

Ashish Sabharwal

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CURRENT APPOINTMENT

Research Associate (2008–present), Computer Science, **Cornell University**, Ithaca, NY
Institute for Computational Sustainability (ICS)
Intelligent Information Systems Institute (IISI)

EDUCATION

Postdoctoral Associate (2005–2008), Computer Science, *Cornell University*, Ithaca, NY
Intelligent Information Systems Institute (IISI)
Supervisors: Profs. Carla P. Gomes and Bart Selman

Ph.D. (2001–2005), Computer Science and Engineering, *University of Washington*, Seattle, WA
Advisors: Profs. Paul Beame and Henry Kautz

M.S. (1998–2001), Computer Science and Engineering, *University of Washington*, Seattle, WA
Advisor: Prof. Paul Beame

B.Tech. (1994–1998), Computer Science and Engineering, *Indian Institute of Technology (IIT), Kanpur*, India
Project Supervisor: Prof. Manindra Agarwal

RESEARCH INTERESTS

Artificial Intelligence; Combinatorial Reasoning; Constraints; Probabilistic Inference; Multi-Agent and Adversarial Reasoning; Optimization. *Application areas*: Planning, Scheduling, Verification.

Recent Focus: Computational Sustainability

AWARDS AND DISTINCTIONS

- Outstanding Paper Award at AAAI-06, the 21st National Conference on Artificial Intelligence, Boston, MA, 2006, for the paper *Model Counting: A New Strategy for Obtaining Good Bounds* with Carla P. Gomes and Bart Selman
- Best Paper Award at CP-06, the 12th International Conference on Constraint Programming, Nantes, France, 2006, for the paper *Revisiting the Sequence Constraint* with Willem-Jan van Hoeve, Gilles Pesant, Louis-Martin Rousseau
- Runner-up recognition for IJCAI-JAIR 5-Year Best Paper Prize for 2003–2008, for the paper *Understanding and Harnessing the Potential of Clause Learning* with Paul Beame and Henry Kautz
- Nominated for best paper award at AAAI-07, the 22nd Conference on Artificial Intelligence, Vancouver, BC, 2007
- Nominated for best paper award at IJCAI-07, the 20th International Joint Conference on Artificial Intelligence, Hyderabad, India 2007
- Nominated for best student paper award at UAI-07, the 23rd Conference on Uncertainty in Artificial Intelligence, Vancouver, BC, 2007

- Nominated for best paper award at ICAPS-06, International Conference on Automated Planning and Scheduling, Cumbria, U.K., 2006
- Jhamandas Watumull Scholarship, University of Washington, Seattle, 2002, 2005
- National Talent Search Scholarship, India 1992–1998
- Gold Medal, National Standard Examination in Physics, India, 1994
- Certificate of Merit in English, Mathematics, and Physics (1994) awarded to 0.1% by Central Board of Secondary Education, India
- International Mathematics Olympiad (IMO) Training/Selection Program, Mumbai, India, 1993–1994
- All India 24th Rank in IIT Entrance Examination (over 60,000 candidates), 1994

