

Institute for Symbolic Artificial Intelligence / Formal Models & Verification



Team:

- **Martina Seidl**
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- Clemens Hofstadler
- Andreas Plank
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- 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)*
 - *Computational Logic in AI (if you do it this semester)*
 - *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



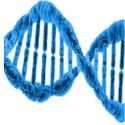
Planning



Security



Verification



Bio-Informatics



Games



Safety

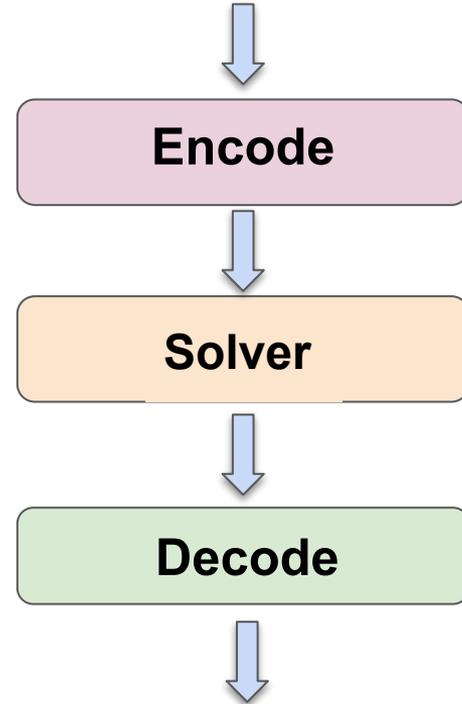


Code
Repair



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



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



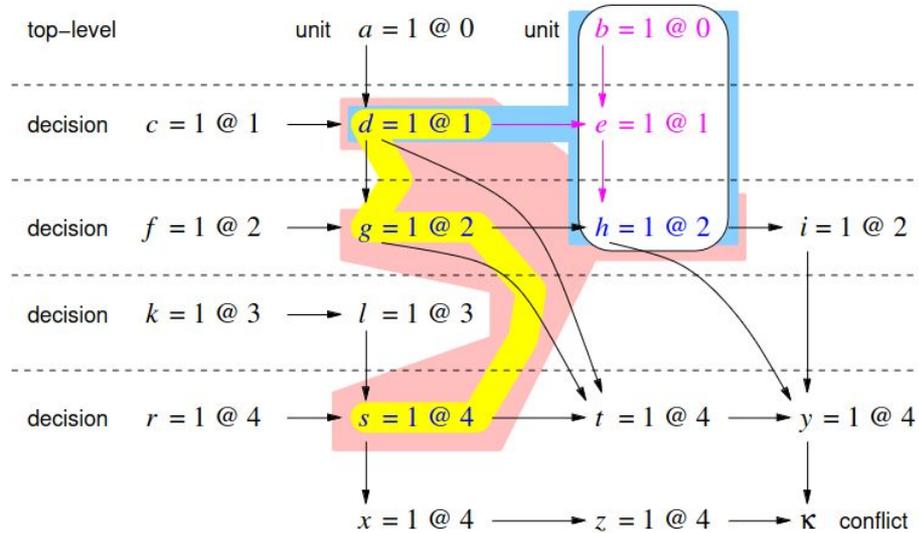
(Selection of) Possible Concrete Topics

