

Trey Smith

Curriculum Vitae

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Research Interests

Robot decision-making in complex, uncertain environments, with an emphasis on probabilistic reasoning, machine learning, fielded robot systems, and applications in astrobiology and planetary science. Specific interests include planning under partial observability, rover science autonomy (i.e. onboard science data understanding and response), rough-terrain navigation, and multi-robot task allocation.

Education

2000-2007 Ph.D., Robotics

Carnegie Mellon University, Pittsburgh
Thesis Title: Probabilistic Planning for Robotic Exploration
Ph.D. Committee:
1. Reid Simmons (chair), CMU Robotics
2. Geoff Gordon, CMU Computer Science
3. Leslie Pack Kaelbling, MIT CSAIL
4. David Wettergreen, CMU Robotics

1995-1999 B.S. / B.S. Computer Science / Math, with University Honors
Carnegie Mellon University, Pittsburgh

Employment

2007-	Carnegie Mellon West / NASA Ames	Systems Scientist
2001-2007	Carnegie Mellon University	Ph.D. Candidate
Summer 2001	NASA Ames Research Center	Summer Internship
Summer 2000	Jet Propulsion Laboratory	Summer Internship
1999-2001	Carnegie Mellon University	Research Programmer
Summer 1998	NASA Ames Research Center	Summer Internship
1996-1997	Carnegie Mellon University	Undergrad. Research Assistant

Journal Articles

- 1. Life in the Atacama: Science Autonomy for Improving Data Quality.**
Trey Smith, David R. Thompson, David S. Wettergreen, Nathalie A. Cabrol, Kimberley

A. Warren-Rhodes, and Shmuel J. Weinstein. *J. Geophys. Res. Biogeosciences*, 2007.

Book Chapters

1. **Coordination of Heterogeneous Robots for Large-Scale Assembly.**
David Hershberger, Reid G. Simmons, Sanjiv Singh, Josue Ramos, and Trey Smith. In Tucker R. Balch and Lynne E. Parker, editors, *Robot Teams: From Diversity to Polymorphism*, A K Peters, 2002.
2. **A Layered Architecture for Coordination of Mobile Robots.**
Reid G. Simmons, Trey Smith, M. Bernardine Dias, Dani Goldberg, David Hershberger, Anthony Stentz, and Robert Zlot. In Alan C. Schultz and Lynne E. Parker, editors, *Multi-Robot Systems: From Swarms to Intelligent Automata*, Kluwer, 2002.

Refereed Conference Papers

1. **Information-Optimal Selective Data Return for Autonomous Rover Traverse Science and Survey.**
David R. Thompson, Trey Smith, and David Wettergreen. In *Proc. IEEE Int. Conf. on Robotics and Automation*, 2008. (To appear)
2. **Generating Exponentially Smaller POMDP Models Using Conditionally Irrelevant Variable Abstraction.**
Trey Smith, David R. Thompson, and David S. Wettergreen. In *Proc. Int. Conf. on Applied Planning and Scheduling (ICAPS)*, 2007.
3. **Focused Real-Time Dynamic Programming for MDPs: Squeezing More Out of a Heuristic.**
Trey Smith and Reid G. Simmons. In *Proc. Nat. Conf. on Artificial Intelligence (AAAI)*, 2006.
4. **Autonomous Rover Detection and Response Applied to the Search for Life Via Chlorophyll Fluorescence in the Atacama Desert.**
Trey Smith, David R. Thompson, Shmuel J. Weinstein, and David S. Wettergreen. In *Proc. Lunar and Planetary Science Conf. (LPSC)*, March 2006.
5. **Autonomous Detection of Novel Biologic and Geologic Features in Atacama Desert Rover Imagery.**
David R. Thompson, Trey Smith, and David S. Wettergreen. In *Proc. Lunar and Planetary Science Conf. (LPSC)*, March 2006.
6. **Searching for Life with Rovers: Exploration Methods and Science Results from the 2004 Field Campaign of the "Life in the Atacama" Project and Applications to Future Mars Missions.**
Nathalie A. Cabrol, David S. Wettergreen, William L. Whittaker, Edmond A. Grin, Jeffrey E. Moersch, Guillermo Chong D., Charles S. Cockell, Peter Coppin, James M. Dohm, Gregory Fisher, Andrew N. Hock, Lucia Marinangeli, Edwin G. Minkley, Gabriele G. Ori, Jennifer L. Piatek, Alan Waggoner, Kimberley A. Warren-Rhodes, Shmuel J. Weinstein, Michael Wyatt, Francisco Calderón, Stuart Heys, Dominic Jonak, R. Allan Lüders, David Pane, Trey Smith, Kristen Stubbs, James P. Teza, Paul Tompkins, Daniel Villa, Christopher Williams, Michael D. Wagner, Geb Thomas, and Justin Glasgow. In *Proc. Lunar and Planetary Science Conf. (LPSC)*, 2005.

