

Daniel R. Golovin

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RESEARCH INTERESTS

I am interested in devising practical algorithms with strong theoretical guarantees for important learning and optimization problems — algorithms for systems which reason about and make decisions in complex environments that may be uncertain, only partially observable, and changing over time. Towards that end I draw on ideas from online and no-regret algorithms, approximation algorithms, combinatorial optimization, and statistical learning theory, among other areas.

EDUCATION

- 2008 *Ph.D. in Computer Science*
Carnegie Mellon University, Pittsburgh, PA
School of Computer Science
Advised by Professor Guy Blelloch, Computer Science Department
Thesis committee: Guy Blelloch, Gary Miller, R. Ravi, and Jon Kleinberg
- 2006 *Masters of Science in Computer Science*
Carnegie Mellon University, Pittsburgh, PA
School of Computer Science
- 2003 *Bachelor of Science, Magna Cum Laude, in Computer Science,*
with a minor in applied mathematics.
Cornell University, Ithaca, NY
College of Engineering

HONORS

- 2011 **Outstanding Paper Award**, Conference on Artificial Intelligence (AAAI)
- 2008 Awarded Research Grant, with Guy Blelloch, from the CMU Center for Computational Thinking, for *Improving Privacy via History Independence*
- 2003–2008 Graduate Fellowship at Carnegie Mellon University
- 2003 & 2004 Honorable Mention, NSF Graduate Fellowship
- 2003 Finalist, John and Fannie Hertz Foundation Graduate Fellowship
- 2002 Selected for the team of three students representing Cornell University in the William Lowell Putnam mathematical competition
- 1998 New Jersey Governor’s School in the Sciences Scholar

POSITIONS HELD

- 2009–2011 Postdoctoral Research Fellow, Center for the Mathematics of Information, California Institute of Technology

- 2008–2009 Postdoctoral Research Fellow, Center for Computational Thinking,
Carnegie Mellon University
- Summer 2006 Research Intern, Amazon.com
I helped redesign the core order-fulfillment algorithm, which decides how
to get merchandise from Amazon’s distributed inventory to the customers.

PUBLICATIONS

PhD Thesis

- [1] Daniel Golovin. *Uniquely Represented Data Structures with Applications to Privacy*. PhD thesis, Carnegie Mellon University, Pittsburgh, PA, August 2008. CMU-CS-08-135.

Papers Under Submission or in Preparation

- [1] Daniel Golovin and Andreas Krause. Adaptive submodularity: Theory and applications in active learning and stochastic optimization. Submitted.
- [2] Daniel Golovin and Andreas Krause. Adaptive submodular optimization under matroid constraints. Submitted.
- [3] Guy E. Blelloch and Daniel Golovin. Uniquely represented data structures. Submitted.

Refereed Journal and Conference Papers

- [1] Daniel Golovin, Andreas Krause, Beth Gardner, Sarah J. Converse, and Steve Morey. Dynamic resource allocation in conservation planning. In *AAAI ’11: Proceedings of the Twenty-Fifth AAAI Conference on Artificial Intelligence*, pages 1331–1336. AAAI Press, 2011. **Winner of the Outstanding Paper Award.**
- [2] Andreas Krause, Alex Roper, and Daniel Golovin. Randomized sensing in adversarial environments. In *IJCAI ’11: Proceedings of the 22nd International Joint Conference on Artificial Intelligence*, pages 2133–2139, 2011.
- [3] Federico Echenique, Daniel Golovin, and Adam Wierman. A revealed preference approach to computational complexity in economics. In *EC ’11: Proceedings of the 12th ACM conference on Electronic Commerce*, pages 101–110, New York, NY, USA, 2011. ACM Press.
- [4] Daniel Golovin, Andreas Krause, and Debajyoti Ray. Near-optimal Bayesian active learning with noisy observations. In J. Lafferty, C. K. I. Williams, J. Shawe-Taylor, R.S. Zemel, and A. Culotta, editors, *NIPS ’10: Advances in Neural Information Processing Systems 23*, pages 766–774. 2010.
- [5] Daniel Golovin and Andreas Krause. Adaptive submodularity: A new approach to active learning and stochastic optimization. In *COLT 2010: 23rd Annual Conference on Learning Theory*, pages 333–345, 2010.
- [6] Daniel Golovin, Matthew Faulkner, and Andreas Krause. Online distributed sensor selection. In *IPSN ’10: Proceedings of the 9th ACM/IEEE International Conference on Information Processing in Sensor Networks*, pages 220–231, New York, NY, USA, 2010. ACM.
- [7] Matthew Streeter, Daniel Golovin, and Andreas Krause. Online learning of assignments. In Y. Bengio, D. Schuurmans, J. Lafferty, C. K. I. Williams, and A. Culotta, editors, *NIPS ’09: Advances in Neural Information Processing Systems 22*, pages 1794–1802. 2009. **NIPS Spotlight paper.**