- 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!**

Topic Area: Bilateral AI

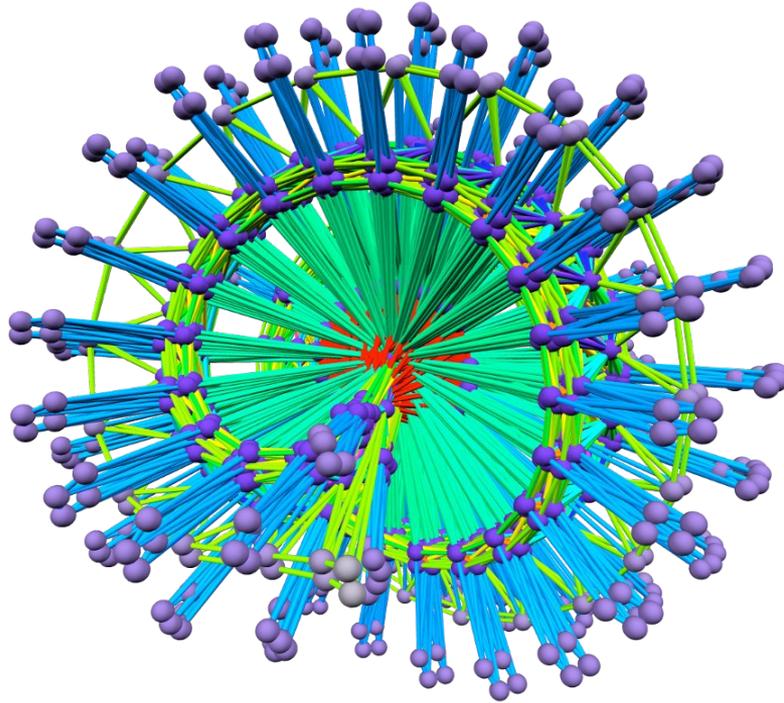
- Combination of symbolic reasoning and machine learning
- Bilateral AI is an Austrian Cluster of Excellence lead by JKU
- Partners: TU Wien, TU Graz, WU Wien, AAU Klagenfurt,
- Involved institutes: CP, FAW, ML, SAI

Topic Example: Visualization of CDCL

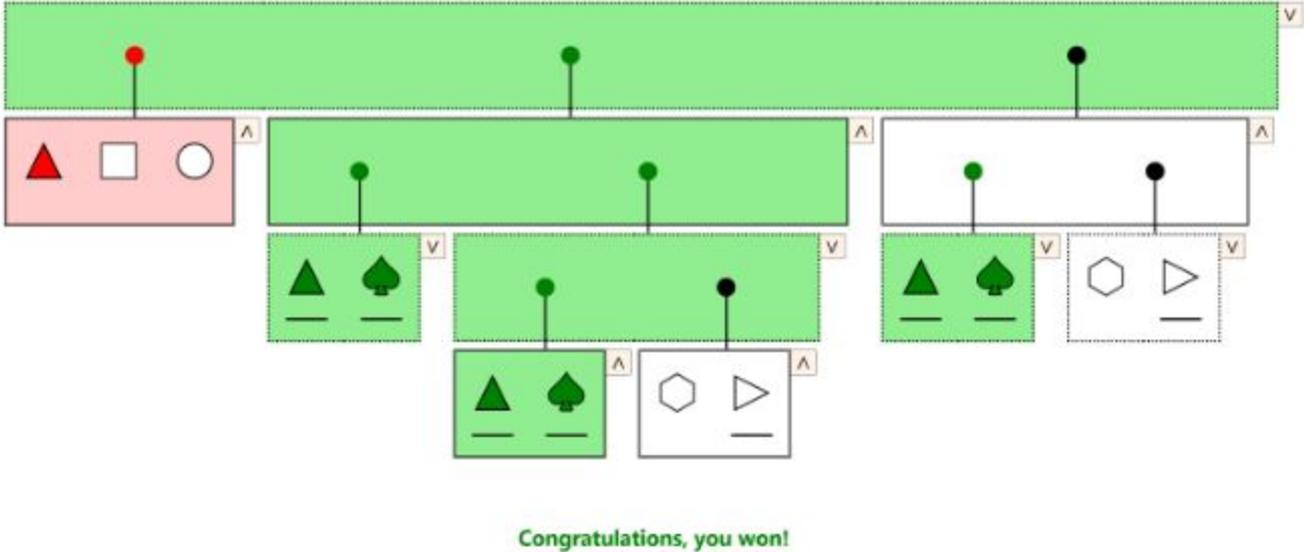


$$\begin{array}{c}
 \frac{(\bar{e} \vee \bar{g} \vee h) \quad (\bar{d} \vee \bar{g} \vee \bar{s} \vee \bar{h})}{(\bar{d} \vee \bar{b} \vee e) \quad (\bar{e} \vee \bar{d} \vee \bar{g} \vee \bar{s})} \\
 \frac{(b)}{(\bar{b} \vee \bar{d} \vee \bar{g} \vee \bar{s})} \\
 \frac{}{(\bar{d} \vee \bar{g} \vee \bar{s})}
 \end{array}$$

Topic Example: Structure of Formulas



Topic Example: Logic as Game



Questions?