PUBLICATIONS

Rigorously Refereed Publications

- [1] L. Kroc, A. Sabharwal, and B. Selman. Leveraging belief propagation, backtrack search, and statistics for model counting. *Annals of Operations Research*, 2010. In Press.
- [2] C. Domshlak, J. Hoffmann, and A. Sabharwal. Friends or foes? on planning as satisfiability and abstract CNF encodings. *JAIR: Journal of Artificial Intelligence Research*, pp. 415–469, Dec. 2009.
- [3] W.-J. van Hoeve, G. Pesant, L.-M. Rousseau, and A. Sabharwal. New filtering algorithms for combinations of Among constraints. *Constraints*, 14(2):273–292, June 2009.
- [4] A. Sabharwal. SymChaff: Exploiting symmetry in a structure-aware satisfiability solver. *Constraints*, 14(4):478–505, Dec. 2009.
- [5] L. Kroc, A. Sabharwal, C. P. Gomes, and B. Selman. Integrating systematic and local search paradigms: A new strategy for MaxSAT. In *IJCAI-09: 21st International Joint Conference on Artificial Intelligence*, pp. 544–551, Pasadena, CA, July 2009.
- [6] L. Kroc, A. Sabharwal, and B. Selman. Relaxed DPLL search for MaxSAT. In *SAT-09: 12th International Conference on Theory and Applications of Satisfiability Testing*, vol. 5584 of *LNCS*, pp. 73–79, Swansea, Wales, U.K., June 2009.
- [7] B. Dilkina, C. P. Gomes, Y. Malitsky, A. Sabharwal, and M. Sellmann. Backdoors to combinatorial optimization: Feasibility and optimality. In *CPAIOR-09: 6th International Conference on Integration of AI and OR Techniques in Constraint Programming*, vol. 5547 of *LNCS*, pp. 56–70, Pittsburgh, PA, May 2009.
- [8] B. Dilkina, C. P. Gomes, and A. Sabharwal. Backdoors in the context of learning. In *SAT-09: 12th International Conference on Theory and Applications of Satisfiability Testing*, vol. 5584 of *LNCS*, pp. 73–79, Swansea, Wales, U.K., June 2009.
- [9] L. Kroc, A. Sabharwal, and B. Selman. Message-passing and local heuristics as decimation strategies for satisfiability. In *24th Annual ACM Symposium on Applied Computing*, pp. 1408–1414, Honolulu, HI, Mar. 2009.
- [10] M. Cary, A. Rudra, A. Sabharwal, and E. Vee. Floodlight illumination of infinite wedges. *Computational Geometry: Theory and Applications*, 2010. In press.
- [11] L. Kroc, A. Sabharwal, and B. Selman. Counting solution clusters in graph coloring problems using belief propagation. In *NIPS-08: 22nd Conference on Advances in Neural Information Processing Systems*, pp. 873–880, Vancouver, BC, Dec. 2008.
- [12] L. Kroc, A. Sabharwal, and B. Selman. Leveraging belief propagation, backtrack search, and statistics for model counting. In *CPAIOR-08: 5th International Conference on Integration of AI and OR Techniques in Constraint Programming*, vol. 5015 of *LNCS*, pp. 127–141, Paris, France, May 2008.

