Wheeler Ruml

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Research Interests	Artificial intelligence, robotics, data science.

Education

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

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

Honors

Best P.C. Member Award, Int'l Conf. on Automated Planning and Scheduling	2020
Fellow, National Academy of Inventors	2018
Senior Member, Association for the Advancement of Artificial Intelligence	2016
Best Student Paper Award, Symposium on Combinatorial Search	2015
Best Paper Award, Symposium on Combinatorial Search	2014
Best Student Paper Award, Symposium on Combinatorial Search	2014
Outstanding Assistant Professor Award, University of New Hampshire	2012
Best Paper Presentation Award, Symposium on Combinatorial Search	2010
Personal letter of commendation from the President of R&D, Xerox Corporation	2006
Golden Acorn Award for most valuable patent of the year (co-winner), PARC	2005
Best Application Paper Award, Int'l Conf. on Automated Planning and Scheduling	2005
Outstanding Performance Award, PARC	2003, 2005
Thomas T. Hoopes Prize for undergraduate research, Harvard College	1993

Professional Experience

UNIVERSITY OF NEW HAMPSHIRE

Professor — August 2017–present
Co-leading creation of undergraduate and graduate data science programs.
Associate Professor — August 2012–July 2017
Led hiring of three additional AI-related faculty.
Assistant Professor — July 2007–July 2012
Restarted the department's research presence in artificial intelligence.

LAAS-CNRS and INSA TOULOUSE

Visiting Researcher — August 2013–July 2014
Sabbatical visitor in the planning and robotics group with Malik Ghallab and Félix Ingrand.

PALO ALTO RESEARCH CENTER

Area Manager, Embedded Reasoning — April 2005–June 2007
Led a group of seven Ph.D.-level researchers in AI and control. Responsible for technical direction, sponsor relationships, hiring, budget, and patent applications.

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

Edited Proceedings

Roman Barták, Wheeler Ruml, Oren Salzman (eds), *Proceedings of the Sixteenth International Symposium on Combinatorial Search (SoCS-23)*, AAAI Press, 209 pp., 2023.

Steve Chien, Alan Fern, Wheeler Ruml, and Minh Do (eds), *Proceedings of the Twenty-fourth International Conference on Automated Planning and Scheduling (ICAPS-14)*, AAAI Press, 564 pp., 2014.

Daniel Borrajo, Ariel Felner, Richard Korf, Maxim Likhachev, Carlos Linares López, Wheeler Ruml, and Nathan Sturtevant (eds), *Proceedings of the Fifth International Symposium on Combinatorial Search (SoCS-12)*, AAAI Press, 232 pp., 2012.

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.

Journal Publications

Benjamin A. Miller, Zohair Shafi, Wheeler Ruml, Yevgeniy Vorobeychik, Tina Eliassi-Rad, and Scott Alfeld, "Attacking Shortest Paths by Cutting Edges," *ACM Transactions on Knowledge Discovery from Data*, 18(2), pp. 1–42, 2023.

Matthew Hatem, Ethan Burns, and Wheeler Ruml, "Solving Large Problems with Heuristic Search: General-Purpose Parallel External-Memory Search," *Journal of Artificial Intelligence Research*, 62, pp. 233–268, 2018.

Christopher Wilt and Wheeler Ruml, "Effective Heuristics for Suboptimal Best-First Search," *Journal of Artificial Intelligence Research*, 57, pp. 273–306, 2016.

Scott Kiesel, Ethan Burns, and Wheeler Ruml, "Achieving Goals Quickly Using Real-time Search: Experimental Results in Video Games," *Journal of Artificial Intelligence Research*, 54, pp. 123–158, 2015.

Jarad Cannon, Kevin Rose, and Wheeler Ruml, "Real-time Heuristic Search for Motion Planning with Dynamic Obstacles," *AI Communications*, 27, pp. 345–362, 2014.

Ethan Burns, Wheeler Ruml, and Minh B. Do, "Heuristic Search When Time Matters," *Journal of Artificial Intelligence Research*, 47, pp. 697–740, 2013.

Ethan Burns and Wheeler Ruml, "Iterative-Deepening Search with On-line Tree Size Prediction," *Annals of Mathematics and Artificial Intelligence*, pp. 1–23, April, 2013.

Wheeler Ruml, Minh Binh Do, Rong Zhou, and Markus P. J. Fromherz, "On-line Planning and Scheduling: An Application to Controlling Modular Printers," *Journal of Artificial Intelligence Research*, 40, pp. 415–468, 2011.

Ethan Burns, Sofia Lemons, Wheeler Ruml, and Rong Zhou, "Best-First Heuristic Search for Multicore Machines," *Journal of Artificial Intelligence Research*, 39, pp. 689–743, 2010.

Yi Shang, Wheeler Ruml, and 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.

Conference Publications

Andrew Coles, Erez Karpas, Andrey Lavrinenko, Wheeler Ruml, Solomon Eyal Shimony, and Shahaf S. Shperberg, "Planning and Acting While the Clock Ticks," *Proceedings of the Thirty-fourth International Conference on Automated Planning and Scheduling (ICAPS-24)*, 2024.

Issa K. Hanou, Devin Wild Thomas, Wheeler Ruml, and Mathijs de Weerdt, "Replanning in Advance for Instant Delay Recovery in Multi-agent Applications: Rerouting Trains in a Railway Hub," *Proceedings of the Thirty-fourth International Conference on Automated Planning and Scheduling (ICAPS-24)*, 2024.

Sofia Lemons, Wheeler Ruml, Robert Holte, and Carlos Linares Lpez, "Rectangle Search: An Anytime Beam Search," *Proceedings of the Thirty-eighth AAAI Conference on Artificial Intelligence (AAAI-24)*, 2024.

Naiqian Zhang, Daroc Alden, Dongpeng Xu, Shuai Wang, Trent Jaeger, and Wheeler Ruml, "No Free Lunch: On the Increased Code Reuse Attack Surface of Obfuscated Programs," *The Fifty-third Annual IEEE/IFIP International Conference on Dependable Systems and Networks (DSN-23)*, 2023.

Amihay Elboher, Ava Bensoussan, Erez Karpas, Wheeler Ruml, Shahaf S. Shperberg, and Solomon E. Shimony, "A Formal Metareasoning Model of Concurrent Planning and Execution," *Proceedings of the Thirty-seventh AAAI Conference on Artificial Intelligence (AAAI-23)*, 2023.

