Wheeler Ruml

Department of Computer Science
University of New Hampshire
33 Academic Way, Durham, NH 03824-2619 USA
ruml at cs.unh.edu, +1-603-862-2683
http://www.cs.unh.edu/~ruml

Research Interests

Artificial intelligence, operations research, cognitive science, information visualization.

Education

HARVARD UNIVERSITY — Ph.D. in Computer Science, 2002
Dissertation: *Adaptive Tree Search*. Advisor: Stuart M. Shieber.

HARVARD UNIVERSITY — A.B. *cum laude* in Computer Science, 1993
Honors thesis: *Stochastic Approximation Algorithms for Number Partitioning*.

Honors

Personal letter of commendation from the President of R&D, Xerox Corporation 2006
PARC Golden Acorn Award for most valuable patent of the year (co-winner) 2005
Best Application Paper Award, Int'l Conf. on Automated Planning and Scheduling 2005
PARC Outstanding Performance Award 2003, 2005
Thomas T. Hoopes Prize for outstanding undergraduate scholarship and research 1993

Professional Experience

UNIVERSITY OF NEW HAMPSHIRE

Assistant Professor — July 2007–present
Founding and leading a research group in artificial intelligence, teaching courses in computer science, and supervising students in the B.S., M.S., and Ph.D. programs.

PALO ALTO RESEARCH CENTER

Area Manager, Embedded Reasoning — April 2005–June 2007
Technical and managerial leadership for a group of seven Ph.D.-level researchers in artificial intelligence and automatic control. Responsible for sponsor relationships ($2.3M/year), hiring, discretionary budget ($42K/year), and evaluation of potential patents.

Research Staff — July 2002–March 2005
Initiated group research direction in artificial intelligence planning and time-bounded heuristic search. Designed and built core software for a major Xerox robotics project.

Edited Proceedings

David Furcy, Sven Koenig, Wheeler Ruml, and Rong Zhou (eds), *Proceedings of the First International Symposium on Search Techniques in Artificial Intelligence and Robotics (STAIR-08)*, AAAI Press Technical Report WS-08-10, 184 pp., 2008.

Ian Miguel and Wheeler Ruml (eds), *Abstraction, Reformulation, and Approximation: Proceedings of the Seventh International Symposium*, Springer Lecture Notes in Artificial Intelligence, volume 4612, 418 pp., 2007.

Raja Bala, Linda Emberley, Patrick Mazeau, Howard Mizes, Emily Moore, Peter Odell, Sudhendu Rai, Palghat Ramesh, Cheryl Roland, Wheeler Ruml, and Tracie Zanders (eds), *Proceedings of the First Annual Xerox Innovation Group Research and Technology Conference*, 328 pp., 2006. (not distributed externally)

Wheeler Ruml and Frank Hutter (eds), *Learning for Search: Papers from the AAAI Workshop*, AAAI Press Technical Report WS-06-11, 154 pp., 2006.

Refereed Journal Publications

Yi Shang, Wheeler Ruml, Markus P. J. Fromherz, "Positioning using Local Maps," *Ad Hoc Networks*, 4(2), pp. 240–253, 2006.

Wheeler Ruml, Alfonso Caramazza, Rita Capasso, and Gabriele Miceli, "Interactivity and Continuity in Language Production: An Investigation Using Italian Aphasics," *Cognitive Neuropsychology*, 22(2), pp. 131-168, 2005.

Yi Shang, Wheeler Ruml, Ying Zhang and Markus P. J. Fromherz, "Localization from Connectivity in Sensor Networks," *IEEE Transactions on Parallel and Distributed Systems*, 15(11), pp. 961–974, 2004.

Alfonso Caramazza, Costanza Papagno, and Wheeler Ruml, "The Selective Impairment of Phonological Processing in Speech Production," *Brain and Language*, 75(3), pp. 428–450, 2000.