- [13] C. P. Gomes, W.-J. van Hoeve, and A. Sabharwal. Connections in networks: A hybrid approach. In *CPAIOR-08: 5th International Conference on Integration of AI and OR Techniques in Constraint Programming*, vol. 5015 of *LNCS*, pp. 303–307, Paris, France, May 2008.
- [14] W.-J. van Hoeve and A. Sabharwal. Filtering Atmost1 on pairs of set variables. In *CPAIOR-08: 5th International Conference on Integration of AI and OR Techniques in Constraint Programming*, vol. 5015 of *LNCS*, pp. 382–386, Paris, France, May 2008.
- [15] P. Beame, R. Impagliazzo, and A. Sabharwal. The resolution complexity of independent sets and vertex covers in random graphs. *Computational Complexity*, 16(3):245–297, 2007.
- [16] C. P. Gomes, W.-J. van Hoeve, A. Sabharwal, and B. Selman. Counting CSP solutions using generalized XOR constraints. In *AAAI-07: 22nd Conference on Artificial Intelligence*, pp. 204–209, Vancouver, BC, July 2007.
- [17] B. Dilkina, C. P. Gomes, and A. Sabharwal. The impact of network topology on pure Nash equilibria in graphical games. In *AAAI-07: 22nd Conference on Artificial Intelligence*, pp. 42–49, Vancouver, BC, July 2007.
- [18] C. P. Gomes, J. Hoffmann, A. Sabharwal, and B. Selman. From sampling to model counting. In *IJCAI-07: 20th International Joint Conference on Artificial Intelligence*, pp. 2293–2299, Hyderabad, India, Jan. 2007.
- [19] L. Kroc, A. Sabharwal, and B. Selman. Survey propagation revisited. In *Proceedings of UAI-07: 23rd Conference on Uncertainty in Artificial Intelligence*, pp. 217–226, Vancouver, BC, July 2007.
- [20] J. Conrad, C. P. Gomes, W.-J. van Hoeve, A. Sabharwal, and J. Suter. Connections in networks: Hardness of feasibility versus optimality. In *CPAIOR-07: 4th International Conference on Integration of AI and OR Techniques in Constraint Programming*, vol. 4510 of *LNCS*, pp. 16–28, Brussels, Belgium, May 2007.
- [21] B. Dilkina, C. P. Gomes, and A. Sabharwal. Tradeoffs in the complexity of backdoor detection. In *CP-07: 13th International Conference on Principles and Practice of Constraint Programming*, vol. 4741 of *LNCS*, pp. 256–270, Providence, RI, Sept. 2007.
- [22] C. P. Gomes, J. Hoffmann, A. Sabharwal, and B. Selman. Short XORs for model counting; from theory to practice. In *SAT-07: 10th International Conference on Theory and Applications of Satisfiability Testing*, vol. 4501 of *LNCS*, pp. 100–106, Lisbon, Portugal, May 2007.
- [23] C. P. Gomes, A. Sabharwal, and B. Selman. Model counting: A new strategy for obtaining good bounds. In *AAAI-06: 21st Conference on Artificial Intelligence*, pp. 54–61, Boston, MA, July 2006.
- [24] C. P. Gomes, A. Sabharwal, and B. Selman. Near-uniform sampling of combinatorial spaces using XOR constraints. In *NIPS-06: 20th Conference on Advances in Neural Information Processing Systems*, pp. 481–488, Vancouver, BC, Dec. 2006.
- [25] W.-J. van Hoeve, G. Pesant, L.-M. Rousseau, and A. Sabharwal. Revisiting the sequence constraint. In *CP-06: 12th International Conference on Principles and Practice of Constraint Programming*, vol. 4204 of *LNCS*, pp. 620–634, Nantes, France, Sept. 2006.
- [26] J. Hoffmann, A. Sabharwal, and C. Domshlak. Friends or foes? an AI planning perspective on abstraction and search. In *ICAPS-06: 16th International Conference on Automated Planning and Scheduling*, pp. 294–303, Lake District, UK, June 2006.
- [27] A. Sabharwal, C. Ansotegui, C. P. Gomes, J. W. Hart, and B. Selman. QBF modeling: Exploiting player symmetry for simplicity and efficiency. In *SAT-06: 9th International Conference on Theory and Applications of Satisfiability Testing*, vol. 4121 of *LNCS*, pp. 353–367, Seattle, WA, Aug. 2006.
- [28] A. Sabharwal. SymChaff: A structure-aware satisfiability solver. In *AAAI-05: 20th National Conference on Artificial Intelligence*, pp. 467–474, Pittsburgh, PA, July 2005.
- [29] P. Beame, H. Kautz, and A. Sabharwal. Understanding and harnessing the potential of clause learning. *JAIR: Journal of Artificial Intelligence Research*, 22:319–351, Dec. 2004.
- [30] J. Buresh-Oppenheim, P. Beame, T. Pitassi, R. Raz, and A. Sabharwal. Bounded-depth Frege lower bounds for weaker pigeonhole principles. *SIAM Journal on Computing*, 34(2):261–276, 2004.

- [31] P. Beame, H. Kautz, and A. Sabharwal. Understanding the power of clause learning. In *IJCAI-03: 18th International Joint Conference on Artificial Intelligence*, pp. 1194–1201, Acapulco, Mexico, Aug. 2003.
- [32] A. Sabharwal, P. Beame, and H. Kautz. Using problem structure for efficient clause learning. In *SAT-03: 6th International Conference on Theory and Applications of Satisfiability Testing*, vol. 2919 of *LNCS*, pp. 242–256, Santa Margherita, Italy, May 2003.
- [33] J. Buresh-Oppenheim, P. Beame, T. Pitassi, R. Raz, and A. Sabharwal. Bounded-depth Frege lower bounds for weaker pigeonhole principles. In *Proceedings of FOCS-02: 43rd Annual Symposium on Foundations of Computer Science*, pp. 583–592, Vancouver, BC, Nov. 2002.
- [34] P. Beame, R. Impagliazzo, and A. Sabharwal. Resolution complexity of independent sets in random graphs. In *Proceedings 16th Annual IEEE Conference on Computational Complexity*, pp. 52–68, Chicago, IL, June 2001.

