

# Carla P. Gomes

Computing and Information Science  
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## Current position

Director, Institute for Computational Sustainability, Cornell University

Professor, Dept. of Computer Science, Dept. of Information Science, and Dyson School of Applied Economics and Management, Cornell University

Cornell Research Field Membership: Computer Science, Information Science, Applied Mathematics, Applied Economics and Management, and City and Regional Planning.

## Education

Ph.D. (Computer Science), University of Edinburgh (1993).

Area: Artificial Intelligence and Operations Research

Advisors: Professors Austin Tate (Artificial Intelligence) and Lyn Thomas (Oper. Research)

M.Sc. (Applied Mathematics), Technical University of Lisbon (1987).

Area: Operations Research

Advisor: Professor Teresa Almeida

## Research Interests:

Computational Sustainability; Scientific Discovery; Combinatorial Decision and Optimization Problems; Connections with Operations Research, Machine and Statistical Learning, and Dynamical Systems; Multi-agent Systems; Approximations, randomization, and sampling techniques to identify structure; Science of Computation (synthesis of formal and experimental research).

## Professional Recognition

*Fellow*, Association for Computing Machinery (ACM), 2017.

*Fellow*, American Association for the Advancement of Science (AAAS), 2013.

*Fellow*, Association for the Advancement of Artificial Intelligence (AAAI), 2007.

*Lead P.I.*, NSF Expeditions in Computing Award (\$10M). CompSustNet: Expanding the Horizons of Computational Sustainability, 2015-2020.

*Lead P.I.*, NSF Expeditions in Computing Award (\$10M). Computational Sustainability: Computational Methods for a Sustainable Environment, Economy, and Society, 2008-2013.

*Fellow*, Radcliffe Institute for Advanced Study, Harvard University, 2011-2012.

*Chair-elect, Chair, Retired Chair*, the Section on Information, Computing and Communication of the American Association for the Advancement of Science (AAAS) 2014, 2015, 2016.

*Member*, Executive Council, Association for the Advancement of Artificial Intelligence, 2002-2005, 2012-2015.

*AAAI Classic Paper Award*, Boosting Combinatorial Search Through Randomization, AAAI, 2016.

*Innovative AI Award*, Phase-Mapper: An AI Platform to Accelerate High Throughput Materials Discovery. IAAI 2016.

*Editor*, special issue on Computational Sustainability, AI Magazine , 2013.

*Program Chair*, 10th International Conference on Integration of Artificial Intelligence and Operations Research Techniques in Constraint Programming, IBM T. J. Watson Research Center, NY, USA (CPAIOR 2013).

*Program Chair*, special track on Computational Sustainability of the Twenty-Third International Joint Conference on Artificial Intelligence,(IJCAI-13).

*Program Chair*, special track on Computational Sustainability of the Twenty-Fifth Conference on Artificial Intelligence, (AAAI-13).

*Best Paper Award*, Model counting: A new strategy for obtaining good bounds. Twenty-first National Conference on Artificial Intelligence (AAAI06), 2006.

*Distinguished Paper Award*, Statistical Regimes Across Constrainedness Regions, Conference on the Principles and Practice of Constraint Programming, 2004.

Computational Sustainability. *The Bridge*, National Academy of Engineering, Volume 39, Number 4, Winter 2009. (Invited article.)

*Program Co-chair*, Twenty-Third Conference on Artificial Intelligence, Chicago, IL, USA (AAAI-08), 2008.

*Program Co-chair*, Ninth International Conference on Theory and Applications of Satisfiability Testing, Seattle, Washington, USA, (SAT 2006), 2006.

*Conference Chair*, International Conference on the Principles and Practice of Constraint Programming, Ithaca, NY, USA (CP-2002), 2002.

*Invited Talk*, World Economic Forum, China. Computational Sustainability, 2016.

*Invited Plenary Talk*, National Academy of Engineering, U.S. Frontiers of Engineering, 2009.

*Invited Plenary Talk*, 24th National Conference of the American Association for Artificial Intelligence (AAAI-10), 2010.

*Invited Plenary Talk*, 17th National Conference of the American Association for Artificial Intelligence (AAAI-00), 2000.

*Invited Plenary Talk*, International Conference on the Integration of Constraint Programming, Artificial Intelligence, and Operations Research, (CPAIOR-2010), 2010.

*Invited Plenary Talk*, 15th International Conference on the Principles and Practice of Constraint Programming (CP09), 2009.

*Invited Plenary Talk*, Grace Hopper Celebration of Women in Computing, (GraceHopper'10), 2010.

*Nature*, "Can Get Satisfaction," 2005 (invited perspective).

*Member, Advisory Committee, International Scientists*, for the Research Council President of the European Union, 2000.

*Special Recognition Award*, Information Directorate, Air Force Research Laboratory, 1999. Citation: Dr. Carla P. Gomes is recognized for her ground-breaking research in integrating Artificial Intelligence and Operations Research techniques which led to a "boosted" search method that allowed several orders of magnitude speedups for solving hard, real-world problems. 1999.

AFRL/IF nominated ROMAN for the *General Ronald Yates Award* for Excellence in Technology Transfer. ROMAN is a system incorporating AI techniques for generating provably correct and safe schedules for planned shutdowns of nuclear power plants. (Carla Gomes was the principal investigator of ROMAN.) 1996.

Ph.D. Scholarship Portuguese Scientific Foundation (3 years).

*Best Student Paper Award*, (Ph.D. Student: Stefano Ermon.) Computing the density of states of Boolean formulas. Conference on the Principles and Practice of Constraint Programming, 2010.

## Publications

### *Journals and Refereed Proceedings*

1. Junwen Bai, Yexiang Xue, Johan Bjorck, Ronan Le Bras, Brendan Rappazzo, Richard Bernstein, Santosh K. Suram, Robert Bruce van Dover, John M. Gregoire, Carla P. Gomes. Phase Mapper: Accelerating Materials Discovery with AI. *AI Magazine* 39(1): 15-26, 2018.
2. Johan Bjorck, Yiwei Bai, Xiaojian Wu, Yexiang Xue, Mark C. Whitmore, Carla P. Gomes. Scalable Relaxations of Sparse Packing Constraints: Optimal Biocontrol in Predator-Prey Networks. *AAAI 2018*: 748-756.
3. Luming Tang, Yexiang Xue, Di Chen, Carla P. Gomes. Multi-Entity Dependence Learning With Rich Context via Conditional Variational Auto-Encoder. *AAAI 2018*: 824-832.
4. Xiaojian Wu, Jonathan Gomes-Selman, Qinru Shi, Yexiang Xue, Roosevelt Garca-Villacorta, Elizabeth Anderson, Suresh Sethi, Scott Steinschneider, Alexander Flecker, Carla P. Gomes. Efficiently Approximating the Pareto Frontier: Hydropower Dam Placement in the Amazon Basin. *AAAI 2018*: 849-859.
5. Guillaume Perez, Brendan Rappazzo, Carla P. Gomes. Extending the Capacity of 1 / f Noise Generation. *CP 2018*: 601-610.
6. Junwen Bai, Sebastian Ament, Guillaume Perez, John M. Gregoire, Carla P. Gomes. An Efficient Relaxed Projection Method for Constrained Non-negative Matrix Factorization with Application to the Phase-Mapping Problem in Materials Science. *CPAIOR 2018*: 52-62.
7. Jonathan M. Gomes-Selman, Qinru Shi, Yexiang Xue, Roosevelt Garca-Villacorta, Alexander S. Flecker, Carla P. Gomes. Boosting Efficiency for Computing the Pareto Frontier on Tree Structured Networks. *CPAIOR 2018*: 263-279.
8. Qinru Shi, Jonathan M. Gomes-Selman, Roosevelt Garca-Villacorta, Suresh Sethi, Alexander S. Flecker, Carla P. Gomes. Efficiently Optimizing for Dendritic Connectivity on Tree-Structured Networks in a Multi-Objective Framework. *COMPASS 2018*: 26:1-26:8.
9. Di Chen, Yexiang Xue, Carla P. Gomes. End-to-End Learning for the Deep Multivariate Probit Model. *ICML 2018*: 931-940.
10. Nils Bjorck, Carla P. Gomes, Bart Selman, Kilian Q. Weinberger. Understanding Batch Normalization. *NeurIPS 2018*: 7705-7716.

11. Xue, Y.; Wu, X.; Morin, D.; Dilkina, D.; Fuller, A.; Royle, A.; Gomes, C. Dynamic Optimization of Landscape Connectivity Embedding Spatial-Capture-Recapture Information. 4552-4558. AAAI 2017.
12. Diaz, M.; Le Bras, R.; Gomes, C. In Search of Balance: The Challenge of Generating Balanced Latin Rectangles. CPAIOR 2017.
13. Bai, J.; Bjorck, J.; Xue, Y.; Suram, S.; Gregoire, J.; Gomes, C. Relaxation Methods for Constrained Matrix Factorization Problems: Solving the Phase Mapping Problem in Materials Discovery. CPAIOR 2017.
14. Chen, D.; Xue, Y.; Fink, D.; Chen, S.; Gomes, C. Deep Multi-species Embedding. IJCAI 2017.
15. Wu, X.; Xue, Y.; Selman, B.; Gomes, C. XOR-Sampling for Network Design with Correlated Stochastic Events. 4640-4647 IJCAI 2017.
16. Xue, Y.; Bai, J.; Le Bras, R.; Rappazzo, B.; Bernstein, R.; Bjorck, J.; Longpre, Suram, S.; van Dover, B.; Gregoire, J.; and Gomes, C. Phase-Mapper: An AI Platform to Accelerate High Throughput Materials Discovery. 4635-4643. AAAI 2017. (IAAI Innovative AI Award).
17. Suram, S.; Xue, Y.; Bai, J.; Le Bras, R.; Rappazzo, B.; Bernstein, R.; Bjorck, J.; Zhou, L.; van Dover, R. B.; Gomes, C.P. Automated Phase Mapping with AgileFD and its Application to Light Absorber Discovery in the V-Mn-Nb Oxide system. *ACS Combinatorial Science*, 19: 37-46, 2017.
18. Xue, Yexiang; Davies, Ian; Fink, Daniel; Wood, Christopher; Gomes, Carla P. Avicaching: A Two Stage Game for Bias Reduction in Citizen Science. *Proceedings of the 2016 International Conference on Autonomous Agents and Multiagent Systems (AAMAS-2016)*, Singapore, 2016.
19. Xue, Yexiang; Davies, Ian; Fink, Daniel; Wood, Christopher; Gomes, Carla P. Behavior Identification in Two-Stage Games for Incentivizing Citizen Science Exploration. *Principles and Practice of Constraint Programming - 22nd International Conference (CP-2016)*, France, 2016.
20. Xue, Yexiang; Ermon, Stefano; Le Bras, Ronan; Gomes, Carla P.; Selman, Bart. Variable Elimination in the Fourier Domain. *Proceedings of the 33rd International Conference on Machine Learning (ICML 2016)*, New York, NY, 2016.
21. Xue, Yexiang; Li, Zhiyuan; Ermon, Stefano; Gomes, Carla P.; Selman, Bart. Solving Marginal MAP Problems with NP Oracles and Parity Constraints. *Proceedings of the Advances in Neural Information Processing Systems 29: Annual Conference on Neural Information Processing Systems (NIPS-2016)*, Barcelona, 2016.
22. Ermon, Stefano; Le Bras, Ronan; Suram, Santosh K.; Gregoire, John M.; Gomes, Carla P.; Selman, Bart; van Dover, Robert Bruce. Pattern Decomposition with Complex Combinatorial Constraints: Application to Materials Discovery. *Proceedings of the Twenty-Ninth AAI Conference on Artificial Intelligence (AAAI-2015)*, Texas, 2015.