Wheeler Ruml, Alfonso Caramazza, Jennifer R. Shelton, and Doriana Chialant, "Testing Assumptions in Computational Theories of Aphasia," *Journal of Memory and Language*, 43(2), pp. 217–248, 2000.

Wheeler Ruml and Alfonso Caramazza, "An Evaluation of a Computational Model of Lexical Access: Comment on Dell et al. (1997)," *Psychological Review*, 107(3), pp. 609–634, 2000.

Wheeler Ruml, J. Thomas Ngo, Joe Marks, and Stuart Shieber, "Easily Searched Encodings for Number Partitioning," *Journal of Optimization Theory and Applications*, 89(2), pp. 251–291, 1996. Also appeared as Harvard CS Technical Report TR-10-94r.

Refereed Conference Publications

Ethan Burns, Seth Lemons, Rong Zhou, and Wheeler Ruml, "Suboptimal and Anytime A* Search on Multi-Core Machines," *Proceedings of the Nineteenth International Conference on Automated Planning and Scheduling (ICAPS-09)*, 2009.

Jordan T. Thayer and Wheeler Ruml, "Using Distance Estimates in Heuristic Search," *Proceedings of the Nineteenth International Conference on Automated Planning and Scheduling (ICAPS-09)*, 2009.

Ethan Burns, Seth Lemons, Rong Zhou, and Wheeler Ruml, "Best-First Heuristic Search for Multi-Core Machines," *Proceedings of the Twenty-first International Joint Conference on Artificial Intelligence (IJCAI-09)*, 2009.

Jordan Thayer and Wheeler Ruml, "Faster than Weighted A*: An Optimistic Approach to Bounded Suboptimal Search," *Proceedings of the Sixteenth International Conference on Automated Planning and Scheduling (ICAPS-08)*, 2008.

Minh B. Do, Rong Zhou, and Wheeler Ruml, "Planning for Modular Printers: Beyond Productivity," *Proceedings of the Sixteenth International Conference on Automated Planning and Scheduling (ICAPS-08)*, 2008.

Minh B. Do, Wheeler Ruml, and Rong Zhou, "On-line Planning and Scheduling: An Application to Controlling Modular Printers," *Proceedings of the Twenty-Third AAAI Conference on Artificial Intelligence (AAAI-08)*, 2008.

Wheeler Ruml and Minh B. Do, "Best-first Utility-guided Search," *Proceedings of the Twentieth International Joint Conference on Artificial Intelligence (IJCAI-07)*, pp. 2378–2384, 2007.

Haitham Hindi and Wheeler Ruml, "Network Flow Modeling for Flexible Manufacturing Systems with Re-entrant Lines," *Proceedings of the 45th IEEE Conference on Decision and Control (CDC-06)*, 2006.

Minh B. Do and Wheeler Ruml, "Lessons Learned in Applying Domain-independent Planning to High-speed Manufacturing," *Proceedings of the Sixteenth International Conference on Automated Planning and Scheduling (ICAPS-06)*, pp. 370–373, 2006.

Wheeler Ruml, Minh B. Do, and Markus P. J. Fromherz, "On-line Planning and Scheduling for High-speed Manufacturing," *Proceedings of the Fifteenth International Conference on Automated Planning and Scheduling (ICAPS-05)*, pp. 30–39, 2005. Winner of the Best Application Paper Award.

Hai Fang and Wheeler Ruml, "Complete Local Search for Propositional Satisfiability," *Proceedings of the Nineteenth National Conference on Artificial Intelligence (AAAI-04)*, pp. 161–166, 2004.

Yi Shang and Wheeler Ruml, "Improved MDS-Based Localization," *Proceedings of the 23rd Conference of the IEEE Communications Society (Infocom '04)*, pp. 2640–2651, 2004.

Yi Shang, Wheeler Ruml, Ying Zhang and Markus P. J. Fromherz, "Localization from Mere Connectivity," *Proceedings of the Fourth ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc '03)*, pp. 201–212, 2003.