Surveys and Book Chapters

- [35] H. Kautz, A. Sabharwal, and B. Selman. Incomplete solvers (for satisfiability). In A. Biere, M. Heule, H. van Maaren, and T. Walsh, editors, *Handbook of Satisfiability*, chapter 6, pp. 105–203. IOS Press, 2009.
- [36] C. P. Gomes and A. Sabharwal. Exploiting runtime variation in complete solvers (for satisfiability). In A. Biere, M. Heule, H. van Maaren, and T. Walsh, editors, *Handbook of Satisfiability*, chapter 9, pp. 271–288. IOS Press, 2009.
- [37] C. P. Gomes, A. Sabharwal, and B. Selman. Model counting. In A. Biere, M. Heule, H. van Maaren, and T. Walsh, editors, *Handbook of Satisfiability*, chapter 20, pp. 633–654. IOS Press, 2009.
- [38] C. P. Gomes, H. Kautz, A. Sabharwal, and B. Selman. Satisfiability solvers. In F. van Harmelen, V. Lifschitz, and B. Porter, editors, *Handbook of Knowledge Representation*, vol. 3 of *Foundations of Artificial Intelligence*, pp. 89–134. Elsevier, 2008.
- [39] H. Kautz, A. Sabharwal, and B. Selman. *Satisfiability Solvers*. Synthesis Lectures on Artificial Intelligence and Machine Learning. Morgan & Claypool, 2010. In preparation.
- [40] A. Sabharwal and B. Selman. Artificial intelligence and complexity. In R. Meyers, editor, *Encyclopedia of Complexity and Systems Science*. Springer, 2010. In preparation.

Workshops, Non-Archival Publications, and Other Work

- [41] J. F. Suter, J. Conrad, C. P. Gomes, W.-J. van Hoeve, and A. Sabharwal. Optimal corridor design for grizzly bear in the U.S. Northern Rockies. In *American Agricultural Economics Association Annual Meeting*, Orlando, FL, July 2008.
- [42] L. Kroc, A. Sabharwal, and B. Selman. Leveraging belief propagation, backtrack search, and statistics for model counting. In *ISAIM-08: 10th International Symposium on Artificial Intelligence and Mathematics*, Fort Lauderdale, FL, Jan. 2008.
- [43] B. Dilkina, C. P. Gomes, and A. Sabharwal. Tradeoffs in backdoors: Inconsistency detection, dynamic simplification, and preprocessing. In *ISAIM-08: 10th International Symposium on Artificial Intelligence and Mathematics*, Fort Lauderdale, FL, Jan. 2008.
- [44] C. P. Gomes, W.-J. van Hoeve, A. Sabharwal, and B. Selman. Counting CSP solutions using generalized XOR constraints. In *INFORMS Annual Meeting*, Washington, DC, Oct. 2008.
- [45] L. Kroc, A. Sabharwal, and B. Selman. Satisfied by message passing: Probabilistic techniques for combinatorial problems. In *AAAI-08: 23rd Conference on Artificial Intelligence*, Chicago, IL, July 2008. Tutorial.
- [46] A. Sabharwal and B. Selman. Beyond traditional SAT reasoning: QBF, model counting, and solution sampling. In *AAAI-07: 22nd Conference on Artificial Intelligence*, Vancouver, BC, July 2007. Tutorial.

- [47] W.-J. van Hoeve, G. Pesant, L.-M. Rousseau, and A. Sabharwal. Filtering algorithms for the sequence constraint. In *INFORMS Annual Meeting*, Seattle, WA, Nov. 2007.
- [48] W.-J. van Hoeve and A. Sabharwal. Two set constraints for modeling and efficiency. In *ModRef-07: 6th International Workshop on Constraint Modelling and Reformulation, in conjunction with CP-07*, Providence, RI, Sept. 2007.
- [49] L. Kroc, A. Sabharwal, and B. Selman. Empirical validation of the relationship between survey propagation and covers in random 3-SAT. In *Workshop on Algorithms, Inference, & Statistical Physics*, Sante Fe, NM, May 2007.
- [50] C. P. Gomes, J. Hoffmann, A. Sabharwal, and B. Selman. Sampling and soundness: Can we have both? In *ISWC-07: 6th International Semantic Web Conference*, Busan, Korea, Nov. 2007.
- [51] B. Dilkina, C. P. Gomes, and A. Sabharwal. The impact of network topology on pure Nash equilibria in graphical games. In *2nd NESCAI: North East Student Colloquium on Artificial Intelligence*, Ithaca, NY, Apr. 2007.
- [52] A. Culotta, A. McCallum, A. Sabharwal, and B. Selman. Sparse message passing algorithms for weighted Max-SAT. In *2nd NESCAI: North East Student Colloquium on Artificial Intelligence*, Ithaca, NY, Apr. 2007.
- [53] C. P. Gomes, A. Sabharwal, M. Sellmann, and B. Selman. Streamlining reasoning for solution finding and counting. In *INFORMS Annual Meeting*, Pittsburgh, PA, Nov. 2006.
- [54] A. Sabharwal. *Algorithmic Applications of Propositional Proof Complexity*. PhD thesis, University of Washington, Seattle, 2005.
- [55] A. Sabharwal. Model checking: Two decades of novel techniques and trends, 2002. General Examination Report, University of Washington, Seattle.
- [56] A. Sabharwal. Notes on proof complexity based on lectures by Prof. Paul Beame, 2004. Scribed lectures for Summer School, Institute for Advanced Study / Park City Math. Inst. (IAS/PCMI), Princeton, Aug 2000, IAS/Park City Mathematics Series, volume 10, pages 199-246.

