STUDY GUIDE

Applications of Artificial Intelligence

EUNICE Research Summer School

Organised by

Université Polytechnique Hauts-de-France (UPHF) & Universidad de Cantabria (UC)

Co-funded by the European Union

1. IDENTIFYING DATA	
Course Name.	Applications of Artificial Intelligence. EUNICE Research Summer School.
Coordinating University.	University Polytechnic Hauts-De-France (UPHF) & Universidad de Cantabria (UC).
Host University.	Universidad de Cantabria (UC).
EUNCE Partner Universities Involved.	Università di Catania (UNICT); Poznan University of Technology (PUT); Instituto Politécnico de Viseu (IPV).
Course Field(s).	Artificial Intelligence. Digital Transformation.
Related Study Programme.	Students having a scientific background and a particular interest in AI are welcome. Mostly 3rd Cycle and 2nd Cycle.
ISCED Code.	0619 Information and Communication Technologies (ICTs).
Sustainable Development Goals	SDG 3. Good Health and Wellbeing. SDG 4. Quality Education. SDG 7. Affordable and Green Energy. SDG 8. Decent Work and Economic growth. SDG 9. Industry, Innovation and Infrastructure. SDG 11. Sustainable Cities and Communities. SDG 12. Responsible Consumption and Production. SDG 13. Climate Action.
Study Level.	Mainly for PhD, but also Master's Degree and last year of degree students doing their final thesis on the topic.

Number of ECTS credits allocated.	3 ECTS
Mode of Delivery.	Blended (face to face and online)
Language of Instruction.	English
Course Dates.	Online: 2 – 19 June 2025. On site: 23 – 27 June 2025.
Schedule of the course.	Face-to-face component: Monday to Friday – 9:30 – 14:00 h.
Key Words.	Artificial Intelligence, Distributed AI, Optimization, Constraint Satisfaction, Evolutionary algorithms, Data analysis
Motivational Phrase.	"Unlock the Power of Tomorrow: Master Distributed Intelligence Today"

Prerequisites and co-requisites.	- EUNICE student - English B2

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	- Scientific background and a particular interest in AI are welcome. - Mainly for PhD, but also Master's Degree and last year of degree students doing their final thesis on the topic.
Number of EUNICE students that can attend the Course.	30.
Course inscription procedure(s).	Students from EUNICE universities: contact your International Relations Office (IRO). UC students: enrol through Virtual Campus.

2. CONTACT DETAILS	
Department.	IT and CYbersecurity training (ICY) - Department of Informatics – UPHF. Department of Computer Science and Electronics – UC.
Name of Lecturer.	Emmanuel Adam (UPHF). Diego García (UC).
E-mail.	Emmanuel.Adam@uphf.fr diego.garcia@unican.es
Other Lecturers.	José González-Abad (UC). Sara Pérez Carabaza (UC). Mario F. Pavone (UNICT). Concetto Spampinato (UNICT). Konrad Miazga (PUT). Raquel Sebastião (IPV).
Course Secretary.	Gema Pérez (eunice@unican.es)

3. COURSE CONTENT
AI has existed for 70 years and is far from being limited to generative AI. AI techniques such as multi-agent systems (MAS), particle swarm optimization (PSO), evolutionary algorithms (EA), feature extraction, and predictive analytics are highly attractive to industries for solving complex problems, optimizing processes, and making informed decisions. MAS enhances collaboration in supply chains and robotics, while PSO excels in logistics and scheduling. Evolutionary algorithms, inspired by natural evolution, allow for the development of innovative solutions in artificial life and data analysis. For signal pre-processing and feature extraction, AI is essential, especially in healthcare to improve patient care.

4. LEARNING OUTCOMES

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The summer school will feature online components preceding the on-site week. These online portions are designed to establish initial contacts and provide foundational knowledge to effectively approach the concepts studied during the in-person sessions.
During the on-site week of the summer school, participants will engage in practical exercises and demonstrations, which can be completed individually or in small groups. These hands-on activities are open to all and do not require prior completion of a computer science curriculum. The goal is to foster a collaborative learning environment where participants can apply theoretical knowledge to real-world scenarios, regardless of their academic background. The objective is that everyone can actively participate and benefit from the summer school experience.

5. OBJECTIVES

The objective of the summer school is to discover, understand, and use the different AI techniques currently in use: logic, agents, machine learning, deep learning, and generative AI.

The summer school provides a comprehensive platform for participants to explore these AI techniques through both theoretical presentations and practical applications, equipping them with the skills needed to address real-world challenges effectively.

The objective of this summer school is also to present AI approaches from different partners: researchers from 5 universities within the Eunice Alliance will present their work and teach how to design, build, produce, and use AI tools.

Another objective of this summer school is to facilitate exchanges between the participants and the researchers, to assist them in their personal work.

6. COURSE ORGANISATION

UNITS	
1.	**Overview of Artificial Intelligence: From Past to Present.** Prof. Emmanuel Adam (UPHF).
2.	**Overview of Distributed Artificial Intelligence: Agents.** Prof. Emmanuel Adam (UPHF).
3.	**Agent based model for crowd simulation.** Prof. Mario F. Pavone (UNICT).
4.	**Deep Learning for Meteorological and Climate Applications**. Prof. José González-Abad (UC).
5.	**From Exact Solvers to Metaheuristics.** Prof. Sara Pérez Carabaza (UC).
6.	**Generative Artificial Intelligence: this is just the beginning!** Prof. Diego García Saiz (UC).

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7.	**Evolutionary design of 3D Agents: Applications.** Prof. Konrad Miazga (PUT).
8.	**Evolutionary design of 3D Agents: Experiments.** Prof. Konrad Miazga (PUT).
9.	**Learning Through Physiological Signals: from Sensors for Data Acquisition to Data Processing for Knowledge Discovery.** Prof. Raquel Sebastiaõ (IPV).
10.	**Learning and Unlearning with Foundation and Generative Models in AI-Driven Health Applications.** Prof. Concetto Spampinato (UNICT).

LEARNING RESOURCES AND TOOLS

Learning resources and tools will be uploaded to EUNICE Moodle Platform.

PLANNED LEARNING ACTIVITIES AND TEACHING METHODS

The training activities will be of a theoretical and practical nature. The teaching methodology will be active, seeking the participation of students with the Professor and in groups. The course will be developed using the EUNICE Moodle Platform. On this platform students will find the presentations, as well as the compulsory readings corresponding to each module.

7. ASSESSMENT METHODS, CRITERIA AND PERIOD

Assessment will be based on:

- Class attendance (minimum 80%).
- Group Works
- Quiz

8. BIBLIOGRAPHY AND TEACHING MATERIALS

- Each lecturer will upload to UNICE Moodle Platform ONE compulsory reading that includes discussion of some of the major global challenges in the topic of interest.
- Lecturers may upload further complementary readings on their topic of interest which students may wish to read for background towards their group presentation.

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