Sofia Lemons, Carlos Linares López, Robert C. Holte, and Wheeler Ruml, "Beam Search: Faster and Monotonic," *Proceedings of the Thirty-second International Conference on Automated Planning and Scheduling (ICAPS-22)*, 2022.

Maximilian Fickert, Tianyi Gu, and Wheeler Ruml, "New Results in Bounded-Suboptimal Search," *Proceedings of the Thirty-sixth AAAI Conference on Artificial Intelligence (AAAI-22)*, 2022.

Benjamin Miller, Zohair Shafi, Wheeler Ruml, Yevgeniy Vorobeychik, Tina Eliassi-Rad and Scott Alfeld, "PATHATTACK: Attacking Shortest Paths in Complex Networks," *Proceedings of the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD-21)*, 2021.

Maximilian Fickert, Tianyi Gu, and Wheeler Ruml, "Bounded-cost Search Using Estimates of Uncertainty," *Proceedings of the Thirtieth International Joint Conference on Artificial Intelligence (IJCAI-21)*, 2021.

Kevin C. Gall, Wheeler Ruml, and Sarah Keren, "Active Goal Recognition Design," *Proceedings of the Thirtieth International Joint Conference on Artificial Intelligence (IJCAI-21)*, 2021.

Shahaf S. Shperberg, Andrew Coles, Erez Karpas, Wheeler Ruml, and Solomon Eyal Shimony, "Situated Temporal Planning Using Deadline-aware Metareasoning," *Proceedings of the Thirty-first International Conference on Automated Planning and Scheduling (ICAPS-21)*, 2021.

Maximilian Fickert, Ivan Gavran, Ivan Fedotov, Jörg Hoffmann, Rupak Majumdar, and Wheeler Ruml, "Choosing the Initial State for Online Replanning," *Proceedings of the Thirty-fifth AAAI Conference on Artificial Intelligence (AAAI-21)*, 2021.

Jiaoyang Li, Wheeler Ruml, and Sven Koenig, "EECBS: A Bounded-Suboptimal Search for Multi-Agent Path Finding," *Proceedings of the Thirty-fifth AAAI Conference on Artificial Intelligence (AAAI-21)*, 2021.

Matthew Westbrook and Wheeler Ruml, "Anytime Kinodynamic Motion Planning using Region-Guided Search," *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS-20)*, 2020.

Shahaf S. Shperberg, Andrew Coles, Erez Karpas, Solomon E. Shimony, Wheeler Ruml, "Trading Plan Cost for Timeliness in Situated Temporal Planning," *Proceedings of the International Joint Conference on Artificial Intelligence - Pacific Rim International Conference on Artificial Intelligence (IJCAI-PRICAI-20)*, 2020.

Kevin C. Gall, Bence Cserna, and Wheeler Ruml, "Envelope-based Approaches to Real-Time Heuristic Search," *Proceedings of the Thirty-fourth AAAI Conference on Artificial Intelligence (AAAI-20)*, 2020.

Maximilian Fickert, Tianyi Gu, Leonhard Staut, Wheeler Ruml, Jörg Hoffmann, and Marek Petrik, "Beliefs We Can Believe In: Replacing Assumptions with Data in Real-Time Search," *Proceedings of the Thirty-fourth AAAI Conference on Artificial Intelligence (AAAI-20)*, 2020.

Michael Cashmore, Andrew Coles, Bence Cserna, Erez Karpas, Daniele Magazzeni, and Wheeler Ruml, "Replanning for Situated Robots," *Proceedings of the Twenty-ninth International Conference on Automated Planning and Scheduling (ICAPS-19)*, 2019.

Andrew Mitchell, Wheeler Ruml, Fabian Spaniol, Jörg Hoffmann, and Marek Petrik, "Real-time Planning as Decision-making Under Uncertainty," *Proceedings of the Thirty-third AAAI Conference on Artificial Intelligence (AAAI-19)*, 2019.

Shahaf Shperberg, Andrew Coles, Bence Cserna, Erez Karpas, Wheeler Ruml, and Solomon Eyal Shimony, "Allocating Search Effort When Actions Expire," *Proceedings of the Thirty-third AAAI Conference on Artificial Intelligence (AAAI-19)*, 2019.

Rebecca Eifler, Maximilian Fickert, Jörg Hoffmann, and Wheeler Ruml, "Refining Abstraction Heuristics During Real-Time Planning," *Proceedings of the Thirty-third AAAI Conference on Artificial Intelligence (AAAI-19)*, 2019.

Michael Cashmore, Andrew Coles, Bence Cserna, Erez Karpas, Daniele Magazzeni, and Wheeler Ruml, "Temporal Planning While the Clock Ticks," *Proceedings of the Twenty-eighth International Conference on Automated Planning and Scheduling (ICAPS-18)*, 2018.

Bence Cserna, William J. Doyle, Jordan S. Ramsdell, and Wheeler Ruml, "Avoiding Dead Ends in Real-time Heuristic Search," *Proceedings of the Thirty-Second AAAI Conference on Artificial Intelligence (AAAI-18)*, 2018.

Scott Kiesel, Tianyi Gu, and Wheeler Ruml, "An Effort Bias for Sampling-based Motion Planning," *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS-17)*, 2017.

Bence Cserna, Marek Petrik, Reazul Hasan Russel, and Wheeler Ruml, "Value Directed Exploration in Multi-Armed Bandits with Structured Priors," *Proceedings of the Thirty-third Conference on Uncertainty in Artificial Intelligence (UAI-17)*, 2017.

Bence Cserna, Wheeler Ruml, and Jeremy Frank, "Planning Time to Think: Metareasoning for On-line Planning with Durative Actions," *Proceedings of the Twenty-seventh International Conference on Automated Planning and Scheduling (ICAPS-17)*, 2017.

Matthew Hatem, Scott Kiesel, and Wheeler Ruml, "Recursive Best-First Search with Bounded Overhead," *Proceedings of the Twenty-ninth AAAI Conference on Artificial Intelligence (AAAI-15)*, 2015.

Matthew Hatem and Wheeler Ruml, "Simpler Bounded Suboptimal Search," *Proceedings of the Twenty-eighth AAAI Conference on Artificial Intelligence (AAAI-14)*, 2014.