- 7. Life in the Atacama Year 2: Geologic Reconnaissance Through Long-Range Roving and Implications on the Search for Life.**
James M. Dohm, Nathalie A. Cabrol, Edmond A. Grin, Jeffrey E. Moersch, Guillermo Chong D., Charles S. Cockell, Peter Coppin, Gregory Fisher, Andrew N. Hock, Lucia Marinangeli, Edwin G. Minkley, Gabriele G. Ori, Jennifer L. Piatek, Kimberley A. Warren-Rhodes, Shmuel J. Weinstein, Michael Wyatt, Trey Smith, Michael D. Wagner, Kristen Stubbs, Geb Thomas, and Justin Glasgow. In *Proc. Lunar and Planetary Science Conf. (LPSC)*, 2005.
- 8. Spectroscopic Results from the Life in the Atacama (LITA) Project 2004 Field Season.**
Jennifer L. Piatek, Jeffrey E. Moersch, Michael Wyatt, Michael L. Rampey, Nathalie A. Cabrol, David S. Wettergreen, William L. Whittaker, Edmond A. Grin, Guillermo Chong D., Charles S. Cockell, Peter Coppin, James M. Dohm, Gregory Fisher, Andrew N. Hock, Lucia Marinangeli, Edwin G. Minkley, Gabriele G. Ori, Alan Waggoner, Kimberley A. Warren-Rhodes, Shmuel J. Weinstein, Dimitrios Apostolopoulos, Trey Smith, Michael D. Wagner, Kristen Stubbs, Geb Thomas, and Justin Glasgow. In *Proc. Lunar and Planetary Science Conf. (LPSC)*, 2005.
- 9. Point-Based POMDP Algorithms: Improved Analysis and Implementation.**
Trey Smith and Reid G. Simmons. In *Proc. Int. Conf. on Uncertainty in Artificial Intelligence (UAI)*, 2005.
- 10. Concepts for Science Autonomy During Robotic Traverse and Survey.**
Trey Smith, Scott Niekum, David R. Thompson, and David S. Wettergreen. In *Proc. IEEE Aerospace Conf.*, 2005.
- 11. Data Mining During Rover Traverse: From Images to Geologic Signatures.**
David R. Thompson, Trey Smith, and David S. Wettergreen. In *Proc. Int. Symp. on Artificial Intelligence, Robotics and Automation in Space (iSAIRAS)*, September 2005.
- 12. Automatic Detection and Classification of Geological Features of Interest.**
David R. Thompson, Scott Niekum, Trey Smith, and David S. Wettergreen. In *Proc. IEEE Aerospace Conf.*, March 2005.
- 13. Second Experiments in the Robotic Investigation of Life in the Atacama Desert of Chile.**
David S. Wettergreen, Nathalie A. Cabrol, Vijayakumar Baskaran, Francisco Calderón, Stuart Heys, Dominic Jonak, R. Allan Lüders, David Pane, Trey Smith, James P. Teza, Paul D. Tompkins, Daniel Villa, Christopher Williams, and Michael D. Wagner. In *Proc. Int. Symp. on Artificial Intelligence, Robotics, and Automation in Space (iSAIRAS)*, 2005.
- 14. Heuristic Search Value Iteration for POMDPs.**
Trey Smith and Reid G. Simmons. In *Proc. Int. Conf. on Uncertainty in Artificial Intelligence (UAI)*, 2004.
- 15. First Results in the Coordination of Heterogeneous Robots for Large-Scale Assembly.**
Reid G. Simmons, Sanjiv Singh, David Hershberger, Josue Ramos, and Trey Smith. In *Proc. Int. Symp. on Experimental Robotics (ISER)*, 2000.
- 16. Recent Progress in Local and Global Traversability for Planetary Rovers.**
Sanjiv Singh, Reid G. Simmons, Trey Smith, Anthony Stentz, Vandii Verma, Alexander

