Teaching Guide				
Identifying Data				2023/24
Subject (*)	Machine Learning I		Code	614544012
Study programme	Máster Universitario en Intelixencia Artificial			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Obligatory	6
Language	English			
Teaching method	Face-to-face			
Prerequisites				
Department	Ciencias da Computación e Tecnoloxías da Información			
Coordinador	Rivero Cebrián, Daniel	E-mail	daniel.rivero@udc.es	
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Web				
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.			

Study programme competences	
Code	Study programme competences
A11	CE10 - Ability to implement, validate and apply a stochastic model starting from the observed data on a real system, and to perform a critical analysis of the obtained results, selecting those ones most suitable for problem solving
A12	CE11 - Understanding and command of the main techniques and tools for data analysis, both from the statistical and the machine learning viewpoints, including those devised for large volumes of data, and ability to select those ones most suitable for problem solving
A13	CE12 - Ability to outline, formulate and solve all the stages of a data project, including the understanding and command of basic concepts and techniques for information search and filtering in big collections of data
A16	CE15 - Knowledge of computer tools in the field of machine learning and ability to select those ones most suitable for problem solving
B2	CG02 - Successfully addressing each and every stage of an AI project
B3	CG03 - Searching and selecting that useful information required to solve complex problems, with a confident handling of bibliographical sources in the field
B4	CG04 - Suitably elaborating written essays or motivated arguments, including some point of originality, writing plans, work projects, scientific papers and formulating reasonable hypotheses in the field
B5	CG05 - Working in teams, especially of multidisciplinary nature, and being skilled in the management of time, people and decision making
B6	CB01 - Acquiring and understanding knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, frequently in a research context
B7	CB02 - The students will be able to apply the acquired knowledge and to use their capacity of solving problems in new or poorly explored environments inside wider (or multidisciplinary) contexts related to their field of study
B8	CB03 - The students will be able to integrate different pieces of knowledge, to face the complexity of formulating opinions (from information that may be incomplete or limited) and to include considerations about social and ethical responsibilities linked to the application of their knowledge and opinions
B9	CB04 - The students will be able to communicate their conclusions, their premises and their ultimate justifications, both to specialised and non-specialised audiences, using a clear style language, free from ambiguities
C3	CT03 - Use of the basic tools of Information and Communications Technology (ICT) required for the student's professional practice and learning along her life
C4	CT04 - Acquiring a personal development for practicing a citizenship under observation of the democratic culture, the human rights and the gender perspective
C7	CT07 - Developing the ability to work in interdisciplinary or cross-disciplinary teams to provide proposal that contribute to a sustainable environmental, economic, political and social development
C8	CT08 - Appreciating the importance of research, innovation and technological development in the socioeconomic and cultural progress of society

C9	CT09 - Being able to manage time and resources: outlining plans, prioritising activities, identifying criticisms, fixing deadlines and sticking to them

Learning outcomes			
Learning outcomes	Study programme competences		
Ability to identify if a problem can be solved using a machine learning technique.	AC12	BC2 BC3 BC4 BC8	CC4 CC7 CC8 CC9
Obtain the ability to choose the most appropriate learning technique for a problem depending on the nature of the data.	AC11 AC15	BC2 BC6 BC7 BC9	CC3 CC8
Ability to design and develop a learning model in a real programming environment.	AC10 AC15	BC5 BC6 BC7 BC8 BC9	CC3 CC7 CC9
Master the different learning models and be able to apply them to real-world problems.	AC11 AC15	BC2 BC3 BC7	CC3 CC8
Know and understand the difference between classification and regression problems.	AC10 AC11	BC3 BC6 BC8	
Understand how to compare the results of the different types of machine learning.	AC10 AC12 AC15	BC7 BC9	CC4 CC8 CC9

Contents	
Topic	Sub-topic
Supervised learning	Introduction to learning Artificial Neural Networks Support Vector Machines Decision trees Regression Instance-based learning
Ensemble modeling	Basic and advanced ensemble modelling
Preprocessing, evaluation and regularization	Data preprocessing. Model creation and evaluation. Complexity and Regularization.
Unsupervised learning	Unsupervised learning: clustering Unsupervised neural networks
Reinforcement learning	Markov decision processes Reinforcement learning

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A11 A12 C4 C8 C9	21	42	63

Laboratory practice	A13 A16 B2 B3 B5 B6 B7 C3 C7	12	24	36
Supervised projects	B2 B3 B4 B5 B8 B9 C4 C8 C9	7	19	26
Objective test	A11 A12 B3 B8 C4 C8 C9	2	20	22
Personalized attention		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	
Methodologies	**Description**
Guest lecture / keynote speech	Theoretical teaching of the subject matter of the course
Laboratory practice	Solve practical problems by using the different techniques that will be explained in the theory classes.
Supervised projects	Writing, under the supervision of the teacher, of the reports explaining the resolution of the problems carried out in the laboratory practices and the results obtained.
Objective test	This is a written assessment test in which the student must demonstrate the knowledge acquired from the subject.

Personalized attention	
Methodologies	**Description**
Laboratory practice Supervised projects	Practical work carried out with the advice of the teacher. Writing of the explanatory report under the teacher's supervision.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Laboratory practice	A13 A16 B2 B3 B5 B6 B7 C3 C7	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
Objective test	A11 A12 B3 B8 C4 C8 C9	Test questions about the contents of the course, based on the different machine learning techniques and their applications.	50
Supervised projects	B2 B3 B4 B5 B8 B9 C4 C8 C9	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

Assessment comments
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.

Sources of information	
Basic	- D. Borrajo, J. González, P. Isasi (2006). Aprendizaje automático. Sanz y Torres - T.M. Mitchell (1997). Machine Learning. McGraw Hill - Basilio Sierra Araujo (2006). Aprendizaje automático: conceptos básicos y avanzados. Aspectos prácticos utilizando el software WEKA. Pearson Education - Saso Dzeroski, Nada Lavrac (). Relational Data Mining. Springer - David Aha (). Lazy Learning. Kluwer Academics Publishers - Richard Sutton, Andrew Barto (). Reinforcement Learning. An Introduction. MIT Press - Andrew Webb (2002). Statistical Pattern Recognition. Wiley - Ethem Alpaydin (2004). Introduction to Machine Learning. MIT Press
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Deep Learning /614544013 Machine Learning II /614544014 Evolutionary Computation /614544015
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.