- [8] Daniel Golovin. B-treaps: A uniquely represented alternative to B-trees. In *ICALP '09: Proceedings of the 36th International Colloquium on Automata, Languages and Programming*, pages 487–499, Berlin, Heidelberg, 2009. Springer-Verlag.
- [9] Konstantin Andreev, Charles Garrod, Daniel Golovin, Bruce M. Maggs, and Adam Meyerson. Simultaneous source location. *ACM Transactions on Algorithms*, 6(1):1–17, 2009.
- [10] Matthew Streeter and Daniel Golovin. An online algorithm for maximizing submodular functions. In D. Koller, D. Schuurmans, Y. Bengio, and L. Bottou, editors, *NIPS '08: Advances in Neural Information Processing Systems 21*, pages 1577–1584. 2008. **NIPS Spotlight paper**. An earlier version appeared as Carnegie Mellon University technical report CMU-CS-07-171.
- [11] Daniel Golovin, Anupam Gupta, Amit Kumar, and Kanat Tangwongsan. All-Norms and All- L_p -Norms approximation algorithms. In *FSTTCS '08: Proceedings of the 28th annual Conference on Foundations of Software Technology and Theoretical Computer Science*, pages 199–210, Bangalore, India, 2008. An earlier version appeared as Carnegie Mellon University technical report CMU-CS-07-153.
- [12] Guy E. Blelloch, Daniel Golovin, and Virginia Vassilevska. Uniquely represented data structures for computational geometry. In *SWAT '08: Proceedings of the 11th Scandinavian Workshop on Algorithm Theory*, pages 17–28, Gothenburg, Sweden, July 2008. Springer.
- [13] Guy E. Blelloch and Daniel Golovin. Strongly history-independent hashing with applications. In *FOCS '07: 48th Annual IEEE Symposium on Foundations of Computer Science*, pages 272–282. IEEE, October 2007.
- [14] Matthew Streeter, Daniel Golovin, and Stephen F. Smith. Combining multiple heuristics online. In *AAAI '07: Proceedings of the Twenty-Second AAAI Conference on Artificial Intelligence*, pages 1197–1203, Menlo Park, California, 2007. AAAI Press.
- [15] Matthew Streeter, Daniel Golovin, and Stephen F. Smith. Restart schedules for ensembles of problem instances. In *AAAI '07: Proceedings of the Twenty-Second AAAI Conference on Artificial Intelligence*, pages 1204–1210, Menlo Park, California, 2007. AAAI Press.
- [16] Daniel Golovin. Stochastic packing–market planning. In *EC '07: Proceedings of the 8th ACM conference on Electronic commerce*, pages 172–181, New York, NY, USA, 2007. ACM Press.
- [17] Daniel Golovin, Viswanath Nagarajan, and Mohit Singh. Approximating the k-multicut problem. In *SODA '06: Proceedings of the seventeenth annual ACM-SIAM Symposium on Discrete algorithms*, pages 621–630, New York, NY, USA, 2006. ACM Press.
- [18] Daniel Golovin, Anupam Gupta, Bruce M. Maggs, Florian Oprea, and Michael K. Reiter. Quorum placement in networks: Minimizing network congestion. In *PODC '06: Proceedings of the twenty-fifth annual ACM symposium on Principles of distributed computing*, pages 16–25, New York, NY, USA, 2006. ACM Press.
- [19] Daniel Golovin, Vineet Goyal, and R. Ravi. Pay today for a rainy day: Improved approximation algorithms for demand-robust min-cut and shortest path problems. In *STACS '06: Proceedings of the 23rd Symposium on Theoretical Aspects of Computer Science*, volume 3884 of *Lecture Notes in Computer Science*, pages 206–217, 2006.
- [20] Daniel Golovin. A model for optimal path planning for self-reconfigurable robots. In *ICAR '03: Proceedings of the 11th International Conference on Advanced Robotics*, 2003.

