IDENTIFYING DATA

Machine learning I

Subject	Machine learning I
Code	O06M193V01105
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
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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 B3 B4 C12 D4 D7 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	
Supervised learning	Introduction to learning
	Artificial Neural Networks
	Support Vector Machines
	Decision trees
	Regression
	Instance-based learning
Ensemble modeling	Ensemble modeling

Preprocessing, evaluation and regularization	Preprocessing and feature extraction techniques.
	Model creation and evaluation.
	Complexity & Regularization.
Unsupervised learning	Unsupervised learning: clustering
	Unsupervised neural networks
Reinforcement learning	Markov decision processes
	Reinforcement learning

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	21	42	63
Laboratory practical	13	24	37
Project based learning	9	19	28
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
Lecturing	Theoretical teaching of the subject matter of the course
Laboratory practical	Solve practical problems by using the different techniques that will be explained in the theory classes.
Project based learning	Writing, under the supervision of the teacher, of reports explaining the resolution of the problems carried out in the laboratory practices and the results obtained.

Personalized assistance

Methodologies	Description
Laboratory practical	Practical work carried out with the advice of the teacher.
Project based learning	Writing of the explanatory report under the teacher's supervision.

Assessment

	Description	Qualification	Training and Learning Results		
Laboratory practical	Resolution of real world problems using the methodology, for which several techniques explained in theory will be used, and the student will be stimulated to generate new ideas for the resolution of these problems.	20	A1 A2	B2 B3 B5	C12 C15	D3 D7
Project based learning	Writing of the report on the resolution of the real problems carried out in the laboratory practices. The writing of the report will include a bibliographic review of the most important works related, written in English for the most part, documentation on the problem to be solved, methodology used, and comparison of the results found in the application of the different techniques, as well as a critical evaluation of both the results obtained and the information used.	30	A3 A4	B2 B3 B4 B5		D4 D8 D9
Objective questions exam	Test questions about the contents of the course, based on the different machine learning techniques and their applications.	50	A2	B3	C10 C11	D4 D8 D9

Other comments on the Evaluation

EVALUATION CRITERIA FOR ALL STUDENTS IN ALL OPPORTUNITIES

Students must achieve at least 40% of the maximum mark for each part (theory, practice) and in any case the sum of both parts must exceed 5 to pass the subject. If any of the above requirements is not met, the grade of the call will be established according to the lowest grade obtained.

In the second opportunity, the evaluation will be carried out with the same criteria, and a new term will be opened for the delivery of the practical works.

The deliveries of the practices must be made within the period established in the virtual campus and must follow the specifications indicated in the statement both for their presentation and their defense.

Students will have the condition of "Presented" if you attend the theoretical test in the official evaluation period.

In the case of fraudulent completion of exercises or tests, the Regulations for evaluating the academic performance of students and reviewing qualifications will be applied. In application of the corresponding regulations on plagiarism, the total or partial copy of any practice or theory exercise will suppose the suspense in the activity in which plagiarism has been detected, with a grade of 0.

EXAM DATES

The official exam dates for the different opportunities, will be published on the ESEI

website: https://esei.uvigo.es/docencia/exames/

CONSULTATION/REQUEST OF TUTORING SESSIONS

Tutoring sessions schedules can be consulted through the faculty's personal page, available at

https://esei.uvigo.es/docencia/profesorado/

Sources of information

Basic Bibliography

D. Borrajo, J. González, P. Isasi, **Aprendizaje automático**, 978-8496094734, 1, Sanz y Torres, 2006

T.M. Mitchell, **Machine Learning**, 978-0070428077, 1, McGraw-Hill, 1997

B. Sierra, **Aprendizaje automático: conceptos básicos y avanzados. Aspectos prácticos utilizando el software WEKA**, 978-84-8322-318-5, 1, Pearson Education, 2006

S. Dzeroski, N. Lavrac, **Relational Data Mining**, 978-3540422891, 1, Springer, 2001

D. Aha, **Lazy Learning**, 978-9048148608, 1, Kluwer Academics Publishers, 1997/2013

R. Sutton, A. Barto, **Reinforcement Learning. An Introduction**, 978-0262039246, 2, MIT Press, 2018

A. Webb, **Statistical Pattern Recognition**, 978-0470682289, 3, Wiley, 2011

E. Alpaydin, **Introduction to Machine Learning**, 978-0262358064, 4, MIT Press, 2020

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Machine learning II/O06M193V01207

Deep learning/O06M193V01206

Evolutionary computation/O06M193V01208

Other comments

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