Course "Automated Planning: Theory and Practice"
Chapter 00: Introduction

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M.S. Course: Artificial Intelligence Systems (LM)
A.A.: 2025-2026
Where: DISI, University of Trento
URL: https://shorturl.at/A81hf

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Useful Informations

- PERIOD: I Semester, 11/09/2025 $\Longrightarrow$ 22/12/2025
- DELIVERY: "Blended"
- DURATION: $\approx$ 14 weeks
- Lecture (academic) hours (including exercises): $\approx$ 54
- CREDITS: 6

Useful Informations: Lectures

- In presence:
  - Monday 13:30-15:30
    - Room A110 - Povo
  - Thursday 15:30-17:30
    - Room A212 - Povo

Useful links

- Web site of the course
  `https://shorturl.at/A81hf`
- Moodle (course material + recordings)
  `https://webapps.unitn.it/gestionecorsi/`
- Esse3
  `https://www.esse3.unitn.it/`

Remember to register to the course within Moodle!

Objectives

- Provide a comprehensive theoretical view of a wide range of planning and scheduling techniques
  - Evaluate and apply a variety of planning techniques and tools for classical planning and scheduling as well as planning and scheduling under different kind uncertainty
  - Explain the practical advantages and disadvantages of different levels of espressivity in planning and scheduling models
- Hands-on experience in constructing and modeling planning domains to solve specific planning problems
  - Model classical planning and scheduling problems in commonly used languages (e.g. PDDL)
  - Evaluate and apply common techniques for goal-directed planning, such as various forms of heuristics and control rules.
- Experiment the control of robotic agents.
  - With realistic robotic agents (physical and/or simulated).

Pre-requirements

- Basic knowledge and understanding of data structures and algorithms
- Basic knowledge of propositional logic and satisfiability and discrete mathematics
- Knowledge of basic artificial intelligence techniques and concepts (e.g. state-space search, heuristics, A*)

Tentative program

- Introduction, applications
- Classical Planning Problems and PDDL
- Planning as Search - an overview of the general concepts
- The forward state space search, algorithms and examples
- The backward state space search, algorithms and examples
- The partial order causal link search space, algorithms and example
- A comparison of general search strategies applicable to all search spaces
- Hierarchical task networks
- Introduction to heuristics in planning
- Simple heuristics, Landmark Heuristics, Relaxed planning graph Heuristics, Pattern Database heuristics
- Planning with control formula
- Temporal Planning and Scheduling
- Planning under uncertainty (and probabilistic planning - if time allows)
- Planning within the ROS infrastructure (ROSPlan/PlanSYS2)

Reference documents

- Notes from the lectures
- Handouts/slides (Available within moodle)
- Suggested books:
  - Malik Ghallab, Dana S. Nau, Paolo Traverso: “Automated planning - theory and practice”. Elsevier 2004, ISBN 978-1-55860-856-6, pp. I-XXVIII, 1-635
  - Hector Geffner, Blai Bonet: “A Concise Introduction to Models and Methods for Automated Planning”. Synthesis Lectures on Artificial Intelligence and Machine Learning, Morgan & Claypool Publishers 2013, ISBN 9781608459698, pp. 1-141
  - Patrik Haslum, Nir Lipovetzky, Daniele Magazzeni, Christian Muise: “An Introduction to the Planning Domain Definition Language”. Synthesis Lectures on Artificial Intelligence and Machine Learning, Morgan & Claypool Publishers 2019
  - Malik Ghallab, Dana S. Nau, Paolo Traverso: “Automated Planning and Acting”. Cambridge University Press 2016, ISBN 978-1-107-03727-4

Exams

- Mode 1
  - Assignments during the course on planning and on the use of the ROS infrastructure
- Mode 2
  - Joint assignments between this course and the course "Robot Planning and its application" by Prof. Palopoli

Tips

- Attend all the lectures!!!!
- Ask clarifications for what not understood
- Do not postpone the study
  - Study and try to implement/model after any lecture
- Always do the “proposed exercises”
- ...

Interaction

- Ask question during lecture
  - Strongly recommended
  - Do not be shy!
- Ask question during pauses
  - Full availability
- Office hours clarifications: on request, with time to be agreed (via email or after lecture),
  - More frequently during lecture period, but always available
- Email
  - Always available, but with moderation (see next slides)
- NEVER VIA PHONE!

Tips on the use of emails

All emails shall be sent from `name.surname@studenti.unitn.it`, and shall have in the subject "APTP"!

Good reasons to send an email

- Request for a face-to-face clarification meeting
- Report possible errors in the slides, problems in accessing the web site, etc.
- Reporting objective problems (e.g. overlapping of lectures, ...)
- Reporting of individual/personal problems e.g.:
  - Students with DSA
  - Students non yet registered/waiting for transfer
  - Working students
  - Students with particular problems/situations

  In this case it is strongly recommended to ask for a face-to-face meeting.
- ...

References I

[1] Hector Geffner and Blai Bonet. *A Concise Introduction to Models and Methods for Automated Planning*. Synthesis Lectures on Artificial Intelligence and Machine Learning. Morgan & Claypool Publishers, 2013. ISBN 9781608459698. doi: 10.2200/S00513ED1V01Y201306AIM022. URL https://doi.org/10.2200/S00513ED1V01Y201306AIM022.

[2] Malik Ghallab, Dana S. Nau, and Paolo Traverso. *Automated planning - theory and practice*. Elsevier, 2004. ISBN 978-1-55860-856-6.

[3] Malik Ghallab, Dana S. Nau, and Paolo Traverso. *Automated Planning and Acting*. Cambridge University Press, 2016. ISBN 978-1-107-03727-4. URL http://www.cambridge.org/de/academic/subjects/computer-science/artificial-intelligence-and-natural-language-processing/automated-planning-and-acting?format=HB.

[4] Patrik Haslum, Nir Lipovetzky, Daniele Magazzeni, and Christian Muise. *An Introduction to the Planning Domain Definition Language*. Synthesis Lectures on Artificial Intelligence and Machine Learning. Morgan & Claypool Publishers, 2019. doi: 10.2200/S00900ED2V01Y201902AIM042. URL https://doi.org/10.2200/S00900ED2V01Y201902AIM042.