Wheeler Ruml, "Constructing Distributed Representations using Additive Clustering," *Advances in Neural Information Processing Systems 14 (NIPS-01)*, pp. 107–114, 2001. A preliminary version appeared as "Assigning Features using Additive Clustering," Harvard CS Technical Report TR-04-01.

Wheeler Ruml, "Incomplete Tree Search using Adaptive Probing," *Proceedings of the Seventeenth International Joint Conference on Artificial Intelligence (IJCAI-01)*, pp. 235–341, 2001.

Joe Marks, Wheeler Ruml, Stuart Shieber, and Tom Ngo, "A Seed-Growth Heuristic for Graph Bisection," *Proceedings of Algorithms and Experiments '98*, pp. 76–87, 1998. Also appeared as Harvard CS Technical Report TR-01-98.

Brad Andalman, Kathy Ryall, Wheeler Ruml, Joe Marks, and Stuart Shieber, "Design Gallery Browsers Based on 2D and 3D Graph Drawing," *Proceedings of Graph Drawing '97*, Lecture Notes in Computer Science, vol. 1353, Springer-Verlag, pp. 322-329, 1998.

Joe Marks, Brad Andalman, Paul Beardsley, William Freeman, Sarah Gibson, Jessica Hodgins, Tom Kang, Brian Mirtich, Hanspeter Pfister, Wheeler Ruml, Kathy Ryall, Josh Seims, and Stuart Shieber, "Design Galleries: A General Approach to Setting Parameters for Computer Graphics and Animation," *Proceedings of SIGGRAPH '97*, pp. 389–400, 1997.

Lightly Refereed Publications

Ethan Burns, Seth Lemons, Wheeler Ruml, and Rong Zhou, "Parallel Best-First Search: Optimal and Suboptimal Solutions," *Proceedings of the International Symposium on Combinatorial Search (SoCS-09)*, 2009.

Silvia Richter, Jordan T. Thayer, and Wheeler Ruml, "The Joy of Forgetting: Faster Anytime Search via Restarting," *Proceedings of the International Symposium on Combinatorial Search (SoCS-09)*, 2009.

Jordan T. Thayer, Wheeler Ruml, and Jeff Kreis, "Using Distance Estimates in Heuristic Search: A Re-evaluation," *Proceedings of the International Symposium on Combinatorial Search (SoCS-09)*, 2009.

Allen Hubbe, Wheeler Ruml, Sungwook Yoon, J. Benton, and Minh B. Do, "On-line Anticipatory Planning," *Proceedings of the ICAPS-08 Workshop on A Reality Check for Planning and Scheduling Under Uncertainty*, 2008.

Jordan T. Thayer, Wheeler Ruml, and Ephrat Bitton, "Fast and Loose in Bounded Suboptimal Heuristic Search," *Proceedings of the First International Symposium on Heuristic Search in Artificial Intelligence and Robotics (STAIR-08)*, pp. 120–126, 2008.

Minh B. Do, Rong Zhou, and Wheeler Ruml, "Beyond Planning for Productivity," *Proceedings of the Second Xerox Innovation Group Research and Technology Conference*, 6 pp., 2008. (not distributed externally)

J. Benton, Minh B. Do, and Wheeler Ruml, "A Simple Testbed for On-line Planning," *Proceedings of the ICAPS-07 Workshop on Moving Planning and Scheduling Systems into the Real World*, 8 pp., 2007. Also appeared in the *Proceedings of the Second International Competition on Knowledge Engineering for Planning and Scheduling (ICKEPS-07)*.

