

Brian Yamauchi

Education

- **Ph.D. Computer Science (1995) — Case Western Reserve University**
- **M.S. Computer Science (1990) — University of Rochester**
- **B.S. Applied Math / Computer Science (1988) — Carnegie Mellon University**

Professional Experience

- **Lead Robotist — iRobot Corporation (Burlington, MA)**

March 2003 – Present: Principal Investigator conducting research in robot autonomy, including:

Wayfarer Principal Investigator for a research project funded by the Army to develop autonomous urban navigation capabilities for the iRobot PackBot. The Wayfarer navigation system uses stereo vision, LIDAR, GPS, and INS sensors in combination with exploration, mapping, and obstacle avoidance algorithms to perform urban reconnaissance.

Mapping Kit Transitioned Wayfarer mapping software to the PackBot Mapping Kit, iRobot's first commercial product providing autonomy for the PackBot.

Scorpion Developed GPS/INS waypoint navigation and obstacle avoidance software for driving autonomous vehicles on urban streets, as part of the DARPA Urban Challenge. iRobot participated as a member of Team Scorpion, led by Raytheon.

Daredevil Principal Investigator for an Army-funded project to develop an all-weather perception payload to enable the PackBot to avoid obstacles and build maps in rain, snow, and dust.

Stingray Principal Investigator for an Army-funded project to develop techniques for the control of a high-speed, man-portable UGV capable of speeds up to 18 mph, using immersive teleoperation and semi-autonomous driver-assist behaviors.

- **Senior Robotist — iRobot Corporation (Burlington, MA)**

January 1999 – February 2003: Developed algorithms for distributed mapping and navigation using heterogeneous mobile robot swarms. Developed a sonar-based mapping and navigation system for the iRobot-LE commercial Internet telepresence robot. Developed a LIDAR-based mapping and navigation system for an autonomous industrial floor-cleaning robot.

- **Research Associate — Naval Research Laboratory (Washington, DC)**

August 1996 - December 1998: Developed techniques enabling mobile robots to explore and map unknown environments. Developed strategies that allow multirobot teams to cooperate in a manner robust to the loss of individual robots.

- **Postdoctoral Fellow/Visiting Scholar — ISLE/Stanford (Palo Alto, CA)**
August 1995 - July 1996: Developed robust methods for place learning and place recognition in dynamic environments using sonar-based occupancy grids. Integrated place learning and recognition in a mobile robot system using a topological map.
- **Research Contractor — Naval Research Laboratory (Washington, DC)**
Summer 1993, Summer 1994: Investigated the use of genetic algorithms to evolve neural network controllers for mobile robots. Implemented a mobile robot system using an topological map for exploration and navigation in dynamic environments.
- **Robotics Engineer — NASA Kennedy Space Center (Cape Canaveral, FL)**
January 1992 - July 1992: Developed control software for a robot designed to inspect radiator panels on the space shuttle. Developed algorithms for aligning the robot with the radiators using sonar and vision to compensate for uncertainty in the shuttle orbiter position.
- **Member of the Technical Staff — Jet Propulsion Laboratory (Pasadena, CA)**
Summer 1991: Designed navigation software for Rocky III, a six-wheeled Mars rover prototype. Developed a behavior-based system for cross-country navigation across unknown terrain. Later versions of the Rocky rovers were used as prototypes for the Sojourner rover used in the Mars Pathfinder mission.

Grants

- Stingray II: Control of High-Speed Unmanned Vehicles, US Army TACOM (TARDEC), \$717,977, October 2008 – October 2010
- Stingray: Control of High-Speed Unmanned Vehicles, US Army TACOM (TARDEC), \$69,900, October 2007 – April 2008
- Daredevil II: Imaging Radar for Small Unmanned Ground Vehicles, US Army TACOM (TARDEC), \$729,766, September 2007 – March 2010
- Sagittarius: A Human-Assisted UAV/UGV Team for Tracking Elusive Dismounts, US Air Force Research Laboratory (AFRL), \$99,572, May 2007 – November 2007
- Daredevil: Imaging Radar for Small Unmanned Ground Vehicles, US Army TACOM (TARDEC), \$68,729, November 2006 – May 2007
- Wayfarer: Robust Outdoor Navigation for Small UGVs, US Army TACOM (TARDEC), \$1,341,173, September 2003 – September 2005
- Sentinel: A System for Command and Control of Small Teleoperated Robots, US Army TACOM (TARDEC), \$69,799, December 2003 – May 2004
- Casualty Extraction Using Mobile Robots, US Army MRMC (TATRC), \$316,398, July 2003 – April 2004
- Griffon: A Small-Scale Unmanned Air/Ground Vehicle, US Army TACOM (TACOM-ARDEC), \$69,915, February 2003 – August 2003
- Valkyrie: A Patient Recovery Robot, US Army MRMC (TATRC), \$69,803, December 2002 – June 2003