23. Ermon, Stefano; Xue, Yexiang; Toth, Russell; Dilkina, Bistra N.; Bernstein, Richard; Damoulas, Theodoros; Clark, Patrick; DeGloari, Steve; Mude, Andrew; Barrett, Christopher; Gomes, Carla P. Learning Large-Scale Dynamic Discrete Choice Models of Spatio-Temporal Preferences with Application to Migratory Pastoralism in East Africa. *Proceedings of the Twenty-Ninth AAAI Conference on Artificial Intelligence (AAAI-2015)*, Texas, 2015.
24. Xue, Yexiang; Ermon, Stefano; Gomes, Carla P.; Selman, Bart. Uncovering Hidden Structure through Parallel Problem Decomposition for the Set Basis Problem. *Computational Sustainability, Papers from the 2015 AAAI Workshop (AAAI WS)*, Texas, 2015.
25. Xue, Yexiang; Ermon, Stefano; Gomes, Carla P.; Selman, Bart. Uncovering Hidden Structure through Parallel Problem Decomposition for the Set Basis Problem: Application to Materials Discovery. *Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence (IJCAI 2015)*, Argentina, 2015.
26. Sullivan, B. L., Aycrigg, J. L., Barry, J. H., Bonney, R. E., Bruns, N., Cooper, C. B., Damoulas, T., Dhondt, A. A., Dietterich, T., Farnsworth, A., Fink, D., Fitzpatrick, J. W., Fredericks, T., Gerbracht, J., Gomes, C., Hochachka, W. M., Iliff, M. J., Lagoze, C., La Sorte, F. A., Merrifield, M., Morris, W., Phillips, T. B., Reynolds, M., Rodewald, A. D., Rosenberg, K. V., Trautmann, N. M., Wiggins, A., Winkler, D. W., Wong, W-K., Wood, C. L., Yu, J. and Kelling, S. The eBird enterprise: An integrated approach to development and application of citizen science. *Biological Conservation*, 169:31-40, 2014.
27. Eaton, Eric; Gomes, Carla P.; Williams, Brian C. Computational Sustainability, editorial. *AI Magazine*, 35(1), 2014.
28. Fink, Daniel; Damoulas, Theodoros; Bruns, Nicholas E.; La Sorte, Frank A.; Hochachka, Wesley M.; Gomes, Carla P.; Kelling, Steve. Crowdsourcing Meets Ecology: Hemisphere-Wide Spatiotemporal Species Distribution Models. *AI Magazine* 35(2), 2014.
29. Eaton, Eric; Gomes, Carla P.; Williams, Brian C. Computational Sustainability: Editorial Introduction to the Summer and Fall Issues. *AI Magazine* 35(3), 2014.
30. Dilkina, Bistra N.; Gomes, Carla P.; Sabharwal, Ashish. Tradeoffs in the complexity of backdoors to satisfiability: dynamic sub-solvers and learning during search. *Annals of Mathematics and Artificial Intelligence* 70(4), 2014.
31. Le Bras, Ronan; Bernstein, Richard; Gregoire, John M.; Suram, Santosh K.; Gomes, Carla P.; Selman, Bart; van Dover, R. Bruce. Challenges in Materials Discovery - Synthetic Generator and Real Datasets (*AAAI-2014*), Canada, 2014.
32. Ermon, Stefano; Gomes, Carla P.; Sabharwal, Ashish; Selman, Bart. Designing Fast Absorbing Markov Chains (*AAAI-2014*), Canada, 2014.
33. Xue, Yexiang; Ermon, Stefano; Gomes, Carla P.; Selman, Bart. Uncovering Hidden Structure through Parallel Problem Decomposition (*AAAI-2014*), Canada, 2014.

34. Le Bras, Ronan; Gomes, Carla P.; Selman, Bart. On the Erds Discrepancy Problem (*Proceedings of Principles and Practice of Constraint Programming - 20th International Conference (CP 2014)*), France, 2014.
35. Le Bras, Ronan; Xue, Yexiang; Bernstein, Richard; Gomes, Carla P.; Selman, Bart. A Human Computation Framework for Boosting Combinatorial Solvers. *Proceedings of the Second AAAI Conference on Human Computation and Crowdsourcing (HCOMP 2014)*, Pennsylvania, 2014.
36. Ermon, Stefano; Gomes, Carla P.; Sabharwal, Ashish; Selman, Bart. Low-density Parity Constraints for Hashing-Based Discrete Integration. *Proceedings of the 31th International Conference on Machine Learning (ICML 2014)*, Beijing, China, 2014.
37. Damoulas, Theodoros; He, Jin; Bernstein, Richard; Gomes, Carla P.; Arora, Anish. String Kernels for Complex Time-Series: Counting Targets from Sensed Movement. *Proceedings of the 22nd International Conference on Pattern Recognition (ICPR 2014)*, Stockholm, Sweden, 2014.
38. Kelling, Steve; Gerbracht, Jeff; Fink, Daniel; Lagoze, Carl; Wong, Weng-Keen, Yu, Jun; Damoulas, Theodoros; Gomes, Carla P. A Human/Computer Learning Network to Improve Biodiversity Conservation and Research. *AI Magazine* , Vol 34, 2013.
39. Ermon, Stefano; Xue, Yexiang; Gomes, Carla P.; Selman, Bart. Learning policies for battery usage optimization in electric vehicles. *Machine Learning*, Vol 92, 2013.
40. LeBras, Ronan; Dilkina, Bistra N.; Xue, Yexiang; Gomes, Carla P.; McKelvey, Kevin S.; Schwartz, Michael K.; Montgomery, Claire A. Robust Network Design For Multispecies Conservation. *Proceedings of the Twenty-Seventh AAAI Conference on Artificial Intelligence (AAAI-2013)*, Bellevue, Washington, 2013.
41. Dilkina, Bistra N.; Lai, Katherine J.; LeBras, Ronan; Xue, Yexiang; Gomes, Carla P.; Sabharwal, Ashish; Suter, Jordan; McKelvey, Kevin S.; Schwartz, Michael K.; Montgomery, Claire A. Large Landscape Conservation - Synthetic and Real-World Datasets. *Proceedings of the Twenty-Seventh AAAI Conference on Artificial Intelligence (AAAI-2013)*, Bellevue, Washington, 2013.
42. Xue, Yexiang; Dilkina, Bistra N.; Damoulas, Theodoros; Fink, Daniel; Gomes, Carla P.; Kelling, Steve. Improving Your Chances: Boosting Citizen Science Discovery. *Proceedings of the First AAAI Conference on Human Computation and Crowdsourcing (HCOMP 2013)*, Palm Springs, CA, 2013.
43. Ermon, Stefano; Gomes, Carla P.; Sabharwal, Ashish; Selman, Bart. Taming the Curse of Dimensionality: Discrete Integration by Hashing and Optimization. *Proceedings of the 30th International Conference on Machine Learning (ICML-2013)*, Atlanta, GA, 2013.
44. LeBras, Ronan; Gomes, Carla P.; Selman, Bart. Double-Wheel Graphs Are Graceful. *Proceedings of the 23rd International Joint Conference on Artificial Intelligence (IJCAI 2013)*, Beijing, China, 2013.

