# COURSE DATA

| Data Subject | |
|---|---|
| **Code** | 44656 |
| **Name** | Machine Learning (II) |
| **Cycle** | Master's degree |
| **ECTS Credits** | 6.0 |
| **Academic year** | 2022 - 2023 |

**Study (s)**

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 2221 - Master's Degree in Data Science | School of Engineering | 1 | Second term |

**Subject-matter**

| Degree | Subject-matter | Character |
|---|---|---|
| 2221 - Master's Degree in Data Science | 8 - Machine learning (II) | Obligatory |

**Coordination**

| Name | Department |
|---|---|
| GOMEZ CHOVA, LUIS | 242 - Electronic Engineering |
| SERRANO LOPEZ, ANTONIO JOSE | 242 - Electronic Engineering |

# SUMMARY

Knowledge and implementation of probabilistic graphical models. Association rules from data bases (basket analysis). Different approaches for the association of expert systems. Knowledge and implementation of clustering algorithms based on matrix decomposition. Deep learning. Most widely-used manifolds, acquiring experience to figure out when to use each one of them

# PREVIOUS KNOWLEDGE

**Relationship to other subjects of the same degree**

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

### Other requirements

## COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

### 2221 - Master's Degree in Data Science

- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- 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.
- Be able to defend criteria with rigor and arguments and to present them properly and accurately.
- Capacidad para trabajar en equipo para llegar a soluciones de problemas interdisciplinarios usando técnicas de análisis de datos.
- 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.
- Extraer conocimiento de conjuntos de datos en diferentes formatos.
- 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.
- Ability to solve classification, modelling, segmentation and prediction problems from a set of data.
- Modelar la dependencia entre una variable respuesta y varias variables explicativas, en conjuntos de datos complejos, mediante técnicas de aprendizaje máquina, interpretando los resultados obtenidos.

## LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

Knowledge and implementation of probabilistic graphical models based on data.
Producing association rules from databases (basket analysis).
Knowledge and implementation of clustering algorithms based on matrix decomposition.
Theoretical foundation of the most widely-used manifolds, getting experience for an optimal application of them.
Different approaches for the association of expert systems.
Bases of deep learning

## DESCRIPTION OF CONTENTS

### 1. Supervised Learning

Association rules; probabilistic graphical models; inference and classification; structural learning.

### 2. Unsupervised Learning

Clustering Espectral; Manifolds (Isomap, MDS, SNE, LLE, t-SNE)

### 3. Other Learning Schemes

Deep learning; active learning; on-line learning.

## WORKLOAD

| ACTIVITY | Hours | % To be attended |
|---|---|---|
| Theoretical and practical classes | 60,00 | 100 |
| Development of individual work | 20,00 | 0 |
| Study and independent work | 12,00 | 0 |
| Readings supplementary material | 3,00 | 0 |
| Preparation of evaluation activities | 12,00 | 0 |
| Preparing lectures | 20,00 | 0 |
| Preparation of practical classes and problem | 13,00 | 0 |
| Resolution of case studies | 10,00 | 0 |
| **TOTAL** | **150,00** | |

## TEACHING METHODOLOGY

*Theoretical activities*. Interactive lectures about the subject with the participation of the student in the resolution of specific issues. Conducting individual evaluation questionnaires.

*Practical activities.* Learning through problem solving exercises and case studies through which skills about different aspects of the subject are acquired.

*Work in laboratory and / or in computer room.* Learning by performing activities individually or in small groups and conducted in computer rooms.

## EVALUATION

The educational evaluation of knowledge and skills achieved by the students will be made continuously throughout the course, and will consist in the following blocks of evaluation:

1. Exercises and the class work submitted during the course and / or partial exams: 40% of the final grade.

2. Final exam: 60% of the final grade.

Grades earned in paragraph 1 shall be kept in the two examination sittings of the academic year in which they were made, since their evaluation is only possible in the teaching period.

## REFERENCES

### Basic

- Richard O. Duda (2016) Pattern Classification, Third Edition, John Wiley & Sons Inc.
- Trevor Hastie, Robert Tibshirani, Jerome Friedman (2011) The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition, Springer (Series in Statistics).
- Christopher Bishop (2010) Pattern Recognition and Machine Learning, First Edition, Springer (Information Science and Statistics).
- Ethem Alpaydin (2014) Introduction to Machine Learning, Third Edition, The Mit Press (Adaptive Computation and Machine Learning Series).

### Additional

- Sebastian Raschka (2015) Python Machine Learning, Packt Publishing.