Personal information

Surname(s) / First name(s)	**Samulowitz, Horst**
Address	1101 Kitchawan Road Yorktown Heights, New York 10598 USA
Phone	+1 914 945 1639
Email	hsamulowitz@googlemail.com
Website	http://www.cs.toronto.edu/~horst

Summary

Within the Cognitive Computing department at IBM Research I am leading the automated machine learning and data science (AMLDS) group. It focuses on projects in Artificial Intelligence and Machine Learning. Topics include Meta-Learning (e.g., automated algorithm selection and configuration), interactive ML systems, combinatorial reasoning and optimization, design and analysis of efficient inference technology for probabilistic reasoning. One current project is the *Cognitive Assistant for Data Scientists*.

Education

09/2003-09/2007	*Ph.D. Computer Science* **University of Toronto**, Canada Artificial Intelligence Group Supervisor: Prof. F. Bacchus "Solving Quantified Boolean Formulas"
10/1997-02/2003	*M.Sc. Computer Science* **RWTH Aachen**, Germany Knowledge-Based Systems Group Supervisor: Prof. G. Lakemeyer "Evaluation-Based Reasoning in First-Order Knowledge Bases"

Work Experience

since 10/2012 — *Research Manager and Research Scientist*

Cognitive Algorithms

IBM TJ Watson Research Center,USA

□ Building Cognitive Systems □ Artificial Intelligence for Combinatorial Search and Optimization □ Machine Learning for automated algorithm selection and configuration (e.g., automatically selecting the most suitable analytic tool) □ Research applied in industrial and government projects

10/2010 - 09/2012 — *Post-Doctoral Researcher*

Business Analytics and Mathematical Sciences

IBM TJ Watson Research Center,USA and **IBM Zürich Research Laboratory**, Switzerland

□ Artificial Intelligence for Combinatorial Optimization (e.g., improvement of IBM ILOG CPLEX) □ Machine Learning for automated algorithm selection and configuration □ Research applied in industrial projects

08/2009 - 09/2010 — *Researcher*

National ICT Australia Ltd, Australia

Research Centre of Excellence

□ Modeling language for search in AI algorithms □ Heuristic Search in AI algorithms

08/2009 - 09/2010 — *Researcher Fellow*

University of Melbourne, Australia

□ Supervision of students and projects

09/2007 - 07/2009 — *Post-Doctoral Researcher*

Constraint Reasoning and Machine Learning Group

Microsoft Research, England

□ Online adaptive search in combinatorial algorithms □ Research results employed in product “Microsoft Solver Foundation”

09/2003 - 08/2007 — *Research Assistant*

Artificial Intelligence Group

University of Toronto, Canada

	□ Research in AI and Knowledge Representation □ Research Group Organizer
07/2006 - 10/2006	*Internship* Constraint Reasoning Group **Microsoft Research**, England □ Stochastic Constraint Satisfaction
04/1995 - 08/2003	*Software Developer and System Admin* **HEWATT GmbH**, Germany □ Software Development for embedded systems □ Simulation of prototypes
05/2001 - 01/2003	*Founder and CEO* **IT-Develop AG**, Germany □ Development of a contemporary communication platform □ Acquisition of funding
02/1999 - 08/2002	*Research Assistant* Virtual Reality Group **RWTH Aachen**, Germany □ Simulation of prototypes using Virtual Reality □ Parallel projection on 50+ projectors □ Exhibited at CeBIT

Other Skills

Computer Languages	C#, C++, F#, Python, Java, HTML, PHP, SQL, Prolog, Mercury
Compute Clusters	High-Performance Compute Clusters (Microsoft Windows HPC and Linux clusters)
Spoken Languages	English, German, Dutch fluent Spanish intermediate; French basic

Patents

Collaborative Expert Portfolio Management	Microsoft Research, Cambridge, UK Manage portfolio of experts such as automated problem solvers, algorithms, services or human experts in order to select the most appropriate expert for a given task online at a negligible cost.

