



# COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

Syllabus  
2024 - 2025

## FICHA TÉCNICA DE LA ASIGNATURA

### Datos de la asignatura

Subject name	Machine Learning and Artificial Intelligence with Python
Subject code	DTC-SAP-333
Credits	6,0 ECTS
Type	Optativa
Department	Department of Telematics and Computer Sciencies

### Datos del profesorado

#### Teacher

Name	Alexandro Badea Romero
Department	Department of Industrial Organization
EMail	abadea@icai.comillas.edu

## DATOS ESPECÍFICOS DE LA ASIGNATURA

### Contextualización de la asignatura

#### Aportación al perfil profesional de la titulación

This introductory course provides students with a hands-on foundation in artificial intelligence (AI) and machine learning (ML), offering a practical, beginner-friendly path to understanding and creating their first AI models. Students will explore essential AI and ML concepts, develop skills in Python programming for AI, and gain experience in popular AI domains such as Natural Language Processing (NLP) and Computer Vision.

#### Prerrequisitos

Python programming.

### Competencias - Objetivos

## BLOQUES TEMÁTICOS Y CONTENIDOS

### Contenidos – Bloques Temáticos

#### Course contents

##### Theory:

- Module 1: Introduction to Artificial Intelligence
- Module 2: Machine Learning Basics
- Module 3: Supervised Learning Algorithms: classification



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- Module 4: Supervised Learning Algorithms: regression
- Module 5: Unsupervised Learning Algorithms: clustering
- Module 6: Unsupervised Learning Algorithms: dimensionality reduction
- Module 7: Introduction to Neural Networks and Deep Learning
- Module 8: Natural Language Processing (NLP)
- Module 9: Computer Vision
- Module 10: Ethics and Social Implications of AI
- Module 11: Final Project and Presentations

### Laboratory:

- Lab 1: Setting up Python environment for AI. Using Python for AI.
- Lab 2: Supervised learning algorithms: k-nearest neighbors and logistic regression
- Lab 3: Supervised learning algorithms: Decision trees and ensemble methods
- Lab 4: Feature selection
- Lab 5: Data preprocessing and implementing linear regression.
- Lab 6: Unsupervised learning algorithms: clustering (k-means, hierarchical, ...)
- Lab 7: Unsupervised learning algorithms: PCA for dimensionality reduction.
- Lab 8: Neural networks and deep learning.
- Lab 9: Natural Language Processing: Text preprocessing.
- Lab 10: Computer Vision: Image preprocessing.
- Lab 11: Ethics in AI: Detecting bias in datasets and evaluating model fairness.
- Lab 12: Final project implementation: Guidance on integrating AI techniques into a final project for presentations.

## METODOLOGÍA DOCENTE

### Aspectos metodológicos generales de la asignatura

## EVALUACIÓN Y CRITERIOS DE CALIFICACIÓN

- Final exam 35%,
- Project 15%,
- Midterm 20%,
- Lab 20%,
- Class participation 10%

### Calificaciones

The following conditions must be met to pass the course:

- A minimum overall grade of at least 5 out of 10.
- A minimum grade in the ordinary and/or extraordinary final exam of 4 out of 10.

The overall grade is obtained as follows:

- Final exam 35%,



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- Project 15%,
- Midterm 20%,
- Lab 20%,
- Class participation 10%

## BIBLIOGRAFÍA Y RECURSOS

### Bibliografía Básica

Introduction to Machine Learning with Python: A Guide for Data Scientists. Andreas C. Mueller & Sarah Guido. O'Reilly.

Materials and codes provided by the instructor.

## **DTC-SAP-333 Machine Learning & Artificial Intelligence with Python**

**SEMESTER:** Spring

**CREDITS:** 6 ECTS (lecture 3 credits + laboratory 3 credits)

**LANGUAGE:** English

**DEGREES:** SAPIENS program

### **Course overview**

This introductory course provides students with a hands-on foundation in artificial intelligence (AI) and machine learning (ML), offering a practical, beginner-friendly path to understanding and creating their first AI models. Students will explore essential AI and ML concepts, develop skills in Python programming for AI, and gain experience in popular AI domains such as Natural Language Processing (NLP) and Computer Vision.

### **Prerequisites**

Python programming.

### **Course contents**

#### **Theory:**

- Module 1: Introduction to Artificial Intelligence
- Module 2: Machine Learning Basics
- Module 3: Supervised Learning Algorithms: classification
- Module 4: Supervised Learning Algorithms: regression
- Module 5: Unsupervised Learning Algorithms: clustering
- Module 6: Unsupervised Learning Algorithms: dimensionality reduction
- Module 7: Introduction to Neural Networks and Deep Learning
- Module 8: Natural Language Processing (NLP)
- Module 9: Computer Vision
- Module 10: Ethics and Social Implications of AI
- Module 11: Final Project and Presentations

#### **Laboratory:**

- Lab 1: Setting up Python environment for AI. Using Python for AI.

- Lab 2: Supervised learning algorithms: k-nearest neighbors and logistic regression
- Lab 3: Supervised learning algorithms: Decision trees and ensemble methods
- Lab 4: Feature selection
- Lab 5: Data preprocessing and implementing linear regression.
- Lab 7 Unsupervised learning algorithms: clustering with k-means, hierarchical clustering, and PCA for dimensionality reduction.
- Lab 7: Unsupervised learning algorithms: PCA for dimensionality reduction.
- Lab 8: Neural networks and deep learning.
- Lab 9: Natural Language Processing: Text preprocessing.
- Lab 10: Computer Vision: Image preprocessing.
- Lab 11: Ethics in AI: Detecting bias in datasets and evaluating model fairness.
- Lab 12: Final project implementation: Guidance on integrating AI techniques into a final project for presentations.

## Textbook

- Introduction to Machine Learning with Python: A Guide for Data Scientists. Andreas C. Mueller & Sarah Guido. O'Reilly.
- Materials and codes provided by the instructor.

## Grading

The following conditions must be accomplished to pass the course:

- A minimum overall grade of at least 5 over 10.
- A minimum grade in the ordinary or/and extraordinary final exam of 4 over 10.

The overall grade is obtained as follows (ordinary and extraordinary):

- Final exam (40%)
- Final project (30%)
- Lab (20%)
- Class participation (10%)