5	Work in teams, especially multidisciplinary teams, and be skilled in time management, people management and decision making.			
C16	Knowledge of the process and tools for data processing and preparation from data acquisition or extraction, cleaning, transformation, loading, organization and access.			
D3	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida.			
D7	Develop the ability to work in interdisciplinary or transdisciplinary teams to offer proposals that contribute to sustainable environmental, economic, political and social development.			
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.			
D9	Have the ability to manage time and resources: develop plans, prioritize activities, identify critical ones, set deadlines and meet them.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
RA1: Develop the capacity to analyse and model data for processing in intelligent systems.	A1 A2	C16	D3 D9	
RA2: Know and understand the process of extraction, cleaning, transformation, load and preprocessing of data.	A3	B2 B3	C16 D7 D9	D3
RA3: Know and learn how to use multidimensional and NoSQL databases.	A2	B3 B4	D8	
RA4: Know the foundations of data lakes and data warehouses.	A2 A3	B2 B5	D3 D7 D8	

Contents
Topic

Concepts and foundations of Data Engineering	Concepts and basic definitions, problems of efficient data load in Big Data scenarios, massive data storage and access.
Techniques of data cleaning and preparation	Common techniques. Definition of processing flows. Quality metrics.
Efficient advanced structures and data warehouses for Big Data	Data warehouses and multidimensional databases, data lakes, NoSQL databases.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	12	0	12
Laboratory practical	10	30	40
Essay questions exam	3	20	23

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	The teacher will introduce given subjects to the students with the aim to acquire information valuable within a specific scope. CONTINUOUS EVALUATION Mandatory character Facultative attendance GLOBAL EVALUATION Mandatory character
Laboratory practical	Problem or problems of practical character whose resolution requires the understanding and application of the theoretical and practical contents covered by the course. The students can work the solution to the proposed problems individually or in groups. CONTINUOUS EVALUATION Mandatory character Mandatory attendance (min. 75% of lab practices) GLOBAL EVALUATION Mandatory character

Personalized assistance

Methodologies	Description
Lecturing	Doubts related to the methodologies and case studies discussed in class will be addressed.
Laboratory practical	Doubts related to the case studies to be analyzed will be addressed.

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Several laboratory practices aimed to evaluate the understanding of the knowledge exposed in theory and/or practical classes. Learning results evaluated: RA3, RA4	60	A2	B2 B5	C16	D3 D7
Essay questions exam	The exam covers all the topics of the course. Students must develop, relate, organise and present the knowledge they have on each given topic in a reasoned and well-articulated answer. Learning results evaluated: RA1, RA3, RA4	40	A1 A2 A3	B3 B4	C16	D7 D8 D9

Other comments on the Evaluation

CONTINUOUS EVALUATION SYSTEM

Assessment 1: Laboratory practical

Description: Several practices aimed to evaluate the understanding of the knowledge exposed in theory and/or practical classes (min. 2).

Methodology(ies) applied: Laboratory practical.

% of mark: 60%.

Minimum %: To pass this part of the course the student has to obtain a grade equal or greater than 5 points (out of 10).

TLRs evaluated: A2,B2,B5,C16,D3,D7.

Expected results evaluated: RA3, RA4

Assessment 2: Essay questions exam

Description: The exam covers all the topics of the course. Students must develop, relate, organise and present the knowledge they have on each given topic in a reasoned and well-articulated answer.

Methodology(ies) applied: Lecturing and laboratory practical.

% of mark: 40%.

Minimum %: To pass this part of the course the student has to obtain a grade equal or greater than 5 points (out of 10).

TLRs evaluated: A1,A2,A3,B3,B4,C16,D7,D8, D9

Expected results evaluated: RA1, RA3, R4

GLOBAL EVALUATION SYSTEM

Procedure for choosing the global evaluation modality: students are considered to have chosen the global evaluation system if they do not take Test 1 of the continuous evaluation system at the established dates.

Assessment assessment 1: Laboratory practical

Description: Several practices aimed to evaluate the understanding of the knowledge exposed in theory and/or practical classes (min. 2).

Methodology to be applied: Laboratory practical.

% of mark: 60%.

Minimum %: To pass this part of the course the student has to obtain a grade equal or greater than 5 points (out of 10).

TLRs evaluated: A2,B2,B5,C16,D3,D7.

Expected results evaluated: RA3, RA4

Assessment 2: Essay questions exam

Description: The exam covers all the topics of the course. Students must develop, relate, organise and present the knowledge they have on each given topic in a reasoned and well-articulated answer.

Methodology(ies) applied: Lecturing and laboratory practical.

% of mark: 40%.

Minimum %: To pass this part of the course the student has to obtain a grade equal or greater than 5 points (out of 10).

TLRs evaluated: A1,A2,A3,B3,B4,C16,D7,D8, D9

Expected results evaluated: RA1, RA3, R4

ASSESSMENT CRITERIA FOR THE EXTRAORDINARY AND END-OF-DEGREE EXAMINATION CALLS

The continuous and global evaluation systems described above will be used.

GRADING PROCEDURE

Regardless of the assessment system and the assessment period, if a student fails any part of the assessment but their overall mark is higher than 4 (out of 10), the mark recorded on the transcript will be 4.

EVALUATION DATES

The dates of the assessments under the continuous and global assessment systems will be published in the calendar of events, available on the ESEI website <https://esei.uvigo.es/docencia/horarios/>.

The official exam dates for the various exam sessions, approved by the ESEI Centre Council, are published on the ESEI website <https://esei.uvigo.es/docencia/exames/>.

USE OF MOBILE DEVICES

All students are reminded that the use of mobile devices is prohibited during exercises and practical sessions, in accordance with Article 13.2.d) of the University Student Regulations, which concerns the duties of university students and stipulates the duty to refrain from engaging in or assisting with fraudulent practices in assessment tests, in coursework or in official university documents.

USE OF ARTIFICIAL INTELLIGENCE

AI is restricted in all assessment tests of the continuous and global evaluation systems.

AI is restricted in all teaching activities.

Furthermore, anyone who uses AI in academic, scientific, creative, administrative or research work must declare the tool used, the function performed, the extent of its involvement and the proportion of the work that constitutes human authorship.

PLAGIARISM DETECTION

Should copying or plagiarism be detected in any of the assessment tests (continuous or global), the final mark will be a FAIL (0) and the matter will be reported to the School Management for appropriate action.

CONSULTATION/TUTORING REQUESTS

Tutoring hours are available at the personal page of the teaching staff, accessible through <https://esei.uvigo.es/docencia/profesorado/>

OTHER CONSIDERATIONS

If any contradiction arises between the different versions of this guide, due to some translation error, the version that will prevail is the Spanish version.

Sources of information

Basic Bibliography

Sadalage, Fowler, **NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence**, 978-0321826626, 1, Addison-Wesley, 2012

Ihab F. Ilyas and Xu Chu, **Data Cleaning. Association for Computing Machinery**, 978-1450371520, Association for Computing Machinery, 2019

Alex Gorelik, **The Enterprise Big Data Lake: Delivering the Promise of Big Data and Data Science**, 978-1491931554, O'Reilly Media, Inc., 2019

Matt Casters, Roland Bouman, Jos van Dongen, **Pentaho Kettle Solutions: Building Open Source ETL Solutions with Pentaho Data Integration**, 978-0470635179, Wiley, 2013

Ralph Kimball & Margy Ross, **The Data Warehouse Toolkit**, 978-1118530801, 3rd Edition, Wiley, 2013

Complementary Bibliography

Avi Silberschatz, Henry F. Korth, S. Sudarshan, **Database System Concepts**, 978-0073523323, 6, McGraw-Hill, 2010

Recommendations

Other comments

Follow the proposed methodology, class assistance and participation, devoting the necessary time to the study and the development of the proposed project and specific problems/case studies with the help of the teacher.

The virtual campus will be used to improve the communication between the students and the teachers, to store the necessary materials and to support in the processes of evaluation.

IDENTIFYING DATA

Reasoning and planning

Subject	Reasoning and planning			
Code	006M193V01103			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language	English			
Department				
Coordinator	Gómez Rodríguez, Alma María			
Lecturers	Gómez Rodríguez, Alma María Otero Cerdeira, Lorena			
E-mail	alma@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				

Training and Learning Results

Code

Expected results from this subject

Expected results from this subject	Training and Learning Results
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Contents

Topic

Planning

Planning	Class hours	Hours outside the classroom	Total hours
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*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Description	
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Personalized assistance

Assessment

Description	Qualification	Training and Learning Results
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Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Natural language understanding				
Subject	Natural language understanding			
Code	006M193V01104			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language	English			
Department				
Coordinator	Darriba Bilbao, Víctor Manuel			
Lecturers	Darriba Bilbao, Víctor Manuel			
E-mail	darriba@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				

Training and Learning Results

Code	
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
A5	CB10 - That students possess the learning skills that will enable them to continue studying in a manner that will be largely self-directed or autonomous.
B1	Maintain and extend sound theoretical approaches to enable the introduction and exploitation of new and advanced technologies in the field of Artificial Intelligence.
B3	Search and select useful information needed to solve complex problems, handling with fluency the bibliographic sources of the field.
B4	Elaborate adequately and with certain originality written compositions or motivated arguments, write plans, work projects, scientific articles and formulate reasonable hypotheses in the field.
C1	Understanding and mastering techniques for text processing in natural language
C2	Understanding and mastery of the fundamentals and techniques of semantic processing of linked, structured, and unstructured documents, and of the representation of their content.
C3	Understanding and knowledge of the techniques of representation and processing of knowledge through ontologies, graphs, and RDF, as well as the tools associated with them.
D2	Master the oral and written expression and comprehension of a foreign language.
D3	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida.
D7	Develop the ability to work in interdisciplinary or transdisciplinary teams to offer proposals that contribute to sustainable environmental, economic, political and social development.
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
To know, understand and analyze the formal representation of diverse lexical, syntactic and semantic phenomena of natural language.	A1 A5	B1 B3 B4	C1 D8	
To know, understand and know how to use the technologies, frameworks and libraries for the construction of natural language processing systems.	A1 A2 A5	B3 B4	C1 C2	D2 D3 D7
To design, implement and know how to use algorithms and data structures to treat and support the various phenomena characteristic of natural language.	A1 A2 A5	B1 B3 B4	C1 C2 C3	D2 D3 D7 D8
To know, understand and analyze natural language processing techniques for processing and disambiguation at the lexical, syntactic and semantic levels.	A1 A2 A5	B1 B3 B4	C1 C2 C3	D2 D3 D7 D8

To know and understand the problems posed by ambiguity and imprecision in natural language data sources and techniques to solve them.

