

**COURSE DATA****DATA SUBJECT**

Code: 46573
Name: Exploratory data analysis
Cycle: Master's Degree
ECTS Credits: 4.5
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
2262 - Master's Degree in Data Science	Escola Tècnica Superior d'Enginyeria	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2262 - Master's Degree in Data Science	Exploratory data analysis	COMPULSORY

COORDINATION

MARTINEZ SOBER MARCELINO

GOMEZ SANCHIS JUAN

GARCIA COSTA DANIEL

SUMMARY

In this course, we describe the initial stages of a data analysis problem. The data scientist is faced with datasets coming from very diverse sources, formats, structures, codifications, etc. The proper acquisition, organization, removal of possible erroneous data (outliers), imputation of missing values (missing data imputation), data transformation, dimensionality reduction (feature selection of the most relevant variables in high-dimensional datasets and feature extraction), elimination of redundant data, etc., constitutes one of the most costly stages in a data analysis process. This stage is crucial for the proper treatment of the problem and for ensuring the reliability and robustness of the results obtained in later stages of analysis (model selection, classification, clustering, estimation, hypothesis testing, etc.). In this module, we will focus on the data preparation stages.

PREVIOUS KNOWLEDGE**RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE**

There are no specified enrollment restrictions with other subjects of the curriculum.



OTHER REQUIREMENTS

Introduction to Data Science

COMPETENCES / LEARNING OUTCOMES

2262 - Master's Degree in Data Science

Ability to access and manage information in different formats for subsequent analysis in order to obtain knowledge from data.

Be able to assess the need to complete their technical, scientific, language, computer, literary, ethical, social and human education, and to organise their own learning with a high degree of autonomy.

Capacidad de análisis y síntesis, en la elaboración de informes, en la exposición, comunicación y defensa de ideas.

Capacidad de organización y planificación de actividades de investigación, desarrollo y consultoría en el área de ciencia de datos.

Entender la utilidad de la ciencia de datos y sus elementos asociados, así como su aplicación en la resolución de problemas, eligiendo las técnicas más adecuadas a cada problema, aplicando de forma correcta las técnicas de evaluación y, finalmente, interpretando los modelos y resultados.

Extraer conocimiento de conjuntos de datos en diferentes formatos.

Ser capaces de acceder a herramientas de información (bibliográficas y de empleo) y utilizarlas apropiadamente.

Ser capaces de asumir la responsabilidad de su propio desarrollo profesional y de su especialización en uno o más campos de estudio, aplicando los conocimientos adquiridos en la identificación de salidas profesionales y yacimientos de empleo.

Students should demonstrate self-directed learning skills for continued academic growth.

DESCRIPTION OF CONTENTS

1. Introduction to exploratory data analysis

In this block, an introduction will be given presenting the main aspects of exploratory data analysis.

2. Obtaining and cleaning data



This block will present the different types of data (continuous, discrete), the import of data stored in the most common formats, data conversion, and the detection of anomalous data.

3. Exploratory data analysis I. Statistical data analysis

This block presents a first approach to the statistical and visual analysis of data. This task is a fundamental part of understanding the available data and detecting incorrect values (univariate and bivariate analysis, correlation, covariance, etc.).

4. Exploratory data analysis II. Anomaly detection

This block presents different types of anomalies found in numerical data, such as outliers and detection methods, as well as the problem of missing values, their types, and imputation methods.

5. Data transformations

This block presents data transformation methods. In this processing stage, the data are transformed or consolidated so that the resulting mining process may be more efficient and the patterns found may be easier to understand.

6. Introduction to dimensionality reduction

This block presents an introduction to dimensionality reduction techniques. In particular, the paradigms of feature selection and feature extraction will be presented. Specifically, simple filter-based feature selection methods and more complex wrapper methods will be presented. Similarly, the feature extraction paradigm will be presented, particularly principal component analysis (PCA).

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	25,00
Theoretical and practical classes	4,00
Laboratory	16,00
Total hours	45,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	7,50
Preparation of lessons	16,50
Preparation for assessment activities	6,00
Resolution of case studies	5,00



TEACHING METHODOLOGY

The course will combine the theoretical and the practical part, without separating sessions devoted to theory from those devoted to practice. The lessons will be taught in a computer equipped classroom.

In the theoretical part of the classes, the teacher will introduce the concepts and methods with examples and exercises to be solved by the students.

The practical sessions will be synchronized with the theory. In these sessions, the students will learn by solving problems, exercises and case studies, in order to acquire the skills of this course.

EVALUATION

The assessment criteria are the same in both examination sittings.

The assessment of the learning of the knowledge and competences acquired by students will be carried out continuously throughout the course and will consist of the following assessment blocks:

1. Assessment of practical activities through the preparation of assignments/reports and/or oral presentations: 60% of the final grade.
2. Objective test, consisting of one or more exams including both theoretical-practical questions and problems: 40% of the final grade.

REFERENCES

- K.Pearson (2018) Exploratory Data Analysis Using R. CRC.
- H. Wickham, G. Grolemund. (2016) R for data Science. O'Reilly Media Inc. <http://r4ds.had.co.nz/>
- Max Kuhn, Kjell Johnson (2021) Feature Engineering and Selection A Practical Approach for Predictive Models-CRC Press
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- R. Buttres y, L.R. Whitaker (2018). A data scientist's guide to acquiring, cleaning and managing data in R . Wiley. (disponible e-libro)
- W. Graham, (2017). The Essentials of Data Science: Knowledge Discovery Using R. Chapman and Hall/CRC. (disponible e-libro)
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- Max Kuhn, Julia Silge (2022), Tidy Modeling with R, O'Reilly Media, Inc. <https://www.tmwr.org/dimensionality.html>
- Alice Zheng, Amanda Casari (2018)- Feature Engineering for Machine Learning_ Principles and



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