UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Foundations of Cognitive Science and Artificial Intelligence

2627-2-F8502R021

Course title

Foundations of Cognitive Science and Artificial Intelligence

Topics and course structure

This course provides a general technical introduction to computer science and the algorithms of symbolic and neural artificial intelligence. It is designed to meet the requirements of the degree program in Educational Sciences and is intended for students with no prior knowledge or experience in computer science. As indicated in the methodology section, part of the course will be conducted in a laboratory setting.

The course will cover the following topics:

1. Introduction to computer architecture.
2. The concept of an algorithm.
3. Programming simple algorithms in Python (in-class lab activity).
4. The structure of symbolic and neural artificial intelligence systems.
5. Programming simple artificial intelligence systems (in-class lab activity)
6. The structure of generative artificial intelligence systems: theoretical overview.

It should be emphasized that the course topics are not pedagogical: the course does not aim to explore the educational and instructional uses of artificial intelligence, but rather to provide a set of basic technical knowledge and skills that may be useful for pedagogical and ethical reflections. The course can be viewed as a prerequisite for other courses in the pedagogical, psychological, and philosophical areas of the degree program, including the course “Filosofia della Relazione,” taught by Prof. Paolo Monti, which analyzes certain ethical issues related to the use of artificial intelligence systems in individual and collective decision-making.

Objectives

1. Knowledge and Comprehension

The course provides basic knowledge of computer architecture, the concept of algorithms, the main algorithms of symbolic and neural artificial intelligence, and the algorithmic structure of generative artificial intelligence systems (or large language models). Lab activities will enable students to acquire basic programming skills and the ability to develop simple computer systems and artificial intelligence systems, thereby reinforcing their knowledge through hands-on practice.
The knowledge and skills acquired will foster an understanding of the structure of the algorithmic processes that take place in the technological devices around us, with a particular focus on the “biases” introduced in programming and machine learning processes.

2. Applied Knowledge and Comprehension

These basic knowledge and skills will be directed toward the study of artificial intelligence systems. They will facilitate an understanding of the potential risks arising from the application of such systems in educational contexts and, more generally, in individual and collective decision-making processes.

3. Independent Judgment

Attendance at the course—in particular, the interactive instruction sessions—will foster students’ ability to develop a personal yet well-reasoned perspective on the role of artificial intelligence in individual and collective decision-making processes, with particular reference to educational contexts.

4. Communication Skills

Attendance at the course—in particular, the laboratory sessions—will foster the ability to interpret and present the content of scientific articles in a coherent and well-reasoned manner, including through the use of multimedia tools.

5. Learning Skills

Especially during interactive sessions, the course will foster students’ ability to independently expand their body of knowledge and skills by consulting the reference materials provided by the instructor and other texts available in the library or online.

Methodologies

The course will be taught in Italian. The course, with a total duration of 56 hours, will include

- 21 hours of Lectures (32%), of which 6 (10.7% of the total hours) will be conducted remotely, using methods to be agreed upon with the students. The lecture-based instruction (conducted in the form of interactive lectures) will focus primarily on the acquisition of theoretical knowledge regarding computer architecture, algorithms, and artificial intelligence systems;

- 35 hours of interactive instruction (68%), conducted in person in the classroom in a lab setting. Students will be guided toward the gradual acquisition of basic programming skills in the Python language, using the computing resources of the RobotiCSS Lab (Robotics Laboratory for Cognitive and Social Sciences).

Although an exam format is provided for non-attending students, the lecture-based and interactive classroom activities will greatly facilitate understanding of the course topics. Classroom attendance is therefore

recommended.

Online and offline teaching materials

At certain key points in the course, the instructor will share on the e-learning platform some of the slides used in lectures to discuss theoretical topics.

During the programming activities conducted in classroom-based labs, students will be able to consult reference manuals on the Python language, including

- The Python reference manual available at docs.python.org (https://docs.python.it/paper-a4/ref.pdf)
- Thinking in Python: How to Think Like a Computer Scientist, available in various versions online (https://www.massimolauria.net/informatica2023/docs/PensareInPython.pdf)

Other online materials and platforms will be identified and shared during the course. The software required for Python programming can be downloaded for free for various operating systems from https://www.python.org/

Programme and references

- Frixione, Porello (2026), “Che cos’è un algoritmo”, Carocci.
- Mitchell (2022), “Intelligenza Artificiale. Una guida per esseri umani pensanti”, Einaudi.

Non-attending students will have to add some chapters of the handbook “Intelligenza Artificiale. Un approccio moderno” by Russell e Norvig.

Assessment methods

Assessment is based on a final oral exam only; there are no midterm exams. The oral exam will assess students’ knowledge and understanding of the course topics, with a focus on communication skills (precision of language, ability to argue a point). The grade will be expressed on a scale of 30.

The final grade takes into account the following aspects (presented in line with the Dublin Descriptors):

1. Knowledge and understanding of the course topics; knowledge and understanding applied to the analysis of learning processes (50%);
2. Autonomy of judgment: ability, demonstrated during interaction with the teacher in the oral exam, to develop and argue one's own points of view (20%);
3. Communication skills: ability to use vocabulary appropriate to the field of study (20%);
4. Learning skills: ability to integrate one's own body of knowledge through independent research (10%).

Office hours

To arrange an appointment online or in person (building U6, fourth floor), please contact the instructor at

edoardo.datteri@unimib.it.

Programme validity

The programs are valid for two academic years.

Course tutors and assistants

Sustainable Development Goals

QUALITY EDUCATION