A1	B1	C1	D2
A2	B3	C3	D3
A5	B4		D7
			D8

Contents

Topic

Planning

Class hours

Hours outside the
classroom

Total hours

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Methodologies

Description

Personalized assistance

Assessment

Description

Qualification

Training and Learning Results

Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Machine learning I				
Subject	Machine learning I			
Code	006M193V01105			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language	English			
Department				
Coordinator	Darriba Bilbao, Víctor Manuel			
Lecturers	Darriba Bilbao, Víctor Manuel			
E-mail	darriba@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description	This course presents an overview of machine learning. The syllabus explains the different techniques and methods, including supervised and unsupervised learning. In the practical part, real cases will be solved.			

Training and Learning Results	
Code	
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
A3	CB8 - the complexity of making judgments based on information that, while incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.
A4	CB9 - Students should be able to communicate their conclusions and the ultimate knowledge and rationale behind them to specialized and non-specialized audiences in a clear and unambiguous manner.
B2	Successfully address all stages of an Artificial Intelligence project.
B3	Search and select useful information needed to solve complex problems, handling with fluency the bibliographic sources of the field.
B4	Elaborate adequately and with certain originality written compositions or motivated arguments, write plans, work projects, scientific articles and formulate reasonable hypotheses in the field.
B5	Work in teams, especially multidisciplinary teams, and be skilled in time management, people management and decision making.
C10	Ability to build, validate and apply a stochastic model of a real system from observed data and the critical analysis of the results obtained
C11	Understanding and mastery of the main data analysis techniques and tools, both from a statistical and machine learning point of view, including those dedicated to the processing of large volumes of data, and the ability to select the most appropriate ones for problem solving.
C12	Ability to plan, formulate and resolve all stages of a data project, including understanding and mastery of basic fundamentals and techniques for searching and filtering information in large data collections.
C15	Knowledge of computer tools in the field of machine learning, and ability to select the most appropriate for solving a problem.
D3	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida.
D4	To develop for the exercise of a citizenship respectful of democratic culture, human rights and gender perspective.
D7	Develop the ability to work in interdisciplinary or transdisciplinary teams to offer proposals that contribute to sustainable environmental, economic, political and social development.
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.
D9	Have the ability to manage time and resources: develop plans, prioritize activities, identify critical ones, set deadlines and meet them.

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Ability to identify if a problem can be solved using a machine learning technique.	A3	B2	C12	D4
		B3		D7
		B4		D8
				D9

Obtain the ability to choose the most appropriate learning technique for a problem depending on the nature of the data.	A1 A2 A4	B2	C11 C15	D3 D8
Ability to design and develop a learning model in a real programming environment.	A1 A2 A3 A4	B5	C10 C15	D3 D7 D9
Master the different learning models and be able to apply them to real-world problems.	A2	B2 B3	C11 C15	D3 D8
Know and understand the difference between classification and regression problems.	A1 A3	B3	C10 C11	
Understand how to compare the results of the different types of machine learning.	A2 A4		C10 C12 C15	D4 D8 D9

Contents

Topic

Planning

Class hours

Hours outside the
classroom

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Methodologies

Description

Personalized assistance

Assessment

Description

Qualification

Training and Learning Results

Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

IDENTIFYING DATA				
Computer vision I				
Subject	Computer vision I			
Code	006M193V01106			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	English			
Department				
Coordinator	Celard Pérez, Pedro			
Lecturers	Celard Pérez, Pedro			
E-mail	pedro.celard.perez@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description	(*) https://formella.webs.uvigo.es/doc/vci23			

Training and Learning Results	
Code	
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
A5	CB10 - That students possess the learning skills that will enable them to continue studying in a manner that will be largely self-directed or autonomous.
B1	Maintain and extend sound theoretical approaches to enable the introduction and exploitation of new and advanced technologies in the field of Artificial Intelligence.
B3	Search and select useful information needed to solve complex problems, handling with fluency the bibliographic sources of the field.
B5	Work in teams, especially multidisciplinary teams, and be skilled in time management, people management and decision making.
C23	Understanding and mastering the basic concepts and techniques of digital image processing.
C24	Ability to apply different techniques to computer vision problems.
C25	Knowledge and skills to design systems for detection, classification and tracking of objects in images and video.
C26	Understanding and mastery of the forms of representation of signals and images according to their data, as well as their fundamental characteristics and their forms of representation.
D3	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida.
D4	To develop for the exercise of a citizenship respectful of democratic culture, human rights and gender perspective.
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.

Expected results from this subject				
Expected results from this subject		Training and Learning Results		
New	A1	B1	C23	D3
	A2	B3	C24	D4
	A5	B5	C25	D8
			C26	
New	A1	B1	C23	D3
	A2	B3	C24	D4
	A5	B5	C25	D8
			C26	
New	A1	B1	C23	D3
	A2	B3	C24	D4
	A5	B5	C25	D8
			C26	
New	A1	B1	C23	D3
	A2	B3	C24	D4
	A5	B5	C25	D8
			C26	

Contents

Topic

Planning

Class hours

Hours outside the
classroom

Total hours

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Description

Personalized assistance

Assessment

Description

Qualification

Training and Learning Results

Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Intelligent robotics I				
Subject	Intelligent robotics I			
Code	006M193V01107			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	English			
Department				
Coordinator	Arias Pérez, Pedro			
Lecturers	Arias Pérez, Pedro			
E-mail	pedro.arias.perez@uvigo.gal			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA				
Explainable and Trustworthy AI				
Subject	Explainable and Trustworthy AI			
Code	006M193V01201			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	2nd
Teaching language	English			
Department				
Coordinator	Fernández Gavilanes, Milagros			
Lecturers	Fernández Gavilanes, Milagros			
E-mail	mfgavilanes@uvigo.gal			
Web	http://https://mia.udc.es/syllabus/			
General description	https://mia.udc.es/syllabus/			
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA

Multiagent systems

Subject	Multiagent systems			
Code	006M193V01202			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	2nd
Teaching language				
Department				
Coordinator	González Moreno, Juan Carlos			
Lecturers	Gómez Rodríguez, Alma María González Moreno, Juan Carlos			
E-mail	jcmoreno@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				

Training and Learning Results

Code

Expected results from this subject

Expected results from this subject	Training and Learning Results
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Contents

Topic

Planning

Planning	Class hours	Hours outside the classroom	Total hours
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*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Homomorphisms	Description
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Personalized assistance

Assessment

Description	Qualification	Training and Learning Results
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Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Knowledge and reasoning under uncertainty				
Subject	Knowledge and reasoning under uncertainty			
Code	006M193V01203			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Gómez Rodríguez, Alma María			
Lecturers	Gómez Rodríguez, Alma María			
E-mail	alma@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject		Training and Learning Results		
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA				
Language modelling				
Subject	Language modelling			
Code	O06M193V01204			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	English			
Department				
Coordinator	Darriba Bilbao, Víctor Manuel			
Lecturers	Darriba Bilbao, Víctor Manuel			
E-mail	darriba@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description	The course introduces the student to the modeling of human language, i.e. the generation of models that allow estimating the plausibility of a text, an essential phase in the design of any application based on the exploitation of its communicative mechanisms. The student will be trained to master the theoretical principles and techniques that allow their construction, both those based on discrete representations of the elements of the language and on continuous representations. Special attention will be given to modeling in contexts of scarce linguistic resources, whether this is motivated by the treatment of novel domains of knowledge or by the exploitation of languages of limited diffusion.			

Training and Learning Results

Code				
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context			
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.			
A5	CB10 - That students possess the learning skills that will enable them to continue studying in a manner that will be largely self-directed or autonomous.			
B1	Maintain and extend sound theoretical approaches to enable the introduction and exploitation of new and advanced technologies in the field of Artificial Intelligence.			
B3	Search and select useful information needed to solve complex problems, handling with fluency the bibliographic sources of the field.			
B4	Elaborate adequately and with certain originality written compositions or motivated arguments, write plans, work projects, scientific articles and formulate reasonable hypotheses in the field.			
C1	Understanding and mastering techniques for text processing in natural language			
C2	Understanding and mastery of the fundamentals and techniques of semantic processing of linked, structured, and unstructured documents, and of the representation of their content.			
C3	Understanding and knowledge of the techniques of representation and processing of knowledge through ontologies, graphs, and RDF, as well as the tools associated with them.			
D2	Master the oral and written expression and comprehension of a foreign language.			
D3	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida.			
D7	Develop the ability to work in interdisciplinary or transdisciplinary teams to offer proposals that contribute to sustainable environmental, economic, political and social development.			
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.			

Expected results from this subject

Expected results from this subject	Training and Learning Results			
To know how to use the techniques and methods of natural language processing to solve real problems of analysis of texts in natural language.	A2	B1	C1	D2
	A5	B3	C3	D3
		B4		D7
To know, understand and analyze deep learning techniques applied to natural language processing.	A1	B1	C1	D2
	A2	B3	C2	D3
	A5			D7
				D8

To know how to use deep learning techniques and methods to solve practical problems in natural language processing.	A1	B1	C1	D2
	A2	B3	C2	D3
	A5	B4		D7
				D8
To know and understand the environmental problems posed by the computational cost of deep learning techniques when applied to text analysis	A1	B1	C1 C2	D2 D8

Contents

Topic

Planning

	Class hours	Hours outside the classroom	Total hours
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*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Description

Personalized assistance

Assessment

Description	Qualification	Training and Learning Results
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Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Web intelligence and semantic technologies				
Subject	Web intelligence and semantic technologies			
Code	006M193V01205			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Celard Pérez, Pedro			
Lecturers	Celard Pérez, Pedro			
E-mail	pedro.celard.perez@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students			

Methodologies
Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Deep learning				
Subject	Deep learning			
Code	006M193V01206			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	2nd
Teaching language	English			
Department				
Coordinator	Rodríguez Liñares, Leandro			
Lecturers	Olivieri Cecchi, David Nicholas Rodríguez Liñares, Leandro			
E-mail	leandro@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject		Training and Learning Results		
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
François Chollet, Deep Learning with Python , 2, Manning, 2021				
Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow , 3, O'Reilly Media, 2022				
Mohamed Elgendy, Deep Learning for Vision Systems , 1, Manning, 2020				
Jakub Langr, Vladimir Bok, GANs in Action: Deep learning with Generative Adversarial Networks , 1, Manning, 2019				
David Foster, Generative Deep Learning: Teaching Machines To Paint, Write, Compose, and Play , 2, O'Reilly Media 2023				
Complementary Bibliography				
Andrew Ferlitsch, Deep Learning Patterns and Practices , 1, Manning, 2021				
Andrew W. Trask, Grokking Deep Learning , 1, Manning, 2019				
Recommendations				