Wheeler Ruml, "Tightly Integrated Parallel Printing: An Overview", *Proceedings of the First Annual Xerox Innovation Group Research and Technology Conference*, pp. 84–85, 2006. (not distributed externally)

Minh B. Do, Wheeler Ruml, and Rong Zhou, "Beyond Scheduling: Using On-line Planning to Control Printers," *Proceedings of the First Annual Xerox Innovation Group Research and Technology Conference*, pp.91–94, 2006. (not distributed externally)

Wheeler Ruml and Elisabeth H. Crawford, "Best-first Utility-Guided Search," *Working Notes of the IJCAI-05 Workshop on Planning and Learning in A Priori Unknown or Dynamic Domains*, pp. 103–109, 2005.

Ying Lu, Lara S. Crawford, Wheeler Ruml, Markus P. J. Fromherz, "Feedback Control for Real-Time Solving," *Working Notes of the CP-04 Workshop on Constraint Solving under Change and Uncertainty (Changes-04)*, pp. 21–35, 2004.

Wheeler Ruml and Markus P. J. Fromherz, "On-line Planning and Scheduling in a High-speed Manufacturing Domain," *Proceedings of the ICAPS-04 Workshop on Integrating Planning into Scheduling*, pp. 60–66, 2004.

Wheeler Ruml, "Heuristic Search in Bounded-depth Trees: Best-Leaf-First Search," *Working Notes of the AAAI-02 Workshop on Probabilistic Approaches in Search*, pp. 45–51, 2002. Preliminary version appeared as Harvard CS Technical Report TR-01-02.

Wheeler Ruml, "Using Prior Knowledge with Adaptive Probing," *Proceedings of the 2001 AAAI Fall Symposium on Using Uncertainty Within Computation* (AAAI Technical Report FS-01-04), pp. 116-120, 2001.

Wheeler Ruml, "Stochastic Tree Search: Where to Put the Randomness?," *Proceedings of the IJCAI-01 Workshop on Stochastic Search*, pp. 43–47, 2001.

Wheeler Ruml, "Learning to Search Trees," selected for oral presentation at *The AAAI-2000 Workshop on Leveraging Probability and Uncertainty in Computation*, 2000.

Wheeler Ruml, "Alan W. Biermann, *Great Ideas in Computer Science*" (book review), *Mind and Machines*, 9(3), pp. 417–421, 1999.

Unrefereed Publications

Wheeler Ruml, Adam Ginsburg, and Stuart Shieber, "Speculative Pruning for Boolean Satisfiability," Harvard CS Technical Report TR-02-99, 18 pp.

Wheeler Ruml, Joe Marks, Stuart Shieber, and Tom Ngo, "Seed-Growth Heuristics for Graph Bisection," Harvard CS Technical Report TR-10-99, 33 pp.

Wheeler Ruml, "Stochastic Approximation Algorithms for Number Partitioning," undergraduate honors thesis and Harvard CS Technical Report TR-17-93, 79 pp.

Grants

Lightweight Metareasoning for Ubiquitous Optimization March, 2009–February, 2010
DARPA Computer Science Study Panel, $99,220.

International Development Grant Summer, 2009
UNH Center for International Education, $500.

Combinatorial Search Algorithms as Rational Agents September, 2008–August, 2011
NSF Robust Intelligence Program, $448,192.

A Symposium Series on Heuristic Search and Its Applications June, 2008–May 2009
Co-PIs: David Furcy, Sven Koenig, Rong Zhou. NSF Robust Intelligence Program, $14,646.

Patents

Nine applications filed but not yet public.

Wheeler Ruml and Elisabeth H. Crawford, "System and Method for Time-aware Path Finding," pending.

Lara S. Crawford, Haitham A. Hindi, Markus P. J. Fromherz, Craig Eldershaw, Wheeler Ruml, and Kimon D. Roufas, "Coordination in a Distributed System," pending.

Wheeler Ruml and Markus P. J. Fromherz, "System and Method for Production Planning Utilizing On-line State-space Planning," pending.

Yi Shang and Wheeler Ruml, "Node Localization in Communication Networks," pending.

Wheeler Ruml, Robert M. Lofthus, Ronald J. Root, Markus P. J. Fromherz, and Marc W. Webster, "Exception Handling in Manufacturing Systems Combining On-line Planning and Predetermined Rules," US patent 7,043,321, May, 2006. Also filed in Europe and Japan.