45. LeBras, Ronan; Bernstein, Richard; Gomes, Carla P.; Selman, Bart; van Dover, R. Bruce. Crowdsourcing Backdoor Identification for Combinatorial Optimization. *Proceedings of the 23rd International Joint Conference on Artificial Intelligence (IJCAI 2013)*, Beijing, China, 2013.
46. Ermon, Stefano; Gomes, Carla P.; Sabharwal, Ashish; Selman, Bart. Embed and Project: Discrete Sampling with Universal Hashing. *Proceedings of Advances in Neural Information Processing Systems 26: 27th Annual Conference on Neural Information Processing Systems (NIPS-2013)*, Lake Tahoe, Nevada, 2013.
47. Finger, Marcelo; LeBras, Ronan; Gomes, Carla P.; Selman Bart. Solutions for Hard and Soft Constraints Using Optimized Probabilistic Satisfiability. *Proceedings of the 16th International Conference of Theory and Applications of Satisfiability Testing (SAT-2013)*, Helsinki, Finland, 2013.
48. Ermon, Stefano; Gomes, Carla P.; Sabharwal, Ashish; Selman, Bart. Optimization with Parity Constraints: From Binary Codes to Discrete Integration. *Proceedings of the Twenty-Ninth Conference on Uncertainty in Artificial Intelligence (UAI-2013)*, Bellevue, WA., 2013.
49. Gomes, Carla P.; Sellmann, Meinolf. Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems. *Proceedings of the 10th International Conference, Lecture Notes in Computer Science 7874, Springer (CPAIOR 2013)*, Yorktown Heights, NY, 2013.
50. Kelling, Steve; Gerbracht, Jeff; Fink, Daniel; Lagoze, Carl; Wong, Weng-Keen; Yu, Jun; Damoulas, Theodoros; and Gomes, Carla P. eBird: A Human/Computer Learning Network for Biodiversity Conservation and Research. *Proceedings of the 24th Innovative Applications of Artificial Intelligence Conference (IAAI 2012)*, Toronto, Canada, 2012.
51. LeBras, Ronan; Gomes, Carla P.; and Selman, Bart. From Streamlined Combinatorial Search to Efficient Constructive Procedures. *Proceedings of the 26th International Conference on Artificial Intelligence (AAAI-12)*, Toronto, Canada, 2012.
52. Conrad, Jon; Gomes, Carla P.; van Hoeve, Willem-Jan; Sabharwal, Ashish; and Suter, Jordan F. Wildlife Corridors as a Connected Subgraph Problem, *Journal of Environmental Economics and Management*, Volume 63, 2012.
53. Ermon, Stefano; Gomes, Carla; Selman, Bart; and Vladimirsky, Alexander. Probabilistic Planning With Non-linear Utility Functions and Worst Case Guarantees. *Proceedings of the 11th International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS-12)*, Valencia, Spain, 2012.
54. Ermon, Stefano; LeBras, Ronan; Gomes, Carla; Selman, Bart; and van Dover, Bruce. SMT-Aided Combinatorial Materials Discovery. *Proceedings of the 15th International Conference on Theory and Applications of Satisfiability Testing (SAT-12)*, 2012.



55. Ermon, Stefano; Gomes, Carla; and Selman, Bart. Uniform Solution Sampling Using a Constraint Solver as an Oracle. *Proceedings of the 28th Conference on Uncertainty in Artificial Intelligence (UAI 2012)*, 2012.
56. Ermon, Stefano; Xue, Yexiang; Gomes, Carla; and Selman, Bart. Learning Policies for Battery Usage Optimization in Electric Vehicles. *Proceedings of the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD-12)*, 2012.
57. Teose, Maarika; Ahmadizadeh, Kiyan; OMahony, Eoin; Smith, Rebecca L.; Lu, Zhao; Ellner, Stephen P.; Gomes, Carla P.; and Grohn, Yrjo. Embedding system dynamics in agent based models for complex adaptive systems. *Proceedings of the 22nd International Joint Conference on Artificial Intelligence (IJCAI-2011)*, Barcelona, Spain, 2011.
58. Lai, Katherine J.; Gomes, Carla P.; Schwartz, Michael K.; McKelvey, Kevin S.; Calkin, David E.; and Montgomery, Claire A. The Steiner Multigraph Problem: Wildlife Corridor Design for Multiple Species. *Proceedings of the 25th AAAI Conference on Artificial Intelligence (AAAI-11)*, San Francisco, CA, 2011.
59. LeBras, Ronan; Damoulas, Theodoros; Gregoire, John M.; Sabharwal, Ashish; Gomes, Carla P.; and van Dover, R. Bruce. Constraint Reasoning and Kernel Clustering for Pattern Decomposition with Scaling. *Proceedings of the 17th International Conference on Principles and Practice of Constraint Programming (CP 2011)*, Perugia, Italy, 2011.
60. Dilkina, Bistra N.; Lai, Katherine J.; and Gomes, Carla P. Upgrading Shortest Paths in Networks. *Proceedings of the 8th International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems (CPAIOR 2011)*, Berlin, Germany, 2011.
61. Gomes, Carla P. Computational Sustainability. *Proceedings of the 10th International Conference on Intelligent Data Analysis (IDA 2011)*, Porto, Portugal, 2011.
62. Ermon, Stefano; Gomes, Carla P.; Sabharwal, Ashish; and Selman, Bart. Accelerated Adaptive Markov Chain for Partition Function Computation. *Proceedings of the 25th Annual Conference on Neural Information Processing Systems (NIPS-11)*, Grenada, Spain, 2011.
63. Anstegui, Carlos; Bjar, Ramn; Fernndez, Csar; Gomes, Carla P.; and Mateu, Carles. Generating highly balanced sudoku problems as hard problems. *Journal of Heuristics*, Volume 17, 2011.
64. Ermon, Stefano; Gomes, Carla; Sabharwal, Ashish; and Selman, Bart. Accelerated Adaptive Markov Chain for Partition Function Computation. *Proceedings of the 25th Annual Conference on Neural Information Processing Systems (NIPS-11)*, Grenada, Spain, 2011.
65. Ermon, Stefano; Gomes, Carla; and Selman Bart. A message passing approach to multiagent gaussian inference for dynamic processes. *Proceedings of the 10th Intl. Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS-11)*, Taipei, Taiwan, 2011.

66. Ermon, Stefano; Conrad, Jon; Gomes, Carla; and Selman Bart. Risk-Sensitive Policies for Sustainable Renewable Resource Allocation. *Proceedings of the 20th International Joint Conference on Artificial Intelligence (IJCAI-11)*, Barcelona, Spain, 2011.
67. Ermon, Stefano; Gomes, Carla; and Selman Bart. A Flat Histogram Method for Computing the Density of States of Combinatorial Problems. *Proceedings of the 20th International Joint Conference on Artificial Intelligence (IJCAI-11)*, Barcelona, Spain, 2011.
68. Dilkina, Bistra and Gomes, Carla. Solving Connected Subgraph Problems in Wildlife Conservation. *Proceedings of the 7th International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems (CP-AI-OR'10)*, 2010.
69. Ermon, Stefano; Gomes, Carla; and Selman Bart. Computing the Density of States of Boolean Formulas. *Proceedings 16th International Conference on Principles and Practice of Constraint Programming (CP 2010)*, 2010. (Best student paper award.)
70. Ermon, Stefano; Conrad, Jon; Gomes, Carla; and Selman, Bart. Playing Games Against Nature: Optimal Policies for Renewable Resource Allocation, *Proceedings of the 26th Conference on Uncertainty in Artificial Intelligence, UAI 2010*, 2010.
71. Ermon, Stefano; Gomes, Carla; and Selman Bart. Collaborative multiagent Gaussian inference in a dynamic environment using belief propagation. *Proc. 9th Intl. Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS-10)*, Toronto, Canada, 2010.
72. Ahmadizadeh, Kiyan; Dilkina, Bistra; Gomes, Carla; and Sabharwal, Ashish. An empirical study of optimization for maximizing diffusion in networks. *Proceedings 16th International Conference on Principles and Practice of Constraint Programming (CP 2010)*, 2010.
73. Damoulas, Theo; Henry, Sam; Farnsworth, Andrew; Lanzone, Michel; and Gomes, Carla. Bayesian Classification of Flight Calls with a novel Dynamic Time Warping Kernel. *Proceedings 9th International Conference on Machine Learning and Applications (ICMLA 2010)*, 2010.
74. Gomes, Carla. Challenges for CPAIOR in Computational Sustainability. In *Proceedings of the 7th International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems (CP-AI-OR'10)*, 2010. (Written version of invited plenary talk.)
75. Sheldon, Daniel; Dilkina, Bistra; Elmachtoub, Adam; Finseth, Ryan; Sabharwal, Ashish; Conrad, Jon; Gomes, Carla; Shmoys, David; Allen, Will; Amundsen, Ole; Vaughan, William. Maximizing Spread of Cascades Using Network Design. *Proceedings of the 26th Conference on Uncertainty in Artificial Intelligence, UAI 2010*, 2010.
76. Ansotegui, Carlos; Bejar, Ramon, Fernandez, Cesar; Gomes, Carla; Mateu, Carlos. Generating Highly Balanced Sudoku Problems as Hard Problems. *Journal of Heuristics*, Volume 16, 2010.

77. Gomes, Carla. Computational Sustainability. *The Bridge*, National Academy of Engineering, Volume 39, Number 4, Winter 2009. (Invited article.)
78. Carvalho, Alda; Crato, Nuno; Gomes, Carla. A generative power-law search tree model. *Computer and Operations Research*, Volume 36, 2376–2386, 2009.
79. Guo, Yunsong and Gomes, Carla. Learning Optimal Subsets with Implicit User Preferences. *Proceedings of the 21st International Joint Conference on Artificial Intelligence (IJCAI-09)*, 2009.
80. Gomes, Carla. Challenges for Constraint Reasoning and Optimization in Computational Sustainability. *Proceedings 15th International Conference on Principles and Practice of Constraint Programming (CP 2009)*, 2009. (Extended abstract of invited plenary talk.)
81. Guo, Yunsong and Gomes, Carla. Ranking structured documents: a large margin based approach for patent prior art search. *Proceedings of the 21st International Joint Conference on Artificial Intelligence (IJCAI-09)*, 2009.
82. Kroc, Lucas; Sabharwal, Ashish; Selman, Bart; and Gomes, Carla. Integrating Systematic and Local Search Paradigms. *Proceedings of the 21st International Joint Conference on Artificial Intelligence (IJCAI-09)*, 2009.
83. Dilkina, Bistra; Gomes, Carla; Sabharwal, Ashish. Backdoors in the Context of Learning. *Proceedings of the 12th International Conference on Theory and Applications of Satisfiability Testing (SAT09)*, 2009.
84. Dilkina, Bistra; Gomes, Carla; Malitski, Yuri; Sabharwal, Ashish; and Sellmann, Meinolf. Backdoors to Combinatorial Optimization: Feasibility and Optimality. In *Proceedings of the 6th International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems (CP-AI-OR'09)*, 2009.
85. Hoffmann, Jorg; Gomes, Carla; and Selman, Bart. Structure and Problem Hardness: Goal Asymmetry and DPLL Proofs in SAT-based Planning, *Logical Methods in Computer Science*, Volume 3 (1-6), 2008.
86. Gomes, Carla; van Hoeve, Willem; Sabharwal, Ashish. Connections in Networks: A Hybrid Approach. In *Proceedings of the 5th International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems (CP-AI-OR'08)*, 2008.
87. Gomes, Carla and Selman, Bart. The Science of Constraints. *Constraint Programming Letters*, Volume 1, 15–20, 2007.
88. van Es, Harold; Gomes, Carla; Sellmann, Meinolf; and van Es Cindy. Spatially-Balanced Complete Block Designs for Field Experiments. *Geoderma Journal*, Volume 140, 346–352, 2007.