IDENTIFYING DATA				
Machine learning II				
Subject	Machine learning II			
Code	O06M193V01207			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Olivieri Cecchi, David Nicholas			
Lecturers	Olivieri Cecchi, David Nicholas			
E-mail	dnolivieri@gmail.com			
Web	http://https://mia.udc.es/syllabus/			
General description				

Training and Learning Results

Code	
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Expected results from this subject

Expected results from this subject	Training and Learning Results
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Contents

Topic	
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Planning

	Class hours	Hours outside the classroom	Total hours
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*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Description	
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Personalized assistance

Assessment

Description	Qualification	Training and Learning Results
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Other comments on the Evaluation

Sources of information

Basic Bibliography

- Bahri, M., Bifet, A., Gama, J., Gomes, H. M., & Maniu, S, **Data stream analysis: Foundations, major tasks and tools. Wiley nterdisciplinary Reviews: Data Mining and Knowledge Discovery**, 11 (3), Wiley nterdisciplinary Reviews, 2021
- Bifet, A., Gavalda, R., Holmes, G., & Pfahringer, B, **Machine learning for data streams: with practical examples in MOA.**, MIT Press, 201
- Gomes, H. M., Read, J., Bifet, A., Barddal, J. P., & Gama, J, **Machine learning for streaming data: state of the art, challenges, and opportunities**, 21(2), 6-22, ACM SIGKDD Explorations Newsletter, 2019
- Hoi, S. C., Sahoo, D., Lu, J., & Zhao, P., **Online learning: A comprehensive survey**, Volume 459, 12 October 2021, Pages 249-289, Neurocomputing, 2021
- Li, T., Sahu, A. K., Talwalkar, A., & Smith, V., **Federated learning: Challenges, methods, and future directions**, Volume: 37 Issue: 3, IEEE signal processing magazine, 2020
- Lu, J., Liu, A., Dong, F., Gu, F., Gama, J., & Zhang, G, **Learning under concept drift: A review.**, Volume: 31, Issue: 12,, IEEE Transactions on Knowledge and DataEngineering, 2019
- Orabona, F., **A modern introduction to online learning**, arXivpreprint, 2019
- Gama, J., Elabbadi, I., Bifet, A., Pechenizkiy, M., & Bouchachia, A., **A survey on concept drift adaptation**, Vol. 46, No. 4, ACM computing surveys(CSUR), 2014

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Evolutionary computation				
Subject	Evolutionary computation			
Code	006M193V01208			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	English			
Department				
Coordinator	Formella , Arno			
Lecturers	Formella , Arno			
E-mail	formella@uvigo.es			
Web	http://formella.webs.uvigo.es/doc/ec26			
General description	The course introduces the student to the modeling of systems capable of adapting to their environments and learning from their experience, imitating the evolutionary processes of nature. In this context, the student will be instructed not only in the use of different techniques for the search of solutions inspired by the prevalence or subsistence strategies of a population, but also in the application of meta-heuristics for their optimization.			

Training and Learning Results				
Code				
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context			
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.			
A3	CB8 - the complexity of making judgments based on information that, while incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.			
B2	Successfully address all stages of an Artificial Intelligence project.			
B3	Search and select useful information needed to solve complex problems, handling with fluency the bibliographic sources of the field.			
B4	Elaborate adequately and with certain originality written compositions or motivated arguments, write plans, work projects, scientific articles and formulate reasonable hypotheses in the field.			
B5	Work in teams, especially multidisciplinary teams, and be skilled in time management, people management and decision making.			
C10	Ability to build, validate and apply a stochastic model of a real system from observed data and the critical analysis of the results obtained			
C11	Understanding and mastery of the main data analysis techniques and tools, both from a statistical and machine learning point of view, including those dedicated to the processing of large volumes of data, and the ability to select the most appropriate ones for problem solving.			
C12	Ability to plan, formulate and resolve all stages of a data project, including understanding and mastery of basic fundamentals and techniques for searching and filtering information in large data collections.			
C15	Knowledge of computer tools in the field of machine learning, and ability to select the most appropriate for solving a problem.			
D3	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida.			
D7	Develop the ability to work in interdisciplinary or transdisciplinary teams to offer proposals that contribute to sustainable environmental, economic, political and social development.			
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.			
D9	Have the ability to manage time and resources: develop plans, prioritize activities, identify critical ones, set deadlines and meet them.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
RA1: Know the basic concepts of evolutionary computation, of classical evolutionary algorithms and of nature-inspired algorithms.	A1	B2	C10	D3
	A2	B3	C11	D7
	A3	B4	C12	D8
		B5	C15	D9

RA2: Have the ability to design nature-inspired models of complex real systems.	A1	B2	C10	D3
	A2	B3	C11	D7
	A3	B4	C12	D8
		B5	C15	D9
RA3: Know and apply techniques based on evolutionary systems, artificial neural networks and other nature-inspired models.	A1	B2	C10	D3
	A2	B3	C11	D7
	A3	B4	C12	D8
		B5	C15	D9
RA4: Identify the appropriate data-driven solution search techniques according to the type of problem. Understand the different possibilities of combination or hybridization between global evolutionary search methods and other local search metaheuristics.	A1	B2	C10	D3
	A2	B3	C11	D7
	A3	B4	C12	D8
		B5	C15	D9
RA5: Know different adaptive bioinspired models and handle tools and environments currently used in the field of the nature-inspired algorithms.	A1	B2	C10	D3
	A2	B3	C11	D7
	A3	B4	C12	D8
		B5	C15	D9

Contents

Topic	
Introduction to algorithms of optimisation	General scheme of evolutionary algorithms. Basic concepts: search domain, constraints, penalties. No Free Lunch theorem. Basic concepts of multi-objective optimization.
Paradigms and meta-heuristic of nature-inspired algorithms	Bio-inspired metaheuristics. Swarm intelligence.
Specific algorithms of evolutionary computation	Genetic algorithms. Evolutionary strategies. Genetic programming. Examples of swarm intelligence: Particle Swarm Optimization, Artificial Bee Algorithm, Bacterial Colony Optimization, Ant Algorithms. Examples of other bio-inspired evolutionary algorithms.
Advances in the automatic adaptation of evolutionary algorithms	Automatic adaptation of the defining parameters of an evolutionary algorithm. Application of memetic algorithms (local search at individuals in population based algorithms). Use of hyper-heuristics.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	10.5	10.5	21
Laboratory practical	10.5	31.5	42
Case studies	5	0	5
Essay	2	2	4
Objective questions exam	3	0	3

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Oral exhibition complemented with the use of audiovisual means and the introduction of some questions headed to the students, with the purpose to transmit knowledges and facilitate the learning. In addition to the time of oral exhibition by part of the professor, this formative activity requires of the student the dedication of a time to prepare and review by own account the material object of the class. CONTINUOUS EVALUATION mandatory assistance non-mandatory GLOBAL EVALUATION mandatory

Laboratory practical	Classes devoted to that the students develop practical works that involve to tackle the resolution of complex problems, and the analysis and design of solutions that constitute a half for his resolution. This activity can require of the students the oral presentation of the works made. The works made by the students can done individually or in groups.
	CONTINUOUS EVALUATION mandatory assistance non-mandatory
	GLOBAL EVALUATION mandatory
Case studies	Present to the students a state-of-the-art work, real or fictitious, that presents a specific topic. The students has to apply the theoretical knowledge of the subject to look for solution to the problem. Like general norm, case studies will make in groups. The distinct groups of work will present and share their solutions.
	CONTINUOUS EVALUATION mandatory assistance non-mandatory
	GLOBAL EVALUATION non-mandatory

Personalized assistance

Methodologies	Description
Laboratory practical	The professor will attend the students in sessions of laboratory with the aim of orientation to the resolution of the exercises and practical works of the subject.
Case studies	The professor will attend the students in sessions of office hours dedicated to the orientation in the study and the resolution of doubts on the contents and works of the subject. Use a remote platform with capacity of forums of discussion both between the students and with the professor.
Tests	Description
Essay	The professor will attend the students in sessions of office hours dedicated to the orientation in the study and the resolution of doubts on the contents and works of the subject.

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	Continuous evaluation: part of the evaluation of the students is based on the evolution and work in the frame of the subject and on the participation in the formative activities. (RA1, RA2, RA3, RA4, RA5)	5	A1 A2 A3	B3		D8
Laboratory practical	Continuous evaluation: part of the evaluation of the students is based on the evolution and work in the frame of the subject and on the participation in the formative activities. (RA1, RA2, RA3, RA4, RA5)	5	A1 A2 A3	B2 B4	C12 C15	D7 D8
Essay	Evaluation of practical works: evaluation of the solutions proposed by the students to the excercises. The evaluation of excercises is carried out by means of a correction by the professor, a defence of the solution done by the student in a written comment or in an oral presentation of the developed solution.	50	A1 A2 A3	B2 B3 B4 B5	C10 C11 C12 C15	D3 D7 D8 D9
Objective questions exam	Final examination: written evaluation at the end of the subject, oriented especially to evaluate the understanding of the theory and laboratory excercises. (RA1, RA2, RA3, RA4, RA5)	40	A1 A2 A3	B3 B4	C10 C11 C12 C15	D8

Other comments on the Evaluation

CONTINUOUS ASSESSMENT SYSTEM

TEST 1: Evaluation in master class

Description: Active participation in theory classes.

Methodology(s) applied(s): Objective oral questions.

% Qualification: 5%

% Minimum (if any): there is no

Assessed skills: A1, A2, A3, B3, D8

Assessed learning outcomes: RA1, RA2, RA3, RA4, RA5

TEST 2: Evaluation in laboratory practices

Description: Active participation in practical classes.

Methodology(s) applied(s): Objective oral questions.

% Qualification: 5%

% Minimum (if any): there is no

Assessed skills: A1, A2, A3, B2, B4, C12, C15, D7, D8

Assessed learning outcomes: RA1, RA2, RA3, RA4, RA5

TEST 3: Work evaluation (part 1, at the end of the first half of the academic period)

Description: Objective test that will include evaluation of the application of theoretical concepts and resolution of exercises.

Methodology(s) applied(s): Delivery of solutions developed with report.