Matthew Hatem and Wheeler Ruml, "External Memory Best-First Search for Multiple Sequence Alignment," *Proceedings of the Twenty-seventh AAAI Conference on Artificial Intelligence (AAAI-13)*, 2013.

Christopher Wilt and Wheeler Ruml, "Robust Bidirectional Search via Heuristic Improvement," *Proceedings of the Twenty-seventh AAAI Conference on Artificial Intelligence (AAAI-13)*, 2013.

Nathan R. Sturtevant, Ariel Felner, Maxim Likhachev, and Wheeler Ruml, "Heuristic Search Comes of Age (invited paper)," *Proceedings of the Twenty-sixth AAAI Conference on Artificial Intelligence (AAAI-12)*, 2012.

Scott Kiesel, Ethan Burns, Christopher Wilt, and Wheeler Ruml, "Integrating Vehicle Routing and Motion Planning," *Proceedings of the Twenty-second International Conference on Automated Planning and Scheduling (ICAPS-12)*, 2012.

Ethan Burns, J. Benton, Wheeler Ruml, Minh Do, and Sungwook Yoon, "Anticipatory On-line Planning," *Proceedings of the Twenty-second International Conference on Automated Planning and Scheduling (ICAPS-12)*, 2012.

Jordan Thayer, Roni Stern, Ariel Felner, and Wheeler Ruml, "Faster Bounded-Cost Search Using Inadmissible Estimates," *Proceedings of the Twenty-second International Conference on Automated Planning and Scheduling (ICAPS-12)*, 2012.

Matthew Hatem, Ethan Burns, and Wheeler Ruml, "Heuristic Search for Large Problems With Real Costs," *Proceedings of the Twenty-fifth AAAI Conference on Artificial Intelligence (AAAI-11)*, 2011.

Jordan T. Thayer and Wheeler Ruml, "Bounded Suboptimal Search: A Direct Approach Using Inadmissible Estimates," *Proceedings of the Twenty-second International Joint Conference on Artificial Intelligence (IJCAI-11)*, 2011.

Jordan T. Thayer, Austin Dionne, and Wheeler Ruml, "Learning Inadmissible Heuristics During Search," *Proceedings of the Twenty-first International Conference on Automated Planning and Scheduling (ICAPS-11)*, 2011.

Bradford Larsen, Ethan Burns, Wheeler Ruml, and Robert C. Holte, "Searching Without a Heuristic: Efficient Use of Abstraction," *Proceedings of the Twenty-fourth AAAI Conference on Artificial Intelligence (AAAI-10)*, 2010.

Sungwook Yoon, Wheeler Ruml, J. Benton, and Minh B. Do, "Improving Determinization in Hindsight for On-line Probabilistic Planning," *Proceedings of the Twentieth International Conference on Automated Planning and Scheduling (ICAPS-10)*, 2010.

Silvia Richter, Jordan T. Thayer, and Wheeler Ruml, "The Joy of Forgetting: Faster Anytime Search via Restarting," *Proceedings of the Twentieth International Conference on Automated Planning and Scheduling (ICAPS-10)*, 2010.

Ethan Burns, Seth Lemons, Wheeler Ruml, and Rong Zhou, "Suboptimal and Anytime Heuristic 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. 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, 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.

Symposium and Workshop Publications

Stephen Wissow, Fanhao Yu, and Wheeler Ruml, "Tunable Suboptimal Heuristic Search," *Proceedings of the Seventeenth International Symposium on Combinatorial Search (SoCS-24)*, 2024.

Devin Wild Thomas, Wheeler Ruml, and Solomon Eyal Shimony, "Real-time Safe Interval Path Planning," *Proceedings of the Seventeenth International Symposium on Combinatorial Search (SoCS-24)*, 2024.

Sean Mariasin, Andrew Coles, Erez Karpas, Wheeler Ruml, Solomon Eyal Shimony, and Shahaf Shperberg, "Evaluating Distributional Predictions of Search Time: Put Up or Shut Up Games (extended abstract)," *Proceedings of the Seventeenth International Symposium on Combinatorial Search (SoCS-24)*, 2024

Bryan McKenney and Wheeler Ruml, "General-Purpose Planning Algorithms in the Card Game *Duelyst II*," *Proceedings of the IEEE Conference on Games (CoG-23)*, 2023.

Sofia Lemons, Wheeler Ruml, Carlos Linares López, and Robert Holte, "Triangle Search: An Anytime Beam Search," *Proceedings of the ICAPS-23 Workshop on Heuristics and Search for Domain-Independent Planning*, 2023.

Devin Wild Thomas, Solomon Eyal Shimony, Wheeler Ruml, Erez Karpas, Shahaf S. Shperberg, and Andrew Coles, "Any-Start-Time Planning for SIPP," *Proceedings of the ICAPS-23 Workshop on Heuristics and Search for Domain-Independent Planning*, 2023.

Bryan McKenney and Wheeler Ruml, "Goal-driven Autonomy Without GDA," *Proceedings of the AAAI-23 Bridge Session on Artificial Intelligence and Robotics*, 2023.

Tianyi Gu, Wheeler Ruml, Shahaf Shperberg, Solomon Eyal Shimony and Erez Karpas, "When to Commit to an Action in Online Planning and Search," *Proceedings of the Symposium on Combinatorial Search (SoCS-22)*, 2022.

Ava Bensoussan, Solomon Eyal Shimony, Shahaf S. Shperberg, and Wheeler Ruml, "A Formal Model of Concurrent Planning and Execution with Action Costs," *Proceedings of the ICAPS-22 Workshop on Heuristics and Search for Domain-independent Planning (HSDIP-22)*, 2022.

Sofia Lemons, Robert C. Holte, Carlos Linares López, and Wheeler Ruml, "Trading Monotonicity for Cost in Beam Search," *Proceedings of the ICAPS-22 Workshop on Heuristics and Search for Domain-independent Planning (HSDIP-22)*, 2022.

Amihay Elboher, Shahaf S. Shperberg, Solomon E. Shimony, and Wheeler Ruml, "Metareasoning for Interleaved Planning and Execution," *Proceedings of the ICAPS-21 Workshop on Integrated Planning, Acting, and Execution (IntEx-21)*, 2021.

Tianyi Gu, Wheeler Ruml, Shahaf Shperberg, Eyal Shlomo Shimony, and Erez Karpas, "When to Commit to an Action in Online Planning," *Proceedings of the ICAPS-21 Workshop on Integrated Planning, Acting, and Execution (IntEx-21)*, 2021.

