Institute for
Symbolic Artificial Intelligence / Formal Models & Verification

Team:

- Martina Seidl

- Simone Heisinger
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- Andreas Plank
- Adrian Rebola
- Nils Froleyks
- Peter Pfeiffer

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The Institute

- *Homepage: https://www.jku.at/institut-fuer-symbolic-artificial-intelligence/*

- *Where you know us from*
    - *Logic (1st semester bachelor)*
    - *Formal Models (4th semester bachelor)*
    - *Planning and Reasoning in AI (maybe)*
    - *Model Checking (maybe)*
    - *SAT Solving (maybe)*
    - *Debugging (maybe)*
    - *Missing Semester (maybe)*

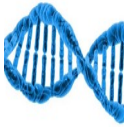
- *Our research interests*
    - *Symbolic reasoning techniques for logic, e.g., SAT, QBF*
    - *Solving problems with logic*
    - *Educational games*

Symbolic Reasoning

Planning

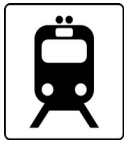
Security

Verification



Bio-Informatics

Games

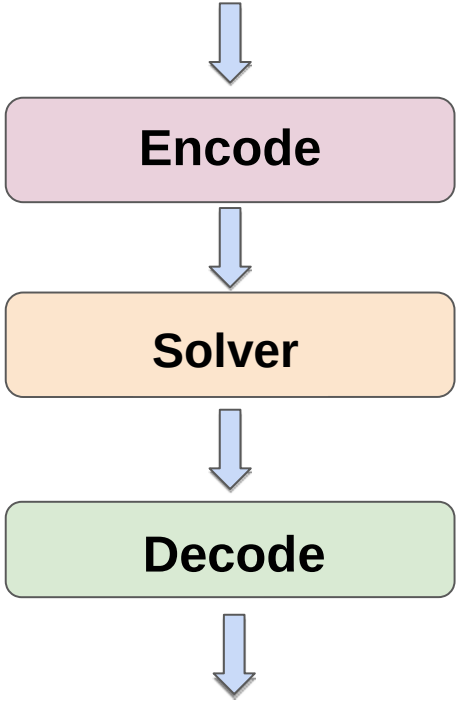


Safety

Code Repair

Logistics

...



Beyond SAT

Sometimes propositional logic is not enough

- more expressive logics are needed, for example
  - Quantified Boolean Formulas (QBF)
  - Satisfiability Modulo Theory (SMT)

Challenge:

VS

Seminar

Topic: **Neurosymbolic AI**

Neuro-symbolic AI is a type of artificial intelligence that integrates neural and symbolic AI architectures to address the weaknesses of each, providing a robust AI capable of reasoning, learning, and cognitive modeling (from Wikipedia).

Tasks:

- Read and understand a scientific paper
- Write a short summary of the paper (2-3 pages)
- Present the content of the paper (about 20 minutes)
- Attend other presentations

Organisational Meeting at the beginning of March

a. Assignment of topics & papers
b. Fix the schedule

Bachelor Thesis

Type of the thesis (depends on topic):

- Practical with implementation / tool evaluation
- Theory only
- Literature study /survey
- ...

Procedure:

- Make individual appointment with supervisor
- Discuss your interests & potential topics (literature is provided)
- Choose topic
- Agree upon milestones and schedule
- Produce content (regular meetings with supervisor)
- Write up thesis

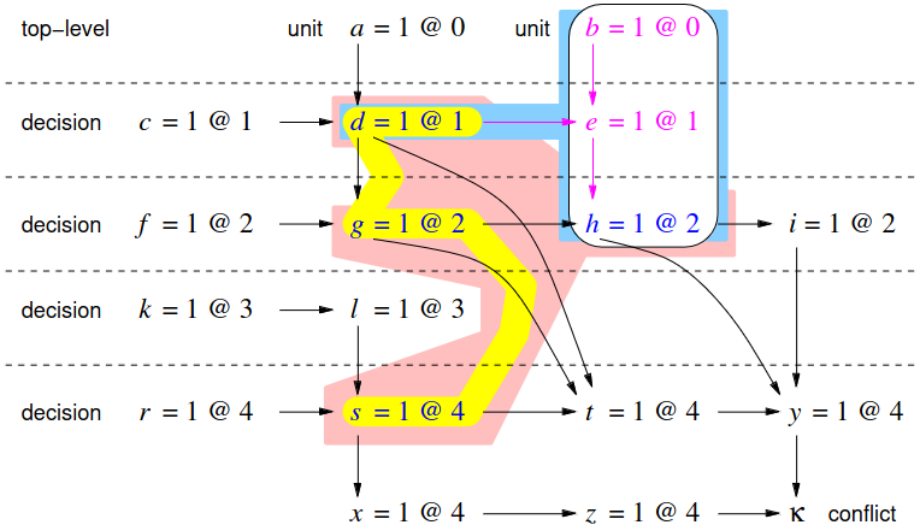
(Selection of) Possible Concrete Topics

- Potential projects directions:
  - Encoding of some reasoning problem (e.g., solving a puzzle) as logical formula
  - Evaluation and comparison of reasoning tools
  - Implementation of (a part of) a solver / reasoning tool
  - Connection with learning techniques