% Qualification: 25%

% Minimum (if any): there is no

Assessed skills: A1, A2, A3, B2, B3, B4, B5, C10, C11, C12, C15, D8

Assessed learning outcomes: RA1, RA2, RA3, RA4, RA5

TEST 4: Work evaluation (part 2, at the end of the academic period)

Description: Objective test that will include evaluation of the application of theoretical concepts and resolution of exercises.

Methodology(s) applied(s): Delivery of solutions developed with report.

% Qualification: 25%

% Minimum (if any): there is no

Assessed skills: A1, A2, A3, B2, B3, B4, B5, C10, C11, C12, C15, D8

Assessed learning outcomes: RA1, RA2, RA3, RA4, RA5

TEST 5: Objective questions exam (during exam period)

Description: Objective test that will include short questions and development questions.

Methodology(s) applied(s): Written exam.

% Qualification: 40%

% Minimum (if any): there is no

Assessed skills: A1, A2, A3, B3, B4, C10, C11, C12, C15, D8

Assessed learning outcomes: RA1, RA2, RA3, RA4, RA5

All students who take any of the tests 2 and 3 are understood to accept the continuous assessment procedure described above. If a student does not appear for any of the tests, a grade of 0 will be assigned to it.

GLOBAL EVALUATION SYSTEM

Procedure for choosing the global assessment modality: It is considered that the student opts for the global assessment system if they do not take Test 1 of the continuous assessment system).

TEST 1: Theoretical, practical and/or laboratory evaluation.

Description: Objective test that will include evaluation of theoretical concepts and resolution of exercises.

Methodology(s) applied(s): Problem solving, Examination of objective questions. They must appear in the top table.

% Rating: 100%

Minimum % (if applicable): reach 50%

Assessed skills: All of the subject.

Evaluated learning outcomes: All of the subject.

EVALUATION CRITERIA FOR EXTRAORDINARY CALL AND FINAL DEGREE

The global evaluation systems previously exposed will be used.

RECORD QUALIFICATION PROCESS

The sum of the sections described above will appear in the minutes.

EVALUATION DATES

The dates of the tests corresponding to the continuous assessment system will be published in the calendar of activities, available on the ESEI website <https://esei.uvigo.es/docencia/horarios/>.

The official exam dates of the different calls, officially approved by the Xunta de Centro of the ESEI, are published on the ESEI website <https://esei.uvigo.es/docencia/exames/>.

USE OF MOBILE DEVICES

All students are reminded of the prohibition of the use of mobile devices in evaluation procedures, in compliance with article 13.2.d) of the University Student Statute, regarding the duties of university students, which establishes the duty to "Refrain from using or cooperation in fraudulent procedures in the evaluation tests, in the works that are carried out or in official documents of the university."

USE OF ARTIFICIAL INTELLIGENCE

AI is limited in all assessment tests, both continuous and comprehensive.

AI is limited in all teaching activities.

Anyone using AI in academic, scientific, creative, administrative, or research work must declare the tool used, the function performed, the scope of their involvement, and the portion of the work that constitutes human authorship.

Specific instructions regarding its use in various teaching and assessment activities will be communicated to students through the course's usual communication channels, preferably during the initial course presentation and via the online platform.

CONSULTATION/REQUEST FOR TUTORIALS

The tutorials can be consulted through the personal page of the teaching staff, accessible through <https://esei.uvigo.es/docencia/profesorado/>

Sources of information

Basic Bibliography

Dan Simon, **Evolutionary Optimization Algorithms**, 978-0-470-93741-9, Wiley, 2013

A. E. Eiben, **Introduction to Evolutionary Computing (Natural Computing Series)**, 978-3-662-44873-1, Springer, 2015

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Computer vision II				
Subject	Computer vision II			
Code	006M193V01209			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	2nd
Teaching language	English			
Department				
Coordinator	Rodríguez Conde, Iván			
Lecturers	Rodríguez Conde, Iván			
E-mail	ivarodriguez@uvigo.gal			
Web	http://https://mia.udc.es/syllabus/			
General description				

Training and Learning Results	
Code	
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
A5	CB10 - That students possess the learning skills that will enable them to continue studying in a manner that will be largely self-directed or autonomous.
B1	Maintain and extend sound theoretical approaches to enable the introduction and exploitation of new and advanced technologies in the field of Artificial Intelligence.
B3	Search and select useful information needed to solve complex problems, handling with fluency the bibliographic sources of the field.
B5	Work in teams, especially multidisciplinary teams, and be skilled in time management, people management and decision making.
C23	Understanding and mastering the basic concepts and techniques of digital image processing.
C24	Ability to apply different techniques to computer vision problems.
C25	Knowledge and skills to design systems for detection, classification and tracking of objects in images and video.
C26	Understanding and mastery of the forms of representation of signals and images according to their data, as well as their fundamental characteristics and their forms of representation.
D3	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida.
D4	To develop for the exercise of a citizenship respectful of democratic culture, human rights and gender perspective.
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.

Expected results from this subject				
Expected results from this subject		Training and Learning Results		
New	A1	B1	C23	D3
	A2	B3	C24	D4
	A5	B5	C25	D8
			C26	
New	A1	B1	C23	D3
	A2	B3	C24	D4
	A5	B5	C25	D8
			C26	
New	A1	B1	C23	D3
	A2	B3	C24	D4
	A5	B5	C25	D8
			C26	

Contents
Topic

Planning

Class hours

Hours outside the
classroom

Total hours

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Description

Personalized assistance

Assessment

Description

Qualification

Training and Learning Results

Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Intelligent robotics II				
Subject	Intelligent robotics II			
Code	O06M193V01210			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Gómez Rodríguez, Alma María			
Lecturers	Gómez Rodríguez, Alma María			
E-mail	alma@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject		Training and Learning Results		
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA				
AI project management				
Subject	AI project management			
Code	006M193V01211			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	2nd
Teaching language				
Department				
Coordinator	Serrano Antón, Belén			
Lecturers	Serrano Antón, Belén			
E-mail	belen.serrano@uvigo.gal			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA				
Process Mining				
Subject	Process Mining			
Code	O06M193V01212			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Gómez Rodríguez, Alma María			
Lecturers	Gómez Rodríguez, Alma María			
E-mail	alma@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA				
Intelligent real-time systems				
Subject	Intelligent real-time systems			
Code	006M193V01213			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	1st	2nd
Teaching language	English			
Department				
Coordinator	González Moreno, Juan Carlos			
Lecturers	González Moreno, Juan Carlos			
E-mail	jcmoreno@uvigo.es			
Web	http://https://moovi.uvigo.gal/			
General description	The main objective of this subject is to provide students with the minimum knowledge necessary for problem solving in the field of intelligent systems in real time, and the appropriate understanding of how to approach the resolution of these problems, but paying special attention to real time management.			

Training and Learning Results

Code				
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context			
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.			
A4	CB9 - Students should be able to communicate their conclusions and the ultimate knowledge and rationale behind them to specialized and non-specialized audiences in a clear and unambiguous manner.			
A5	CB10 - That students possess the learning skills that will enable them to continue studying in a manner that will be largely self-directed or autonomous.			
B1	Maintain and extend sound theoretical approaches to enable the introduction and exploitation of new and advanced technologies in the field of Artificial Intelligence.			
B2	Successfully address all stages of an Artificial Intelligence project.			
B5	Work in teams, especially multidisciplinary teams, and be skilled in time management, people management and decision making.			
C19	Knowledge of different application areas of AI-based technologies and their capacity to offer a differentiating added value.			
C20	Ability to combine and adapt different techniques, extrapolating knowledge between different fields of application.			
C21	Knowledge of techniques that facilitate the organization and management of AI projects in real environments, resource management and task planning in an efficient way, taking into account concepts of knowledge dissemination and open science.			
C22	Knowledge of techniques that facilitate the security of data, applications and communications and their implications in different AI application areas.			
C30	Be able to pose, model and solve problems requiring the application of artificial intelligence methods, techniques and technologies.			
D3	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida.			
D7	Develop the ability to work in interdisciplinary or transdisciplinary teams to offer proposals that contribute to sustainable environmental, economic, political and social development.			
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.			
D9	Have the ability to manage time and resources: develop plans, prioritize activities, identify critical ones, set deadlines and meet them.			

Expected results from this subject

Expected results from this subject	Training and Learning Results			
RA2: Ability to design and program a real-time system.	A1	B1	C20	D3
	A2	B5		D7
	A4			D8
RA3: Know the most common programming languages for real-time systems, both synchronous and asynchronous.	A1	B1	C20	D3
	A2	B5	C21	D7
	A4			D8
	A5			D9

RA4: Know the production of reliable software components, with special attention to fault tolerance and error recovery.	A1	B1	C20	D3
	A2	B5	C21	D7
	A4		C22	D8
	A5			D9
RA5: Know the basics of concurrent programming, communication and synchronization in real-time systems.	A2	B2	C21	D7
	A5		C22	D9
			C30	
RA6: Know the temporal requirements of the functionalities of the language and the strategies to satisfy them, both in the synchronous and asynchronous case.	A1	B1	C20	D3
	A2	B5	C22	D7
	A4			D8
	A5			D9
RA7: Know the architectures of integration of artificial intelligence in real-time systems, with a view to an efficient treatment of planning.	A4	B1	C19	D3
	A5	B2	C21	D8
			C30	D9

Contents

Topic

Real-time systems.	Introduction. RTS design. Intelligent Systems in RT.
Determinism and reliability.	Determinism. Reliability. Fault tolerance. Exception handling.
Parallelism.	Concurrence. Synchronous and asynchronous hypothesis. Real time. Planning. Distribution.
Planning.	Strategies. Verification of behavior. Architectures.
Implementation languages.	General purpose languages. Agent-based languages. Simulation.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	12	12	24
Laboratory practical	8	24	32
Case studies	1	2	3
Project based learning	0	16	16

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Presentation by the teacher of the main contents of the subject. CONTINUOUS ASSESSMENT Mandatory character Attendance: Mandatory OVERALL ASSESSMENT Mandatory character
Laboratory practical	Presentation and supervision by the teacher of practical problems that complement the theoretical contents seen in the master classes and in the presentations. CONTINUOUS ASSESSMENT Mandatory character Attendance: Mandatory OVERALL ASSESSMENT Mandatory character

Case studies	Teacher will present to Students a work scenario, real or fictitious, that exposes a certain problem. Students must solve it and present the solution through a video of about 10' in length; the solution will be elaborated by applying the knowledge acquired along the course. CONTINUOUS ASSESSMENT Mandatory character Attendance: Mandatory OVERALL ASSESSMENT Mandatory character
Project based learning	The teacher will propose to the students a series of practical projects for their resolution using the contents seen both in theory and in the laboratory. The solution will be composed of an annotated code and a memory that adequately describes the solution provided. CONTINUOUS ASSESSMENT Mandatory character Attendance: Mandatory OVERALL ASSESSMENT Mandatory character

Personalized assistance

Methodologies	Description
Case studies	Teacher will advise the student on how to organize the contents chosen for exposure to the rest of the students. Teacher will use as support the telematic means available.
Project based learning	Teacher will advise the student on how to approach the design and organization of the solution proposed by the student to the assigned project. Teacher will use as support the telematic means available.