Journal/Conference Activities

- Reviewer, *Adaptive Behavior*
- Reviewer, *Autonomous Robots*
- Reviewer, *IEEE Transactions on Robotics and Automation*
- Reviewer, *IEEE Transactions on Systems, Man, and Cybernetics*
- Reviewer, *Journal of Field Robotics*
- Program Committee, Conference on Simulation of Adaptive Behavior
- Program Committee, SPIE Conference on Unmanned Systems Technology

Publications

Journal Papers

- 1) "Sequential Behavior and Learning in Evolved Dynamical Neural Networks", Brian Yamauchi and Randall Beer, *Adaptive Behavior*, Vol. 2, No. 3, Winter 1994
- 2) "Spatial Learning for Navigation in Dynamic Environments", Brian Yamauchi and Randall Beer, *IEEE Transactions on Systems, Man, and Cybernetics — Part B: Cybernetics*, Special Issue on Learning Autonomous Robots, Vol. 26, No. 3, June 1996
- 3) "Place Recognition in Dynamic Environments", Brian Yamauchi and Pat Langley, *Journal of Robotic Systems*, Special Issue on Mobile Robots, Vol. 14, No. 2, February 1997
- 4) "Integrating Exploration and Localization for Mobile Robots," Brian Yamauchi, Alan Schultz, and William Adams, *Adaptive Behavior*, Vol. 7, No. 2, Spring 1999
- 5) "Integrating Exploration, Localization, Navigation and Planning Through a Common Representation," Alan Schultz, William Adams, and Brian Yamauchi, *Autonomous Robots*, Vol. 6, No. 3, June 1999
- 6) "Frontier-Based Exploration Using Multiple Robots," Brian Yamauchi, *Journal of Robotics and Autonomous Systems*, Vol. 29, No. 2-3, November 1999
- 7) "Griffon: A Man-Portable Hybrid UGV/UAV," Brian Yamauchi and Pavlo Rudakevych, *Industrial Robot*, Vol. 31, No. 5, pp. 443-450, 2004

Conference Papers

- 1) "Juggler: Real-Time Sensorimotor Control Using Independent Agents", Brian Yamauchi, *Image Understanding and Machine Vision*, Cape Cod, MA, Optical Society of America, June 1989
- 2) "A Behavior-Based Architecture for Robots Using Real-Time Vision", Brian Yamauchi and Randal Nelson, *Proceedings of the 1991 IEEE International Conference on Robotics and Automation (ICRA 91)*, Sacramento, CA, April 1991