89. Bejar, Ramon; Cabiscol, Alba; Fernandez, Cesar; Manyá, Felip; and Gomes, Carla. Regular-SAT: A Many-Valued Approach for Solving Combinatorial Problems. *Discrete Applied Mathematics*, Elsevier, Volume 155 (12), 1613–1626, 2007.
90. Conrad, Jon; Gomes, Carla; van Hoeve, Willem Jan; Sabharwal, Ashish; Suter, Jordan. Connections in Networks: Hardness of Feasibility Versus Optimality. In *Proceedings of the 4th International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems (CP-AI-OR'07)*, 2007.
91. Dilkina, Bistra; Gomes, Carla; Sabharwal. The Impact of Network Topology on Pure Nash Equilibria in Graphical Games. *Proceedings of the 22nd National Conference on Artificial Intelligence (AAAI-07)*, 2007.
92. Dilkina, Bistra; Gomes, Carla; Sabharwal, Ashish. Tradeoffs in the Complexity of Backdoor Detection. *Proceedings 13th International Conference on Principles and Practice of Constraint Programming (CP 2007)*, 2007.
93. Gomes, Carla; van Hoeve, Willem; Sabharwal, Ashish; Selman, Bart. Counting CSP Solutions Using Generalized XOR Constraints. *Proceedings of the 22nd National Conference on Artificial Intelligence (AAAI-07)*,
94. Gomes, Carla; Hoffmann, Joerg; Sabharwal, Ashish; Selman, Bart. From Sampling to Model Counting. *Proceedings of the 20th International Joint Conference on Artificial Intelligence (IJCAI-07)*, 2007.
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101. Hoffmann, Jorg; Gomes, Carla; and Selman, Bart. Structure and Problem Hardness: Goal Asymmetry and DPLL Proofs in Sat-Based Planning. *Proceedings of International Conference on Automated Planning and Scheduling*, UK, 2006.
102. Ansotegui, Carlos; Bejar, Ramon; Fernandez, Cesar; Gomes, Carla P.; and Mateu, Carles. The Impact of Balancing on Problem Hardness in a Highly Structured Domain. *Proceedings of 21st National Conference on Artificial Intelligence (AAAI-06)*, 2006.
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140. Gomes, Carla; Wicker, Stephen; and Xie, Xi. A Connection Between Phase Transitions in Complexity and Good Decodings. *Proceedings of the International Symposium on Information Theory and Its Applications*, Honolulu, Hawaii, November 2000.
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145. Gomes, Carla; McAloon, Ken; Selman, Bart; and Tretkoff, Carol. Randomization in Backtrack Search: Exploiting Heavy-Tailed Profiles for Solving Hard Scheduling Problems. *Proceedings of the Fourth International Conference on Artificial Intelligence Planning Systems (AIPS-98)*, Pittsburgh, PA, 1998.
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147. Gomes, Carla and Selman, Bart. Algorithm Portfolio Design: Theory vs. Practice. *Proceedings of the 13th Conference on Uncertainty in Artificial Intelligence (UAI-97)*, New Providence, RI, 1997.
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151. Alguire, Karen and Gomes, Carla. Technology for Planning and Scheduling under Complex Constraints. *Proceedings of the International Society for Optical Engineering*. Boston, Massachusetts, 1996.
152. Alguire, Karen and Gomes, Carla. ROMAN: An Application of Advanced Technology to Outage Management, *Proceedings of the Sixth Annual Dual-Use Technologies & Applications Conference*, IEEE Computer Society Press, 1996.
153. Gomes, Carla. Derivation of Correct Programs for Planning. *Proceedings of the Fifth Annual Dual-Use Technologies & Applications Conference*, IEEE Computer Society Press, 1995.
154. Roberts, N.; Kudla, A.; and Gomes, C. Making “Dual-Use” of Formal Methods. *Proceedings of the Fourth Annual Dual-Use Technologies & Applications Conference*, 67–77. IEEE Computer Society Press, 1994.
155. Gomes, Carla; Tate, Austin; and Lyn, Thomas. A Distributed Scheduling Framework. *Proceedings of the 6th International Conference on Tools with Artificial Intelligence*, 1994.
156. Gomes, Carla and Beck, Howard. Synchronous and Asynchronous Factory Scheduling. *Journal of the Singapore Computer Society*, 5 (2), 1992.

*Invited Survey Articles and Book Chapters*

157. Gomes, Carla; Kautz, Henry; Sabharwal, Ashish; and Selman, Bart. Satisfiability Solvers. In *Handbook of Knowledge Representation, in the series Foundations of Artificial Intelligence*, F. van Harmelen, Vl. Lifschitz, and B. Porter (Eds.), Elsevier, 2008. (Invited chapter.)
158. Gomes, Carla and Sabharwal, Ashish. Exploiting Runtime Variation in Complete Solvers. In *Handbook of Satisfiability*, A. Biere, M. Heule, H. van Maaren, and T. Walsh (Eds.), IOS Press, 2009. (Invited chapter.)
159. Gomes, Carla; Sabharwal, Ashish; and Selman, Bart. Model Counting. In *Handbook of Satisfiability*, A. Biere, M. Heule, H. van Maaren, and T. Walsh (Eds.), IOS Press, 2009. (Invited chapter.)
160. Lesser, W. and C. Gomes, 2007. Network Analysis for Interpreting Patent Date: A Preliminary, Visual Approach. In *Agricultural Biotechnology and Intellectual Property Seeds of Change*, J. Kesan (Ed.). Cambridge, MA: CABI. 2007.
161. Gomes, Carla and Walsh, Toby. Randomness and Structure. In *Handbook of Constraint Programming*, P. van Beek, F. Rossi, and T. Walsh (Eds.), Elsevier, 2006. (Invited chapter.)

162. Gomes, Carla and Williams, Ryan. Approximation Algorithms. In *Introduction to Optimization, Decision Support and Search Methodologies*, Burke and Kendall (Eds.), Kluwer, 2005. (Invited survey.)
163. Gomes, Carla. Complete Randomized Backtrack Search. In *Constraint and Integer Programming: Toward a Unified Methodology*, Milano, M., (ed.), Kluwer, 2003, 233–283. (Invited survey.)
164. Selman, Bart and Gomes, Carla. Hill Climbing Search. In *Nature Encyclopedia of Cognition*, Nature Publ., 2002. (Invited article.)
165. Gomes, Carla; Xie, Xi; and Wicker, Stephen. Complexity, Phase Transitions, and the Sequential Decoding of Convolutional Codes. In *Forney Festschrift*, Kluwer, 2000. (Invited article.)
166. Gomes, Carla; Selman Bart; Crato, Nuno; and Kautz, Henry. Heavy-tailed phenomena in satisfiability and constraint satisfaction problems. In *SAT-2000, Highlights of Satisfiability Research in the Year 2000*. Kluwer Academic Publishers, Holland, 2000. (Invited article.)

*Edited Proceedings*

167. Fox, Dieter and Gomes, Carla (Eds.). Proceedings of the Twenty-Third AAAI Conference on Artificial Intelligence (AAAI-08), Chicago, Illinois, 2008.
168. Biere, Armin and Gomes, Carla (Eds.). Proceedings of the Ninth Conference on Theory and Applications of Satisfiability Testing (SAT 2006), Seattle, Washington, 2006.

*Other Publications*

169. Gomes, Carla; Hoeve, Willem; and Lucian Leahu. The Power of Semidefinite Programming Relaxations for SAT. *Technical Report, IISI, Cornell*, 2006.
170. Hoffmann, Joerg; Gomes, Carla; and Selman, Bart. Synthetic Planning Domains with Small Backdoors. *Proceedings of the Workshop on Constraint Propagation and Implementation at CP'05*, Sitges, Spain, 2005.
171. Lesser, W.; and C. Gomes. Network Analysis For Interpreting Patent Data: A Preliminary, Visual Approach, in *J. Kasen (ed.)*, 2005.
172. van Es, H; Gomes, C.; Sellmann, M.; and van Es Cindy. Spatially-Balanced Designs: A Proposed Standard for Agronomic Experiments. *What's Cropping Up? A Newsletter for New York Field Crops & Soils*, Vol. 15, (1), 2005, 1–4.