Maximilian Fickert, Tianyi Gu, Leonhard Staut, Sai Lekyang, Wheeler Ruml, Joerg Hoffmann, and Marek Petrik, "Real-time Planning as Data-driven Decision-making," *Proceedings of the ICAPS Workshop on Bridging the Gap Between AI Planning and Reinforcement Learning (PRL-20)*, 2020.

Chao Chi Cheng and Wheeler Ruml, "Real-time Heuristic Search in Dynamic Environments," *Proceedings of the Symposium on Combinatorial Search (SoCS-19)*, 2019.

Bence Cserna, Kevin C. Gall, and Wheeler Ruml, "Improved Safe Real-time Heuristic Search," *Proceedings of the Symposium on Combinatorial Search (SoCS-19)*, 2019. An extended version is available on `arXiv.org` as paper 1905.06402.

Jingwei Chen, Nathan R. Sturtevant, William Doyle, and Wheeler Ruml, "Revisiting Suboptimal Search," *Proceedings of the Symposium on Combinatorial Search (SoCS-19)*, 2019.

Andrew Coles, Shahaf S. Shperberg, Erez Karpas, Solomon Eyal Shimony, and Wheeler Ruml, "Beyond Cost-to-go Estimates in Situated Temporal Planning," *Proceedings of the ICAPS-19 Workshop on Heuristics and Search for Domain-independent Planning (HSDIP-19)*, 2019

Bence Cserna, William J. Doyle, Tianyi Gu, and Wheeler Ruml, "Safe Temporal Planning for Urban Driving," *Proceedings of the AAAI Workshop on Artificial Intelligence Safety (SafeAI-19)*, 2019.

Shane Kochvi and Wheeler Ruml, "Does Fast Beat Thorough?: Comparing LSS-LRTA* and RTAA*," *Proceedings of the Symposium on Combinatorial Search (SoCS-18)*, 2018.

Michael Cashmore, Andrew Coles, Bence Cserna, Erez Karpas, Daniele Magazzeni, Wheeler Ruml, "Situated Planning for Execution Under Temporal Constraints," *AAAI Spring Symposium on Integrating Representation, Reasoning, Learning, and Execution for Goal Directed Autonomy (SIRLE-18)*, 2018.

Alison Paredes and Wheeler Ruml, "Real-Time Planning for Traffic Signal Control," *Proceedings of the AAAI-18 Workshop on AI Enhanced IoT Data Processing for Intelligent Applications (SmartIoT)*, 2018.

Alison Paredes and Wheeler Ruml, "Goal Reasoning as Multilevel Planning," *Proceedings of the ICAPS-17 Workshop on Integrated Execution of Planning and Acting (IntEx-17)*, 2017.

Scott Kiesel and Wheeler Ruml, "A Bayesian Effort Bias for Sampling-based Motion Planning," *Proceedings of the ICAPS-15 Workshop on Planning and Robotics (PlabRob-16)*, 2016.

Bence Cserna, Mike Bogochow, Stephen Chambers, Michaela Tremblay, Sammie Katt, and Wheeler Ruml, "Anytime versus Real-Time Heuristic Search for On-Line Planning," *Proceedings of the Symposium on Combinatorial Search (SoCS-16)*, 2016.

Dylan O'Ceallaigh and Wheeler Ruml, "Metareasoning in Real-time Heuristic Search," *Proceedings of the Symposium on Combinatorial Search (SoCS-15)*, 2015. Winner of the Best Student Paper Award. A mildly augmented version entitled "Metareasoning for Concurrent Planning and Acting" appeared in *Proceedings of the ICAPS-15 Workshop on Planning and Robotics (PlanRob-15)*.

Christopher Wilt and Wheeler Ruml, "Building a Heuristic for Greedy Search," *Proceedings of the Symposium on Combinatorial Search (SoCS-15)*, 2015.

Alon Palombo, Roni Stern, Rami Puzis, Ariel Felner, Scott Kiesel, and Wheeler Ruml, "Solving the Snake in the Box Problem with Heuristic Search: First Results," *Proceedings of the Symposium on Combinatorial Search (SoCS-15)*, 2015.

Roni Stern, Scott Kiesel, Rami Puzis, Ariel Felner, and Wheeler Ruml, "Max is More than Min: Solving Maximization Problems with Heuristic Search," *Proceedings of the Symposium on Combinatorial Search (SoCS-14)*, 2014. Winner of the Best Paper Award.

Christopher Wilt and Wheeler Ruml, "Speedy versus Greedy Search," *Proceedings of the Symposium on Combinatorial Search (SoCS-14)*, 2014. Winner of the Best Student Paper Award.

Matt Hatem and Wheeler Ruml, "Bounded Suboptimal Search in Linear Space: New Results," *Proceedings of the Symposium on Combinatorial Search (SoCS-14)*, 2014.

Scott Kiesel and Wheeler Ruml, "Planning Under Temporal Uncertainty Using Hindsight Optimization," *Proceedings of the ICAPS-14 Workshop on Planning and Robotics (PlanRob-14)*, 2014.

Ethan Burns, Scott Kiesel, and Wheeler Ruml, "Experimental Real-time Heuristic Search Results in a Video Game," *Proceedings of the Symposium on Combinatorial Search (SoCS-13)*, 2013.

Matthew Hatem, Roni Stern, and Wheeler Ruml, "Bounded Suboptimal Heuristic Search in Linear Space" *Proceedings of the Symposium on Combinatorial Search (SoCS-13)*, 2013.

Scott Kiesel, Ethan Burns, Wheeler Ruml, J. Benton and Frank Kreimendahl, "Open World Planning for Robots via Hindsight Optimization," *Proceedings of the ICAPS-13 Workshop on Planning and Robotics (PlanRob-13)*, 2013.

Jarad Cannon, Kevin Rose, and Wheeler Ruml, "Real-time Motion Planning with Dynamic Obstacles," *Proceedings of the Symposium on Combinatorial Search (SoCS-12)*, 2012.

Christopher Wilt and Wheeler Ruml, "When does Weighted A* Fail?," *Proceedings of the Symposium on Combinatorial Search (SoCS-12)*, 2012.