Under Review and in Preparation

- [57] R. Ramanujan, A. Sabharwal, and B. Selman. On adversarial search spaces and sampling-based planning, 2010. Under review.
- [58] B. Dilkina, C. P. Gomes, and A. Sabharwal. Backdoors in the context of dynamic sub-solvers and learning. *Annals of Mathematics and Artificial Intelligence*, 2010. Under review.
- [59] E. Kim, A. Sabharwal, A. Vetta, and M. Blanchette. Predicting direct protein interactions from affinity purification mass spectrometry data, 2010. Under review.
- [60] L. Kroc, A. Sabharwal, and B. Selman. Solution clusters in combinatorial problems: Exact and approximate inference methods. *PNAS: Proceedings of the National Academy of Science*, 2010. In preparation.
- [61] J. Conrad, C. P. Gomes, W.-J. van Hoeve, A. Sabharwal, and J. Suter. Incorporating economic and ecological information into the optimal design of wildlife corridors. *Conservation Biology*, 2010. In preparation.
- [62] W.-J. van Hoeve and A. Sabharwal. Cardinality constraints on the intersection of pairs of set variables. *Constraints*, 2010. In preparation.
- [63] W.-J. van Hoeve and A. Sabharwal. Filtering the length-lex set partition constraint, 2010. In preparation.
- [64] B. Dilkina, A. Elmachtoub, R. Finseth, C. P. Gomes, A. Sabharwal, D. Sheldon, and D. Shmoys. Network diffusion models and stochastic optimization for bird conservation, 2010. In preparation.
- [65] T. Damoulas, C. P. Gomes, J. Gregoire, R. LeBras, A. Sabharwal, and B. Selman. Computational thinking in material discovery, 2010. In preparation.

- [66] K. Ahmadizadeh, C. P. Gomes, A. Sabharwal, and B. Selman. Exploiting cloud computing for stochastic optimization for bird conservation, 2010. In preparation.
- [67] L. Kroc, A. Sabharwal, C. P. Gomes, and B. Selman. On heavy tailed behavior in local search, 2010. In preparation.

INVITED TALKS

- Banff International Research Station for Mathematical Innovation and Discovery, Workshop on Search in Constraint Programming, Banff, AB, Canada, 2009
- McGill University, SoCS Colloquium, Montreal, QC, Canada, 2009
- University of British Columbia (UBC), Laboratory of Computational Intelligence (LCI) Forum, Vancouver, BC, Canada, 2008
- Carnegie Mellon University (CMU), Computer Science Colloquium, Pittsburgh, PA, 2008
- University of California, Merced, CA, 2008
- Nordic Institute for Theoretical Physics (NORDITA), Workshop on Physics of Distributed Information Systems (PhysDIS), Sweden, Stockholm, 2008
- 2nd Asian-Pacific School on Statistical Physics and Interdisciplinary Applications, Kavli Institute for Theoretical Physics China (KITPC), Chinese Academy of Sciences, Beijing, China, 2008
- CORS-INFORMS Annual Meeting, *Backdoors in the Context of Learning*, Toronto, ON, Canada, 2009
- CORS-INFORMS Annual Meeting, *Integrating Systematic and Local Search Paradigms: A New Strategy for MaxSAT*, Toronto, ON, Canada, 2009
- INFORMS Annual Meeting, *Hidden Structure in Constraint Reasoning Problems*, Washington, DC, 2008
- INFORMS Annual Meeting, *Solution Counting Methods for Combinatorial Problems*, Washington, DC, 2008
- INFORMS Annual Meeting, *Hidden Structure in Combinatorial Problems*, Seattle, WA, Nov 2007.