Software

IBM Data Science Experience

Automated Model Selection in DSX

`http://datascience.ibm.com/`

Microsoft Solver Foundation

Contributed to the Microsoft Solver Foundation (C#)

`http://www.solverfoundation.com`

G12 - Constraint Reasoning Platform

Contributed to the G12 - Constraint Reasoning Platform (Mercury)

`http://g12.research.nicta.com.au/`

QBF Solvers

Developed multiple award-winning QBF solvers (C++)

`http://www.cs.toronto.edu/~horst/index_files/software.html`

Teaching, Supervision and Mentoring

Supervision Honours Project

Titel: "Constraint-Based Local Search", University of Melbourne, 2010

Supervision Summer Student

Titel: "Partial Booleanization of Constraints defined in more Expressive Modelling Languages", University of Melbourne, 2010

Supervision Intern

Titel: "Using Reinforcement Learning to Dynamically Adapt Search when solving Constraint Problems", Microsoft Research, 2008

Teaching Assistant

Lecture: "The How and Why of Computing (CSC 147, University of Toronto)", 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.

Spring 2007

Mentoring	Mentoring Undergraduate and Master students at the University of Toronto, 2005-2007
Teaching Assistant	Lecture: “Introduction to Artificial Intelligence (CSC 384, University of Toronto)”, 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 setting up assignments/exams.
	Winter 2003, Spring 2004, Winter 2004, Spring 2005, Winter 2005, Spring 2006, Winter 2006

Academic Awards and Funding

Winning Entries at International SAT Competition 2011/12/13	Multiple first place; more than 10 1st,2nd,3rd ranked entries in total
	`http://www.satcompetition.org`
Winner of the International QBF Competition 2006	1st, 2nd, and 3rd place on industrial benchmarks:
	`http://www.qbflib.org`
Ph.D. Scholarship	$\approx CAD100.000$, University of Toronto, 2003
Interest-free Loan for Start-Up	$\approx EUR200.000$, Sparkasse Aachen, Germany, 2001

Other Skills

Computer Languages	C#, C++, F#, Python, Java, HTML, PHP, SQL, Prolog, Mercury
Compute Clusters	High-Performance Compute Clusters (Microsoft Windows HPC and Linux clusters)
Spoken Languages	English, German, Dutch fluent
	Spanish intermediate; French basic

Senior/Program Committee

Senior Program Committee	International Joint Conference on Artificial Intelligence, **IJCAI**, 2011, 2013,2015
Program Committee	Twenty-Eight Conference on Artificial Intelligence, **AAAI**, 2014, 2015
Program Committee	21st European Conference on Artificial Intelligence, **ECAI**, 2014
Program Committee	17th International Conference on Theory and Applications of Satisfiability Testing, **SAT**, 2014
Program Committee	Learning and Intelligent Optimization, **LION**, 2010, 2012, 2013, 2014
Program Committee	International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems, **CPAIOR**, 2013
Program Committee	Twenty-Sixth Conference on Artificial Intelligence, **AAAI**, 2012
Program Committee	Principles of Knowledge Representation and Reasoning, **KR**, 2012
Program Committee	Learning and Intelligent Optimization, **LION** 2010, 2012, 2013
Program Committee	Twenty-Fifth Conference on Artificial Intelligence, **AAAI**, 2011
Program Committee	Doctoral Programme in Constraint Programming, **CP-DP**, 2011
Program Committee	Twenty-Fourth Conference on Artificial Intelligence, **AAAI**, 2010
Program Committee	Doctoral Symposium on Engineering Stochastic Local Search Algorithms, 2009
Program Committee	The International Joint Conference on Artificial Intelligence, **IJCAI**, 2009
Program Committee	Twenty-Third AAAI Conference on Artificial Intelligence, **AAAI**, 2008
Program Committee	Workshop on Autonomous Search at the Principles and Practice of Constraint Programming Conference, 2007

