# HORST SAMULOWITZ

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## Research Interests

My research is aimed at improving automated intelligent decision making in real world applications. To that end, I have developed novel and efficient solvers for general problem representation languages. So far much of my work has focused on solvers for problems expressed as Quantified Boolean Formulas (QBF), in which many types of problems like planning and verification are easily expressed. I have a passion for integrating techniques from other research areas such as Machine Learning. This has enabled me not only to develop truly novel approaches producing state of the art results, but also to engage in exciting cross-disciplinary collaborations; I am eager to continue along these lines. Lastly, my interests also extend to other kinds of reasoning and inference problems such as optimization and probabilistic reasoning.

## Research Positions

- **Post-Doctoral Researcher**, Constraint Reasoning Group, Microsoft Research, Cambridge, UK **September 2007-present.**

## Education

- **Ph.D.** Computer Science, University of Toronto, Knowledge Representation Group. Advisor: Professor Fahiem Bacchus. Project: *Quantified Boolean Formulas*, **September 2003-August 2007**
- **M.Sc.** Computer Science (*Minor:* Neurobiology), University of Technology (RWTH), Aachen, Germany, Knowledge Representation Group. Advisor: Professor Gerhard Lakemeyer. Project: *Evaluation-Based Reasoning in First-Order Knowledge Bases*, **October 1997 - February 2003**

## Refereed Conference Proceedings

- $[LION2009]$ Yuehua Xu, David Stern, Horst Samulowitz: **Learning Adaptation to Solve Constraint Problems**, short paper, *LION 2009, Learning and Intelligent OptimizatioN*, 2009
- $[AAAI2007]$ Horst Samulowitz, Roland Memisevic: **Learning to Solve QBF**, *AAAI 2007, The Twenty-Second AAAI Conference on Artificial Intelligence*, 2007
- $[NESCAI2007]$ Jessica Davies, Eric Hsu, Horst Samulowitz: **Solution Backtracking for #SAT**, *NESCAI 2007, North East Student Colloquium on Artificial Intelligence*, 2007
- $[SAT2007]$ Horst Samulowitz, Fahiem Bacchus: **Dynamically Partitioning for Solving QBF**, *SAT 2007, Tenth International Conference on Theory and Applications of Satisfiability Testing*, 2007
- $[SAC2007]$ Lucas Bordeaux, Horst Samulowitz: **On the Stochastic Constraint Satisfaction Framework**, *SAC2007, The 22nd Annual ACM Symposium on Applied Computing*, 2007

- $[CP2006]$ Horst Samulowitz, Jessica Davies, Fahiem Bacchus: **Preprocessing QBF**, *CP 2006, Principles and Practice of Constraint Programming*, Springer New York, 2006
- $[SAT2006]$ Horst Samulowitz, Fahiem Bacchus: **Binary Clause Reasoning in QBF**, *SAT 2006, Ninth International Conference on Theory and Applications of Satisfiability Testing*, Springer New York, 2006
- $[NESCAI2006]$ Horst Samulowitz, Jessica Davies, Fahiem Bacchus: Preliminary version of **Preprocessing QBF**, *NESCAI 2006, North East Student Colloquium on Artificial Intelligence*, 2006
- $[NESCAI2006]$ Horst Samulowitz, Fahiem Bacchus: Updated and compacted version of **Using SAT in QBF**, *NESCAI 2006, North East Student Colloquium on Artificial Intelligence*, 2006
- $[CP2005]$ Horst Samulowitz, Fahiem Bacchus: **Using SAT in QBF**, *CP2005, Principles and Practice of Constraint Programming*, Springer New York, 2005
- $[GI2001]$ Alexander Hornung, Horst Samulowitz: **3D-Visualization of Music**, German Society for Computer Science (GI), *Computer Science Days*, Ulm, 2001
- $[CGI2000]$ Walter Oberschelp, Alexander Hornung, Horst Samulowitz: **Visualization of Eclipses and Planetary Conjunction Events: The Interplay between Model Coherence, Scaling and Animation**, *Computer Graphics International (CGI2000)*, Geneva, 2000

**Journal Publications**

- $[JVC2001]$ Walter Oberschelp, Alexander Hornung, Horst Samulowitz: **Visualization of eclipses and planetary conjunction events. The interplay between model coherence, scaling and animation**. *The Visual Computer*, Vol. 17(5): 310-317, 2001

**Theses**

- Horst Samulowitz, **Solving Quantified Boolean Formulas**, *PhD Thesis*, University of Toronto, 2008
- Horst Samulowitz, **The Efficiency and Implementation of an Evaluation-Based Reasoning Procedure with Disjunctive Information in First-Order Knowledge Bases**, *Master Thesis*, RWTH Aachen, 2003

**Awards**

- **Winner of the International QBF Competition 2006**
  1st, 2nd, and 3rd place on the industrial benchmarks (see `http://www.qbflib.org` for more details)

**Software**

- Contributed to the Microsoft Solver Foundation
  `http://code.msdn.microsoft.com/solverfoundation`

- The following software to solve Quantified Boolean Formulas (QBF) is available:
  - QBF Preprocessor **PreQuel**
  - QBF Solver **SQBF**
  - QBF Solver **2clsQ**

  The software (developed in Microsoft Visual Studio) can be found at:
  `http://www.cs.toronto.edu/~fbacchus/qbf.html`.