Yahja, and Kurt Schwehr. In *Proc. IEEE Int. Conf. on Robotics and Automation (ICRA)*, 2000.

17. Autonomous Rovers for Mars Exploration.

Richard Washington, Keith Golden, John Bresina, David E. Smith, Corin Anderson, and Trey Smith. In *Proc. IEEE Aerospace Conf.*, 1999.

Refereed Workshop Papers

1. Science Autonomy in the Atacama.

Trey Smith. In *Proc. Int. Conf. on Machine Learning (ICML) Workshop on Machine Learning Technologies for Autonomous Space Applications*, 2003.

2. A Distributed Layered Architecture for Mobile Robot Coordination: Application to Space Exploration.

Dani Goldberg, Vincent Cicirello, M. Bernardine Dias, Reid G. Simmons, Stephen Smith, Trey Smith, and Anthony Stentz. In *Proc. Int. NASA Workshop on Planning and Scheduling for Space*, 2002.

3. Constructing and Clearing Combinatorial Auctions Using Preference Elicitation.

Trey Smith, Tuomas Sandholm, and Reid G. Simmons. In *Proc. Nat. Conf on Artificial Intelligence (AAAI) Workshop on Preferences in AI and CP*, 2002.

Technical Reports and Theses

1. Probabilistic Planning for Robotic Exploration.

Trey Smith. Ph.D. Thesis, The Robotics Institute, Carnegie Mellon University, Pittsburgh, PA, CMU-RI-TR-07-26, 2007.

2. Rover Science Autonomy: Probabilistic Planning for Science-Aware Exploration.

Trey Smith. 2004. Ph.D. thesis proposal, The Robotics Institute, Carnegie Mellon University.

3. Technology for Autonomous Space Systems.

Ashley Stroupe, Sanjiv Singh, Reid G. Simmons, Paul D. Tompkins, Vandi Verma, Regina Vitti-Lyons, and Michael D. Wagner. Technical Report CMU-RI-TR-00-02, The Robotics Institute, Carnegie Mellon University, 2001.

Other Publications

1. Future Directions in Multi-Robot Autonomy and Planetary Surface Construction.

Trey Smith, Reid G. Simmons, Sanjiv Singh, and David Hershberger. In *Proc. Space Studies Inst. Conf. (SSI)*, 2001.

Teaching Assistantships

1. CMU 16-731 Introduction to Artificial Intelligence, instr. Andrew Moore, Spring 2003.
2. CMU 16-862 Introduction to Mobile Robot Programming, instr. Illah Nourbakhsh, Fall 1998.

Awards

1. NASA Graduate Student Research Program Fellowship (Ames Research Center), 2003-2005.
2. Carnegie Mellon University Honors in Computer Science and Mathematics, 1999.
3. Carnegie Mellon University Andrew Carnegie Scholarship, 1995-1999.

Professional Activities

1. Program Committee, Int. Conf. on Applied Planning and Scheduling (ICAPS), 2008.
2. Program Committee, Int. Conf. on Machine Learning (ICML), 2008.
3. Co-Chair, Workshop on Advancements in POMDP Solvers, Nat. Conf. on Artificial Intelligence (AAAI), 2008.