Wheeler Ruml and Markus P. J. Fromherz, "System and Method Utilizing Temporal Constraints to Coordinate Multiple Planning Sessions," US patent 6,898,475, May, 2005. Also filed in Europe and Japan. Co-winner of 2005 PARC Golden Acorn Award for most valuable patent of the year.

Wheeler Ruml, Joseph Marks, Kathleen Ryall, and Stuart M. Shieber, "User Interface for Creation of Image Generation and Transformation Functions," US patent 6,421,050, July, 2002. Also filed in Europe.

Invited External Presentations

Invited Talks

"Job Hunting in Industry and Academia"
ICAPS Doctoral Consortium, September, 2008

"Planning Under Time Pressure"
Williams College, October, 2007

"Heuristic Search and Rational Agents"
University of New Hampshire, March 2007
Worcester Polytechnic Institute, February 2007
Pomona College, February 2007

"Learning to Search Trees"
Stanford University, March 2006

"On-line Planning for High-speed Manufacturing"
University of Nebraska, Lincoln, November 2005
University of Alberta, Edmonton, November 2005

"Best-first Search for Combinatorial Optimization"
University of California, Berkeley, April 2002
SRI International, April 2002
Palo Alto Research Center, April 2002

"Computational Modeling of Lexical Access"
U.S. Army Research Laboratory, Aberdeen Proving Ground, February, 2000

Panel presentations

ICAPS Workshop on Planning and Learning, 2007
ICAPS Workshop on Planning Under Uncertainty and Execution Control for Autonomous Systems, 2006
AAAI Fall Symposium on Using Uncertainty Within Computation, 2001

Teaching Experience

University of New Hampshire

Instructor

Introduction to Artificial Intelligence	Spring 2008, 2009
Combinatorial Search and Heuristic Optimization	Fall 2008
Classic Papers in Artificial Intelligence	Fall 2008
Undergraduate Presentation Seminar	Fall 2007, Spring 2008

Guest Lecturer

Graduate Research Seminar	Fall 2007, 2008

Palo Alto Research Center

Guest Lecturer

Foundations of Constraint Processing (University of Nebraska, Lincoln)	Fall 2005

Harvard University

Instructor

Introduction to Artificial Intelligence	Fall 2001

Co-lecturer

Introduction to Artificial Intelligence	Fall 1999, 2000

Guest Lecturer

Introduction to Computer Science II (Harvard Summer School)	Summer 1998, 1999
Theory of Computation (Harvard University)	Fall 1997
Theory of Computation (Harvard Extension School)	Fall 1997

Students Supervised

University of New Hampshire

Graduate Research

Chris Wilt, Beam search	Summer 2009–present
David Bond, Real-time search	Spring 2009–present
Ethan Burns, Multi-core search, iterative deepening search	Fall 2008–present
Seth Lemons, Multi-core search, real-time search	Fall 2008–present
Jake Mandel, Multi-body planning. heuristic error, scheduling	Fall 2007, Fall 2008–present
Jordan Thayer, Time-aware shortest-path search	Summer 2007–present

Undergraduate Research

Kevin Rose, Adaptive tree search	Spring 2009–present
Allen Hubbe, Modeling heuristic error	Summer 2008
Austin Dionne, Shortest-path search under a deadline	Fall 2007–Spring 2008

Student Mentoring

International Conference on Automated Planning and Scheduling (ICAPS)	2007, 2008

Palo Alto Research Center

Graduate Interns

J. Benton (Arizona State), On-line continual planning	Summer 2006
Elisabeth Crawford (Carnegie Mellon), Time-aware search	Summer 2004
Hai Fang (Yale), Complete local search	Summer–Fall 2003