Reviewing

JAIR 2014	Journal of Artificial Intelligence Research
JAI 2014	Journal of Artificial Intelligence
CP 2005, 2007, 2009, 2010, 2011, 2012, 2013	International Conference on Principles and Practice of Constraint Programming
CPAIOR 2010	International Conference on Integration of Artificial Intelligence (AI) and Operations Research (OR) techniques in Constraint Programming
SAT 2006, 2007, 2010, 2011, 2012	International Conference on Theory and Applications of Satisfiability Testing
DATE 2010	Design, Automation and Testing Conference
Journal of Heuristics 2009	Journal of Heuristics
JSAT 2008, 2009	Journal of Satisfiability
Grant Proposal 2009	Grant Proposal Review for the Government of Chile
Letters to Constraint Processing 2008	Special Issue on Autonomous Search
PhD. Proposals 2008	PhD. Proposals at Microsoft Research, Cambridge
STAIR 2008	STAIR workshop at the Conference on Artificial Intelligence (AAAI)
NESCAI 2007, 2008	North East Student Colloquium on Artificial Intelligence
AI 2007	Twentieth Australian Joint Conference on Artificial Intelligence

Talks

Siemens Research USA Princeton, 2014	"Adaptive Combinatorial Search"
IBM Austin Research Lab Austin, 2011	"Algorithm Selection and Scheduling"

IBM TJ Watson Research Lab New York, 2011	"Automated Algorithm Selection"
DOCOMO Research Munich, 2010	"Improving Combinatorial Search"
University of Melbourne Melbourne, 2010	"Design of a Lightweight Standard Search Language"
AAAI 2010 Atlanta, 2010	"Expert Portfolio Manager"
IBM TJ Watson Research Lab New York, 2010	"Improving Combinatorial Search"
NICTA Melbourne, 2009	"Impact-Based Search"
Microsoft Research Cambridge, 2009	"Learning Adaptation to Solve Constraint Satisfaction Problems"
Okinawa Institute of Science and Technology Okinawa, 2009	"Improving Constraint-Based Solvers"
LION 2009 Trento, 2009	"Learning Adaptation to Solve Constraint Satisfaction Problems"
Microsoft Seattle, 2008	"Adaptive Search in Constraint Satisfaction Problems"
University of Durham Durham, 2008	"Improving Constraint-Based Solvers"
Microsoft Research Cambridge, 2007	"Improving Constraint-Based Solvers"
ETH Zürich Zürich, 2007	"Improving Constraint-Based Solvers"
AAAI 2007 Vancouver, 2007	"Learning to Solve QBF"
University of Toronto Toronto, 2007	"Solving Quantified Boolean Formulas"
SAT 2007 Lissabon, 2007	"Dynamically Partitioning for Solving QBF"
Microsoft Research Cambridge, 2007	"Improving Search"
University of Toronto Toronto, 2006	"Propositional Satisfiability"
CP 2006 Nantes, 2006	"Preprocessing Quantified Boolean Formulas"
NESCAI 2006 Cornell University, 2006	"Using SAT in QBF"

NESCAI 2006 Cornell University, 2006	“Preprocessing QBF”
Microsoft Research Cambridge, 2006	“Stochastic Constraint Satisfaction”
CP 2005 Sitges, 2005	“Using SAT in QBF”
University of Toronto Toronto, 2003	“Efficient Reasoning in First-Order Knowledge Bases”
RWTH Aachen Aachen, 2003	“Evaluation-Based Reasoning in First-Order Knowledge Bases”
Dagstuhl Seminar Dagstuhl, 1999	“Visualization of Eclipses and Planetary Conjunction Events: The Interplay between Model Coherence, Scaling and Animation”

List of Taken Graduate Courses

Master of Science

Department of Computer Science

RWTH Aachen

Germany

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

Doctor of Philosophy

Department of Computer Science

University of Toronto

Canada

- □COMPUTABILITY AND LOGIC (Steve Cook)
- □ MACHINE LEARNING AND NEURAL NETS (Richard Zemel)
- □ CONSTRAINT SATISFACTION PROBLEMS (Fahiem Bacchus)
- □ TOPICS IN GRAPH THEORY (COMPUTATIONAL BIOLOGY) (Michael Brudno)

