UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Introduzione all'Intelligenza Artificiale

2526-3-E3101Q141

Aims

Knowledge and Understanding (Dublin Descriptor 1)

At the end of the course, the student will be able to:

- understand the theoretical and historical foundations of Artificial Intelligence, with particular reference to both symbolic approaches (such as ontology-based reasoning, planning, and reasoning under uncertainty) and sub-symbolic ones (such as supervised and unsupervised machine learning);
- become familiar with the main tools and technologies underlying the Semantic Web and Knowledge Graphs;
- understand the main methodologies for knowledge representation and automated problem solving;
- comprehend the characteristics of the main learning algorithms (classification, regression, clustering, neural networks), how they work, and the contexts in which they can be applied.

Applying Knowledge and Understanding (Dublin Descriptor 2)
At the end of the course, the student will be able to:

- critically assess the applicability of AI techniques and tools to real-world problems, with an awareness of their methodological and practical limitations;
- use operational tools (such as Protégé, DBpedia, and machine learning environments) to design and test solutions based on AI models;
- analyze real-world data using machine learning techniques and interpret the results in order to formulate relevant solutions;
- apply symbolic and sub-symbolic approaches in various contexts, recognizing the assumptions and conditions of use for each class of techniques.

Other Objectives (Dublin Descriptors 3, 4, 5)
The course fosters:

- independent judgment, through activities such as case study discussions, exercises, and an (optional) group project that requires motivated methodological choices;
- communication skills, especially through the writing of short reports and optional oral presentations, aimed at making reasoning and adopted solutions explicit;
- learning skills, by encouraging autonomous access to up-to-date scientific materials and promoting individual in-depth study, also through the use of online resources and specialized literature.

Contents

The course will present a historical introduction to the discipline, then it will focus on selected contribution in the area of the so-called symbolic AI, with specific reference to (i) ontologies, technologies, and inferential capabilities offered by Semantic Web technologies, (ii) planning, (ii) brief introduction to reasoning in presence of uncertainty. Finally, selected contributions of the so-called sub-symbolic AI will also be discussed, with specific reference to data analysis techniques based on machine learning approaches (supervised and unsupervised).

Detailed program

- Introduction to the discipline
- Intelligent agents and environments as a way to characterize problems
- Symbolic AI
    - Brief introduction to basic concepts
    - Introduction to Semantic Web (Knowledge Graphs, querying, and inference; enabling instruments: DBPedia, WikiData, Protegé)
    - Solving problems with search, introduction to planning
    - Brief introduction to reasoning in presence of uncertainty
- Sub-symbolic AI
    - Brief introduction to basic concepts
    - Classification (Decision trees and ensemble methods, K-NN, Neural Networks)
    - Regression
    - Clustering (K-means, DBSCAN)
    - Deep neural networks and deep learning
- Additional topics as invited seminars (on ethics, emerging topics, or particularly significant results) defined during the course

Prerequisites

Topics discussed within the classes of Fundamentals of Computer Science, Programming Languages, Probability and Statistics For Computer Science will be considered known and reasonably clear.

Teaching form

Theoretical and methodological aspects will be presented along with practical examples and case studies, employed to exemplify the introduced topics; specific tools for the realization of presented models and approaches

will be presented; suitable references to the relevant and recent scientific literature will be given for supporting an in depth study of the treated topics.

The course consists of 68 hours, of which 48 hours are lectures (approximately 66% of which are expository and the rest interactive) and 20 hours are interactive exercises. The lectures and exercises are conducted in person, unless unforeseen problems or changes arise, which will be promptly announced, and will be recorded and made available.

The course is in Italian although the teaching material is mostly in English.

Textbook and teaching resource

Slides, papers and selected additional material, selected chapters from reference books, among which Artificial Intelligence: Foundations of Computational Agents, 2nd Edition, David L. Poole and Alan K. Mackworth (https://artint.info/2e/html/ArtInt2e.html). Additional resources will be indicated during the course.

Semester

First semester

Assessment method

Written and optional oral examination on topics discussed during the course; knowledge about concepts, techniques, issues discussed in the course, as well as the ability to solve exercises proposed, and the ability to choose solutions based on their appropriateness to the context of the problem will also be evaluated. The ability to convey knowledge and abilities in a compact and effective way will be appreciated. An optional group project (2-3 members) will be proposed; a single possibility to carry out the project will be defined, plausibly close to the end of the course, with assignment due in the months of January/February. It could lead to extra points for the final evaluation, provided the project is discussed.

Office hours

Giuseppe Vizzari: wednesday morning, by appointment, potentially also via teleconferencing systems.

Sustainable Development Goals

INDUSTRY, INNOVATION AND INFRASTRUCTURE | SUSTAINABLE CITIES AND COMMUNITIES