Undergraduate Interns

Ephrat Bitton (Berkeley), Fast shortest-path search	Summer 2006–Spring 2007
Kevin Canini (Cornell), Data structures for temporal planning	Summer 2005
Daniel Hsu (Berkeley), Local search algorithms	Summer 2003

Student Mentoring

International Conference on Automated Planning and Scheduling (ICAPS)	2004, 2005

Harvard University

Senior Theses

Gaby Pollack, Cognitive modeling of brain-damaged picture naming	Spring 1999–Spring 2000
Ellis Verosub, Heuristic search for protein folding	Spring 1997–Spring 1998
Nailah Robinson, Analysis of algorithms for boolean satisfiability	Spring 1997–Spring 1998
Adam Ginsburg, Heuristic search for boolean satisfiability	Fall 1996–Spring 1997

Undergraduate Research

Paul Gusmorino, Visualization for combinatorial optimization	Fall 2001
Lea Sullivan, Estimating probabilities for human naming errors	Fall 2000–Spring 2001
Jeffrey Enos, Heuristic tree search algorithms	Spring 2000
Jeffrey Shneidman, Heuristic tree search algorithms	Spring 2000
Kevin Cheung, Stochastic search algorithms	Spring 2000
Emil Gilliam, Local search algorithms for additive clustering	Fall 1999
Joseph Turian, Move strategies for local search	Fall 1998–Spring 1999
Pavel Vasilyev, Heuristic search and geometric embedding	Fall 1997–Fall 1999
Angelos Kottas, Cognitive modeling of brain-damaged picture naming	Fall 1997–Winter, 1999
Joshua Von Korff, Cross-validation for clustering	Fall 1997–Spring 1998

Professional Activities

Conference Organization

Co-chair, International Symposium on Combinatorial Search (SoCS-09), 2009.
Co-chair, International Symposium on Search Techniques in Artificial Intelligence and Robotics (STAIR-08), 2008.
Co-chair, Seventh International Symposium on Abstraction, Reformulation, and Approximation (SARA-07), 2007.
Organizing committee, International Knowledge Engineering Competition for Planning and Scheduling, 2007.
Organizing committee, First Annual Xerox Innovation Group Research and Technology Conference, 2006. (attendance restricted to employees)
Co-chair, AAAI-06 Workshop on Learning for Search, 2006.

Editorial Board

Journal of Artificial Intelligence Research, 2006–2012.

Grant Reviewing

National Science Foundation
Natural Sciences and Engineering Research Council of Canada
U.S. Army Research Office
U.S.-Israel Binational Science Foundation

Journal Reviewing

Ad Hoc Networks
Advances in Artificial Intelligence
Artificial Intelligence
Cognitive Neuropsychology
Computer Networks
IBM Journal of Research and Development
IEEE Transactions on Mobile Computing
Journal of Artificial Intelligence Research
Journal of Automated Reasoning
Journal of Combinatorial Optimization
Journal of Heuristics
Journal of Machine Learning Research
Operations Research
Psychological Review

Robotics and Autonomous Systems
Telecommunication Systems

Conference Reviewing
AAAI Conference on Artificial Intelligence
European Conference on Artificial Intelligence
IEEE Wireless Communications and Networking Conference
International Conference on Automated Planning and Scheduling
International Conference on Machine Learning
International Federation of Automatic Control World Congress
International Florida Artificial Intelligence Research Society Conference
International Joint Conference on Artificial Intelligence (senior program committee, 2009)
International Symposium on Artificial Intelligence and Mathematics
Learning and Intelligent Optimization
Symposium on Abstraction, Reformulation, and Approximation
Workshop of the UK Planning and Scheduling Special Interest Group

Membership
Association for Computing Machinery
Association for the Advancement of Artificial Intelligence (life member)

University Activities

Department
Graduate program committee, 2007–present.
Video colloquium founder and organizer, 2007–present.

University
Undergraduate research advisory committee, 2007–2010.

Citizenship U.S.A.

[Information current as of June 16, 2009.]