Technical Reports which do not overlap with above lists

- [1] Daniel Golovin. The B-skip-list: A simpler uniquely represented alternative to B-trees. *CoRR*, abs/1005.0662, 2010.
- [2] Daniel Golovin. Max-min fair allocation of indivisible goods. Technical Report CMU-CS-05-144, School of Computer Science, Carnegie Mellon University, June 2005.

Other Publications

- [1] Federico Echenique, Daniel Golovin, and Adam Wierman. Complexity and Economics: computational constraints may not matter empirically. *SIGecom Exch.*, 10(1):2–5, 2011. **Invited Paper.**
- [2] Matthew Streeter, Daniel Golovin, and Stephen F. Smith. Combining multiple constraint solvers: Results on the CPAI'06 competition data. In *Proceedings of the Second International CSP Solver Competition*, pages 11–18, 2008. **Invited Paper.**
- [3] Daniel Golovin. More expressive market models and the future of combinatorial auctions. *SIGecom Exch.*, 7(1), 2007. **Invited Paper.**

TEACHING

- Winter 2010 Instructor (with Andreas Krause) for *Advanced Topics in Machine Learning*.
- Fall 2008 Instructor (with Guy Blelloch) for graduate level *Algorithms in the Real World*.
- Spring 2007 Teaching Assistant for *Graduate Algorithms*.
- Spring 2006 Teaching Assistant for undergraduate level *Algorithm Design and Analysis*.

PROFESSIONAL SERVICE

Program Committee Member

International Joint Conferences on Artificial Intelligence (IJCAI) 2011

Reviewer for Journals and Conferences (Each listed only once):

Algorithmica, Algorithmic Learning Theory (ALT), Approximation Algorithms for Combinatorial Optimization Problems (APPROX), Conference on Artificial Intelligence (AAAI), Conference on Learning Theory (COLT), European Symposium on Algorithms (ESA), Foundations of Computer Science (FOCS), International Joint Conferences on Artificial Intelligence (IJCAI), Information Processing Letters (IPL), Journal on Computing (SICOMP), Journal of Machine Learning Research (JMLR), Symposium on Discrete Algorithms (SODA), Symposium on Theory of Computing (STOC), Workshop on Internet & Network Economics (WINE).

CONFERENCE & INVITED TALKS

Adaptive Submodularity: A New Approach to Active Learning and Stochastic Optimization

- May 2011 Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM)
- March 2011 SIAM Conference on Computational Science and Engineering (CSE)
- February 2011 IBM Research, Almaden
- February 2011 Sandia National Labs
- February 2011 Yahoo! Labs

January 2011 INFORMS Computing Society Conference (ICS)
December 2010 NIPS Workshop on Discrete Optimization in Machine Learning (DISCML)
December 2010 Caltech/Yahoo! Microeconomics Workshop (SISHOO)
November 2010 Stanford University
November 2010 Yahoo! Research
October 2010 University of Washington
October 2010 University of California, Los Angeles
October 2010 University of California, San Diego
September 2010 University of Southern California
May 2010 Carnegie Mellon University

Dynamic Resource Allocation in Conservation Planning

August 2011 The AAAI Conference on Artificial Intelligence (AAAI)

The Revealed Preference Approach to Computational Complexity in Economics

June 2011 ACM Conference on Electronic Commerce (EC)
March 2011 Carnegie Mellon University

Online Maximization of Submodular Functions

October 2010 Microsoft Research, Redmond
December 2009 NIPS Workshop on Discrete Optimization in Machine Learning
March 2009 Yahoo! Research
March 2009 Ohio State University

Uniquely Represented Data Structures with Applications to Privacy

October 2010 University of California, San Diego
November 2008 Stanford University
November 2008 Microsoft Research, Silicon Valley Center
April 2008 Northeastern University
March 2008 University of Rochester
March 2008 University of Massachusetts Amherst

Strongly History Independent Hashing with Applications

October 2007 IEEE Symposium on Foundations of Computer Science (FOCS)

Stochastic Packing-Market Planning

June 2007 ACM Conference on Electronic Commerce (EC)

Robust Minimum Cut and Shortest Path Problems

June 2006 Amazon.com Algorithms Seminar
May 2005 Lamps of ALADDIN Student Workshop at Carnegie Mellon University

PERSONAL DETAILS

Citizenship: United States of America

REFERENCES

Available upon request.