1. BASIC INFORMATION

Course	Introduction to Artificial Intelligence
Degree program	Degree in Physics
School	School of Science, Engineering and Design
Year	3rd
ECTS	6
Credit type	Elective
Language(s)	English
Delivery mode	In-person
Semester	2nd
Academic year	2024/2025
Coordinating professor	Alejandro Perdiguero O'Leary
Professor	Alejandro Perdiguero O'Leary

2. PRESENTATION

Artificial intelligence is a rapidly evolving field with immense present and future relevance, not only in computer science but also in physics. In modern scientific research, AI has become an essential tool for data analysis, simulation, and modeling complex systems, among many other applications. As physicists, understanding and working with intelligent models is becoming a common practice, and it is essential to know how these models operate to achieve the best results.

In this course, we will explore the foundations of artificial intelligence with a focus on its applications in physics. We will begin with a conceptual overview, studying the basic components that underpin various intelligent algorithms. The process of data analysis in physics will be examined, along with practical examples of how intelligent models can be applied to solve real-world scientific problems.

Finally, we will introduce neural networks, one of the most powerful tools for modeling complex physical systems and making predictions in a wide range of physics-based scenarios.

3. COMPETENCIES AND LEARNING OUTCOMES

Core competencies:

- CB1: Students must have demonstrated that they possess and understand knowledge in an area of study that is based on general secondary education, and is usually at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study
- CB2: Students must know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study

Cross-curricular competencies:

- CT01: Ethical values: Ability to think and act according to universal principles based on the value of the person that are aimed at their full development and that entails a commitment to certain social values.
- CT02: Autonomous learning: A set of skills to select strategies for searching, analyzing, evaluating, and managing information from a variety of sources, as well as to independently learn and put into practice what has been learned.
- CT03: Teamwork: Ability to integrate and collaborate actively with other people, areas and/or organizations to achieve common goals.
- CT05: Analysis and problem solving: Be able to critically evaluate information, break down complex situations into their constituent parts, recognize patterns, and consider other alternatives, approaches, and perspectives to find optimal solutions and efficient negotiations.

Specific competencies:

- CE6. Ability to apply the fundamental principles and basic techniques of intelligent systems.
- CE7. Ability to analyze the life cycle of data, from operation to visualization, including the process of creating new knowledge and its use.
- CE8. Ability to design the appropriate technology and infrastructure requirements for the development and deployment of distributed systems.
- CE9. Ability to apply the criteria and mechanisms for security assessment and certification, as well as current legislation on personal data, privacy

Learning outcomes:

- LO1. Describe the fundamental principles and basic techniques of intelligent systems.
- LO2. Select the basic techniques of intelligent systems that best suit a given project.
- LO3. Develop computer applications that use intelligent systems to find the solution to a given problem.

The following table shows the relationship between the competencies developed during the course and the learning outcomes pursued:

Competencies	Learning outcomes
CB1, CE6, CE7	LO1. Describe the fundamental principles and basic techniques of intelligent systems.
CB1, CB2, CT02, CT05, CE6, CE7, CE8, CE9	LO2. Select the basic techniques of intelligent systems that best suit a given project.
CB2, CT01, CT02, CT03, CT05, CE9	LO3. Develop computer applications that use intelligent systems to find the solution to a given problem.

4. CONTENT

Unit 1. Introduction to artificial intelligence and machine learning.
Unit 2. Information extraction algorithms.
Unit 3. Artificial intelligence techniques for data analysis.
Unit 4. Applications of artificial intelligence and machine learning.

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Lectures
- Cooperative learning
- Problem-Based Learning
- Project-based learning
- Learning based on laboratory teachings (laboratory practices, workshop practices, simulation environments)

6. LEARNING ACTIVITIES

Listed below are the types of learning activities and the number of hours the student will spend on each one:

Campus-based mode:

Learning activity	Number of hours
Lectures	24,6
Problem solving	16
Case studies and field studies	10
Laboratory practicals	15
Debate and colloquium	4
Learning contract (definition of interests, needs and objectives)	1,6
Self-study	45,4
Tutorials	7,6
Face-to-face knowledge tests	1,6
TOTAL	**150**

7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

Campus-based mode:

Assessment system	Weight
Presential tests to assess	60
theoretical/practical content objectives	20
Non-face-to-face tests to assess	5
theoretical/practical content objectives	5
Tests to evaluate attitudes	10

When you access the course on the *Campus Virtual*, you'll find a description of the assessment activities you have to complete, as well as the delivery deadline and assessment procedure for each one.

When you access the course on the Virtual Campus(*Campus Virtual*), you will be able to consult in detail the assessment activities that you must carry out, as well as the delivery dates and the assessment procedures for each one of them. Please note that the assessment procedures for each of the different activities may be specific and two activities do not necessarily have the same weighting, and/or the assessment criteria/rubric may be different. For each of the activities, both the assessment criteria and the weighting of these within the block of training activities will be specified.

The assessment process is based on the personal work of each student and presupposes the authenticity of the authorship and originality of the exercises carried out. Lack of authenticity in the authorship or originality of the assessment tests; copying or plagiarism are irregular conducts that may have academic and disciplinary consequences.

7.1. First exam period

To pass the course in the first exam period, you must obtain a final course grade of at least 5 out of 10 (weighted average).

In any case, you will need to obtain a grade of at 5.0 in the final exam in order for it to count towards the final grade along with all the grades corresponding to the other activities.

To be eligible to take the first period evaluation exam, attendance at in-person classes must be 60% or higher. Attendance must be in person. Synchronous virtual attendance via HyFlex is only counted in cases that are approved and justified by the university.

The professor will establish as 'Late Attendance' those cases in which the student arrives late or leaves the classroom before the end of the session, in this case, missing more than 20% of the duration of the session will be recorded as non-attendance.

7.2. Second exam period

To pass the course in the second exam period, you must obtain a final grade of at least 5 out of 10 (weighted average).

In any case, you will need to obtain a grade of at 5.0 in the final exam in order for it to count towards the final grade along with all the grades corresponding to the other activities.

The student must deliver the activities not successfully completed in the first exam period after having received the corresponding corrections from the professor, or those that were not delivered in the first place.

The activities not passed in the regular call must be submitted after receiving the corresponding corrections from the instructor, or those that were not submitted (these will have a 0.7 penalty on the grade obtained). The instructor may also assign some complementary activities that must be submitted by the indicated date. The instructor will personally meet in due time with the students who failed the regular call to determine which activities, assignments, etc., need to be completed for the extraordinary call.

8. SCHEDULE

This table shows the delivery deadline for each assessable activity in the course:

Assessable activities	Deadline
Experimental Practice 1	Experimental Practice 1
Knowledge Test 1	Knowledge Test 1
Experimental Practice 2	Experimental Practice 2
Practice Test	Practice Test
Problem Solving 1	Problem Solving 1
Problem Solving 2	Problem Solving 2
Knowledge Tes t2	Knowledge Test 2

This schedule may be subject to changes for logistical reasons relating to the activities. The student will be notified of any change as and when appropriate.

9. REFERENCES

The main reference work for this subject is:

- Dursun Delen, Predictive Analytics: Data Mining, Machine Learning and Data Science for Practitioners, 2nd Edition", Pearson FT Press.

The recommended Bibliography is:

- Robert Layton, "Learning Data Mining with Python Second Edition", Packt.
- Glenn J. Myatt , Wayne P. Johnson, Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, 2nd Edition ", Wiley.
- David Carmona, "The AI Organization", O'Reilly.

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 means 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.uev@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 in virtual campus or via e-mail.

Your assessment is necessary for us to improve.

Thank you very much for your participation.