References

Fahiem Bacchus, Professor

Department of Computer Science
University of Toronto
Toronto, ON M5S 3G4, Canada
Email: fbacchus@cs.toronto.edu
Website: http://www.cs.toronto.edu/~fbacchus/

Ralf Herbrich, Manager

Microsoft Research
United Kingdom
Email: rherb@microsoft.com
Website: http://research.microsoft.com/en-us/people/rherb

Gerhard Lakemeyer, Professor

RWTH Aachen
Department of Computer Science
Knowledge-Based Systems Group
Aachen, 52056
Email:
gerhard@informatik.rwth-aachen.de
Website: http://www-i5.informatik.rwth-aachen.de/gerhard/

Hector Levesque, Professor

Department of Computer Science
University of Toronto
Toronto, ON M5S 3G4, Canada
Email: hector@cs.toronto.edu
Website: http://www.cs.toronto.edu/~hector/

Michael Brudno, Professor

Department of Computer Science and Computational Biology
University of Toronto
Toronto, ON M5S 3G4, Canada
Email: brudno@cs.toronto.edu
Website: http://www.cs.toronto.edu/~brudno/

Refereed Publications

Cognito: Automated Feature Engineering for Supervised Learning	Udayan Khurana, Horst Samulowitz, Deepak Turaga, Srinivasan Parthasrathy
[ICDM-DEMO], 2016	IEEE International Conference on Data Mining
Adaptive data augmentation for image classification	Alhussein Fawzi, Horst Samulowitz, Deepak Turaga, Pascal Frossard
[ICIP], 2016	International Conference on Image Processing
Deep Learning for Algorithm Portfolios	Andrea Loreggia, Yuri Malitsky, Horst Samulowitz, Vijay Saraswat
[AAAI], 2016	29th AAAI Conference on Artificial Intelligence
Near-Optimal Training Data Allocation With Bounded Regret	Ashish Sabharwal, Horst Samulowitz, Gerry Tesauro
[AAAI], 2016	29th AAAI Conference on Artificial Intelligence
Model-based Genetic Algorithms for Algorithm Configuration	Carlos Ansotegui-Gil, Yuri Malitsky, Horst Samulowitz, Meinolf Sellmann, Kevin Tierney
[IJCAI], 2015	24th International Joint Conference on Artificial Intelligence
Towards Cognitive Automation of Data Science	Horst Samulowitz, Gerry Tesauro, Deepak Turaga, Alain Bliem, Yuri Malitsky, Chandra Reddy, Tim Klinger, Anton Riabov, Daby Sow, Mark Feblowitz
[AAAI-DEMO], 2015	Demonstration Track at the 28th AAAI Conference on Artificial Intelligence
Insights into Parallelism with Intensive Knowledge Sharing	Ashish Sabharwal, Horst Samulowitz
[CP], 2014	20th International Conference on Principles and Practice of Constraint Programming (CP)
Parallel Combinatorial Optimization with Decision Diagrams	David Bergman, Andre Cire, Ashish Sabharwal, Horst Samulowitz, Vijay Saraswat, Willem-Jan van Hoeve
[CPAIOR], 2014	11th International Conference on Integration of AI and OR Techniques in Constraint Programming

