COURSE DATA

DATA SUBJECT

Code: 46581
Name: Machine learning (III)
Cycle: Master's Degree
ECTS Credits: 3
Academic year: 2025-26

STUDY (S)

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

SUBJECT-MATTER

Degree	Subject-matter	Character
2262 - Master's Degree in Data Science	Machine learning (III)	COMPULSORY

COORDINATION

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SUMMARY

Machine Learning 3 is a compulsory subject within the curriculum of the official master's degree in Data Science at the Universitat de València. It is taken chronologically after Machine Learning 1 and 2 and takes advantage of the contents previously taught to introduce more advanced types of learning as well as the latest methodologies that allow to take advantage of data from new perspectives (anomaly analysis) or to analyze the behavior of machine learning models (explainable AI).

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 / 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.

Ability to solve classification, modelling, segmentation and prediction problems from a set of 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.

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.

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.

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.

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. Other learning schemes.

Other types of learnings:
- Multilabel, multitask and multimodal.
- Semi-supervised learning.
- Active learning.
- Incremental / on-line learning.

2. Anomaly detection

Detection of anomalies:
Anomalies in tabular data.
Anomalies in temporary series.
Anomalies in images and video.
Anomalies in graphs.

3. Explanable IA

Interpretable models: (generalized) linear models, decision trees / rules, naive Bayes, k-nn.
Model agnostic methods: partial dependence plots, permutation feature importance, global surrogates, local surrogates (LIME), Shapley values and SHAP.
Model specific methods: neural networks, attributions, adversarial samples, integrated gradients.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	8,00
Theoretical and practical classes	4,00
Laboratory	18,00
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	30,00
Preparation of lessons	0,00
Preparation for assessment activities	5,00
Resolution of case studies	0,00
Total hours	**45,00**

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 roo

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

REFERENCES

- Interpretable Machine Learning: A Guide for Making Black Box Models Explainable, Christoph Molnar, https://christophm.github.io/interpretable-ml-book, 2022.
- Explanatory Model Analysis, Przemyslaw Biecek and Tomasz Burzykowski, Chapman and Hall/CRC, New York, https://pbiecek.github.io/ema/. 2021.
- TKishan G. Mehrotra, Chilukuri K. Mohan, and HuaMing Huang. 2017. Anomaly Detection Principles and Algorithms (1st. ed.). Springer Publishing Company, Incorporated.
- Baltruaitis, Tadas et al. Multimodal Machine Learning: A Survey and Taxonomy. IEEE Transactions on Pattern Analysis and Machine Intelligence 41 (2017): 423-443. https://arxiv.org/abs/1705.09406
- Xiaojin Zhu, Andrew B. Goldberg, Ronald Brachman, and Thomas Dietterich. 2009. Introduction to Semi-Supervised Learning. Morgan and Claypool Publishers.
- Settles, Burr. Active Learning. : Morgan & Claypool Publishers, 2012.
- Aggarwal, C. C. (2013). Outlier Analysis. Springer. ISBN: 978-1-4614-6396-2
- Xu, P., Zhu, X., & Clifton, D.A. (2022). Multimodal Learning with Transformers: A Survey. IEEE

transactions on pattern analysis and machine intelligence, https://arxiv.org/abs/2206.06488

- Olivier Chapelle, Bernhard Schölkopf, and Alexander Zien. 2006. Semi-Supervised Learning (Adaptive Computation and Machine Learning). The MIT Press.