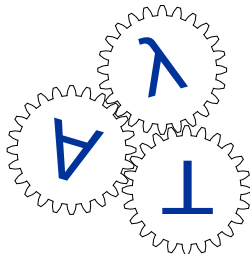


System Description: GAPT 2.0

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- 1 Motivation
- 2 Features
- 3 Demonstration
- 4 Future work

Motivation

- Computational proof theory
 - ▶ Classical first-/higher-order logic
 - ▶ Cut-elimination
 - ▶ Herbrand disjunctions
 - ▶ ...

- ⇒ Implementation in a common framework: GAPT
- ▶ “General Architecture for Proof Theory”
 - ▶ Scala library

Applications

Lemma generation

- Example: transitivity in meet-join-lattices.
- Requires:
 - ▶ First-order (expansion) proofs
 - ▶ SAT/SMT solvers
 - ▶ MaxSAT solvers

Cut-elimination by resolution

- Resolution refutation as skeleton of cut-free proof
- Requires:
 - ▶ Proof input
 - ▶ Resolution proofs
 - ▶ Conversion to expansion proofs
 - ▶ Visualization

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Basic functionality

- Formulas, positions, substitution, unification, subsumption, ...
- Parsing
- Export
- Clausification
- ...

Interfaces to external solvers

SAT solvers:
PicoSAT, Glucose,
miniSAT, Sat4j, ...

First-order provers:
Vampire, SPASS, E,
Prover9, Metis, leanCoP, ...

GAPT

with proof import!

MaxSAT solvers:
OpenWBO, QMaxSAT, ...

SMT solvers:
veriT, Z3, CVC4, ...

Proof systems

⇒ Classical higher-order logic with equality

- Expansion proofs
 - $\simeq$ generalized Herbrand-disjunctions
 - ▶ answer substitutions / witness terms
- Sequent calculus (LK)
- Resolution proofs
- ...

Operations on proofs

- Conversions
- Tactics (for sequent calculus)
 - ▶ Embedded domain-specific language
- Visualization
- Transformations
 - ▶ Cut-elimination
 - ▶ Minimization
- and more!

Demonstration

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Future work

- Inductive prover based on tree grammars
- Synthesis by program extraction
- Natural deduction
- Deskolemization
- New solver interfaces: QBF, more SMT theories, ...
- <https://logic.at/gapt>