Resolution and Parallelizability: Barriers to the Efficient Parallelization of SAT Solvers	George Katsirelos, Ashish Sabharwal, Horst Samulowitz, Laurent Simon
[AAAI], 2013	27th AAAI Conference on Artificial Intelligence
Algorithm Portfolios Based on Cost-Sensitive Hierarchical Clustering	Yuri Malitsky, Ashish Sabharwal, Horst Samulowitz, Meinolf Sellmann
[IJCAI], 2013	23rd International Joint Conference on Artificial Intelligence
Snappy: A Simple Algorithm Portfolio (Tool-Paper)	Horst Samulowitz, Chandra Reddy, Ashish Sabharwal, Meinolf Sellmann
[SAT], 2013	16th International Conference on Theory and Applications of Satisfiability Testing
Search Combinators	Tom Schrijvers, Guido Tack, Pieter Wuille, Horst Samulowitz, Peter Stuckey
[Constraints Journal], 2013	Constraints Journal, Special Issue on Modeling and Reformulation
Stronger Inference Through Implied Literals From Conflicts and Knapsack Covers	Tobias Achterberg, Ashish Sabharwal, Horst Samulowitz
[CPAIOR2013], 2013	10th International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems (CPAIOR)
SatX10: A Scalable Plug&Play Parallel SAT Framework (Tool-Paper)	Bard Bloom, David Grove, Benjamin Herta, Vijay Saraswat, Ashish Sabharwal, Horst Samulowitz
[SAT2012], 2012	15th International Conference on Theory and Applications of Satisfiability Testing (SAT2012)
Learning Back-Clauses in SAT	Ashish Sabharwal, Horst Samulowitz, and Meinolf Sellmann
[SAT2012], 2012	15th International Conference on Theory and Applications of Satisfiability Testing (SAT2012)
Augmenting Clause Learning with Implied Literals	Arie Matsliah, Ashish Sabharwal, and Horst Samulowitz
[SAT2012], 2012	15th International Conference on Theory and Applications of Satisfiability Testing (SAT2012)

Boosting Sequential Satisfiability Solver Portfolios through Knowledge Sharing and Accuracy Prediction	Yuri Malitsky, Ashish Sabharwal, Meinolf Sellmann, Horst Samulowitz
[LION], 2013	Learning and Intelligent OptimizatioN Conference
Parallel SAT Solver Selection and Scheduling	Yuri Malitsky, Ashish Sabharwal, Meinolf Sellmann, Horst Samulowitz
[CP2012], 2012	18th International Conference on Principles and Practice of Constraint Programming
Guiding Combinatorial Optimization with UCT	Ashish Sabharwal, Horst Samulowitz
[CPAIOR2012], 2012	9th international on Integration of AI and OR in Constraint Programming
Scheduling for Algorithm Portfolios	Yuri Malitsky, Ashish Sabharwal, Meinolf Sellmann, Horst Samulowitz
[CP2011a], 2011	17th International Conference Principles and Practice of Constraint Programming (CP)
Search Combinators	Tom Schrijvers, Guido Tack, Pieter Wuille, Horst Samulowitz, Peter Stuckey
[CP2011b], 2011	17th International Conference on Principles and Practice of Constraint Programming (CP)
Non-Model-Based Algorithm Portfolios for SAT	Yuri Malitsky, Ashish Sabharwal, Meinolf Sellmann, Horst Samulowitz
[SAT2011], 2011	Fourteenth International Conference on Theory and Applications of Satisfiability Testing (SAT2011)
Collaborative Portfolio Manager	David Stern, Horst Samulowitz, Luca Pulina, Armando Tacchella, Ralf Herbrich, Thore Graepel
[AAAI2010], 2010	The Twenty-Fourth AAAI Conference on Artificial Intelligence (AAAI2010)
Experiments with Massively Parallel Constraint Solving	Lucas Bordeaux, Youssef Hamadi, Horst Samulowitz
[IJCAI2009], 2009	International Joint Conference on Artificial Intelligence (IJCAI2009)
Learning to Solve QBF	Horst Samulowitz, Roland Memisevic
[AAAI2007], 2007	The Twenty- Second AAAI Conference on Artificial Intelligence (AAAI2007)