Ethan Burns, Matthew Hatem, Michael J. Leighton, and Wheeler Ruml, "Implementing Fast Heuristic Search Code," *Proceedings of the Symposium on Combinatorial Search (SoCS-12)*, 2012.

Scott Kiesel, Ethan Burns, and Wheeler Ruml, "Abstraction-guided Sampling for Motion Planning," *Proceedings of the Symposium on Combinatorial Search (SoCS-12)*, 2012. Extended version available as UNH Technical Report 12-01, 2012

Ethan Burns and Wheeler Ruml, "Iterative-Deepening Search with On-line Tree Size Prediction," *Proceedings of the Sixth International Conference on Learning and Intelligent Optimization (LION-12)*, 2012. Earlier version available as UNH Technical Report 11-01, 2011.

Austin J. Dionne, Jordan T. Thayer, and Wheeler Ruml, "Deadline-Aware Search Using On-line Measures of Behavior," *Proceedings of the Symposium on Combinatorial Search (SoCS-11)*, 2011.

Michael J. Leighton, Wheeler Ruml, and Robert C. Holte, "Faster Optimal and Suboptimal Hierarchical Search," *Proceedings of the Symposium on Combinatorial Search (SoCS-11)*, 2011.

Christopher Wilt and Wheeler Ruml, "Cost-Based Heuristic Search is Sensitive to the Ratio of Operator Costs," *Proceedings of the Symposium on Combinatorial Search (SoCS-11)*, 2011.

Kevin Rose, Ethan Burns, and Wheeler Ruml, "Best-first Search for Bounded-depth Trees," *Proceedings of the Symposium on Combinatorial Search (SoCS-11)*, 2011.

David Biegelsen, Lara Crawford, Minh Do, Dave Duff, Craig Eldershaw, Markus Fromherz, Haitham Hindi, Greg Kott, Dan Larner, Barry Mandel, Steve Moore, Bryan Preas, Wheeler Ruml, Greg Schmitz, Lars Swartz, and Rong Zhou, "Integrated Parallel Printing Systems with Hypermodular Architecture," *IS&T/SPIE Conference on Electronic Imaging, Symposium on Parallel Processing for Imaging Applications*, 2011.

Jordan Thayer and Wheeler Ruml, "Finding Acceptable Solutions Faster Using Inadmissible Information," *Proceedings of the Symposium on Combinatorial Search (SoCS-10)*, 2010. Extended version available as UNH CS Technical Report 10-01, 19pp.

Wheeler Ruml, "The Logic of Benchmarking: A Case Against State-of-the-Art Performance," *Proceedings of the Symposium on Combinatorial Search (SoCS-10)*, 2010.

David M. Bond, Niels A. Widger, Wheeler Ruml and Xiaoxun Sun, "Real-Time Search in Dynamic Worlds," *Proceedings of the Symposium on Combinatorial Search (SoCS-10)*, 2010.

Jordan Thayer and Wheeler Ruml, "Anytime Heuristic Search: Frameworks and Algorithms," *Proceedings of the Symposium on Combinatorial Search (SoCS-10)*, 2010.

Christopher Wilt, Jordan Thayer and Wheeler Ruml, "A Comparison of Greedy Search Algorithms," *Proceedings of the Symposium on Combinatorial Search (SoCS-10)*, 2010.

Ethan Burns, Sofia Lemons, Wheeler Ruml, and Rong Zhou, "Parallel Best-First Search: The Role of Abstraction," *Proceedings of the AAAI-10 Workshop on Abstraction, Reformulation, and Approximation (WARA-10)*, 2010.

Seth Lemons, J. Benton, Wheeler Ruml, Minh B. Do, and Sungwook Yoon, "Continual On-line Planning as Decision-Theoretic Incremental Heuristic Search," *Proceedings of the AAAI Spring Symposium on Embedded Reasoning*, 2010.

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.

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 the International Symposium on Graph Drawing (GD '97)*, Lecture Notes in Computer Science, vol. 1353, Springer-Verlag, pp. 322-329, 1998.

Trade Publications   Lara S. Crawford, Minh Binh Do, Wheeler Ruml, Haitham Hindi, Craig Eldershaw, Rong Zhou, Lukas Kuhn, Markus P.J. Fromherz, David Biegelsen, Johan de Kleer, Daniel Larner, "On-line Reconfigurable Machines," *AI Magazine*, Fall, pp. 73–88, 2013.

Matthew Hatem, Ethan Burns, and Wheeler Ruml, "Problem Solving with Heuristic Search and Java," *IBM developerWorks*, July, 2013, 24 pp. Chinese, Japanese, and Russian translations, January, 2014.

Theses   Wheeler Ruml, *Adaptive Tree Search*. Ph.D. thesis, Harvard University, May, 2002, 144 pp.

Wheeler Ruml, *Stochastic Approximation Algorithms for Number Partitioning*. Undergraduate honors thesis and Harvard CS Technical Report TR-17-93, April, 1993, 79 pp.

Unrefereed Publications   Christopher Wilt, Jordan Thayer, and Wheeler Ruml, "Selecting a Greedy Search Algorithm," UNH CS Technical Report 10-07, 18 pp.

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.

Grants   *Planning and Acting While Time Passes*   October, 2020–September, 2024
NSF Robust Intelligence Program, $499,807. Additional funding for international collaborators via the NSF-BSF program.

A Handbook for Heuristic Search   September, 2020–May, 2021
UNH Faculty Scholars Program, sabbatical teaching release.

Modular AI Based Response Engine for ICS NTA and Correction   July, 2018–December, 2019
In cooperation with C3I, Inc. NH IRC, $60,453.

Advanced Analysis of Geothermal Heat Pump System Data   July, 2017–August, 2018
PI: Matt Davis. DoE SBIR Program, $150,000.

UNH Data Science Working Group   July, 2017–June, 2018
Co-PIs: Mark Lyon, Tevfik Aktekin. UNH CoRE Program, $9,915.

Research Experiences for Undergraduates Supplement   Summer, 2015
NSF Robust Intelligence Program, $6,160.

Visiting Researcher Fellowship   August, 2013–May, 2014
LAAS-CNRS and INSA Toulouse.

From Heuristic Search To Robotics   September, 2013–May, 2014
UNH Faculty Scholars Program, sabbatical teaching release.

Time-Aware Heuristic Search   June, 2012–May, 2017
NSF Career Program, $498,403.

International Collaboration Supplement   Summer, 2011
NSF Robust Intelligence Program, $18,508.

