UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2016/17
Subject (*)	Técnicas de Análise e Modelado de Datos para a Eficiencia		Code	770523021
Study programme	Mestrado Universitario en Eficiencia e Aproveitamento Enerxético			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optativa	3
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	ComputaciónMatemáticas			
Coordinador	Fontenla Romero, Oscar	E-mail	oscar.fontenla@udc.es	
Lecturers	Fontenla Romero, Oscar Tarrio Saavedra, Javier	E-mail	oscar.fontenla@udc.es javier.tarrio@udc.es	
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General description	The main objective of this course is that students learn the fundamental concepts and the main models of data mining, both from a standpoint of machine learning and statistical, and their application in the field of energy efficiency.			

Study programme competences / results	
Code	Study programme competences / results
A11	Capacidad para aplicar métodos de análisis de datos para la creación de sistemas energéticos eficientes.
B3	Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.
B6	Buscar y seleccionar alternativas considerando las mejores soluciones posibles.
B14	Aplicar conocimientos de ciencias y tecnologías avanzadas a la práctica profesional o investigadora de la eficiencia
C3	Aplicar una metodología que fomente el aprendizaje y el trabajo autónomo.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Demonstrate detailed understanding of the main methods of data mining.		BC3	
Recognize problems that are amenable to energy optimization by using data mining techniques.		BC6	
Propose solutions for improving energy efficiency in systems that have operating data provided by different data acquisition systems.	AJ11		CC3
Knowing tools for dimension reduction		BC14	
Application of classification and regression techniques to data obtained by monitoring critical variables on energy efficiency	AJ11	BC14	

Contents	
Topic	Sub-topic
1. Introduction to machine learning and data mining	1.1. Preliminary concepts 1.2. Exploratory data analysis 1.3. Types of problems: classification, regression, clustering, anomaly detection, etc. 1.4. Types of learning: supervised, unsupervised, reinforcement, etc.
2. Models for supervised and unsupervised classification	2.1. Preliminary concepts 2.2. Main models: k-nearest neighbors, SVMs, clustering, etc.
3. Regression/system identification models for estimation and prediction	3.1. Preliminary concepts 3.2. Main models

4. Data processing techniques	4.1. Data preparation and standardization 4.2. Dimension reduction
5. Experimental methodology and analysis of results	5.1. Metrics for evaluating the models and techniques for unbiased estimate of the error 5.2. Model selection and analysis of results
6. Statistical Quality Control	6.1. Control graphs 6.2. Process capacity analysis
7. Applications in Energy Efficiency	7.1. Examples in forecasting 7.2. Examples for anomaly detection

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	B3	9	18	27
Laboratory practice	A11 B14	12	10	22
Supervised projects	B6 C3	0	22	22
Objective test	B3	3	0	3
Personalized attention		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	
Methodologies	Description
Guest lecture / keynote speech	Classroom activity used to establish the fundamental concepts of matter. It consists of the oral presentation complemented by the use of audiovisual/multimedia media and performing some questions to students in order to transmit knowledge and facilitate learning.
Laboratory practice	Development of practices in the computer lab. This will consist of case studies and examples. Besides the students will solve exercises posed by teachers.
Supervised projects	Performing work related to any of the topics on the agenda of the subject. Students will deliver them in electronic format, including a memory and a presentation that will have to expose the teacher. These works require the assistance of at least one personal tutoring for each group.
Objective test	Evaluation test to be held at the end of course in the corresponding official announcements. It will consist of a written test that will be necessary to respond to different theoretical and practical issues.

Personalized attention	
Methodologies	Description
Supervised projects	The personalized attention will be needed to show the progress of the proposed work and to provide appropriate guidance and ensure quality. It will also be used for solving conceptual questions and monitoring the execution of the work. These tutorials be made in person at the teacher's office.

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Supervised projects	B6 C3	Autonomous individual or small group work. It will be necessary to deliver the materials (memory and presentation) in a timely manner as described in the statement. In addition, it will require oral presentation by all members of the working group, using for that presentation delivered. It is taken into account for the evaluation of this activity the memory, the presentation and also the answers to the teacher's questions during compulsory presentation. Omission of the presentation will be a grade of zero in this activity.	30

Objective test	B3	Final test of matter consisting of conducting individual examination. This test will have questions and related theoretical concepts studied in lectures, laboratory practices or content of such practices tutored projects.	60
Laboratory practice	A11 B14	It will consist of collecting all the exercises in the labs during the course. These exercises should be done in the time allotted to practical classes and will be delivered at the end of them. While performing these exercises, students can raise questions to the teacher or consult the materials it deems appropriate. Therefore, this activity will evaluate the daily work of the student in practical classes.	10

Assessment comments
In order to pass the course the student must meet the following requirements (score between 0 and 10 in all activities):-Achieving a grade greater or equal than 3.5 in the objective test conducted at the end of the semester.-Achieving a grade greater or equal than 5 adding of all the grades of the assessment tests. Noteson activities: -All activities will have a unique opportunity for delivery during the academic year, except the final objective test that will have two official exam opportunities.

Sources of information	
Basic	- T. Agami Reddy (2011). Applied Data Analysis and Modeling for Energy Engineers and Scientists. Springer - Basilio Sierra Araujo (2006). Aprendizaje Automático: conceptos básicos y avanzados. Pearson Prentice Hall - Douglas Montgomery (2005). Introduction to Statistical Quality Control. John Wiley & Sons
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
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.