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	At the end of each topic, problems/exercises will be proposed that will be used for an evaluation through continuous monitoring of the subject. It allows the evaluation of RA1, RA3, RA4, RA5 and RA6 To release this assessment test, the student must get 5 points or more in their final grade. In the case of opting for the global evaluation, on the date of the exam the students will be able to answer the exercises that are presented.	40	A1	B1	C19 C20 C21 C22 C30	
Case studies	Presentation of a video with its own solution to a proposed case study. It allows the evaluation of RA1, RA3, RA4, RA5, RA6 and RA7 This methodological test is compulsory, both in continuous and global evaluation. To release this part of the evaluation, the student must get 5 points or more in their grade. Late deliveries and those that are delivered in a different format than the order will be rated 0.	20	A4 A5	B1	C19 C20 C21 C22 C30	D8 D9

Project based learning	The solution (code + explanatory memory) to a practical project proposed and assigned will be evaluated. It allows the evaluation of RA2, RA4, RA6, and RA7	40	A1 A2 A4 A5	B2 B5	C19 C20 C21 C22 C30	D3 D7 D8 D9
	This test will be evaluated with the applications provided to be carried out in groups of 2 people.					
	This methodological test is compulsory, both in continuous and global evaluation.					
	The delivery must be made on the dates and in the manner indicated. Late deliveries and those that are delivered in a different format than asked will be rated with 0.					
	The delivery could require a defense by the members of the group on the date and in the manner indicated.					
	To release this assessment test, the student must get 5 points or more in their final grade					

Other comments on the Evaluation

CONTINUOUS ASSESSMENT SYSTEM

TEST 1: Resolution of problems and/or exercises

Description: Resolution of exercises and/or problems proposed at the end of each topic to evaluate the comprehension of the unit and carry out continuous monitoring of the subject. These exercises will be carried out and delivered offline.

Methodology(s) applied(s): Lecturing.

Qualification: 40%

Minimum: For the release of this part of the subject, the student must obtain a grade equal to or greater than 5 points (out of 10) in the final grade of the test, which will be calculated cumulatively by adding the points achieved in each installment.

TEST 2: Elaboration of Memory and Video

Description: Preparation of a video and a brief report that presents/defends the student's solution to the assigned case study. The work will be developed in pairs and delivered offline on the date to be determined.

Methodology(s) applied: Case studies

Qualification: 20%

Minimum: For the release of this part of the subject, the student must obtain a score equal to or greater than 5 points (out of 10) in the evaluation of both the memory and the video. Late deliveries and those that do not meet the parameters set for delivery will be scored with 0 points.

TEST 3: Development of a practice and a practice report

Description: After the second week, a "Project" will be proposed to be developed and solved in pairs. The solution will evolve over the weeks with the support of laboratory classes in which doubts will be solved and the feasibility of the proposed solution will be continuously verified.

Methodology(s) applied: Project Based Learning

Qualification: 40%

Minimum: For the release of this part of the subject, the student must obtain a grade equal to or greater than 5 points (out of 10) in the evaluation, both in the code and in the report. Once the delivery has been made, a defense of the work carried out may be required in order to verify its authorship.

- The final grade for the subject is calculated using the weighted average of the previous tests. In order to take said

average, the student must achieve at least a 4 in each of the tests.

- If, at the end of the course, a student presents a grade of less than 4, in two or more of the previous tests, his/her grade will be determined by the minimum value between the average of the grades and 4.
- All the deliveries of the previous tests that are not carried out on time and in the requested form will be graded with a 0.

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GLOBAL EVALUATION SYSTEM

Procedure for choosing the global assessment modality: Since the default assessment system is CONTINUOUS ASSESSMENT, it is considered that all enrolled students opt for said system. In case of wanting to be evaluated through the GLOBAL EVALUATION system, "Once the period of one month from the beginning of the semester has passed, a period of 5 working days will be enabled for the students enrolled in the subject to formally state their intention to benefit from the GLOBAL EVALUATION system"

TEST 1: Theory Exam

Description: Objective test that will include the evaluation of the theoretical concepts seen throughout the course and resolution of exercises/problems proposed in the Continuous Assessment System.

Applied Methodology(s): Lecture

Qualification: 40%

Minimum: For the release of this part of the subject, the student must obtain a grade equal to or greater than 5 points (out of 10).

TEST 2: Elaboration of Memory and Video

Description: Preparation of a video and a brief memory that presents/defends the student's solution to a determined case study. The work will be delivered on the date determined prior to the final exam.

Methodology(s) applied: Case study

Qualification: 20%

Minimum: For the release of this part of the subject, the student must obtain a score equal to or greater than 5 points (out of 10) in the evaluation of both the memory and the video. A late delivery or one that does not conform to the parameters set for the delivery will be qualified with 0 points.

TEST 2: Development of a practice and a practice report

Description: Delivery of a solution to a "Project" that will be proposed for students who use this system and that must be delivered on the date (prior to the exam date) and in a manner determined. The solution will consist of a code with the solution and a report that explains and defends the proposed solution.

Methodology(s) applied: Project Based Learning

Qualification: 40%

Minimum: For the release of this part of the subject, the student must obtain a grade equal to or greater than 5 points (out of 10) in the evaluation, both in the code and in the report. Once the delivery has been made, the defense of the work carried out may be required in order to verify its authorship on the examination date by answering several questions related to the assigned "Project".

- The final grade for the subject is calculated using the weighted average of the previous tests. In order to take said average, the student must achieve at least a 4 in each of the tests.
- If, at the end of the course, a student presents a grade of less than 4, in one or more of the previous tests, their grade will be determined by the minimum value between the average of the grades of said tests and four.

- All the deliveries of the previous tests that are not carried out on time and in the requested form will be graded with a 0.

EVALUATION CRITERIA FOR EXTRAORDINARY CALL AND FINAL DEGREE

The continuous and global evaluation systems described above will be used.

RECORD QUALIFICATION PROCESS

Regardless of the evaluation system and the call, if any part of the evaluation is not passed, but the overall score is greater than 4 (out of 10), the qualification in the minutes will be 4.

EVALUATION DATES

The dates of the tests corresponding to the continuous assessment system will be published in the calendar of activities, available on the ESEI website <https://esei.uvigo.es/docencia/horarios/> and on the master MIA teams platform.

The official exam dates of the different calls, officially approved by the Xunta de Centro of the ESEI, are published on the website <https://esei.uvigo.es/docencia/horarios/>, and on the master MIA website <https://mia.udc.es/wp-content/uploads/2026/05/MIA-26-27-exams.pdf>

USE OF MOBILE DEVICES

All students are reminded of the prohibition of the use of mobile devices in exercises and practices, in compliance with article 13.2.d) of the University Student Statute, regarding the duties of university students, which establishes the duty to "Refrain from using or cooperation in fraudulent procedures in the evaluation tests, in the works that are carried out or in official documents of the university."

USE OF ARTIFICIAL INTELLIGENCE

AI is prohibited in all assessments, both continuous and comprehensive. AI is recommended for monitoring teaching activities such as lectures and flipped learning, as support for understanding the associated theoretical content.

PLAGIARISM DETECTION

In the event of plagiarism or copying detected in any assessment (continuous or comprehensive), the final grade will be a **FAIL (0)**, and the matter will be reported to the Center's Administration for appropriate action.

CONSULTATION/REQUEST FOR TUTORIALS

The tutorials can be consulted through the personal page of the teaching staff, accessible through <https://esei.uvigo.es/docencia/profesorado/>

Sources of information

Basic Bibliography

Alan Burns, Andy Wellings, **Sistemas de tiempo real y lenguajes de programación**, 84-7829-058-3, 3ª, Addison-Wesley, 2003

Olivier Boissier, Rafael H. Bordini, Jomi Hubner, Alessandro Ricci, **Multi-Agent Oriented Programming: Programming Multi-Agent Systems Using JaCaMo**, 978-0-262-04457-8, MIT Press, 2020

Complementary Bibliography

Manuel I. Capel Tuñón, **Programación Concurrente y en tiempo real: Fundamentos y aplicaciones**, 978-84-17289-36-2, Garceta, 2022

Rafael H. Bordini, Jomi Fred Hübner, Michael Wooldridge, **Programming Multi-agent systems in Agent-Speak with Jason**, 978-0-470-02900-8, Wiley, 2007

Ammar Attoui, **Real-time and multi-agent systems**, 978-1-85233-252-5, Springer, 2000

Recommendations

Subjects that it is recommended to have taken before

Multiagent systems/O06M193V01202

IDENTIFYING DATA				
Internships				
Subject	Internships			
Code	O06M193V01214			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language				
Department				
Coordinator	Rodríguez Martínez, Francisco Javier			
Lecturers	Rodríguez Martínez, Francisco Javier			
E-mail	franjrm@uvigo.es			
Web				
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA				
Computational aspects of cognitive science				
Subject	Computational aspects of cognitive science			
Code	006M193V01301			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	2nd	1st
Teaching language				
Department				
Coordinator	Gómez Rodríguez, Alma María			
Lecturers	Gómez Rodríguez, Alma María			
E-mail	alma@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject		Training and Learning Results		
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA				
Text mining				
Subject	Text mining			
Code	006M193V01302			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Fernández González, Daniel			
Lecturers	Fernández González, Daniel Fernandez Lanza, Santiago			
E-mail	danifg@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The course introduces the student to the derivation of information and knowledge from the analysis of a collection of documents in natural language, which refers to almost all generated and stored data.			
	The student will be trained in content analysis on enriched document representation models to address specific applications in different domains.			
	Special attention will be paid to the extraction of relevant information, the determination of the contextual polarity (sentiment) of a content, and the automatic response to questions posed directly in natural language.			
	In short, the goal is to answer fundamental questions in the development of interfaces, decision support environments, and access to new knowledge.			