Research Experiences for Undergraduates Supplement   Summer, 2011
NSF Robust Intelligence Program, $12,000.

Time-aware Optimization for Battlespace Management   June, 2010–May, 2013
DARPA Computer Science Study Group Program, $396,120.

A Symposium on Combinatorial Search   July, 2009–June, 2010
Co-PIs: Sven Koenig, Rong Zhou. NSF Robust Intelligence Program, $30,971.

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

Lightweight Metareasoning for Ubiquitous Optimization   March, 2009–May, 2010
DARPA Computer Science Study Group Program, $99,220.

Combinatorial Search Algorithms as Rational Agents   September, 2008–August, 2012
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   Sungwook Yoon, Wheeler Ruml, Minh B. Do, "AI Planning-based Quasi-Montecarlo Simulation Method for Probabilistic Planning," US patent 8,473,447 issued June, 2013.

Wheeler Ruml, Minh B. Do, Rong Zhou, and Haitham Hindi, "System and Method for Real-Time System Control Using Precomputed Plans," US patent 7,925,366, issued April, 2011. Also filed in Japan.

Minh B. Do, Wheeler Ruml, and Rong Zhou, "Model-Based Planning with Multi-Capacity Resources," US patent 9,250,967 issued February, 2016. Also filed in Europe.

Wheeler Ruml, Minh B. Do, and Rong Zhou, "System and Method for On-Line Planning Utilizing Multiple Planning Queues," US patent 7,590,464 issued September, 2009 and US patent 8,463,416 issued June, 2013. Also filed in Japan.

Wheeler Ruml, "System and Method for Bounded Sub-Optimal Problem-Solving," US patent 7,966,336, issued June, 2011. Also filed in Japan.

Wheeler Ruml and Minh B. Do, "Exception Handling," US parent 8,145,335, issued March 2012. Also filed in Japan.

Wheeler Ruml, Robert M. Lofthus, and Minh B. Do, "Model-Based Planning Using Query-Based Model Components," US patent 7,689,311, issued March, 2010. Also filed in Japan.

Wheeler Ruml, "System and Method for Solving Multiple Interacting State-Space Search Problems," US patent 8,086,595, issued December, 2011.

Meera Sampath, Markus P. J. Fromherz, Dusan G. Lysy, Rajinderjeet S. Minhas, Naveen Sharma, William J, Hannaway, Wheeler Ruml, "Fault Management for a Printing System," US patent 8,607,102 issued December, 2013.

Haitham Hindi and Wheeler Ruml, "System and Method for Manufacturing System Design and Shop Scheduling Using Network Flow Modeling," US patent 8,407,077, issued March, 2013.

Wheeler Ruml and Elisabeth H. Crawford, "System and Method for Time-aware Path Finding," US patent 7,389,279, issued June, 2008.

Lara S. Crawford, Haitham A. Hindi, Markus P. J. Fromherz, Craig Eldershaw, Wheeler Ruml, and Kimon D. Roufas, "Distributed Control Systems and Methods that Selectively Acivate Respective Coordinators for Respective Tasks," US patent 7,873,962 issued January, 2011.

Wheeler Ruml and Markus P. J. Fromherz, "System and Method for Production Planning Utilizing On-line State-space Planning," US patent 7,451,132, issued November, 2008.

Yi Shang and Wheeler Ruml, "Node Localization in Communication Networks," US patent 7,457,860, issued November, 2008.

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, issued 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, issued 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, issued July, 2002. Also filed in Europe and Japan.

Invited Presentations

Invited Talks

"Artificial Intelligence: What, Why, and When"
UNH Institute on Disability, April 2024
Portsmouth Public Library, November 2023
Durham Active Retirees Association, October 2018

"Suboptimal Heuristic Search"
Symposium on Combinatorial Search, July 2022

"Writing Papers and Giving Talks"
ICAPS Doctoral Consortium, June 2022

"Planning Under Time Pressure: Beyond Lower Bounds"
University of Oxford, March 2022

"Planning Under Time Pressure as Decision-making Under Uncertainty"
University of New Hampshire, February 2020

"Fast Motion Planning Using Ideas from Graph Search"
Worcester Polytechnic Institute, November 2018

"Robots: Today and Tomorrow"
Durham Active Retirees Association, November 2018

"Goal Reasoning as Multilevel Planning"
IJCAI-18 Workshop on Goal Reasoning, July 2018

"Planning: When Optimal Is Just Not Good Enough"
New Mexico State University (the 2015-16 Frank Harary Distinguished Lecture), April 2016

"Robots: Today and Tomorrow"
Kendal at Hanover Retirement Community, January 2015

"Two General Approaches for Fast Planning"
MIT, October 2014

"Better Than Optimal Planning: Balancing Search Time and Solution Cost"
 Ben-Gurion University of the Negev, Israel, March 2014
 Universität Basel, Switzerland, March 2014
 LAAS-CNRS, France, February 2014
 ONERA Toulouse, France, January 2014

"The Symposium on Combinatorial Search: What's Hot"
 AAAI, July 2013

"What Your Mama Didn't Tell You About Heuristic Search"
 ICAPS, June 2013

"Integrating Vehicle Routing and Motion Planning"
 ICRA Workshop on Combining Task and Motion Planning, May 2013

"Planning Algorithms: When Optimal Just Isn't Good Enough"
 Vassar College, November 2012
 Harvard University, September 2012
 Tufts University, September 2012
 University of Massachusetts, Lowell, November 2011

"Search Algorithms as Agents"
 Symposium on Combinatorial Search, July 2011

"Best-first Graph Search on Multicore Machines"
 Dagstuhl Seminar on Graph Search Engineering, November 2009

"Job Hunting in Industry and Academia"
 ICAPS Doctoral Consortium, September 2008, May 2010, June 2013, June 2015

"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

Tutorials

"Suboptimal Heuristic Search and Motion Planning"
 ICAPS Summer School, May 2024

"Recent Directions in Heuristic Search"
 with Ariel Felner and Nathan Sturtevant, AAAI 2016

"Heuristic Search: The Basics and Beyond"
   with Jordan Thayer, ICAPS 2012 and AAAI 2012

"Using Solution Length Estimates in Heuristic Search"
   with Jordan Thayer, ICAPS 2011