173. Gomes, Carla and Shmoys, David. Completing Quasigroups: A Structured Graph Coloring Problem. *Proceedings Computational Symposium on Graph Coloring and Generalizations*, 2002.
174. Gomes, Carla. Hybrid Compute Intensive Approaches for Combinatorial Optimization. *Technical Report, RL-TR-02-65, AFRL, Information Directorate*, 2002.
175. Bejar, Ramon; Gomes, Carla; and Vetsikas, Ioannis. Fair Allocations for the Virtual Transportation Company Problem. *Technical Report, DARPA-TASK meeting, Sante Fe, NM*, 2001.
176. Bejar, Ramon; Krishnamachari, Bhaskar; Gomes, Carla; and Selman, Bart. Distributed Constraint Satisfaction in a Wireless Sensor Tracking System. *Proceedings of Workshop on Distributed Constraint Reasoning (CONS-2), IJCAI-2001, Seattle*, 2001.
177. Meier, Andreas; Gomes, Carla; and Melis, Erica. Heavy-Tailed Behavior and Randomization in Proof Planning. *Proceedings AAAI Symposium on Model-based Validation of Intelligence, Stanford, CA*, 2001.
178. Gomes, Carla. Artificial Intelligence and Operations Research: Challenges and Opportunities in Planning and Scheduling. *Technical Report, RL-TR-00-57, AFRL, Information Directorate*, 2000.
179. Gomes, C.; Smith D.; and Westfold, S. A Transformational Approach Applied to Outage Management of Nuclear Power Plants. *Proceedings of 13th HICC, IEEE Computer Society*, 1997.
180. Gomes, Carla and Selman, Bart. Practical Aspects of Algorithm Portfolio Design, *Proceedings of the 3rd ILOG Conference, Paris, France*, 1997.
181. Crato, Nuno; Gomes, Carla; and Selman, Bart. Non-Gaussian Stable Distributions, *Proceedings of CEMAPRE*, 1997.
182. Gomes, Carla. Exploiting Stochasticity in Systematic Search: Results on a Highly Structured Domain. *Technical Report, RL-TR-97-167, Rome Laboratory*, 1997.
183. Gomes, Carla. Automatic Scheduling of Outages of Nuclear Power Plants with Time Windows. *Technical Report, RL-TR-96-157, Rome Laboratory*, 1996.
184. Gomes, Carla. O-Plan2 vs. Sipe-2 — A General Comparison. *Technical Report, RL-TR-94-96, Rome Laboratory*, 1996.
185. Gomes, Carla. Planning and Scheduling of Nuclear Power Plant Outages. *Proceedings of the First International Workshop of AI and OR. Timberline, Oregon*, 1995.
186. Gomes, Carla. Planning in KIDS. *Technical Report, RL-TR-95-205, Rome Laboratory*, 1995.
187. Gomes, Carla and Hsu, Julie. An Assignment Based Algorithm. *Proceedings of the Workshop on Scheduling at the Conference on Tools with Artificial Intelligence, New Orleans, Louisiana*, 1994.

188. Gomes, Carla. and Alguire, Karen. Looking at O-PLAN2 and SIPE2 through Missionaries and Cannibals. *Proceedings of the ARPA-RL Planning Initiative Workshop*. Arizona, 1994.
189. Gomes, Carla. Achieving Global Coherence by Exploiting Conflict: A Distributed Framework for Job Shop Scheduling. *Ph.D. Thesis, University of Edinburgh*, 1993.
190. Gomes, Carla. Achieving Global Coherence by Exploiting Conflict. *Proceedings of the 10th UK SIG Planning*, Cambridge, 1991.
191. Gomes, Carla, and Almeida, Teresa. Pairing Generation — A Graph Partitioning Approach to a Short Haul Fleet Problem. *Proceedings of AGIFORS*, Copenhagen, 1988.
192. Gomes, Carla. Pairing Generation — A Graph Partitioning Approach to a Short Haul Fleet Problem. *Master's Thesis, University of Lisbon*, 1987.

## **Invited Talks, Survey Lectures, Tutorials, and Research Briefings**

### *Invited Talks*

1. *Webinar*, Materials Research Society (MRS), Machine Learning, AI, and Data-Driven Materials Development and Design, 2018.
2. *Talk*, Sci-Foo Camp, Google, 2018.
3. *Invited talk*, Eighth International Workshop on Statistical Relational AI (StarAI-2018), IJCAI, 2018.
4. *Talk*, MURI kickoff meeting, AFOSR, Dayton, OH, Scientific Autonomous Reasoning Agent for Materials Discovery (SARA), 2018.
5. *Colloquium*, Computer Science Department, National University Singapore (NUS), 2018.
6. *Invited talk*, Artificial Intelligence for Materials Development Forum, Materials Research Society (MRS), 2018.
7. *Keynote speaker*, AI\*IA, Bari, Italy, 2017.
8. *Keynote speaker*, SustainIT, Sustainable Internet and ICT for Sustainability, Funchal, Portugal, 2017.
9. *Invited talk*, SCI Institute Distinguished Lecture Series, University of Utah Scientific Computing and Imaging Institute, Salt Lake City, Utah, Computational Sustainability, 2017.
10. *Invited plenary speaker*, Microsoft Faculty Summit, Redmond, Washington, 2017.

11. *Plenary panelist*, Microsoft Faculty Summit, Redmond, Washington, 2017.
12. *Keynote speaker*, Workshop Advanced Computing for Earth Sciences (ACES), Porto, Portugal, 2017.
13. *Invited talk*, Amazon Dams II Conference, Lima, Peru, 2017.
14. *Panelist*, Mechanism for Social Good, MIT, 2017.
15. *Invited talk*, AAAI symposium on "AI for Social Good", Stanford University, 2017.
16. *Co-organizer and Invited talk*, Accelerating Science: A Grand Challenge for AI, AAAI Fall Symposium, Arlington, VA, Challenges for AI in Computational Sustainability, 2016.
17. *Invited talk*, Carnegie Mellon School of Computer Science, Challenges for AI in Computational Sustainability, AI Lunch and Seminar, 2016.
18. *Invited talk in computational sustainability session, chair, and tutorial host*, International Conference on Principles and Practice of Constraint Programming, CP2016, Toulouse, France, 2016.
19. *Invited talk*, World Economic Forum, remote to China, Harnessing artificial intelligence to target conservation efforts, 2016.
20. *Keynote speaker*, Computing Research: Addressing National Priorities and Societal Needs CCC Computing Community Consortium, Catalyst Series, Computational Sustainability: Computational Methods for Sustainable Development, 2016.
21. *Invited Talk*, University of Washington AI Research seminar series, Challenges for AI in Computational Sustainability, 2016.
22. *Invited Talk*, AAAS, Washington D.C., Computational Sustainability: UDiscoverIt: Incentivizing Citizen Science Discovery for a Sustainable World, 2015.
23. *Keynote Speaker*, Third International Green Computing Conference (IGCC'12), San Jose, CA, 2012.
24. *Keynote Speaker*, National Academy of Engineering Regional Symposium, Toward a Sustainable Future, Cornell University, Ithaca, NY, 2012.
25. *Colloquium Speaker*, University of Waterloo Computer Science Colloquium on Computational Sustainability, Waterloo, Canada, 2012.
26. *Invited Talk*, Radcliffe Institute for Advanced Study at Harvard University, Computational Sustainability: Computational Methods for a Sustainable Environment, Economy, and Society, 2011.
27. *Colloquium Speaker*, Department of Computer Science, Tufts University, Medford, MA, 2011.

28. *Invited Talk*, Workshop on Information and Communication Technologies for Sustainability (WICS), Salt Lake City, UT, 2011.
29. *Keynote Speaker*, NSF-IITD Indo-US PC3: Pervasive Communication and Computing Workshop (PC3). Computational Sustainability. New Delhi, India, 2011.
30. *Invited Talk*, Carnegie Mellon University, Department of Computer Science, Sustainability and Computer Science Seminar. Computational Sustainability. Pittsburgh, PA, 2011.
31. *Invited Plenary Talk*, National Symposium for the Advancement of Women in Science. The Future of Computer Science. Cambridge, MA, 2011.
32. *Invited Plenary Talk*, NSF/CCC Workshop on IT and Sustainability Enterprise: Role of Information Sciences in Sustainability (RISES). Computational Sustainability. Washington, DC, 2011.
33. *Invited Plenary Talk*, 24th National Conference of the American Association for Artificial Intelligence (AAAI-10). Challenges for AI in Computational Sustainability. Atlanta, Georgia, 2010.
34. *Invited Plenary Talk*, 7th International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems (CP-AI-OR'10). Challenges for CPAIOR in Computational Sustainability. Bologna, Italy, 2010.
35. *Invited Plenary Technical Talk*, Grace Hopper Celebration of Women in Computing, (Grace-Hopper'10). Computational Sustainability: Computational Methods for a Sustainable Future. Atlanta, Georgia, 2010.
36. *Invited Plenary Talk*, National Academy of Engineering, U.S. Frontiers of Engineering, Computational Sustainability: Computational Methods for a Sustainable Future. Irvine, 2009.
37. *Invited Plenary Talk*, 15th International Conference on the Principles and Practice of Constraint Programming (CP09). Computational Sustainability: Computational Methods for a Sustainable Future. 2009.
38. *Keynote Speaker*, Envisa workshop on Intelligent Analysis of Environmental Data. Computational Sustainability: Computational Methods for a Sustainable Future. Cork, Ireland, 2010.
39. *Colloquium Speaker*, University of Rochester, Department of Computer Science. Computational Sustainability: Computational Methods for a Sustainable Future. 2010.
40. *Colloquium Speaker*, CMU, Tepper Business School. Exploiting Structure and Randomization in Combinatorial Search. 2009.
41. *Invited Talk*, NSF Workshop on the Next Generation of Data Mining, (NGDM09). Computational Sustainability: Computational Methods for a Sustainable Future. Baltimore, 2009.
42. *Invited Talk*, Symposium on on Satisfiability Solvers and Program Verification (SSPV 2006). Beyond Satisfiability: Model Counting, Quantification, and Randomization, 2006.