**Work Experience**

- **Internship at Microsoft Research, Cambridge, England, July to October 2006** Together with Lucas Bordeaux I worked on a new constraint satisfaction framework. We focused mainly on a natural integration of uncertainty within the context of constraint satisfaction. For more details please refer to the previously mentioned publications.
- **Founder and Executive Board, IT-DEVELOP, Aachen, Germany, May 2001 - January 2003** The main activities were related to the development of a contemporary communication platform that enabled interactive location-based event management. Mobility is becoming evermore important and present in our society - both in business and in private life. People use mobile phones, PDAs and laptop computers, drive to work and to events, fly to business meetings and on holidays. But whereas mobility is increasing and peoples geographical horizons are broadening, information sources did not keep up.
- **Editor, March 2003** German translation of the book "The Essence of Artificial Intelligence" by Alison Cawsey.
- **Research Assistant, Virtual Reality Lab, RWTH Aachen, Germany, February 1999 - August 2002** Besides developing and designing several presentations for computer trade fairs (*e.g.*, CeBIT Hannover) the work mainly concentrated on developing a virtual reality software that supported multiple projectors and operated on a distributed system (Linux Cluster).
- **Software Developer and System Administrator, HEWATT Corp., Stolberg, Germany, 1995 - 2003** The software projects were mainly focused on embedded systems and the simulation of prototypes (*e.g.*, blood pressure meter). The duties as a system administrator included the installation and support of Windows/Linux machines and networking (SAMBA).

**Teaching and Mentoring**

- Teaching Assistant for **Introduction to Artificial Intelligence** (CSC 384, University of Toronto), Winter 2003, Spring 2004, Winter 2004, Spring 2005, Winter 2005, Spring 2006, Winter 2006.
  *Topics:* What is AI, Search (*e.g.*, Backtracking/Game Tree Search), Knowledge Representation, Reasoning Under Uncertainty, Planning
  Duties included marking assignments and exams, conducting weekly one hour classroom tutorials, office hours, and also setting up assignments/exams.
- Teaching Assistant for **The How and Why of Computing** (CSC 147, University of Toronto), Spring 2007.
  *Topics:* HTML, JAVA, Algorithms and Data Structures, Database Systems, Theory of Computation
  Duties included marking assignments and exams, conducting weekly one hour classroom tutorials/lab sessions, maintaining newsgroup and also setting up assignments, tutorials, and lab questions.

- Mentoring Undergraduate and Master students at the University of Toronto, 2005-2007
- Leading Internship in the Constraint Reasoning Group at Microsoft Research, 2008

**Program Committee**

- The International Joint Conference on Artificial Intelligence, IJCAI 2009
- The Conference on Artificial Intelligence, AAAI 2008
- Workshop on Autonomous Search at the Principles and Practice of Constraint Programming (CP) Conference, CP 2007

**Reviewing**

- Journal of Satisfiability (JSAT), 2008
- Letters to Constraint Processing, Special Issue on Autonomous Search, 2008
- Conference on Artificial Intelligence, AAAI 2008
- PhD. Proposals at Microsoft Research, 2008
- STAIR workshop at the Conference on Artificial Intelligence, AAAI 2008
- Principles and Practice of Constraint Programming (CP), 2005, 2007
- North East Student Colloquium on Artificial Intelligence, NESCAI 2007
- International Conference on Theory and Applications of Satisfiability Testing (SAT), 2006, 2007

**Other Skills**

- Computer Languages: C#, C, C++, F#, Python, Java, HTML, PHP, SQL, Prolog
- Familiar with High-Performance Computing Cluster (Microsoft Windows HPC and Linux cluster)
- Research Group Organizer (Cognitive Robotics Group, University of Toronto)
- Fluent in English, German, and Dutch; at an intermediate level in Spanish; basic knowledge in French.

**References**


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**List of Taken Graduate Courses**

*Masters - Department of Computer Science, Universtity of Technology (RWTH), Aachen*

- INTERNET TECHNOLOGY
- PERFORMANCE OF COMPUTER COMMUNICATION
- INTRODUCTION TO ARTIFICIAL INTELLIGENCE
- EFFICIENT ALGORITHM DESIGN
- OPERATING SYSTEMS
- DATABASES
- LOGIC OF KNOWLEDGE BASES
- LOGIC PROGRAMMING
- IMAGE PROCESSING AND COMPUTER GRAPHICS

*Doctor of Philosophy - Department of Computer Science, University of Toronto, Toronto*

- COMPUTABILITY AND LOGIC
- MACHINE LEARNING AND NEURAL NETS
- CONSTRAINT SATISFACTION PROBLEMS
- TOPICS IN GRAPH THEORY (COMPUTATIONAL BIOLOGY)