SUMMER SCHOOLS AND INTERNSHIPS

Participant and Tutorial Presenter, 2nd Asian-Pacific School on Statistical Physics and Interdisciplinary Applications (March 2008)

Kavli Institute for Theoretical Physics China (KITPC), Chinese Academy of Sciences, Beijing, China

Participant and Scribe, IAS/PCMI Summer School in Theoretical Computer Science (Summer 2000)

Institute for Advanced Study (IAS), Princeton, NJ, U.S.A.

Research Intern (Summer 1999)

Microsoft Research, Redmond, WA, U.S.A.

Supervisor: Dr. John Manferdelli, Anti-Piracy Group

Worked on Digital Rights Management; designed methods that use control- and data-flow analysis on binary program code to embed hard-to-break license authentication protocols in arbitrary programs.

Intern, Visiting Students Research Program (Summer 1997)

Tata Institute of Fundamental Research (TIFR), Mumbai, India

Supervisor: Prof. Paritosh K. Pandya, Theoretical Computer Science Group

Worked on Formal Verification; explored efficient monadic second order logic operators useful for verification, by exploiting connections between logic and automata-theoretic frameworks.

TEACHING EXPERIENCE

Tutorial Presenter

- State-of-the-Art Techniques in Systematic Satisfiability Solvers
Banff Intl. Research Station for Mathematical Innovation and Discovery, Banff, AB, Canada, 2009
- Satisfied by Message Passing: Probabilistic Techniques for Combinatorial Problems
AAAI-08 Conference, Chicago, IL, July 2008
- Combinatorial Problems (lecture series: I – Solving, II – Counting and Sampling, III – QBF Reasoning)
Kavli Institute for Theoretical Physics China (KITPC), Chinese Academy of Sciences, Beijing, China, March 2008
- Beyond Traditional SAT Reasoning: QBF, Model Counting, and Solution Sampling
AAAI-07 Conference, Vancouver, BC, Canada, July 2007
- Quantified Boolean Formula (QBF) Reasoning
Defense Advanced Research Projects Agency (DARPA), Arlington, VA, 2007

Lecturer, University of Washington, Seattle, WA (Fall 2003)

Organized and taught with the help of two teaching assistants an *undergraduate Data Structures* course to a class of 46 students. Increased effectiveness of lectures by using a new tablet PC based interactive slide system. Was praised for enthusiasm and knowledge. Overall student evaluation rating: 4.2/5.0.

Teaching Assistant, University of Washington, Seattle, WA (1998–2002)

Graduate level: Design and Analysis of Algorithms, Applied Algorithms, Computability & Complexity
Courses involving teaching: Introduction to Computing, Data Structures, Machine Organization
Other courses: Introduction to Formal Models, Introduction to Compiler Construction, Algorithms and Computational Complexity

Volunteer Tutor, University of Washington, Seattle, WA

Provided one-on-one volunteer tutoring help to several undergraduate computer science students.

PROFESSIONAL EXPERIENCE AND SERVICE

Grant Proposals and Management

- Major contributor to a successful *NSF Expeditions in Computing* proposal (\$10M) in 2007, which led to the creation of the Institute for Computational Sustainability (ICS) headed by Prof. Carla Gomes at Cornell University.
- Others proposals and grants include those to the following agencies:
 - National Science Foundation (NSF): programs on Robust Intelligence (RI), Information and Intelligent Systems (IIS), and Interdisciplinary Research (IDR)
 - Defense Advanced Research Projects Agency (DARPA)
 - Air Force Office of Scientific Research (AFOSR)
 - Kodak Research Laboratories

Conference/Workshop Organizer

- WARA-10: Workshop on Abstraction, Reformulation and Approximation, 2010 (upcoming)
- CompSust09: 1st International Conference on Computational Sustainability, Ithaca, NY, June 2009

- CROCS-09: 1st International Workshop on Constraint Reasoning and Optimization for Computational Sustainability, in conjunction with CP-09, Lisbon, Portugal, Sep 2009