Training and Learning Results				
Code				
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context			
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.			
A5	CB10 - That students possess the learning skills that will enable them to continue studying in a manner that will be largely self-directed or autonomous.			
B1	Maintain and extend sound theoretical approaches to enable the introduction and exploitation of new and advanced technologies in the field of Artificial Intelligence.			
B3	Search and select useful information needed to solve complex problems, handling with fluency the bibliographic sources of the field.			
B4	Elaborate adequately and with certain originality written compositions or motivated arguments, write plans, work projects, scientific articles and formulate reasonable hypotheses in the field.			
C1	Understanding and mastering techniques for text processing in natural language			
C2	Understanding and mastery of the fundamentals and techniques of semantic processing of linked, structured, and unstructured documents, and of the representation of their content.			
C3	Understanding and knowledge of the techniques of representation and processing of knowledge through ontologies, graphs, and RDF, as well as the tools associated with them.			
D2	Master the oral and written expression and comprehension of a foreign language.			
D3	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida.			
D7	Develop the ability to work in interdisciplinary or transdisciplinary teams to offer proposals that contribute to sustainable environmental, economic, political and social development.			
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
New	A1	B1	C1	D2
	A2	B3	C2	D3
	A5	B4	C3	D7
				D8

Contents

Topic	
Introduction to text mining.	Concepts and definitions. Techniques and applications.
Information retrieval.	Concepts and definitions. Typical architectures, technical and tools. Current trends.
Question answering.	Concepts and definitions. Typical architectures, technical and tools. Current trends.
Information extraction.	Concepts and definitions. Typical architectures, technical and tools. Current trends.
Sentiment analysis.	Concepts and definitions. Typical architectures, technical and tools. Current trends.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	10	10	20
Laboratory practical	5	15	20
Mentored work	5	29	34
Objective questions exam	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Presentation of the theoretical content of the course. In order to facilitate the understanding of the same and to increase the interest of the student, various examples and exercises will be included, in which the active participation of the student may be required. Various examples and exercises in which the active participation of the student may be required. An active attitude is promoted by encouraging questions and proposing open-ended questions for the student's reflection.
Laboratory practical	Hands-on problems that involve the use of specific tools and the programming of software related to the course content. CONTINUOUS ASSESSMENT Character: mandatory Attendance: not mandatory GLOBAL ASSESSMENT Character: mandatory Attendance: not mandatory
Mentored work	One or more individual theoretical-practical works, deliverable and evaluable, on the theoretical aspects presented in the course and worked on in the practical activities developed by the students. This is an autonomous task that will have occasional guidance from the teacher. The result will be expressed in one or more reports with a structure to be determined. CONTINUOUS ASSESSMENT Character: mandatory Attendance: not mandatory GLOBAL ASSESSMENT Character: mandatory Attendance: not mandatory

Personalized assistance

Methodologies	Description
Laboratory practical	The teacher will guide the student in the laboratory for the realization of the projects that will be evaluated at the end of the course, answering doubts and questions individually.
Mentored work	Follow-up of students' work, solving general doubts and sharing specific theoretical/practical problems related to the course topics.

Assessment

Description	Qualification	Training and Learning Results
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Laboratory practical	Evaluation of the proposed hands-on exercises by submitting a written report and/or the developed code.	40	A2	B1	C1 C2 C3	D3 D8
	The submission of these exercises is mandatory.					
	They will have a delivery date and, optionally, a defense date.					
	- MINIMUM SCORE: 4 points out of 10 - LEARNING OUTCOMES: RA1					
Mentored work	Evaluation of the written report of the supervised research work (or works) of theoretical-practical nature assigned to each student.	35	A1 A5	B3 B4	C1 C2 C3	D2 D8
	The ability to synthesize, completeness and adequate presentation of ideas and concepts related to the chosen topic will be evaluated.					
	The submission of these papers is compulsory. They will have a due date and, optionally, a defense date					
	- MINIMUM SCORE: 4 points out of 10 - LEARNING OUTCOMES: RA1					
Objective questions exam	Written test that evaluates the content and competencies reviewed in the lectures and the theoretical aspects of their implementation in the practical sessions.	25	A1 A2	B1	C1 C2 C3	
	The type of test will consist of a series of multiple choice or short answer questions on specific concepts.					
	It will take place on the official date indicated in the academic calendar.					
	- MINIMUM SCORE: no minimum score required - LEARNING OUTCOMES: RA1					

Other comments on the Evaluation

(1) CONTINUOUS ASSEMENT SYSTEM

TEST 1: Practical hand-on exercises

Description: Evaluation of the written reports and the code of the laboratory hand-on exercises delivered on the

stipulated dates.

Applied methodology: Laboratory practical

% Qualification: 40%

Minimum %: grade equal to or greater than 4 points (out of 10)

Evaluated learning results: A2, B1, C1, C2, C3, D3, D8

Expected results: RA1

TEST 2: Tutored work/essay

Description: Evaluation of the written report of the supervised research work (or works) of theoretical-practical nature

assigned to each student.

Applied methodology: Mentored work

% Qualification: 35%

Minimum %: grade equal to or greater than 4 points (out of 10)

Evaluated learning results: A2, A5, B3, B4, C1, C2, C3, D2, D8

Expected results: RA1

TEST 3: Final exam

Description: Multiple-choice final test on the theoretical contents of the subject.

Applied methodology: Objective questions exam

% Qualification: 25%

Minimum %: no minimum score required

Evaluated learning results: : A1, A2, B1, C1, C2, C3

Expected results: RA1

ADDITIONAL CLARIFICATIONS

- To pass the subject it is necessary to reach the minimums indicated in the previous tests and to add in the final weighted grade a minimum of 5 points out of 10.
- In the case of finding unethical behavior (copying, plagiarism) in any of the deliveries made (total or partial), the total contribution of the corresponding evaluation element on the final grade will be annulled.

(2) GLOBAL ASSEMENT SYSTEM

Procedure for the choice of the global assessment modality:

- The continuous assessment modality is assumed by default.
- Students who opt for the global evaluation must communicate it via Moovi, using the mechanisms that are enabled and within the stipulated period, once the period of one month from the beginning of the term has passed.

TEST 1: Practical hand-on exercises

Description: Evaluation of the written reports and the code of the laboratory hand-on exercises delivered on the

stipulated dates.

Applied methodology: Laboratory practical

% Qualification: 40%

Minimum %: grade equal to or greater than 5 points (out of 10)

Evaluated learning results: A2, B1, C1, C2, C3, D3, D8

Expected results: RA1

TEST 2: Tutored work/essay

Description: Evaluation of the written report of the supervised research work (or works) of theoretical-practical nature

assigned to each student.

Applied methodology: Mentored work

% Qualification: 35%

Minimum %: grade equal to or greater than 5 points (out of 10)

Evaluated learning results: A2, A5, B3, B4, C1, C2, C3, D2, D8

Expected results: RA1

TEST 3: Final exam

Description: Multiple-choice final test on the theoretical contents of the subject.

Applied methodology: Objective questions exam

% Qualification: 25%

Minimum %: grade equal to or greater than 5 points (out of 10)

Evaluated learning results: : A1, A2, B1, C1, C2, C3

Expected results: RA1

ADDITIONAL CLARIFICATIONS

- To pass the subject it is necessary to reach the minimums indicated in the previous tests and to add in the final weighted grade a minimum of 5 points out of 10.
- In the case of finding unethical behavior (copying, plagiarism) in any of the deliveries made (total or partial), the total contribution of the corresponding evaluation element on the final grade will be annulled.

(3) ASSESSMENT CRITERIA FOR EXTRAORDINARY AND FINAL CALLS

- The continuous and global evaluation systems described above will be used.
- In these calls, students must only take the tests in which they have not obtained the minimum grade indicated.

(4) GRADING PROCESS

In the case of students who pass part of the evaluated elements, but do not reach the minimum required to pass the whole subject, the grade to be included in the respective minutes will be calculated as the minimum between the weighted average of the parts passed and 4.9.

(5) EVALUATION DATES

The official exam dates of the different calls, officially approved by the Xunta de Centro of the ESEI, are published on the ESEI website <https://esei.uvigo.es/docencia/horarios/>.

(6) USE OF MOBILE DEVICES

All students are reminded of the prohibition of the use of mobile devices in exercises and practices, in compliance with article 13.2.d) of the University Student Statute, regarding the duties of university students, which establishes the duty to "Refrain from using or cooperating in fraudulent procedures in the assessment activities, in the delivered assignments or in official documents of the university."

(7) USE OF ARTIFICIAL INTELLIGENCE

The use of AI is prohibited in all assessment activities, including both continuous assessment and final examinations.

The use of AI is prohibited in all teaching and learning activities.

(8) PLAGIARISM DETECTION

In the event that copying or plagiarism is detected in any assessment activity (continuous assessment or final examination), the final grade will be FAIL (0), and the incident will be reported to the School Administration for the appropriate actions to be taken.

(9) TUTORING SCHEDULE AND PERSONAL TUTORING REQUEST

The tutoring schedule, and the way to request a personal tutoring, is published in the personal page of the teaching staff, accessible through <https://esei.uvigo.es/docencia/profesorado/>.

Sources of information

Basic Bibliography

Apuntes y material proporcionado por el profesorado.,

Berry, M. W., & Kogan, J. (Eds.), **Text mining: applications and theory.**, 978-0-470-74982-1, 1, John Wiley & Sons., 2010

Complementary Bibliography

TaeHo Jo, **Text Mining: Concepts, Implementation, and Big Data Challenge (Studies in Big Data Book 45)**, 978-331991814, 1, Springer, 2019

Recommendations

Subjects that it is recommended to have taken before

Language modelling/O06M193V01204

Natural language understanding/O06M193V01104

Other comments

Course coordinated by the University of Vigo

IDENTIFYING DATA				
AI in big data environments				
Subject	AI in big data environments			
Code	O06M193V01303			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Fernandez Lanza, Santiago			
Lecturers	Fernández González, Daniel Fernandez Lanza, Santiago			
E-mail	sflanza@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description	The every time greater quantity of accessible information through Internet does that the efficient processing of big quantities of data was every time of greater interest. This has carried to the development of new technicians of storage and processing of *ingentes quantities of information, technicians that adapt of natural form to the systems distributed.			
	The main aim of this matter is to provide to the students the knowledges and necessary skills to comprise, develop and apply technicians of artificial intelligence (*IA) in surroundings of *Big Dates.			