43. *Keynote Speaker*, Ninth International Symposium on Artificial Intelligence and Mathematics. (AI & Math 2006). Adventures in Randomized Complete Methods, USA. 2006.
44. *Invited Talk*, American Association for the Advancement of Science (AAAS). Heavy-tailed Phenomena in Computation. Symposium entitled “The Pervasiveness of Extreme Phenomena in Science, Economics, and Engineering.” Annual Meeting, Washington D.C., 2005.
45. *Invited Talk*, Inaugural Conference of the Northwestern Institute on Complex Systems (NICO). Heavy-Tailed Behavior in Computation, Northwestern University, 2004.
46. *Invited Talk*, Institute for Mathematics and its Applications (IMA). Heavy-Tailed Behavior in Computation. Feb. 2004.
47. *Invited Talk*, Institute for Pure and Applied Mathematics, UCLA. Randomization, Structure, and Complexity in Combinatorial Optimization. 2003.
48. *Colloquium Speaker*, University of Michigan, AI Colloquium. Bridging Paradigms for Combinatorial Search. 2003.
49. *Invited Talk*, Institute for Pure and Applied Mathematics, UCLA. The Integration of Constraint Programming and Mathematical Programming Methods. 2002.
50. *Colloquium Speaker*, University of Lisbon. Heavy-Tailed Phenomena in Combinatorial Search. March 2001.
51. *Invited Plenary Talk*, 17th National Conference of the American Association for Artificial Intelligence (AAAI-00). Structure, Duality, and Randomization — Common Themes in AI and OR. August, 2000.
52. *Invited Talk*, Stanford University, Broad Area Colloquium. Structure, Duality, and Randomization — Common Themes in AI and OR. Nov. 2000.
53. *Invited Talk*, SRI International. Structure, Duality, and Randomization — Common Themes in AI and OR. Nov. 2000.
54. *Invited Talk*, NASA, Ames. Structure, Duality, and Randomization — Common Themes in AI and OR. Nov. 2000.
55. *Invited Session Talk*, Institute for Operations Research and the Management Sciences (INFORMS). Algorithm Portfolio Approach for Solving Hard Combinatorial Problems. Cincinnati, OH, 1999.
56. *Colloquium Speaker*, University of Alberta, Colloquium, Dept. of Computer Science. Exploiting Heavy-Tail Phenomena to Speed-up Search. June, 1999.
57. *Invited Talk*, SRI International. Heavy-Tail Phenomena in Combinatorial Search. April, 1998.
58. *Colloquium Speaker*, Syracuse University, Colloquium, Dept. of Computer Science. Exploiting Heavy-Tail Phenomena to Speed-up Search. Oct., 1998.

59. *Invited Session Talk*, Institute for Operations Research and the Management Sciences (INFORMS). Practical Aspects of Randomized Algorithms. Montreal, Canada, April, 1998.
60. *Invited Talk*, Information 2000: Intelligent Information for the Next Millennium Workshop. Integration of Artificial Intelligence and Operations Research for Combinatorial Problems. Vernon, NY, Oct. 1997.
61. *Invite Talk, Distinguished Lecture Series*, AFRL/IF, Integration of Artificial Intelligence/Operations Research for Combinatorial Problems. Rome, NY, July 1997.
62. *Invited Talk*, Electrical Power Research Institute — Members Conference. Synthesis of Nuclear Power Plant Outage Schedulers. San Diego, CA. Nov. 1995.
63. *Colloquium Speaker*, Louisiana State University, Colloquium. A Distributed Framework for Scheduling. Baton Rouge, LA, Nov. 1994.
64. *Invited Talk*, Electrical Power Research Institute, Members Conference. Formal Methods Applied to Schedule Generation. Orlando, FL, Jul. 1994.

*Invited Survey Lectures and Tutorials*

65. Scientific Use of Experimentation for Combinatorial Optimization. Master Class on Experimental Study of Algorithms and Benchmarking. CPAIOR. Italy, 2010.
66. Complete Randomized Backtrack Search. American Association for Artificial Intelligence (AAAI), 2005.
67. Complete Randomized Backtrack Search. Conference on the Principles and Practice of Constraint Programming, 2005.
68. Heuristic Algorithms: Theory and Practice. Summer School on “Statistical Physics, Probability Theory, and Computational Complexity”, The International Centre for Theoretical Physics, Trieste, Italy, September 2002.
69. Randomization and Rational Decision Making in Optimization. Uncertainty in Artificial Intelligence (UAI), Edmonton, Alberta, Canada, 2002.
70. Phase Transitions and Structure in Combinatorial Problems. American Association for Artificial Intelligence (AAAI), Edmonton, Canada, July, 2002.
71. Exploiting Structure and Randomization in Combinatorial Search. School on Optimization. CPAI-OR 2002, Le Croisic, France, March 2002.
72. Phase Transitions and Structure in Combinatorial Problems. International Joint Conference on Artificial Intelligence (IJCAI), Seattle, WA, 2001.



73. Integration of Artificial Intelligence and Operations Research Techniques. American association for Artificial Intelligence (AAAI), Madison, WI, 1999.
74. Integration of Artificial Intelligence and Operations Research Techniques. American Association for Artificial Intelligence (AAAI), Providence, RI, 1998.

#### *Research Briefings*

75. NSF, Research talk to the NSF Advisory Board, Computing and Information Science and Engineering (CISE), 2009. Computational Sustainability: Computational Methods for a Sustainable Future, 2009.
76. AFOSR, Research Briefing to Dr. Lyle Schwartz (Director of AFOSR) and Dr. Herbert Carlson (Chief Scientist of AFOSR). Accomplishments and Future Directions for the Intelligent Information Systems Institute. June 2003.
77. AFRL/IF, Scientific Advisory Board. Vision and Directions for the Intelligent Information Systems Institute. Nov. 2001.
78. AFRL/IF, Distinguished Visitors, Research briefing to Maj. Gen. Neilsen (Commander of AFRL), Rome, NY, February, 2001.
79. AFRL/IF, Scientific Advisory Board, Research briefing, Rome, NY, Dec. 1999.
80. AFRL/IF, Distinguished Visitors, Research briefing to Dr. Donald Daniel and Dr. Cliff Rhoades (Director of Mathematics Geosciences Directorate of AFOSR), Rome, NY, September 1998.
81. AFRL/IF, Distinguished Visitors, Research briefing to Dr. Janni (Director of AFOSR), Rome, NY, August 1998.
82. AFRL/IF, Distinguished Visitors, Research briefing to Maj. Gen. Paul (Commander of AFRL), Rome, NY, July 1998.
83. AFRL/IF, Distinguished Visitors, Research briefing to Dr. Kenneth Harwell (Chief Scientist of AFRL) and Col. Jim Heald (Vice-Cmd of AFRL), Rome, NY, June 1998.
84. AFRL/IF, Distinguished Visitors, Research briefing to Dr. Hastings (Chief Scientist of US Air Force) Rome, NY, May, 1998.
85. AFRL/IF, Distinguished Visitors, Research briefing to Dr. Feigenbaum (Chief Scientist of US Air Force) Rome, NY, 1996.

### **Open Source, Demos, and Web Applications**

1. Quasigroup Completion Problem and Heavy Tailed Phenomena (Java Applet)  
<http://www.cs.cornell.edu/gomes/QUASIdemo.html>
2. Computational Methods for the Generation of Spatially Balanced Latin Squares for Experimental Design. <http://www.cs.cornell.edu/gomes/sbls.htm>
3. Visualization of Portfolios of Algorithms (Java Applet)  
<http://www.cs.cornell.edu/Info/People/gomes/visualBrelaz/visualBrelaz.html>
4. Generator of Quasigroup Completion Problem and related problems (C code)  
<http://www.cs.cornell.edu/gomes/lencode-v1.1.tar.Z>
5. Paramedic Crew Assignment (Java Applet)  
<http://www.cs.cornell.edu/gomes/demos/demo/html/people.html>
6. Visualization of Heavy-tailed Behavior (Java Applet)  
<http://www.cs.cornell.edu/gomes/BalancedBranchApplet/ImbalancedApplet.html>
7. Sudoku  
<http://www.cs.cornell.edu/gomes/SUDOKU/sudoku.html>
8. Grizzly Bear Wildlife Corridor Problem Generator
9. Red-Cockaded Woodpecker (endangered species) Problem Generator  
<http://www.cs.cornell.edu/kiyan/rcw/generator.htm>

## Teaching, Course Development, and Research Advising at Cornell

### *Courses developed recently*

CS/AEM/INFO-2770 — *Excursions in Computational Sustainability*. This is an introductory undergraduate level course. An important objective of the course is to show how the often ill-defined notions of sustainability can be made operational through computational and mathematical models, and how those models can improve policies to alter or modify unsustainable human behavior. The course introduces the students to a range of sustainability notions, concepts, and challenges as they arise in different fields (ecology, geology, economics, and other biological, physical, and social sciences). Sustainability topics include sustainable development, biodiversity and wildlife conservation, poverty mitigation, food security, renewable resources, energy, transportation, and climate change. In the context of these sustainability topics, the course will introduce students to mathematical and computational modeling techniques, algorithms, and machine and statistical learning methods.

### *Other courses taught*

CS/INFO-6702 — *Topics in Computational Sustainability*.

INFO7990 — *Distributed Seminar on Sustainability Science*.

CS-4700 — *Foundations of Artificial Intelligence*.

CS-4701 — *Artificial Intelligence Practicum*.

CS/INFO-3720 — *Explorations in Artificial Intelligence*.

CS-6730 — *Integration of Artificial Intelligence and Operations Research Techniques for Combinatorial Problems*.

AEM-4120 — *Computational Methods for Management and Economics*.

