

Fundamentals of Artificial Intelligence and Knowledge Representation

Module 1



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

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Course content

- The course introduces the fundamental principles and methods used in Artificial Intelligence to solve problems, with a special focus on the search in the state space, planning, knowledge representation and reasoning, and on the methods for dealing with uncertain knowledge.
- The course will include hands-on labs and seminars on selected topics.
- Prerequisites: user-level knowledge of a high-level programming language, in order to successfully understand case studies and applications presented during the lessons.

Course content

- Module 1
- Introduction to Artificial Intelligence: historical perspective, main application fields, introduction to knowledge-based systems and architectural organization.
- Problem-solving in AI: representation through the notion of state, forward e backward reasoning, solving as a search and search strategies. Games. Constraint satisfaction problems.
- Local Search methods, meta heuristics, solving through decomposition, constraint relaxation, branch-and-bound techniques
- Introduction to Planning, Linear planning, partial order planning, graph-based methods (GraphPlan), Scheduling.

Course content

PART II (Modules 2):

- Module 2 (Prof. Federico Chesani)
 - Introduction to knowledge representation and reasoning
 - Representing Terminological Knowledge: semantic networks, description logics, foundation of ontologies
 - Representing actions, situations, and events.
 - Reasoning with Beliefs.
- Module 3 (Prof. Paolo Torroni)
 - Uncertainty
 - Probabilistic Reasoning

Assessment Method

- The exam aims at assessing the student's knowledge and skills in the course topics and it consists of two independent parts:
- Part I, covering the material taught in the fall semester (Module 1),
- Part II, covering the material taught in the spring semester (Modules 2 and 3).
- There will be a separate written exam for each part. Each written exam will include exercises and open questions about all the topics presented in the relevant part of the course. The final grade will be the average of the grades obtained in the two parts.
- During the course there will be exercises on one game and on planning to be submitted to a contest (not mandatory)
- More information later during the course

Hands on sessions

- During the course there will be hands-on sessions.
 - Bring your laptop
 - If no laptop available, let us know
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- Software:
 - AIMA library and Java
 - Graphplan, SAT plan, Black box

Text books

Slides will be distributed during the course on the web site

<https://virtuale.unibo.it/course/view.php?id=58748>

Recommended textbook:

- **S. J. Russel, P. Norvig, *Artificial Intelligence: A modern approach*, Prentice Hall, International edition.**

Further readings:

- R. J. Brachman, H. J. Levesque, *Knowledge Representation and Reasoning*, Elsevier, 2004.
- F. Baader, D. Calvanese, D.L. McGuinness, D. Nardi, P.F. Patel-Schneider (editors), *The description logic handbook: Theory, implementation, and applications*, Cambridge University Press New York, NY, USA, 2007

Other AI books:

- Nils J. Nilsson: *Artificial Intelligence: A New Synthesis*, Morgan Kaufman, 1998.
- M. Ginsberg: *Essentials of Artificial Intelligence*, Morgan Kaufman, 1993.
- P. H. Winston: *Artificial Intelligence*, Addison-Wesley, 1992.

Useful Information

- Office hours
 - Thursday 10-12 (via Teams)
 - Send me an email if you need to talk to me
- Email
 - michela.milano@unibo.it
 - **Important:** I receive a huge amount of email. Please use as subject **Foundamentals of AI**
- Phone 051.20.93790