1. BASIC INFORMATION

Course	Machine Learning
Degree Program	Masters Degree in Big Data Analytics
School	Escuela de Arquitectura, Ingeniería y Diseño
Year	1
ECTS	6
Credit Type	Compulsory
Language	English
Delivery Mode	Face-to-face/On-line
Semester	2
Curso académico	2025-2026
Coordinating Professor	Pablo Carlos del Saz Orozco Huang

2. PRESENTATION

This compulsory 6 ECTS course introduces students to the concepts used when discussing artificial intelligence, its application in business, an introduction to the most commonly used programming languages in the field of artificial intelligence, and the main platforms for its implementation.
Throughout this module, students will be trained in the areas of Machine Learning and Deep Learning, acquiring knowledge in supervised and unsupervised learning, learning techniques, as well as metrics, models, model selection, and model tuning.

3. LEARNING OUTCOMES

Knowledge

- CON02. Explain how Big Data architectures and techniques are applied in the analysis of static and dynamic, structured and unstructured data

Skills

- HAB03. Evaluate supervised and unsupervised machine learning models to solve a problem.
- HAB06. Use effective data visualization techniques to facilitate understanding when presenting conclusions supported by data analysis to both specialist and non-specialist audiences.

Competencies

- CP04. Design and execute a complete knowledge discovery process, including data storage, processing and visualization phases.
- CP05. Apply data analysis techniques, supervised and unsupervised machine learning models, even when the information available is incomplete or limited

4. CONTENT

The subject is organized into learning units, which are further divided into topics.

Unit 1. Introduction to Machine Learning

- Introduction to Machine Learning
- Application of AI in the business environment
- Main AI providers
- Machine Learning processes
- Mathematical and statistical foundations

Unit 2. Supervised Learning

- Linear prediction methods
- Symbolic methods
- Fundamentals of Deep Learning
- Challenges in predictive learning

Unit 3. Other Learning Techniques

- Unsupervised Learning – Clustering
- Unsupervised Learning – Dimensionality Reduction
- Recommender Systems
- Metric and ranking learning
- Reinforcement Learning

Unit 4. Learning Evaluation

- Evaluation concepts
- Evaluation of supervised learning
- Calculation of effectiveness measures in supervised learning
- SHAP values
- Evaluation of unsupervised learning

Unit 5. Text and Multimedia Content Analysis

- Semantic and sentiment analysis
- Image classification with classical ML
- Introduction to PyTorch
- Image detection with Deep Learning

Unit 6. Ethics in Artificial Intelligence

- Ethical guidelines for AI model development
- Bias detection
- Examples of ethical dilemmas

Unit 7. Implementation of Machine Learning Projects in Big Data Architectures

5. TEACHING-LEARNING METHODOLOGIES

The following types of teaching-learning methodologies will be applied:

- MD1: Face-to-face lectures or, where applicable, via the virtual campus
- MD2: Cooperative Learning
- MD3: Problem-Based Learning
- MD4: Group Research (a) and/or (b) Group Problem Solving
- MD6: Simulation Environments and Field Experiences

6. LEARNING ACTIVITIES

Face-to-face:

Learning Activity	Number of Hours
Masterclasses	20
Individual Activities	35
Applied activities of integrative nature	15
Laboratory activities	10
Autonomous work	68
Knowledge tests	2
TOTAL	**150**

On-line:

Learning Activity	Number of Hours
Masterclasses	20
Individual Activities	30
Applied activities of integrative nature	20
Laboratory activities	16
Autonomous work	60
Knowledge tests	4
TOTAL	**150**

7. ASSESSMENT

Face-to-face:

Evaluation type	Weight
SE1: Exams and tests	50%
SE2: Written reports	30%
SE3: Practical Case Studies	20%

On-line:

Evaluation Type	Weight
SE1: Exams and tests	60%
SE2: Written reports	25%
SE3: Practical Case Studies	15%

On the Virtual Campus, when you access the course, you will be able to consult detailed information about the assessment activities you must complete, as well as the submission deadlines and the evaluation procedures for each of them.

7.1. First exam period

To pass the course in the regular exam session, you must obtain a final (weighted average) grade equal to or greater than 5.0 out of 10.0.
In any case, it is necessary to obtain a grade equal to or greater than 4.0 in the final exam for it to be included in the average with the rest of the activities.

7.2. Second exam period

To pass the course in the resit (extraordinary) exam session, you must obtain a final (weighted average) grade equal to or greater than 5.0 out of 10.0.
In any case, it is necessary to obtain a grade equal to or greater than 4.0 in the final exam for it to be included in the average with the rest of the activities.
You must submit the activities that were not passed during the regular session, after receiving the corresponding feedback from the instructor, or those that were not submitted.

8. SCHEDULE

Assessable Activity	Deadline
Activity 1	Semana 5
Activity 2	Semana 7
Activity 3	Semana 9
Activity 4	Semana 11
First exam period	At the end of the subject
Second exam period	First week of September

This schedule may be subject to changes due to logistical reasons related to the activities. Any modifications will be communicated to students in a timely and appropriate manner.

9. BIBLIOGRAPHY

The main reference work for the subjet is:

- Bishop, C. M. (2006). Pattern Recognition and Machine Learning. Springer.
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
- Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.
- Hastie, T., Tibshirani, R., & Friedman, J. (2009). The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Springer. 2ª edición.
- Shalev-Shwartz, S., & Ben-David, S. (2014). Understanding Machine Learning: From Theory to Algorithms. Cambridge University Press.
- Russell, S., & Norvig, P. (2020). Artificial Intelligence: A Modern Approach. Pearson. 4ª edición.
- Raschka, S., & Mirjalili, V. (2019). Python Machine Learning. Packt Publishing. 3ª edición.
- Géron, A. (2019). Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. O'Reilly Media. 2ª edición.
- James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An Introduction to Statistical Learning: with Applications in R. Springer.
- Zhou, Z-H. (2021). Machine Learning. Springer. 2ª edición.

10. EDUCATIONAL GUIDANCE, DIVERSITY AND INCLUSION UNIT

From the Educational Guidance, Diversity and Inclusion Unit we offer support to our students throughout their university life to help them reach their academic achievements. Other main actions are the students' inclusions with specific educational needs, universal accessibility on the different campuses of the university and equal opportunities.

From this unit we offer to our students:

1. Accompaniment and follow-up by mean of counselling and personalized plans for students who need to improve their academic performance.
2. In terms of attention to diversity, non-significant curricular adjustments are made in terms of methodology and assessment for those students with specific educational needs, pursuing an equal opportunity for all students.
3. We offer students different extracurricular resources to develop different competences that will encourage their personal and professional development.
4. Vocational guidance through the provision of tools and counselling to students with vocational doubts or who believe they have made a mistake in their choice of degree.

Students in need of educational support can write to us at:

orientacioneducativa@universidadeuropea.es

11. ONLINE SURVEYS

Your opinion matters!

The Universidad Europea encourages you to participate in several surveys which help identify the strengths and areas we need to improve regarding professors, degree programs and the teaching-learning process.

The surveys will be made available in the “surveys” section on virtual campus or via e-mail.

Your assessment is necessary for us to improve.

Thank you very much for your participation.