- Example topics can be found here: http://teaching.pages.sai.jku.at/thesis-starters/

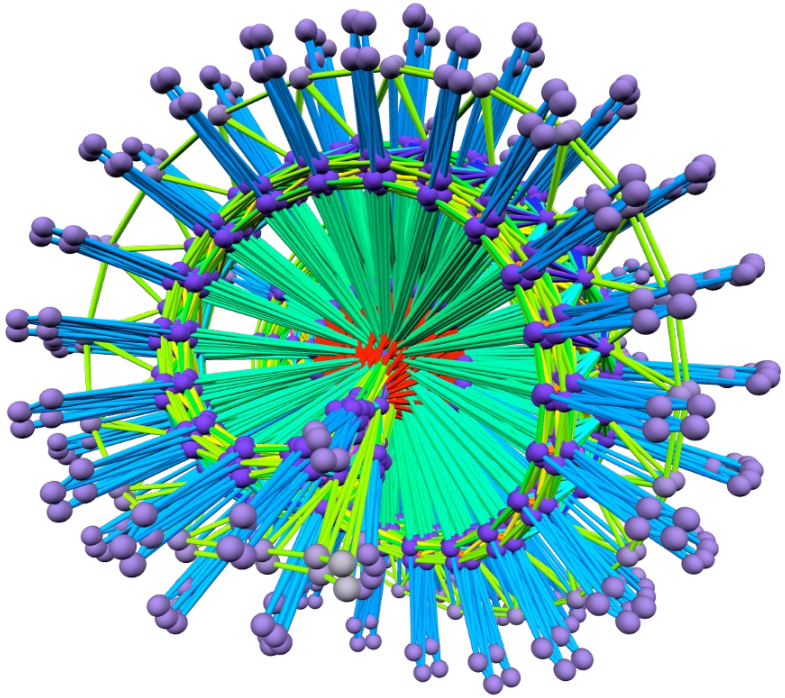
- General information: **Contact us!**

Visualization of CDCL

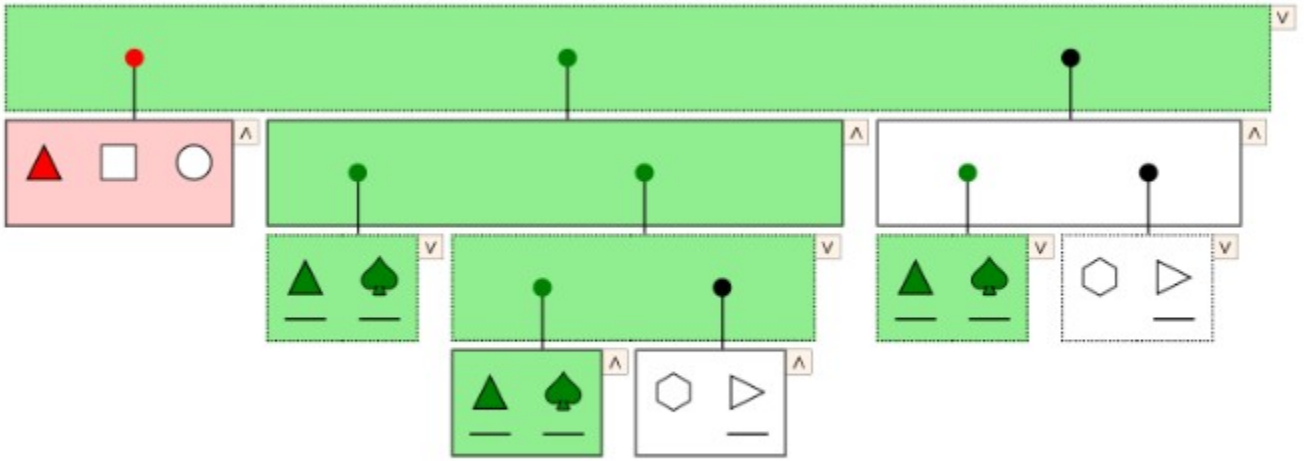


$$\dfrac{\dfrac{(b) \qquad (\overline{b} \vee \overline{d} \vee \overline{g} \vee \overline{s})}{(\overline{d} \vee \overline{g} \vee \overline{s})} \qquad (\overline{d} \vee \overline{b} \vee e)}{\dfrac{(\overline{d} \vee \overline{b} \vee e) \qquad (\overline{e} \vee \overline{d} \vee \overline{g} \vee \overline{s})}{(\overline{e} \vee \overline{g} \vee h)}} \qquad (\overline{d} \vee \overline{g} \vee \overline{s} \vee \overline{h})$$

Structure of Formulas



Logic as Game: teaching.pages.sai.jku.at/abg/



Congratulations, you won!

Questions?