*Student research advising, Ph.D. / M.Eng. / Undergraduate:*

Brendan Rappazzo (Ph.D., CS), Wenting Zhao (Ph.D., CS), Di Chen (Ph.D., CS), Junwen Bai (Ph.D., CS), Dieqiao Feng (Ph.D., CS, with Bart Selman), Sebastian Ament (Ph.D., CS), Johan Bjorck (Ph.D., CS), Qinru Shi (Ph.D., Applied Math), Avralt-Od Purevjav (Ph.D., AEM; chair: Shanjun Li), Duhan Zhang (Ph.D., Mechanical Engineering; chair: Robert Shepherd), Yexiang Xue (Ph.D., CS, now Assistant Professor at Purdue University), Bistra Dilkina (Ph.D., CS, now Assistant Professor at University of Southern California), Stefano Ermon (Ph.D., CS, now Assistant Professor at Stanford), Katherine Lai (Ph.D., CS), Ronan Le Bras (Ph.D., CS, now researcher at Paul Allen Institute for Artificial Intelligence), Maarika Teose (Ph.D., CAM), Yunsong Guo (Ph.D., CS, now at Pinterest), Ricardo Arguello (Ph.D., CRP, 2009, minor; chair: Nancy Chau), Zevi Azzaino (Ph.D., CRP, minor; chair: Jon Conrad), Ryan Finseth (M.Sc., AEM, minor; chair: Jon Conrad), Yan Zhao (M.Sc., AEM), Keith Savageau (M.Sc., AEM, 2005), Sam Henry (M.Eng., research project Sp 2010), Lisa Cai (M.Eng., research project Sp 2005), Anan Kapur (M.Eng., research project Spring 2005), Keith Savageau (M.Sc., AEM, 2005), Ryan Williams (M.Eng., research project Summer 2002), Sean N. Byrnes (M.Eng, research project 2001), Vicky Weissman (M.Eng., research project Summer 1999), Anmol Kabra (Undergrad, research projects), Tharun Sankar (Undergrad, research projects), Liane Longpre (Undergrad, research projects), Steven McDonald (Undergrad, research projects), Jordan Stout (Undergrad, research projects), John Tregurtha (Undergrad, research projects), Galen Weld (Undergrad, research projects), Runzhe Yang (Undergrad, Shanghai Jiao Tong University), Yiwei Bai (Undergrad, Shanghai Jiao Tong University), Luming Tang (Undergrad, Shanghai Jiao Tong University), Jonathan Nino Cortes (Undergrad, Universidad de los Andes, Colombia), Noah Sorbello (Undergrad), Andrew Perreault (Undergrad), Gregory Sadowski (Undergrad Fall 2009), Raoul Reit (Undergrad Spring 2010), Sarah Chung (Undergrad Fall 2002), Nir Etzion (Undergrad Fall 2001), Guilherme Luiz Karnas Hoefel (Undergraduate / M.Eng. OR - Research project 2001/2002), Patrick Dowell (Undergrad, research project Summer 2001), Radha Narayan (Undergrad, research project Summer 2001), Mike Sweredoski (Undergrad, research project Summer 2002), Ben Kraus (Undergrad, research project Summer 2000).

*Postdoctoral associates:*

Shufeng Kong (2018-present); Roosevelt Garcia (2017-2018, with Alex Flecker, EEB); Guillaume Perez (2017-2018); Xiaojian Wu (2016-2017); Theodoros Damoulas (2009-2013, now Assistant Professor at University of Warwick, UK); Carlos Ansotegui (2005, now Professor at Lleida University, Spain); Ramon Bejar (2003, now Professor at Lleida University, Spain); Ashish Sabharwal (2005-2010, now at Paul Allen Institute for Artificial Intelligence); Willem van Hove (2005-2010, currently Associate Professor, CMU); Meinolf Sellmann (2004, now at IBM T.J. Watson Research Center); Cesar Fernandez (2004, now Professor, Lleida University, Spain); Carmel Domshlak (2002-2003, now Associate Professor, Technion University, Israel); Ramon Bejar (2001, currently Assoc. Professor, Lleida University)

## **Professional Service**

Editorial Boards (past and current):

*ACM Transaction on Intelligent Systems and Technology* (current)

*Journal of Artificial Intelligence Research*

*ACM Transactions on Programming Languages and Systems*  
*Constraints Journal*  
*Journal of Knowledge Engineering Review*  
*Journal of Satisfiability, Boolean Modeling and Computation*

Chair, Scientific Review Panel, Portuguese Minister of Science and the President of the Portuguese Foundation of Science and Technology (FCT) (2018).

Member, Artificial Intelligence Staging Task Force, Materials Research Society (MRS) (2017-2018).

Member, Cornell University Sustainability Task Force (2017).

Guest Editor, *ACM Transactions on Intelligent Systems and Technology*, Special issue on Computational Sustainability (2010-2011).

Program Chair (with Brian Williams) Special Track on Computational Sustainability at AAAI, 25th Conference on Artificial Intelligence, CompSust@AAAI, San Francisco, 2011.

Program Chair (with Tom Dietterich and Brian Williams) 2nd Intl. Conference on Computational Sustainability (CompSust-2009), MIT, Boston, USA, 2009.

Program Chair (with Jon Conrad and David Shmoys) 1st Intl. Conference on Computational Sustainability (CompSust-2009), Cornell University, Ithaca, USA, 2009.

Program Chair (with Dieter Fox), Twenty-Third Conference on Artificial Intelligence (AAAI-08), Chicago, USA, 2008.

Program Chair (with Armin Biere), Ninth International Conference on Theory and Applications of Satisfiability Testing (SAT 2006), Seattle, Washington, USA, 2006.

Conference Chair, Eighth International Conference on the Principles and Practice of Constraint Programming (CP2002), Ithaca, NY, 2002.

Co-Chair:

AAAI Tutorial program, American Association for Artificial Intelligence AAAI-2006.

AAAI Workshop on Probability and Search, Edmonton, Canada, 2002 (with Toby Walsh).

AAAI Fall Symposium, Uncertainty in Computation, Boston, Nov. 2001 (with Toby Walsh).

AAAI Workshop, Leverage Randomization, and Probability, Austin, TX, 2000 (with H. Hoos).

External committee member (Ph.D.):

Alda Carvallho, Applied Mathematics, Technical University of Lisbon, 2010.

Mathew Streeter, Comp. Sci. Dept., Carnegie Mellon University, 2008.

Erik van der Meers, Information Technology, University of Copenhagen, 2006.

Vincent Cicerello, Comp. Sci. Dept., Carnegie Mellon University, 2004.

Carlos Ansoategui, Comp. Sci. Dept., Univ. Lleida, Spain, 2004.

Ines Lynce, Comp. Sci. Dept., University of Lisbon, 2003

Ramon Bejar, Comp. Sci. Dept., Univ. Aut3noma de Barcelona, Spain, 2000.

Anil Menon, Computer Science Department, University of Syracuse, 1998.

Guest Editor, *J. of Knowledge Engineering Review*, on AI/OR for Planning and Scheduling (2001).

Program Committees:

National Conference of the American Association for Artificial Intelligence AAAI-2010 (Nectar

PC); 16th International Conference on the Principles and Practice of Constraint Programming, CP-2010; International Conference on the Integration of AI and OR in CP for Combinatorial Optimization (CPAIOR-2009);

21st International Joint Conference on Artificial Intelligence, IJCAI-2009; International Conference on the Integration of AI and OR in CP for Combinatorial Optimization (CPAIOR-2008); International Conference on the Integration of AI and OR in CP for Combinatorial Optimization (CPAIOR-2007); International Conference on the Integration of AI and OR in CP for Combinatorial Optimization (CPAIOR-2006); International Conference on Automated Planning and Scheduling, ICAPS-2006; International Joint Conference on Artificial Intelligence, IJCAI-2005; International Conference on the Integration of AI and OR in CP for Combinatorial Optimization (CPAIOR-2005); International Conference on Automated Planning and Scheduling, ICAPS-2005; National Conference of the American Association for Artificial Intelligence AAAI-2005 (senior PC); International Conference on the Integration of AI and OR in CP for Combinatorial Optimization (CPAIOR-2004); International Conference on Automated Planning and Scheduling, ICAPS-2004; 7th International Conference on the Theory and Applications of Satisfiability Testing, SAT-2004; International Conference on Automated Planning and Scheduling, ICAPS-2003; 9th International Conference on the Principles and Practice of Constraint Programming, CP-2003; 6th International Conference on the Theory and Applications of Satisfiability Testing, SAT-2003; American Association for Artificial Intelligence AAAI-2002; Symp. on the Theory and Applications of Satisfiability Testing (SAT-2001, part of LICS-2001); Abstract State Machine Workshop, ASM-2000; European Conference on Planning, ECP-1999; Agents 1999; American Association for Artificial Intelligence AAAI-1996; Artificial Intelligence Tools (AI-TOOLS) 1994; AI/OR Workshop, Vermont, 1994.

Judge, Intel International Science and Engineering Fair, May 12-18, 2002, USA.

Advisory Committee Member, *International Scientists, Presidency of European Community*, 2000.

Member, Electrical and Computer Engineering — Robotics and Information Systems, Funding Review Panel of the National Science and Technology Foundation, Portugal, Febr. 2002.

Member, DARPA Future Directions Study Group (ISAT), Self-Configuring Wireless Sensor Networks, Woods Hole, MA, August 2000; Study on Probabilistic Methods in Computational Systems and Infrastructure, Woods Hole, MA, August 1999.

Organizer, New World Vistas AFOSR Annual Review, 1999.

Reviewer for:

Artificial Intelligence Journal; Constraints: An International Journal; Discrete Applied Mathematics; Constraint Programming; American Association for Artificial Intelligence (AAAI); Air Force Office of Scientific Research (AFOSR); Artificial Intelligence Tools Journal; IEEE Expert; International Joint Conference on Artificial Intelligence (IJCAI); Journal of Automated Reasoning; Journal of Artificial Intelligence Research; NASA; and NSF.

## **Employment History**

Since Jul. 2008	Director, Institute for Computational Sustainability.
Since Jul. 2010	Professor, Dept. of Computer Science, Dept. of Information Science and Dyson School of Economics and Management, Cornell University.
2003-2010	Associate Professor, Computing and Information Science, Dept. of Applied Economics and Management, and Dept. of Computer Science, Cornell University.
2001-2008	Director, Intelligent Information Systems Institute (IISI), Computing and Information Science, Cornell University.
1998-2000	Research Associate, Computer Science Dept., Cornell University.
1993-1998	Researcher, Air Force Research Lab, Information Directorate, Information Technology, Technical Advisor: Nort Fowler.
1990-1992	Teaching Assistant at the University of Edinburgh.
1987-1989	Research Analyst, Department of Informatics, Air Portugal. Main projects: Crew Scheduling and Automatic Passenger Profile Analysis.