Dynamically Partitioning for Solving QBF	Horst Samulowitz, Fahiem Bacchus
[SAT2007], 2007	Tenth International Conference on Theory and Applications of Satisfiability Testing (SAT2007)
On the Stochastic Constraint Satisfaction Framework	Lucas Bordeaux, Horst Samulowitz
[SAC2007], 2007	The 22nd Annual ACM Symposium on Applied Computing (SAC2007)
Iterated Expressions in Constraint Programming	Lucas Bordeaux, Youssef Hamadi, Claude-Guy Quimper, and Horst Samulowitz
[JFPC2007], 2007	In Proceedings of Troisime Journes Francophones de Programmation par Contraintes (JFPC2007)
Preprocessing QBF	Horst Samulowitz, Jessica Davies, Fahiem Bacchus
[CP2006], 2006	12th International Conference on Principles and Practice of Constraint Programming (CP2006)
Binary Clause Reasoning in QBF	Horst Samulowitz, Fahiem Bacchus
[SAT2006], 2006	Ninth International Conference on Theory and Applications of Satisfiability Testing (SAT2006)
Using SAT in QBF	Horst Samulowitz, Fahiem Bacchus
[CP2005], 2001	11th International Conference on Principles and Practice of Constraint Programming (CP2006)
Visualization of eclipses and planetary conjunction events. The interplay between model coherence, scaling and animation.	Walter Oberschelp, Alexander Hornung, Horst Samulowitz
[JVC2001], 2001	The Visual Computer, Vol. 17(5)
3D-Visualization of Music	Alexander Hornung, Horst Samulowitz
[GI2001], 2001	German Society for Computer Science (GI), Computer Science Days
Visualization of eclipses and planetary conjunction events. The interplay between model coherence, scaling and animation.	Walter Oberschelp, Alexander Hornung, Horst Samulowitz

[CGI2000], 2000	Computer Graphics International (CGI2001)

Refereed Workshop Publications

Automating Feature Engineering	Udayan Khurana, Fatemeh Nargesian, Horst Samulowitz, Elias Khalil and Deepak Turaga
[NIPS-AI4DS], 2016	AI for Data Science Workshop at NIPS 2016
Cognitive Automation of Data Science	Horst Samulowitz, Ashish Sabharwal, Chandra Reddy
[ICML-AUTOML], 2014	Auto-ML Workshop at ICML 2014
An Introduction to Search Combinators	Tom Schrijvers, Pieter Wuille, Horst Samulowitz, Guido Tack, Peter Stuckey
[LOPSTR], 2012	22nd International Symposium on Logic-Based Program Synthesis and Transformation
Search Combinators for MiniZinc	Tom Schrijvers, Pieter Wuille, Horst Samulowitz, Guido Tack, Peter Stuckey
[MZN2011], 2011	Minizinc Workshop (MZN2011) at the Seventeenth International Conference on Principles and Practice of Constraint Programming (CP 2011)
Guiding Combinatorial Optimization with UCT	Ashish Sabharwal, Horst Samulowitz
[ICAPS2011], 2011	ICAPS Monte Carlo Tree Search (MCTS2011) Workshop
Memoizing a Monadic Mixin DSL	Tom Schrijvers, Guido Tack, Pieter Wuille, Horst Samulowitz, Peter Stuckey
[WFLP2011], 2011	20th International Workshop on Functional and (Constraint) Logic Programming (WFLP)
Towards a Lightweight Standard Search Language	Horst Samulowitz, Guido Tack, Julien Fischer, Peter Stuckey, Mark Wallace
[MODREF10], 2010	9th International Workshop on Constraint Modelling and Reformulation (ModRef)
Learning Adaptation to Solve Constraint Problems	Yuehua Xu, David Stern, Horst Samulowitz

[LION09], 2009	Learning and Intelligent OptimizatioN (LION)

Other Refereed Work

Automated Design of Search with Composability	Horst Samulowitz, Ashish Sabharwal, Tom Schrijvers, Guido Tack, Pieter Wuille, Peter Stuckey
[AAAI2013], 2013	27th AAAI Conference on Artificial Intelligence
Solution Backtracking for #SAT	Jessica Davies, Eric Hsu, Horst Samulowitz
[NESCAI2007], 2007	North East Student Colloquium on Artificial Intelligence (NESCAI)
Using SAT in QBF	Horst Samulowitz, Fahiem Bacchus
[NESCAI2006], 2006	North East Student Colloquium on Artificial Intelligence (NESCAI)
Preprocessing QBF	Horst Samulowitz, Fahiem Bacchus
[NESCAI2006], 2006	North East Student Colloquium on Artificial Intelligence (NESCAI)

Thesis

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