Training and Learning Results

Code				
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context			
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.			
A3	CB8 - the complexity of making judgments based on information that, while incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.			
B2	Successfully address all stages of an Artificial Intelligence project.			
B3	Search and select useful information needed to solve complex problems, handling with fluency the bibliographic sources of the field.			
B4	Elaborate adequately and with certain originality written compositions or motivated arguments, write plans, work projects, scientific articles and formulate reasonable hypotheses in the field.			
B5	Work in teams, especially multidisciplinary teams, and be skilled in time management, people management and decision making.			
C10	Ability to build, validate and apply a stochastic model of a real system from observed data and the critical analysis of the results obtained			
C11	Understanding and mastery of the main data analysis techniques and tools, both from a statistical and machine learning point of view, including those dedicated to the processing of large volumes of data, and the ability to select the most appropriate ones for problem solving.			
C12	Ability to plan, formulate and resolve all stages of a data project, including understanding and mastery of basic fundamentals and techniques for searching and filtering information in large data collections.			
C15	Knowledge of computer tools in the field of machine learning, and ability to select the most appropriate for solving a problem.			
D3	Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida.			
D7	Develop the ability to work in interdisciplinary or transdisciplinary teams to offer proposals that contribute to sustainable environmental, economic, political and social development.			
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.			
D9	Have the ability to manage time and resources: develop plans, prioritize activities, identify critical ones, set deadlines and meet them.			

Expected results from this subject

Expected results from this subject		Training and Learning Results		
New	A2	B2	C10 C11 C12 C15	D3

New	A1	B3	C10	D3
	A2	B4	C11	D7
	A3	B5	C12	D8
			C15	D9
New	A1	B2	C10	D3
	A2	B3	C11	D7
	A3	B4	C12	D8
		B5	C15	D9
New	A1	B2	C12	D3
	A2		C15	D7
	A3			D9
New	A1	B3	C11	D3
	A2	B5	C15	D7
				D9
New	A1	B2	C11	D3
	A3	B3	C12	D7
		B5	C15	D8
				D9
New	A2	B2	C10	D3
	A3	B3	C11	D9
			C15	

Contents

Topic

(*)Introducción ao Big Data	(*)Que é Big Data Aplicacións Big Data Analítica Big Data Problemática da análise de datos en contornas Big Data
(*)Preparación e visualización de datos	(*)Técnicas de preprocesado de datos Técnicas de visualización
(*)Aprendizaxe federada	(*)Aprendizaxe no borde Preservación da privacidade
(*)Infraestructuras para o almacenamento e procesamento de Big Data	(*)Paralelismo e sistemas distribuídos Computación de Altas Prestacións e Computación Big Data Apache Hadoop e MapReduce
(*)Procesamento de datos a gran escala: Apache Spark	(*)Procesamento en lote e procesamento continuo Arquitectura Spark Core (RDDs) e Spark SQL, DataSets & DataFrames Spark DataFrames
(*)Aprendizaxe automática con Apache Spark	(*)O fluxo de traballo en aprendizaxe automática Aprendizaxe automática supervisada e non supervisada Axuste de hiperparámetros, avaliación e pipelines

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	14	44	58
Mentored work	9	20	29
Lecturing	20	21	41
Objective questions exam	2	20	22

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Laboratory practical	(*)Clases prácticas en el aula de informática, que permiten al alumno familiarizarse desde un punto de vista práctico con las cuestiones expuestas en las clases teóricas.
Mentored work	(*)Aprendizaje basado en problemas, seminarios, estudio de casos o proyectos, que permiten que el alumnado adquiera determinadas competencias en base a la resolución de ejercicios, estudio de casos y realización de proyectos.
Lecturing	(*)Clases de teoría, en las que se expone el contenido de cada tema. El alumno dispondrá de copias de las transparencias con anterioridad y el profesor promoverá una actitud activa, realizando preguntas que permitan aclarar aspectos concretos y dejando cuestiones abiertas para la reflexión del alumno.

Personalized assistance

Methodologies	Description
Laboratory practical	
Mentored work	

Assessment						
	Description	Qualification	Training and Learning Results			
Laboratory practical	(*)Avaliación de traballos prácticos: 50% dá nota Avaliaranse as solucións propostas polo alumnado ás prácticas expostas. A avaliación de prácticas pode levar a cabo mediante unha corrección por parte do profesor, unha defensa da solución achegada por parte do alumno ante o profesor ou unha presentación oral da solución desenvolvida. Todos os traballos deberán ser entregados antes das datas que se especificarán e deberán cumprir uns requisitos mínimos de calidade para ser tidos en consideración. Valorarase o grao de cumprimento das especificacións, a metodoloxía e rigorosidade e a presentación de resultados	50	A1	B2	C10	D3
			A2	B3	C11	D7
			A3	B4	C12	D8
				B5	C15	D9
Objective questions exam	(*)Preguntas sobre os contidos da asignatura (que poden ser de tipo test ou problemas para resolver), baseada nas distintas técnicas avanzadas de aprendizaxe automática e as súas aplicacións.	50	A1	B2	C10	D8
			A2		C11	D9
			A3		C12	
					C15	

Other comments on the Evaluation

Sources of information

Basic Bibliography

Apuntes y material proporcionado por el profesorado.,

Tom White, **Hadoop: The Definitive Guide, 4th Edition**, 4, O'Reilly Media, Inc., 2015

Bill Chambers, Matei Zaharia, **Spark: The Definitive Guide**, 1, O'Reilly Media, Inc., 2018

Complementary Bibliography

Rezaul Karim, Sridhar Alla, **Scala and Spark for Big Data Analytics**, 1, Packt Publishing, 2017

Nick Pentreath, **Machine Learning with Spark**, 1, Packt Publishing, 2015

Michael Bowles, **Machine Learning with Spark and Python: Essential Techniques for Predictive Analytics**, 2, Wiley, 2019

Recommendations

Subjects that it is recommended to have taken before

Deep learning/O06M193V01206

Data engineering/O06M193V01102

Machine learning I/O06M193V01105

Machine learning II/O06M193V01207

IDENTIFYING DATA				
AI in health				
Subject	AI in health			
Code	O06M193V01304			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	2nd	1st
Teaching language				
Department				
Coordinator	Garcia Lourenço, Anália Maria			
Lecturers	Garcia Lourenço, Anália Maria			
E-mail	analía@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA				
Intelligent IoT				
Subject	Intelligent IoT			
Code	O06M193V01305			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	2nd	1st
Teaching language	Spanish English			
Department				
Coordinator	Díaz-Cacho Medina, Miguel Ramón			
Lecturers	Díaz-Cacho Medina, Miguel Ramón			
E-mail	mcacho@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description	(*)Materia coordinada por la UDC. Ver web de la UDC.			

Training and Learning Results

Code

Expected results from this subject

Expected results from this subject Training and Learning Results

Contents

Topic

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	10	20	30
Lecturing	10	20	30
Objective questions exam	2	13	15

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Laboratory practical	
Lecturing	

Personalized assistance

Methodologies	Description
Laboratory practical	
Lecturing	

Assessment

	Description	Qualification	Training and Learning Results
Laboratory practical		0	
Objective questions exam		0	

Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Intelligent cybersecurity				
Subject	Intelligent cybersecurity			
Code	006M193V01306			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Ribadas Pena, Francisco José			
Lecturers	Fernández Gavilanes, Milagros Ribadas Pena, Francisco José			
E-mail	ribadas@uvigo.es			
Web	http://http://moovi.uvigo.gal			
General description	The course introduces the student to the development of strategies based on artificial intelligence for the defense of computer systems and networks against malicious attacks that seek to control them or to gain access to the information residing or circulating in them. Students will be trained in the prevention, detection, analysis and elimination of threats in a continuously evolving context. Typical use cases of artificial intelligence in cybersecurity scenarios will be reviewed.			

Training and Learning Results

Code	
A1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
A2	CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
A4	CB9 - Students should be able to communicate their conclusions and the ultimate knowledge and rationale behind them to specialized and non-specialized audiences in a clear and unambiguous manner.
A5	CB10 - That students possess the learning skills that will enable them to continue studying in a manner that will be largely self-directed or autonomous.
B1	Maintain and extend sound theoretical approaches to enable the introduction and exploitation of new and advanced technologies in the field of Artificial Intelligence.
B2	Successfully address all stages of an Artificial Intelligence project.
B4	Elaborate adequately and with certain originality written compositions or motivated arguments, write plans, work projects, scientific articles and formulate reasonable hypotheses in the field.
B5	Work in teams, especially multidisciplinary teams, and be skilled in time management, people management and decision making.
C8	Ability to design and develop secure intelligent systems, in terms of integrity, confidentiality and robustness.
C19	Knowledge of different application areas of AI-based technologies and their capacity to offer a differentiating added value.
C20	Ability to combine and adapt different techniques, extrapolating knowledge between different fields of application.
C21	Knowledge of techniques that facilitate the organization and management of AI projects in real environments, resource management and task planning in an efficient way, taking into account concepts of knowledge dissemination and open science.
C22	Knowledge of techniques that facilitate the security of data, applications and communications and their implications in different AI application areas.
C30	Be able to pose, model and solve problems requiring the application of artificial intelligence methods, techniques and technologies.
D5	To understand the importance of the entrepreneurial culture and to know the means available to entrepreneurs.
D8	Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society.
D9	Have the ability to manage time and resources: develop plans, prioritize activities, identify critical ones, set deadlines and meet them.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
RA1: Know techniques and tools to implement AI-based solutions that allow automated detection of vulnerabilities, attacks, fraudulent content and applications.	A1 A2	B1 B2	C8 C19 C21 C22	D8 D9

RA2: Know, understand and analyze real cases of application of AI techniques in different areas of cybersecurity.	A2 A5	B2 B5	C8 C20 C22 C30	D5 D8
RA3: Learn techniques that facilitate security by design, enable the secure administration of communication systems and networks, allow for risk management, and enable rapid recovery from cybersecurity events.	A1 A2	B1 B4	C21 C22 C30	D5
RA4: Understand the importance of the concept of identity and to learn techniques to ensure data access and privacy.	A2 A4	B4 B5	C8 C20 C22	D8

Contents

Topic

Introduction to cybersecurity and related concepts.

Threat detection and attack prevention models.

Detection of fraudulent content and applications.

Data mining in event management systems.

Identity control, biometrics and behavioral patterns.

Anomaly detection and clustering for the detection of communication attacks.