## Recent Media

- *AI adjusts for gaps in citizen science data*, Cornell Chronicle, Jan 25, 2019.
- *Giving algorithms a sense of uncertainty could make them more ethical*, MIT Technology Review, Jan 18, 2019.
- *Learning from the big picture*, Nature Materials: News & Views, Nov 23, 2018.
- *NSF grants \$1.3M to Cornell, partners to hunt eelgrass disease*, Cornell Chronicle, Sep 25, 2018.
- *Recent PhD grad wins highest award for junior AI researchers*, Stanford Engineering, May 8, 2018.
- *ACM Recognizes 2017 Fellows for Making Transformative Contributions and Advancing Technology in the Digital Age: Carla Gomes*, Association for Computing Machinery, Dec 11, 2017.
- *AI for Discovering Clean Energy Materials*, Cornell Research, Oct 19, 2017.
- *CS Profs on Research Team to Receive \$7.5M Grant*, Cornell CIS, Aug 3, 2017.
- *Two groups both win \$7.5M to study AI, autonomous systems*, Cornell Chronicle, Jul 19, 2017.
- *Collaboration across (baseball) fields leads to Amazonian rivers*, Cornell Chronicle, 7/6/2017.
- *Phase Mapper wins Innovation Application Award at IAAI 2017*, Cornell CS News, Mar 16, 2017.
- *Combining Artificial Intelligence with Combinatorial X-ray Diffraction Enables Rapid Phase Mapping of New Materials*, Joint Center for Artificial Photosynthesis, Jan 23, 2017.

- *Computing cost-effective wildlife corridors*, Mongabay Wildtech, Nov 11, 2016.
- *Teaching robots to solve their own problems*, Cornell Chronicle, Nov 10, 2016.
- *When animals share, conservation is affordable*, Cornell Chronicle, Oct 27, 2016.
- *Wildlife migration routes for multiple species can link conservation reserves at lower cost*, Phys.org, Oct 21, 2016.
- *Economist, partners clinch USAID award for drought insurance*, Cornell Chronicle, Oct 12, 2016.
- *Materials to do anything under the sun*, Cornell Engineering Magazine, October 4, 2016.
- *Optimization technique identifies cost-effective biodiversity corridors*, ScienceDaily, September 27, 2016.
- *Students Come Together to Code, Solve Problems at the BigRed Hacks*, Cornell Sun, September 19, 2016.
- *Three ways artificial intelligence is helping to save the world*, Ensia, April 26, 2016.
- *Computers play a crucial role in preserving the Earth*, NSF Web site, April 20, 2016.
- *Computing and Information Science receives 10 million dollar grant*, Cornell Chronicle, March 29, 2016.
- *Cornellians illuminate world's scientific strides*, Cornell Chronicle, February 18, 2016.
- *Incentivizing citizen science discovery for a sustainable world*, Phys.org, February 13, 2016.
- *Cornellians to share scientific studies at AAAS meeting*, Cornell Chronicle, February 2, 2016.
- *Prof Awarded 10 million dollar Grant for Computational Sustainability Work*, Cornell Daily Sun, January 28, 2016.
- *Harnessing the power of computers to create a sustainable future*, Research News @ Vanderbilt, January 8, 2016.
- *NSF puts 30 million dollars behind software bug killing, synthetic biology and computational sustainability*, Network World, January 8, 2016.
- *NSF Commits 30 million dollars to Theoretical Computer Science, Synthetic Biology, Computational Sustainability*, Scientific Computing, January 7, 2016.
- *NSF commits 30 million dollars to expand the frontiers of computing*, NSF press release, January 7, 2016.
- *Computing and Information Science receives 10 million dollar grant*, Cornell Chronicle, January 7, 2016.

- *Cornell joins pleas for responsible AI research*, Cornell Chronicle, August 26, 2015.
- *Ecological corridor to preserve Ecuadorian Andes bears*, Cornell Chronicle, March 9, 2015.
- *App tracks Kenya's best places to graze*, Futurity Science and Technology, February 20, 2015.
- *Space-age technology points African herders in right direction*, Cornell Chronicle, February 15, 2015.
- *Forging a New Path: Working to Build the Perfect Wildlife Corridor*, Pacific Standard Nature and TEch, September 25, 2014.
- *Forging a New Path*, On Earth, September 15, 2014.
- *Interview, Planetary Skin, cross media project, Werden Wir die erde retten?*, A project by Roman Brinzanik, Tobias Hlswitt and Gunther Kreis, on behalf of the Federal Cultural Foundation and in cooperation with the Suhrkamp Verlag, 2012.

## Research Funding

Lead Principal Investigator — Collaborative Research: CompSustNet: Expanding the Horizons of Computational Sustainability, NSF Expedition: Award CCF-1522054 (2015-2020). \$10,000,000.

Lead Principal Investigator — Collaborative Research: Computational Sustainability: Computational Methods for a Sustainable Environment, Economy, and Society, NSF Expedition: Award CNS-0832782 (2008-2016). \$10,000,000.

Co-Principal Investigator — Collaborative Research: The role of a keystone pathogen in the geographic and local-scale ecology of eelgrass decline in the eastern Pacific, NSF: Award OCE-1829921 (2018-2021). \$1,302,932.

Principal Investigator — Accelerated Learning Lab: Capturing Deep Structure to Accelerate Materials Discovery, Toyota Research Institute, (2017-2020). \$1,000,000.

Co-Principal Investigator — A Scientific Autonomous Reasoning Agent: Integrating Theory, Experiment Computation, Multidisciplinary University Research Initiative, AFOSR (2017-2022). \$7,500,000.

Principal Investigator — A Platform for Computational-and-Data-Intensive Methods for Large-Scale Intelligent Distributed Systems, ARO, DURIP, (2017-2018), \$425,000.

Co-Principal Investigator — The Integration of Reasoning and Learning Strategies for Scientific Discovery, AFOSR (2017-2020), \$566,000.

Principal Investigator — UDiscoverIt: Integration of Computational Reasoning, Learning, and Crowd-Sourcing for Accelerating Materials Discovery, National Science Foundation INSPIRE Track 1: Award IIS-1344201 (2013-2017). \$699,986.



Principal Investigator — Crowd-Sourcing for Scientific Discovery, DOD-Army Research Office (ARO) Award W911-NF-14-1-0498 (2014-2017) \$600,000.

Principal Investigator — NSF Collaborative Project: Wireless Sensor Networks for Protecting Wildlife and Humans (with Ohio State and UCLA), CNS-1143651, National Science Foundation Collaborative Project (2011-2014). \$121,791.

Principal Investigator — Exploratory Research in Automated Computational Analysis of Inorganic Materials Libraries, National Science Foundation EAGER: Award IIS-1258330 (2013-2014) \$133,440.

Principal Investigator — The human and environmental impacts of migratory pastoralism in arid and semi-arid East Africa, Collaborative Project: Wireless Sensor Networks for Protecting Wildlife and Humans, Australian Development Research Awards Scheme (ADRAS): Collaborating with University of Sydney, (2013-2015), \$156,837. \$600,000.

Principal Investigator — Computing research infrastructure for constraint optimization, machine learning, and dynamical models for computational sustainability, CNS-1059284, National Science Foundation (2011-2012). \$378,016.

Principal Investigator — Integrating Ecological and Social Data to Optimize Economic Decisions on Wildlife Corridors, US Forest Service, Rocky Mountain Research Station, 10-JV11221635-241, (2010-2015), \$60,613.

Principal Investigator — Bridging the Gap Between Theory and Practice: Structure and Randomization in Large Scale Combinatorial Search, Air Force Office of Scientific Research. Basic research FA9550-08-1-0196, (2008–2010). \$419,987.

Co-Principal Investigator — Extending the Reach of SAT Technology: Quantification, Counting, and Sampling, National Science Foundation, 713499,(2007-2010). \$405,000.

Principal Investigator — Computational Intelligence for Print Shop Workflows, University of Rochester, (2007–2008). \$30,000.

Principal Investigator — Computational Intelligence for Print Shop Workflows, Kodak Eastman, Supplement 12, (2007–2008). \$170,000.

Principal Investigator — Intelligent Information Systems Institute, Air Force Office of Scientific Research, Basic research, FA9550-04-1-0151, (2004–2008). \$3,870,000.

Co-Principal Investigator — Boosting Reasoning Technologies Through Randomization, Structure Discovery, and Hybrid Strategies, DOD-DARPA/AFRL, FA8750-04-2-0216, (2004-2009). \$3,580,000.

Principal Investigator — Intelligent Information Systems Institute, Air Force Office of Scientific Research, Basic research, F49620-01-1-0076, (2000–2004). \$3,200,000.

Co-Principal Investigator — Controlling Computational Cost: Structure, Phase Transitions, and Randomization, DOD-DARPA/AFRL, F30602-00-2-0596, (2000-2003), \$550,000.

Co-Principal Investigator — Controlling Computational Cost: Structure, Phase Transitions, and Randomization, DOD-DARPA/AFRL, F30602-00-2-0530, (2000-2003), \$1,621,041.

Co-Principal Investigator — Principled Analysis & Synthesis of Agent Systems Using Tools from Statistical Physics. DARPA, (2000-2003). \$650,000.

Co-Principal Investigator — Self-Configuring Wireless Transmission and Decentralized Data Processing for Generic Sensor Networks, DARPA, (with S. Wicker (PI), T. Fine, L. Tong, and V. Veeravalli, 2000-2003), \$890,000.

Co-Principal Investigator — Cooperative Control in Uncertain, Adversarial Environments. Air Force Office of Scientific Research, (MURI) Principal Investigator J. Shamma, UCLA. Joint with UCLA, MIT, Caltech (2001-2006). Cornell portion: \$1,000,000. (2001-2006).

Principal Investigator — Hybrid Approaches for Combinatorial Problems, DOD-DARPA/AFRL, F30602-99-1-0006, (1999-2002), \$260,688.

Principal Investigator — Integration of AI and OR for Mixed Initiative Continuous Planning and Scheduling, Air Force Office of Scientific Research, (1996-2001), \$1,150,000.

Principal Investigator — Compute-Intensive Methods for Combinatorial Problems, DOD-Air Force Research Labs, F30602-99-1-0005, (1999-2001), \$395,817.

Principal Investigator — Compute-Intensive Methods for Combinatorial Problems, AFOSR, DURIP, F49620-99-1-0195, (1999-2000), \$158,076.

Principal Investigator — Compute-Intensive Methods for Combinatorial Problems, DOD - Air Force, Rome Laboratories, F30602-98-1-0008, (1998-1999), \$203,677.