

# Research Group Artificial Intelligence

## Bachelor Theses

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University of Basel

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# AI Research Group

# Research Group Artificial Intelligence



Malte Helmert



Gabi Röger



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Clemens Büchner



Remo Christen



Simon Dold



Claudia Grundke



Tanja Schindler

# Research Focus

our main research areas:

- classical action planning
- heuristic search

# Teaching

# Teaching

## autumn semester 2023:

- Discrete Mathematics in CS (Bachelor, 1st/3rd semester)
- Planning and Optimization (Master, 1st semester)

## spring semester 2024:

- Algorithms and Data Structures (Bachelor, 2nd semester)
- Theory of Computer Science (Bachelor, 4th semester)
- Foundations of Artificial Intelligence (Bachelor, 6th semester)

# Lecture: Foundations of Artificial Intelligence (Spring 2024)

- lecture, Bachelor, 8 CP
- **lecturers:** Malte Helmert
- **target audience:** Bachelor students in 6th semester

## contents:

- introduction and historical development of AI
- rational agents
- problem solving and search
- constraint satisfaction problems
- formal logic
- automated planning
- board games

# Theses



# Bachelor and Master's Theses

- **completed:** 64 Bachelor theses, 39 Master's theses  
    ↪ <https://ai.dmi.unibas.ch/theses.html>
- **interested?** **get in touch!**  
    ↪ email to [malte.helmert@unibas.ch](mailto:malte.helmert@unibas.ch) or talk to me

# Thesis Life Cycle

- $T_0$ : you contact me about interest in B.Sc. thesis
- $T_0 + 1$  week: initial meeting
  - you, me and potential supervisor
  - we suggest 3 topics to choose from
  - discuss possible starting date for thesis
- $T_0 + 3$  weeks: topic decision
  - you select a topic (or decline)
  - set up learning contract with official starting date  $T_1$
- $[T_1, T_1 + 3$  months]: work on thesis
  - 4 months possible if other commitments exist
  - weekly meetings with supervisor
  - ends with submission of thesis
- $\sim 2$  weeks later: thesis presentation
  - you are done, congratulations!

# Bachelor's Thesis Example

Sebastian Schlachter (2022)

Encoding Diverse Sudoku Variants as SAT Problems

(supervised by Augusto Blaas Corrêa)

- Study Sudoku variants from YouTube channel “Cracking the Cryptic”
- Model complex problem constraints as logical formulas
- Compare efficiency of solvers on resulting models

# Bachelor's Thesis Example

Raphael Kreft (2022)

Generation of Domain Abstractions using  
Counterexample-Guided Abstraction Refinement

(supervised by Clemens Büchner)

- Adaptation of CEGAR framework to a heuristic design problem
- Implementation in the Fast Downward planner
- Evaluation of different algorithm variants and parameters

# Bachelor's Thesis Example

Esther Mugdan (2022)

## Optimality Certificates for Classical Planning

(supervised by Salomé Eriksson and Remo Christen)

- Theoretical framework for computer-verifiable proofs of optimality for solutions to shortest-path problems
- Integration with classical planning algorithms
- Implementation in the Fast Downward planner
- Evaluation of different algorithm variants and parameters

The End