Teaching Guide				
Identifying Data				2023/24
Subject (*)	Fundamentals of Machine Learning		Code	614G03018
Study programme	Grao en Intelixencia Artificial			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Second	Obligatory	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Ciencias da Computación e Tecnoloxías da Información			
Coordinador	Rivero Cebrián, Daniel	E-mail	daniel.rivero@udc.es	
Lecturers	Fernández Blanco, Enrique Rivero Cebrián, Daniel Rodríguez Tajes, Álvaro	E-mail	enrique.fernandez@udc.es daniel.rivero@udc.es a.tajes@udc.es	
Web				
General description	This course presents an overview of machine learning. The syllabus explains the different techniques and methods. In the practical part, real cases will be solved.			

Study programme competences	
Code	Study programme competences
A1	Capacidad para utilizar los conceptos y métodos matemáticos y estadísticos para modelizar y resolver problemas de inteligencia artificial.
A2	Capacidad para resolver problemas de inteligencia artificial que precisen algoritmos, aplicando correctamente metodologías de desarrollo software y diseño centrado en usuario/a.
A12	Conocer los fundamentos de los algoritmos de la inteligencia artificial y la optimización, entender su complejidad computacional y saber aplicarlos a la resolución de problemas.
A15	Conocer y saber aplicar y explicar correctamente las técnicas de validación de las soluciones de inteligencia artificial.
B3	Que el alumnado tenga la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética.
B5	Que el alumnado haya desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía.
B7	Capacidad para resolver problemas con iniciativa, toma de decisiones, autonomía y creatividad.
B9	Capacidad para seleccionar y justificar los métodos y técnicas adecuadas para resolver un problema concreto, o para desarrollar y proponer nuevos métodos basados en inteligencia artificial.
B10	Capacidad para concebir nuevos sistemas computacionales y/o evaluar el rendimiento de sistemas existentes, que integren modelos y técnicas de inteligencia artificial.
C3	Capacidad para crear nuevos modelos y soluciones de forma autónoma y creativa, adaptándose a nuevas situaciones. Iniciativa y espíritu emprendedor.

Learning outcomes			
Learning outcomes	Study programme competences		
Know, understand and know how to use the fundamentals of machine learning processes.	A1 A12	B5 B10	C3
Know the fundamentals of regression, classification and clustering models.	A2 A12	B3 B7 B9	

Know how to build advanced statistical models for data analysis.	A2 A12 A15	B7 B9	C3
Know how to base modeling and problem solving using machine learning techniques.	A1 A2 A12	B5 B7 B9	C3
Know how to build machine learning models for regression, classification and clustering.	A1 A2 A12 A15	B5 B7 B9 B10	C3

Contents	
Topic	**Sub-topic**
1. Introduction	1.1. Introduction to Machine Learning 1.2. Learning Paradigms 1.3. Inductive Learning 1.4. No free Lunch Theorems
2. Supervised learning	2.1. Introduction 2.2. Artificial Neural Networks 2.3. Support Vector Machines 2.4. Decision trees 2.5. Regression trees and regression model trees 2.6. Instance-based learning
4. Methodologies in data analysis	4.1. Training, evaluation and model selection methodologies 4.2. Methodologies of a data analysis project
3. Evolutionary Computation	3.1. Genetic Algorithms 3.2. Genetic Programming 3.3. Swarms and other Evolutionary Computation techniques
5. Clustering	5.1. Clustering methods

Planning				
Methodologies / tests	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
Guest lecture / keynote speech	A12 A15 B5 B9 B10 C3	30	38	68
Laboratory practice	A1 A2 B3 B7 C3	15	24	39
Supervised projects	A1 A2 A15 B3 B7 B10	15	24	39
Objective test	A1 A12 B5 B7 B10	2	0	2
Personalized attention		2	0	2
(*)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. Office hours: Office hours will be used to solve students' doubts related to the contents of the subject. These office hours can be both face-to-face and virtual (via email, virtual campus or Microsoft Teams platform). Virtual Classroom: This subject will have a virtual classroom where students will be provided with all the necessary material in digital format. Different communication tools will also be provided to support both teaching and office hours, including videoconferencing, chat, e-mail, forums...

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Laboratory practice	A1 A2 B3 B7 C3	Development of a Machine Learning system based on explanations made in theory.	25
Supervised projects	A1 A2 A15 B3 B7 B10	Writing of the report on the resolution of the real problem 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.	25
Objective test	A1 A12 B5 B7 B10	Test questions about the contents of the course, based on the different machine learning techniques and their applications.	50

Assessment comments
In order to pass the subject, the student must obtain a minimumscore of 5 out of 10 in the result of combining the grades of the objectivetest, the laboratory practices and the supervised works. In addition, thestudent must obtain a minimum score of 2 out of 5 points in the objective test.If the student does not obtain this minimum grade, the grade of the subjectwill be that corresponding to the grade of the objective test. In the second opportunity, the grade obtained in the laboratory practices and supervised works will be maintained, not being able to obtain again a grade since it results from the continuous evaluation of the workduring the credits of practice of the subject. The student can retake the examination of the objective test, the criteria for obtaining the total scorebeing those indicated at the beginning of this section. Part-time students must deliver in their reports on the same dates as full-time students, and attend the RGTs in which they will be corrected. Similarly, it is recommended that they attend the practice classes. No-show qualification: The student will receive the qualification of "no-show" when he/she does not take the final exam. Fraudulent performance of exercises or tests: The fraudulent execution of tests or assessment activities, once proven, will result in a direct failing grade in the examination in which it was committed. The student will be given a grade of "suspenso" (numeric grade 0) in the corresponding academic year's examination, whether the offense occurs in the first opportunity or the second. In order to do so, the student's grade will be modified in the first opportunity's record, if necessary.

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 - Andrew Webb (2002). Statistical Pattern Recognition. Wiley - Ethem Alpaydin (2004). Introduction to Machine Learning. MIT Press - Marcos Gestal, Daniel Rivero, Juan Ramón Rabuñal, Julián Dorado, Alejandro Pazos (2010). Introducción a los Algoritmos Genéticos y a la Programación Genética. Servicio de Publicaciones de la Universidade da Coruña
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Programming I/614G03006 Programming II/614G03007 Discrete Mathematics/614G03003 Algebra/614G03001 Calculus and Numerical Analysis/614G03002 Statistics/614G03004 Algorithms/614G03008 Basic Algorithms of Artificial Intelligence/614G03019 Knowledge Representation and Reasoning/614G03020
Subjects that are recommended to be taken simultaneously
Mathematical Optimisation/614G03005
Subjects that continue the syllabus
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.