- 3) "Escaping Static and Cyclic Behavior in Autonomous Agents", Brian Yamauchi and Randall Beer, *Proceedings of the Second European Conference on Artificial Life (ECAL 93)*, Brussels, Belgium, May 1993
- 4) "Integrating Reactive, Sequential, and Learning Behavior Using Dynamical Neural Networks", Brian Yamauchi and Randall Beer, *From Animals to Animats 3: Proceedings of The Third International Conference on the Simulation of Adaptive Behavior (SAB 94)*, Brighton, England, MIT Press, July 1994
- 5) "Dynamical Neural Networks for Mobile Robot Control", Brian Yamauchi, *Proceedings of the Fifth International Symposium on Robotics and Manufacturing (ISRAM 94)*, Maui, HI, ASME Press, August 1994
- 6) "Mobile Robot Localization in Dynamic Environments Using Dead Reckoning and Evidence Grids", Brian Yamauchi, *Proceedings of the 1996 IEEE International Conference on Robotics and Automation (ICRA 96)*, Minneapolis, MN, April 1996
- 7) "Place Learning in Dynamic Real-World Environments", Brian Yamauchi and Pat Langley, *Proceedings of ROBOLEARN-96: International Workshop on Learning for Autonomous Robots*, Key West, FL, May 1996
- 8) "A Frontier-Based Approach for Autonomous Exploration," Brian Yamauchi, *Proceedings of the 1997 IEEE International Symposium on Computational Intelligence in Robotics and Automation*, Monterey, CA, July 1997
- 9) "Frontier-Based Exploration Using Multiple Robots," Brian Yamauchi, *Proceedings of the Second International Conference on Autonomous Agents (Agents '98)*, Minneapolis, MN, May 1998
- 10) "Integrating Exploration, Localization, and Navigation," Brian Yamauchi, Alan Schultz, and William Adams, *AAAI Spring Symposium on Integrating Robotics Research*, Stanford, CA, March 1998
- 11) "Mobile Robot Exploration and Map-Building with Continuous Localization," Brian Yamauchi, Alan Schultz, and William Adams, *Proceedings of the 1998 IEEE International Conference on Robotics and Automation (ICRA 98)*, Leuven, Belgium, May 1998
- 12) "Integrating Map Learning, Localization, and Planning in a Mobile Robot," Brian Yamauchi, Alan Schultz, and William Adams, *Proceedings of the 1998 IEEE International Symposium on Computational Intelligence in Robotics and Automation*, Special Session on Integration and Cross-Platform Validation in Robotics, Gaithersburg, MD, September 1998
- 13) "Unifying Exploration, Localization, Navigation and Planning Through a Common Representation," Alan Schultz, William Adams, Brian Yamauchi, and Michael Jones, *Proceedings of the 1999 IEEE International Conference on Robotics and Automation (ICRA 99)*, Detroit, MI, May 1999
- 14) "Derived Performance Metrics and Measurements Compared to Field Experience for the PackBot", Tom Frost, Christopher Norman, Scott Pratt, and Brian Yamauchi, *Proceedings of the Performance Metrics for Intelligent Systems Workshop*, Gaithersburg, MD, August 2002
- 15) "Bloodhound: A Semi-Autonomous Battlefield Medical Robot", Brian Yamauchi, Polly Pook, and Amanda Gruber, *Proceedings of the 23rd Army Science Conference*, Orlando, FL, December 2002

- 16) "PackBot: A Versatile Platform for Military Robotics", Brian Yamauchi, *Proceedings of SPIE Vol. 5422: Unmanned Ground Vehicle Technology VI*, Orlando, FL, April 2004
- 17) "The Wayfarer Modular Navigation Payload for Intelligent Robot Infrastructure," Brian Yamauchi, *Proceedings of SPIE Vol. 5804: Unmanned Ground Technology VII*, Orlando, FL, March 2004
- 18) "Wayfarer: An Autonomous Navigation Payload for the PackBot," Brian Yamauchi, *Proceedings of AUVSI Unmanned Vehicles North America 2005*, Baltimore, MD, June 2005
- 19) "Autonomous Urban Reconnaissance Using Man-Portable UGVs," Brian Yamauchi, *Proceedings of SPIE: Unmanned Ground Vehicle Technology VIII*, Orlando, FL, April 2006
- 20) "Daredevil: Ultra Wideband Radar Sensing for Small UGVs," Brian Yamauchi, *Proceedings of SPIE: Unmanned Systems Technology IX*, Orlando, FL, April 2007
- 21) "All-Weather Perception for Small Autonomous UGVs", Brian Yamauchi, *Proceedings of SPIE: Unmanned Systems Technology X*, Orlando, FL, April 2008
- 22) "Stingray: High-Speed Teleoperation of UGVs in Urban Terrain Using Driver-Assist Behaviors and Immersive Telepresence," *Proceedings of the 26th Army Science Conference*, Orlando, FL, December 2008
- 23) "Stingray: High-Speed Control of Small UGVs in Urban Terrain," Brian Yamauchi, *Proceedings of SPIE: Unmanned Systems Technology XI*, Orlando, FL, April 2009
- 24) "All-Weather Perception for Man-Portable Robots Using Ultra-Wideband Radar," Brian Yamauchi, *Proceedings of the 2010 IEEE International Conference on Robotics and Automation (ICRA 2010)*, Anchorage, Alaska, May 2010