"A Survey of Suboptimal Search Algorithms"
   with Jordan Thayer, ICAPS 2011

Panel Presentations
'Ideas on Tap' by New Hampshire Humanities, 2019
Symposium on Combinatorial Search, 2015 (moderator)
Symposium on Combinatorial Search, 2010 (moderator)
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–present
Algorithms	Fall 2010–present
Planning for Robots	Spring 2013, Fall 2014–present
Combinatorial Search and Heuristic Optimization	Fall 2008–2009, Spring 2011–2012
Classic Papers in Artificial Intelligence	Fall 2008
Undergraduate Presentation Seminar	Fall 2007, Spring 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	Fall 1997
Theory of Computation (Harvard Extension School)	Fall 1997

Students Supervised	UNIVERSITY OF NEW HAMPSHIRE

Ph.D. Dissertations

Tianyi Gu, *Metareasoning for Heuristic Search Using Uncertainty*	Summer 2016–Fall 2021
Bence Cserna, *Real-time Planning for Robots*	Spring 2015–Spring 2019
Scott Kiesel, *Robotics Needs Non-classical Planning*	Fall 2010–Summer 2016
Matt Hatem, *Heuristic Search with Limited Memory*	Fall 2010–Spring 2014
Chris Wilt, *Steps Towards a Science of Heuristic Search*	Summer 2009–Spring 2014
Ethan Burns, *Planning Under Time Pressure*	Fall 2008–Spring 2013
Jordan Thayer, *Heuristic Search Under Time and Cost Bounds*	Summer 2007–Spring 2012

M.S. Theses

Kevin Gall, *Active Goal Recognition Design*	Spring 2020–Spring 2021

Alex Brown, *Real Time Motion Planning for Path Coverage with*   Fall 2018–Summer 2020
　Applications in Ocean Surveying
Brendan McGuirk, *Assigning Students to Groups Based on*   Fall 2019–Spring 2020
　Preference and Traits
Daroc Alden, *Exploiting More Binaries by Using Planning to*   Spring 2019–Spring 2020
　Assemble ROP Attacks
Andrew Mitchell, *Real-time Planning as Decision-making Under*   Fall 2017–Fall 2018
　Uncertainty
Dylan O'Ceallaigh, *Metareasoning in Real-time Heuristic Search*   Spring 2013–Fall 2014
Frank Kreimendahl, *Stacker Crane Problem State Space Reduction* Summer 2012–Spring 2013
Chris Sexton, *Anytime Solving by Solution Refinement*   Fall 2011–Fall 2012
Mike Leighton, *Faster Optimal and Suboptimal Hierarchical Search* Summer 2010–Spring 2012
Jarad Cannon, *Robot Motion Planning Using Real-time Heuristic Search*   Fall 2010–Fall 2011
Kevin Rose, *Real-time Sampling-based Motion Planning with*   Summer 2010–Fall 2011
　Dynamic Obstacles
Austin Dionne, *Heuristic Search Under a Deadline*   Summer 2010–Spring 2011

M.S. Projects
Yi Wang, Motion Planning Amid Dynamic Obstacles   Spring 2019–Spring 2020
Sai Lekyang, Monte Carlo Tree Search   Spring 2019–Summer 2019
Kasra Dalvand, Exploring a Maze Using a Pioneer 3-DX Robot   Spring 2014–Spring 2015
Jake Mandel, Scheduling for Quality   Fall 2007–Fall 2009

Graduate Research
Bryan McKenney, AI for *Duelyst II*   Spring 2023–present
Devin Thomas, Situated planning   Fall 2021–present
Steve Wissow, Contract search   Summer 2020–present
Sofia Lemons, Suboptimal search   Fall 2008–2010, Summer 2020–present
Yi Wang, Anyangle pathfinding   Spring 2019–Spring 2022
Jordan Ramsdell, Real-time search   Spring 2017–Summer 2017
Nate Beaulieu, Suboptimal search   Fall 2016–Summer 2017
Alison Paredes, Longest paths   Summer 2016–Fall 2018
William Doyle, Suboptimal search   Summer 2016–Fall 2020
Patrick Merrill, Multi-level planning   Spring–Summer 2015
Simon Obgamichael, Class sectioning   Summer 2014
Stephen Dunn, Motion planning   Summer 2013–Summer 2014
David Bond, Real-time search   Spring–Fall 2009

Ph.D. External Examiner
Maximilian Fickert, *Adaptive Search Techniques in AI Planning and Heuristic Search*,
　Saarland University, January, 2022
Marlin P. Strub, *Leveraging Multiple Sources of Information to Search Continuous Spaces*,
　University of Oxford, January, 2022
Rick Valenzano, *Design Decisions in Suboptimal Heuristic Search-based Systems*, University of
　Alberta, September, 2014
David Tolpin, *Rational Metareasoning in Problem-Solving Search*, Ben-Gurion University of
　the Negev, January, 2014
Santiago Franco, *Automatic Heuristic Selection, on a Problem by Problem Basis, Using an
　Analytical Model and In Situ Sampling*, University of Auckland, November, 2010

Ph.D. Committee Member
Bahram Behzadian, *Efficient Data-Driven Robust Policies for Reinforcement Learning*,
　University of New Hampshire, May, 2022.
Madison Clark-Turner, *High Level Learning Using the Temporal Features of
　Human Demonstrated Sequential Tasks*, University of New Hampshire, August, 2021.

Reazul Hasan Russel, *Learning to Act with Robustness*, University of New Hampshire,
   June, 2021

Dan Pineo, *The Application of Computational Modeling to Data Visualization*, University of
   New Hampshire, December, 2010

M.S. Committee Member

Leonhard Staut, *Data-driven Nancy for Real-time Planning*, Saarland University, December,
   2019

Fabian Spaniol, *Planning under strict time limits*, Saarland University, September, 2018

Mike Johnson, Extraterrestrial Resource Prospecting Using Particle Swarm Optimization and
   Conflict-based Search, University of New Hampshire, December, 2016

Chris Hebert, *Inferring Types to Eliminate Ownership Checks in an Intentional
   JavaScript Compiler*, University of New Hampshire, May, 2015

Doctoral Mentoring Programs

AAAI Conference on Artificial Intelligence (AAAI)   2024
International Joint Conference on Artificial Intelligence (IJCAI)   2011
International Conference on Automated Planning and Scheduling (ICAPS)   2007, 2008, 2010,
   2013, 2019