Program Committee Member

- AAI-10/08/07/06: AAI Conference on Artificial Intelligence
- ISAIM-10: International Symposium on Artificial Intelligence and Mathematics
- ASPOCP-10: Workshop on Answer Set Programming and Other Computing Paradigms
- IJCAI-09: International Joint Conference on Artificial Intelligence
- CPAIOR-09: Intl. Conference on Integration of AI and OR Techniques in Constraint Programming
- CP-09: International Conference on Principles and Practice of Constraint Programming
- Counting-08: Workshop on Counting Problems in CSP and SAT, and other Neighboring Problems
- ISC-07: International Symmetry Conference
- SAT-06: International Conference on Theory and Applications of Satisfiability Testing

Journal Editorial Board Member and Reviewer

Editorial Board Member: J. of Artificial Intelligence Research (JAIR)

Artificial Intelligence J. (AIJ); J. on Satisfiability, Boolean Modeling and Computation (JSAT); J. of Heuristics; Constraints J.; Transactions on Computational Logic (ToCL); Acta Informatica

Conference Reviewer

AAMAS-09, AAI-10/08/07/06/05, SAT-07/06, CPAIOR-07, CP-08/06, ISC-07, NESCAI-07/06, ISAIM-10/08, STACS-07, ITNG-07, PRICAI-06, CSR-06, SASIMI-06, ISVLSI-06, SAC-06

Member

Association for the Advancement of Artificial Intelligence (AAAI)
 Institute for Operations Research and Management Sciences (INFORMS)
 Constraint Programming Society in North America (CPNA)
 New York Academy of Sciences (NYAS)

SELECTED RESEARCH PROJECTS

For additional information on my work in these funded research projects and beyond, please refer to the detailed research interests statement.

Computational Sustainability (NSF): Funded by the National Science Foundation under the Expeditions in Computing program, this project, led by Prof. Carla Gomes, has the overarching vision that computer scientists can—and should—play a key role in increasing the efficiency and effectiveness of the way we manage and allocate our resources, while enriching and transforming Computer Science. This work seeks to employ state-of-the-art computational methods to address challenging problems in the arena of sustainability, ranging from wildlife preservation (e.g., by designing movement corridors or removing carefully selected fish passage barriers) to renewable energy (e.g., biofuels production and sustainable communities) to balancing socio-economic demands and the environment (e.g., optimizing rotational opening and closing of fisheries). This effort is highly interdisciplinary, involving close interactions with environmental agencies as well as researchers in conservation biology, resource economics, environmental engineering, civil engineering, and materials science, to name a few.

Real-World Reasoning (DARPA): Funded by the Defense Advanced Research Projects Agency, this project seeks to significantly improve the scalability and robustness of general reasoning technology to address

large-scale adversarial and contingency settings. This work achieved orders of magnitude improvement over prior technology by introducing novel problem modeling and solution techniques.

Beyond Traditional SAT Technology (NSF): Funded by the National Science Foundation under the Robust Intelligence program, this project aims at new scientific advances in automated reasoning systems that go beyond traditional combinatorial search and are applicable to competitive and unpredictable settings. This work explored connections between logical and probabilistic reasoning and developed several state-of-the-art practical tools for counting solutions and near-uniform sampling solutions in intricate combinatorial spaces.

New Message Passing Techniques for Uncovering the Solution Space Structure of Combinatorial Problems (NSF, under review): This project aims to advance our understanding of the structure of the solution space of combinatorial problems, particularly with respect to the clustering behavior of solutions. Our preliminary work in this direction has provided the first clear understanding of a very promising message passing technique called Survey Propagation (SP) purely in terms of a BP-like message passing algorithm over well-defined clusters. The project seeks innovative ways of uncovering and utilizing the solution space geometry of such problems, for instance to solve very hard instances, to find robust solutions that lie in large clusters, or to sample a variety of solutions lying in spatially separated clusters.

Cloud Computing for Computational Sustainability and Combinatorial Inference (Yahoo!): As part of a 4-university initiative by Yahoo! to advance cloud computing systems and applications research, this project explores novel ways of using Yahoo!'s Hadoop-based "M45" compute cluster for solving challenging reasoning and optimization problems, with a particular emphasis on applications in computational sustainability. Access to this powerful platform has resulted in new discoveries in computational hardness profiles of search algorithms, and new and scalable ways of addressing stochastic optimization problems. While cloud computing is becoming common for data-intensive applications, we seek to use this platform fruitfully for compute-intensive applications as well.