

Special Issue on Automated Deduction

Jürgen Giesl

Published online: 5 February 2010
© Springer-Verlag 2010

A key problem in artificial intelligence is the question how to perform mathematical proofs automatically. This is not just a theoretical question, but it has numerous highly important practical applications. In particular, tools that perform *automated deduction* are used to verify software and hardware in safety-critical applications.

For this reason, automated deduction has always been an important area within artificial intelligence. Articles on different aspects of automated deduction can be found in many issues of the KI Journal, but there have also been two special issues (in 1992 and 1998) devoted to the relationship of AI and logic and to automated deduction and its applications, respectively. These two issues also marked the beginning and the end of the DFG priority program “Deduction” which had a tremendous impact on the research in the field in Germany.

The current special issue focuses on the research in automated deduction after 1998. This research can roughly be classified by the different logics under consideration. For propositional logic, the article by U. Egly and L. Haller describes SAT solving for non-clausal formulas and compares it with the more conventional SAT solving for formulas in conjunctive normal form. To apply automated deduction for knowledge representation, instead of propositional logic one usually regards specialized logics like description logics. The article of F. Baader, C. Lutz, and A.-Y. Turhan discusses the trend to new less expressive description logics

with more efficient reasoning procedures. However, most research in automated deduction concerns logics where proving the validity of formulas is undecidable. The paper of P. Baumgartner and E. Thorstensen gives an overview on an important family of recent first-order calculi, so-called instance based methods.

The special issue also contains several articles devoted to applications of theorem provers. The paper by W. Ahrendt, B. Beckert, M. Giese, and P. Rümmer as well as the report on the Verisoft XT project by B. Beckert and M. Moskal describe how to use automated deduction systems for software verification. While verification is one of the main application areas for automated deduction, the project report by U. Furbach, I. Glöckner, H. Helbig, and B. Pelzer shows how to use automated reasoning in other areas of AI like natural language processing.

In addition, the special issue contains summaries of two recent outstanding dissertations in the area. The dissertation of A. Platzer shows how to apply theorem proving for hybrid systems and the dissertation of P. Schneider-Kamp presents a special-purpose prover to analyze the termination behavior of programs.

I want to thank the KI editors for the invitation to prepare this special issue, the authors for submitting high quality articles which indeed provide a good sample of the state of the art in automated deduction, and the reviewers of the articles for their many in-depth comments and suggestions.

J. Giesl (✉)
Lehr- und Forschungsgebiet Informatik 2,
RWTH Aachen University, Ahornstraße 55, 52074 Aachen,
Germany
e-mail: giesl@informatik.rwth-aachen.de
url: <http://verify.rwth-aachen.de/giesl>

Automated Deduction—Contents

- **Fachbeiträge**
 - Current Trends in Automated Deduction
Jürgen Giesl
 - A SAT Solver for Circuits Based on the Tableau Method
Uwe Egly, Leopold Haller
 - Small is Again Beautiful in Description Logics
Franz Baader, Carsten Lutz, Anni-Yasmin Turhan
 - Instance Based Methods—A Brief Overview
Peter Baumgartner, Evgenij Thorstensen
 - Practical Aspects of Automated Deduction for Program Verification
Wolfgang Ahrendt, Bernhard Beckert, Martin Giese, Philipp Rümmer
- **Projekte**
 - Logic-Based Question Answering
Ulrich Furbach, Ingo Glöckner, Hermann Helbig, Björn Pelzer
 - Deductive Verification of System Software in the Verisoft XT Project
Bernhard Beckert, Michał Moskal
- **Dissertationen**
 - Differential Dynamic Logics
André Platzer
 - Static Termination Analysis for Prolog using Term Rewriting and SAT Solving
Peter Schneider-Kamp

Automated Deduction—Service

In the following, we compile the main journals and conferences in the field of automated reasoning. Moreover, we also mention the main organizations in the area. For more information, we refer to the respective web sites.

Journals

- **ACM Transactions on Computational Logic**, ACM
tocl.acm.org
- **Annals of Mathematics & Artif. Intelligence**, Springer
www.springer.com/computer/artificial/journal/10472
- **Applicable Algebra in Engineering, Communication and Computing**, Springer
www.springer.com/computer/mathematics/journal/200
- **Information and Computation**, Elsevier
www.elsevier.com/locate/ic
- **Journal of Applied Logic**, Elsevier
www.elsevier.com/locate/jal

- **Journal of Automated Reasoning**, Springer
www.springer.com/computer/foundations/journal/10817
- **Journal of Logic and Computation**, Oxford U. Press
logcom.oxfordjournals.org
- **Journal of Symbolic Computation**, Elsevier
www.elsevier.com/locate/jsc
- **Journal on Satisfiability, Boolean Modeling and Computation**, IOS Press
www.isa.ewi.tudelft.nl/Jsat
- **Logical Methods in Computer Science**
www.lmcs-online.org
- **Theoretical Computer Science**, Elsevier
www.elsevier.com/locate/tcs

Conferences

- **AISC**, International Conference on Artificial Intelligence and Symbolic Computation
events.cs.bham.ac.uk/cicm08/aisc08
- **ASE**, IEEE/ACM International Conference on Automated Software Engineering
ase-conferences.org
- **CADE**, International Conference on Automated Deduction
www.cadeconference.org
- **CALCULEMUS**, Symposium on the Integration of Symbolic Computation and Mechanized Reasoning
www.calculemus.net
- **CAV**, International Conference on Computer Aided Verification
www.cav-conference.org
- **CSL**, Annual Conference on Computer Science Logic
www.eacsl.org/conferences.html
- **FLoC**, Federated Logic Conference
www.floc-conference.org
- **FroCoS**, International Symposium on Frontiers of Combining Systems
combination.cs.uiowa.edu/frocoss
- **FSTTCS**, Annual Conference on Foundations of Software Technology and Theoretical Computer Science
www.fsttcs.org
- **FTP**, International Workshop on First-Order Theorem Proving
www.csc.liv.ac.uk/FTP-WS
- **IJCAR**, International Joint Conference on Automated Reasoning
www.ijcar.org
- **ITP**, International Conference on Interactive Theorem Proving
www.floc-conference.org
- **JELIA**, European Conference on Logics in Artificial Intelligence
www.jelia.eu

- **LICS**, IEEE Symposium on Logic in Computer Science
www2.informatik.hu-berlin.de/lics
 - **LPAR**, International Conference on Logic for Programming, Artificial Intelligence and Reasoning
www.lpar.net
 - **RTA**, International Conference on Rewriting Techniques and Applications
rewriting.loria.fr/rtta
 - **SAT**, International Conference on Theory and Applications of Satisfiability Testing
www.satisfiability.org
 - **SEFM**, IEEE International Conference on Software Engineering and Formal Methods
sefm.iist.unu.edu
 - **TABLEAUX**, International Conference on Automated Reasoning with Analytic Tableaux and Related Methods
i12www.ira.uka.de/TABLEAUX
 - **TACAS**, International Conference on Tools and Algorithms for the Construction and Analysis of Systems
www.etaps.org
 - **TAP**, International Conference on Tests and Proofs
tap.ethz.ch
 - **TPHOLS**, International Conference on Theorem Proving in Higher Order Logics
tphols.in.tum.de
- ### Organizations
- **Association for Automated Reasoning (AAR)**
www.aarinc.org
 - **Fachgruppe Deduktionssysteme der Gesellschaft für Informatik**
users.rsise.anu.edu.au/~baumgart/activities/fg121