Senior Theses

Bryan McKenney, *General-Purpose Planning Algorithms in Partially-Observable Stochastic Games*	Spring 2022–Spring 2023
Brian Cawley, *Quantization in Suboptimal Heuristic Search*	Fall 2018–Spring 2019
Chao Chi Cheng, *Real-time Heuristic Search in Dynamic Environments*	Summer 2018–Spring 2019
Shane Kochvi, *Does Fast Beat Thorough?: Comparing Real-Time Search Algorithms LSS-LRTA* and RTAA**	Fall 2016–2017
Adam Nastasia, *Explorations with a Custom RGBD Camera System*	Fall 2016–Spring 2017
Dylan O'Ceallaigh, *Enhanced Real-time Search for Dynamic Worlds*	Fall 2012–Spring 2013
Chris Hebert, *Real-time Cooperative Path-finding*	Spring 2012–2013
Kevin Rose, *Best-first Search for Solving Constraint Satisfaction Problems*	Spring 2009–2010

Undergraduate Research

Lucas Guerrette and Bryan McKenney, Task and motion planning	Summer 2020
Tyler Slabinski, Motion planning	Summer 2015
Jennifer Baker, Real-time search	Fall 2010–2011
Allen Hubbe, Modeling heuristic error	Summer 2008
Austin Dionne, Shortest-path search under a deadline	Fall 2007–Spring 2008

Senior Projects

Matin Masimli, Aung Khant Nyar; model fitting	Fall 2017–Spring 2018
Bradley Snay, Zachary Specht; class sectioning	Fall 2015–Spring 2016
William Breen, Tyler Janowski, Alex Schwartz; robotic manipulation	Fall 2012–Spring 2013
Bryan Custer, Zach Piispanen, Jeremy Smith; robot navigation	Fall 2012–Spring 2013

Undergraduate Mentoring Program

AAAI Conference on Artificial Intelligence   2020

Secondary School Research

Fanhao Yu (Nashua High School South), Suboptimal search	Spring–Fall 2023
Charles Bogatyrenko (St. Paul's School), Task and motion planning	Summer 2020
Bernard Suwirjo (Pinkerton Academy), Robotics	Fall 2015–Summer 2016

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

Doctoral Mentoring Program

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

Steering Committees

International Conference on Automated Planning and Scheduling (ICAPS), 2014–2020.
      Councilor, Treasurer (2015–2019).
International Symposium on Combinatorial Search (SoCS), 2008–2017, 2023–present.
      Co-founder (2008), President (2008–2016), Past President (2016–2017),
      Co-treasurer (2010–2014).

Conference Organization

PC Co-chair, International Symposium on Combinatorial Search (SoCS-23), 2023.
Co-chair, ICAPS-17 Doctoral Consortium, 2017.
Co-chair, International Conference on Automated Planning and Scheduling (ICAPS-14), 2014.
Co-chair, International Symposium on Combinatorial Search (SoCS-12), 2012.
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, 2006–2014. Associate editor, 2014–2017.

Program Reviewing

Plymouth State University

Grant Reviewing
Australian Research Council
Comisión Nacional de Investigación Científica y Tecnológica (Chile)
European Research Council
Israel Science Foundation
L'Agence Nationale de la Recherche (France)
National Science Foundation
Natural Sciences and Engineering Research Council of Canada
Nederlandse Organisatie voor Wetenschappelijk Onderzoek (Netherlands)
Swiss National Science Foundation
U.S. Army Research Office
U.S.-Israel Binational Science Foundation

Manuscript Reviewing
Morgan Kaufmann Publishers

Journal Reviewing
ACM Transactions on Intelligent Systems and Technology
Ad Hoc Networks
Advances in Artificial Intelligence
AI Communications
Artificial Intelligence
Cognitive Neuropsychology
Computer Networks
Constraints
IBM Journal of Research and Development
IEEE Transactions on Mobile Computing
IEEE Transactions on Robotics
International Journal of Robotics Research
International Journal on Artificial Intelligence Tools
Journal of Artificial Intelligence Research
Journal of Automated Reasoning
Journal of Combinatorial Optimization
Journal of Heuristics
Journal of Machine Learning Research
Journal of Mathematical Modelling and Algorithms
Journal of Scheduling
Operations Research
Psychological Review
Robotics and Autonomous Systems
Telecommunication Systems

Trade Magazine Reviewing
AI Magazine

Conference Reviewing
AAAI Conference on Artificial Intelligence
European Conference on Artificial Intelligence
IEEE International Conference on Robotics and Automation
IEEE/RSJ International Conference on Intelligent Robots and Systems
IEEE Wireless Communications and Networking Conference
International Conference on Automated Planning and Scheduling
International Conference on Autonomous Agents and Multiagent Systems
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
International Symposium on Artificial Intelligence and Mathematics
International Workshop on Parallel and Distributed Methods in Verification
International Workshop on the Algorithmic Foundations of Robotics
Learning and Intelligent Optimization
Robotics: Science and Systems
SIGGRAPH
Symposium on Abstraction, Reformulation, and Approximation
Symposium on Combinatorial Search
Workshop of the UK Planning and Scheduling Special Interest Group
and various other international workshops

Membership
Association for Computing Machinery
Association for the Advancement of Artificial Intelligence (Senior Member as of 2016,
    life member as of 2003)
IEEE and the IEEE Robotics and Automation Society
    including the Technical Committee on Algorithms for
    Planning and Control of Robot Motion

University Activities

Department
Faculty search committee, 2011, 2012–13, 2013–14, 2015–16 (chair), 2019–20 (chair),
    2021–22 (chair)
Chair, promotion and tenure committee, 2019–present
Library representative, 2012–present
Graduate program committee, 2007–present
Video colloquium, founder and organizer, 2007–2014, 2016–2017

College
Member, Analytics & Data Science Steering Committee, 2018–present
Co-Director, B.S. Program in Analytics & Data Science, 2018–2022
Promotion and Tenure Committee, 2019–2020
Research Excellence Awards Committee, 2020
Robotics Seminar, co-organizer, 2015–2017
Integrated Applied Math Program, affiliated faculty

University
Faculty Senate, 2015-2017, 2021-2022. Co-chair, IT Committee, 2016–17
Ad hoc Committee on Data Science, 2016–2017
Undergraduate research advisory committee, 2007–2012

Citizenship   U.S.A.

[Information current as of May, 2024.]