IA risk management, critical risks and normal profiles, malicious uses, and contingency and recovery plans.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	10	10	20
Laboratory practical	5	15	20
Mentored work	5	29	34
Objective questions exam	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Presentation of the theoretical content of the course. In order to facilitate the understanding of the same and to increase the interest of the student, various examples and exercises will be included, in which the active participation of the student may be required. An active attitude is promoted by encouraging questions and proposing open-ended questions for the student's reflection.
Laboratory practical	Hands-on problems that involve the use of specific tools and the programming of software related to the course content. CONTINUOUS ASSESSMENT Character: mandatory Attendance: not mandatory GLOBAL ASSESSMENT Character: mandatory

Mentored work	One or more individual theoretical-practical works, deliverable and evaluable, on the theoretical aspects presented in the course and worked on in the practical activities developed by the students. This is an autonomous task that will have occasional guidance from the teacher. The result will be expressed in one or more reports with a structure to be determined. CONTINUOUS ASSESSMENT Character: mandatory Attendance: not mandatory GLOBAL ASSESSMENT Character: mandatory
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Personalized assistance

Methodologies	Description
Laboratory practical	The teacher will guide the student in the laboratory for the realization of the projects that will be evaluated at the end of the course, answering doubts and questions individually.
Mentored work	Follow-up of students' work, solving general doubts and sharing specific theoretical/practical problems related to the course topics.

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Evaluation of the proposed hands-on exercises by submitting a written report and/or the developed code. The submission of these exercises is mandatory. They will have a delivery date and, optionally, a defense date. - MINIMUM SCORE: 4 points out of 10 - LEARNING OUTCOMES: RA1, RA2, RA3, RA4	40	A1 A2 A5	B1 B2 B5	C8 C19 C20 C21 C22 C30	D5 D8 D9
Mentored work	Evaluation of the written report of the supervised research work (or works) of theoretical-practical nature assigned to each student. The ability to synthesize, completeness and adequate presentation of ideas and concepts related to the chosen topic will be evaluated. The submission of these papers is compulsory. They will have a due date and, optionally, a defense date - MINIMUM SCORE: 4 points out of 10 - LEARNING OUTCOMES: RA1, RA2, RA3, RA4	35	A1 A4	B4 B5	C19 C20 C22 C30	D8 D9
Objective questions exam	Written test that evaluates the content and competencies reviewed in the lectures and the theoretical aspects of their implementation in the practical sessions. The type of test will consist of a series of multiple choice or short answer questions on specific concepts. It will take place on the official date indicated in the academic calendar. - MINIMUM SCORE: no minimum score required - LEARNING OUTCOMES: RA1, RA2, RA3, RA4	25	A5	B1	C8 C19 C20 C21 C22 C30	

Other comments on the Evaluation

(1) CONTINUOUS ASSEMENT SYSTEM

TEST 1: Practical hand-on exercises

Description: Evaluation of the written reports and the code of the laboratory hand-on exercises delivered on the

stipulated dates.

Applied methodology: Laboratory practical

% Qualification: 40%

Minimum %: grade equal to or greater than 4 points (out of 10)

Evaluated learning results: A1,A2,A5,B1,B2,B5,C8,C19,C20,C21,C22,C30,D5,D8,D9

Expected results: RA1, RA2, RA3, RA4

TEST 2: Tutored work/essay

Description: Evaluation of the written report of the supervised research work (or works) of theoretical-practical nature

assigned to each student.

Applied methodology: Mentored work

% Qualification: 35%

Minimum %: grade equal to or greater than 4 points (out of 10)

Evaluated learning results: A1,A4,B4,B5,C19,C20,C22,C30,D8,D9

Expected results: RA1, RA2, RA3, RA4

TEST 3: Final exam

Description: Multiple-choice final test on the theoretical contents of the subject.

Applied methodology: Objective questions exam

% Qualification: 25%

Minimum %: no minimum score required

Evaluated learning results: : A5,B1,C8,C19,C20,C21,C22,C30

Expected results: RA1, RA2, RA3, RA4

ADDITIONAL CLARIFICATIONS

- To pass the subject it is necessary to reach the minimums indicated in the previous tests and to add in the final weighted grade a minimum of 5 points out of 10.
- In the case of finding unethical behavior (copying, plagiarism) in any of the deliveries made (total or partial), the total contribution of the corresponding evaluation element on the final grade will be annulled.

(2) GLOBAL ASSEMENT SYSTEM

Procedure for the choice of the global assessment modality:

- The continuous assessment modality is assumed by default.
- Students who opt for the global evaluation must communicate it via Moovi, using the mechanisms that are enabled and within the stipulated period, once the period of one month from the beginning of the term has passed.

TEST 1: Practical hand-on exercises

Description: Evaluation of the written reports and the code of the laboratory hand-on exercises delivered on the stipulated dates.

Applied methodology: Laboratory practical

% Qualification: 40%

Minimum %: grade equal to or greater than 5 points (out of 10)

Evaluated learning results: : A1,A2,A5,B1,B2,B5,C8,C19,C20,C21,C22,C30,D5,D8,D9

Expected results: RA1, RA2, RA3, RA4

TEST 2: Tutored work/essay

Description: Evaluation of the written report of the supervised research work (or works) of theoretical-practical nature

assigned to each student.

Applied methodology: Mentored work

% Qualification: 35%

Minimum %: grade equal to or greater than 5 points (out of 10)

Evaluated learning results: A1,A4,B4,B5,C19,C20,C22,C30,D8,D9

Expected results: RA1, RA2, RA3, RA4

TEST 3: Final exam

Description: Multiple-choice final test on the theoretical contents of the subject.

Applied methodology: Objective questions exam

% Qualification: 25%

Minimum %: grade equal to or greater than 5 points (out of 10)

Evaluated learning results: A5,B1,C8,C19,C20,C21,C22,C30

Expected results: RA1, RA2, RA3, RA4

ADDITIONAL CLARIFICATIONS

- To pass the subject it is necessary to reach the minimums indicated in the previous tests and to add in the final weighted grade a minimum of 5 points out of 10.
- In the case of finding unethical behavior (copying, plagiarism) in any of the deliveries made (total or partial), the total contribution of the corresponding evaluation element on the final grade will be annulled.

(3) ASSESSMENT CRITERIA FOR EXTRAORDINARY AND FINAL CALLS

- The continuous and global evaluation systems described above will be used.
- In these calls, students must only take the tests in which they have not obtained the minimum grade indicated.

(4) GRADING PROCESS

In the case of students who pass part of the evaluated elements, but do not reach the minimum required to pass the whole subject, the grade to be included in the respective minutes will be calculated as the minimum between the weighted average of the parts passed and 4.9.

(5) EVALUATION DATES

The official exam dates of the different calls, officially approved by the Xunta de Centro of the ESEI, are published on the ESEI website <https://esei.uvigo.es/docencia/horarios/>.

(6) USE OF MOBILE DEVICES

All students are reminded of the prohibition of the use of mobile devices in exercises and practices, in compliance with article 13.2.d) of the University Student Statute, regarding the duties of university students, which establishes the duty to "Refrain from using or cooperating in fraudulent procedures in the assessment activities, in the delivered assignments or in official documents of the university."

(7) TUTORING SCHEDULE AND PERSONAL TUTORING REQUEST

The tutoring schedule, and the way to request a personal tutoring, is published in the personal page of the teaching staff, accessible through <https://esei.uvigo.es/docencia/profesorado/>.

(8) USE OF ARTIFICIAL INTELLIGENCE

The use of AI is restricted in certain assessment activities, both continuous and final.

The use of AI is restricted in certain teaching and learning activities.

The assessment activities in which the use of AI is permitted will be duly communicated by the teaching staff. Furthermore, any person who uses AI in academic, scientific, creative, administrative, or research work must declare the tool used, the function performed, the extent of its intervention, and the portion of the work that constitutes human authorship.

(9) PLAGIARISM DETECTION

In the event that copying or plagiarism is detected in any assessment activity (continuous or final), the final grade will be FAIL (0), and the incident will be reported to the School/Faculty Administration for the appropriate actions.

Sources of information

Basic Bibliography

Bojan Kolosnjaji, Huang Xiao, Peng Xu, Apostolis Zarras, **Artificial Intelligence for Cybersecurity: Develop AI approaches to solve cybersecurity problems in your organization**, 978-1805124962, 1, Packt Publishing, 2024

William Stallings, **Effective Cybersecurity: A Guide to Using Best Practices and Standards**, 978-0134772806, 1, Addison-Wesley Professional, 2018

Clarence Chio, David Freeman., **Machine Learning and Security: Protecting Systems with Data and Algorithms, 1ra edición**, 978-1491979907, 1, O'Reilly, 2018

Chiheb Chebbi, **Mastering Machine Learning for Penetration Testing: Develop an extensive skill set to break self-learning systems using Python, 1ra edición**, 978-1788997409, 1, Packt Publishing, 2018

Complementary Bibliography

Alessandro Parisi, **Hands-On Artificial Intelligence for Cybersecurity: Implement smart AI systems for preventing cyber attacks and detecting threats and network anomalies**, 978-1789804027, 1, Packt Publishing, 2019

ENISA., **ENISA. Agencia de la Unión Europea para la Ciberseguridad**. <https://www.enisa.europa.eu/>, online, CCN-CERT (Centro Criptológico Nacional), **Guías e Informes del CCN**. <https://www.ccn-cert.cni.es/es/informes.html>, online,

William Stallings, **Effective Cybersecurity: A Guide to Using Best Practices and Standards**, 1, Addison-Wesley Professional, 2018

Recommendations

Subjects that it is recommended to have taken before

Deep learning/O06M193V01206

Knowledge and reasoning under uncertainty/O06M193V01203

Machine learning I/O06M193V01105

Machine learning II/O06M193V01207

Other comments

Course coordinated by the University of Vigo

IDENTIFYING DATA				
Emergent and entrepreneurial aspects in IA				
Subject	Emergent and entrepreneurial aspects in IA			
Code	006M193V01307			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Optional	2nd	1st
Teaching language				
Department				
Coordinator	Candal Ventureira, David			
Lecturers	Candal Ventureira, David			
E-mail	dcandal@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject		Training and Learning Results		
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				
Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				

IDENTIFYING DATA				
Master Thesis				
Subject	Master Thesis			
Code	006M193V01309			
Study programme	Máster universitario en Inteligencia artificial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	12	Mandatory	2nd	1st
Teaching language				
Department				
Coordinator	Gómez Rodríguez, Alma María			
Lecturers	Gómez Rodríguez, Alma María			
E-mail	alma@uvigo.es			
Web	http://https://mia.udc.es/syllabus/			
General description				
Training and Learning Results				
Code				
Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Contents				
Topic				
Planning				
	Class hours	Hours outside the classroom	Total hours	
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Methodologies				
	Description			
Personalized assistance				
Assessment				
Description	Qualification	Training and Learning Results		
Other comments on the Evaluation				
Sources of information				
Basic Bibliography				
Complementary Bibliography				
Recommendations				