

MICHAEL KRAININ

Contact Information

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Education

- **University of Washington**—Seattle, WA
Ph.D. Candidate; M.S., Computer Science & Engineering
 - Research Assistant with Professor Dieter Fox (June 2009–Present)
- **University of Massachusetts Amherst**—Amherst, MA
B.S., Computer Science; B.S., Mathematics; Minor in Physics.
 - GPA: 3.98/4.00, Summa Cum Laude (Graduated May 2009)
 - Undergraduate Researcher with Professor Victor Lesser (June 2006–June 2009)
 - Semester Abroad at Uppsala University – Uppsala, Sweden (Spring 2008)

Research Experience

- **University of Washington + Intel Labs Seattle**—Seattle, WA
Research Assistant/Intern. June 2009–Present (Intel affiliation through April 2011)
 - Project: Autonomous Robot Learning Through Object Interaction
 - Advisor: Professor Dieter Fox
 - We aim to enable robots to learn about their environments and how to interact with them through experience. Toward this goal, we have developed techniques to allow robots to pick up and to model previously unknown objects. The robot simultaneously models the object and tracks its own manipulator (we do not assume accurate manipulators) with the same RGB-D sensor [4, 7]. We are also exploring applications of these new sensors to SLAM [2, 3, 5, 9].
- **Willow Garage, Inc.**—Menlo Park, CA
Research Intern. Summer 2011
 - Project: Object Pose Estimation in the Presence of Heavy Clutter and Occlusion
 - Advisor: Professor Kurt Konolige
 - This project explored pose quality metrics which provide improved robustness to clutter and occlusion. Topics covered during this internship included optimization techniques for beam-based probabilistic sensor models and the use of over-segmentation of range images to improve pose estimates [1].

- **National Robotics Engineering Center**—Pittsburgh, PA
Summer Scholar/Software Engineer II Intern. June 2008–February 2009
 - Project: Simultaneous Localization and Mapping for Gold-Mining Robots
 - Advisor: Dr. David LaRose
 - Due to the high fatality rates in gold mines, some mining companies are seeking to move toward more automated systems. The project involved designing a robot to be tele-operated in the more dangerous areas of mines. My contribution was to develop tools for mapping and visualizing these mines from stereo camera data.

- **Collaborative Adaptive Sensing of the Atmosphere NSF Research Center**—Amherst, MA
Undergraduate Researcher. June 2006–June 2009
 - Project: Decentralization of the Meteorological Command and Control System
 - Advisor: Professor Victor Lesser
 - This work focused on distributing the task allocation process in a network of short-range, adaptive, weather-sensing radars. This provides fault-tolerance and improved scalability for a crucial infrastructure. I led an effort to explore decentralization techniques such as automated negotiation [10] and max-sum message passing [6]. This project also involved collaborations with researchers from UNC-Charlotte and the University of Southampton.

Publications

- [1] **M. Krainin**, K. Konolige, and D. Fox. Exploiting Segmentation for Robust 3D Object Matching. In *Proc. of the IEEE International Conference on Robotics & Automation (ICRA 2012)*, St. Paul, MN, May 2012. (To Appear).
- [2] A. Huang, N. Roy, A. Bachrach, **M. Krainin**, D. Maturana, and D. Fox. Estimation, Planning and Mapping for Autonomous Flight Using an RGB-D Camera in GPS-denied Environments. *International Journal of Robotics Research (IJRR)*, 2012. (To Appear).
- [3] P. Henry, **M. Krainin**, E. Herbst, X. Ren, and D. Fox. RGB-D Mapping: Using Kinect-Style Depth Cameras for Dense 3D Modeling of Indoor Environments. *International Journal of Robotics Research (IJRR)*, 31(5):647–663, April 2012.
- [4] **M. Krainin**, P. Henry, X. Ren, and D. Fox. Manipulator and Object Tracking for In-Hand 3D Object Modeling. *International Journal of Robotics Research (IJRR)*, 30(11):1311–1327, September 2011.
- [5] A. Huang, N. Roy, A. Bachrach, **M. Krainin**, D. Maturana, and D. Fox. Visual Odometry and Mapping for Autonomous Flight Using an RGB-D Camera. In *Proc. of the 15th International Symposium on Robotics Research (ISRR 2011)*, Flagstaff, AZ, August 2011.
- [6] Y. Kim, **M. Krainin**, and V. Lesser. Effective Variants of Max-Sum Algorithm to Radar Coordination and Scheduling. In *Proc. of the International Conference on Intelligent Agent Technology (IAT 2011)*, Lyon, France, August 2011. (21% acceptance rate).
- [7] **M. Krainin**, B. Curless, and D. Fox. Autonomous Generation of Complete 3D Object Models Using Next Best View Manipulation Planning. In *Proc. of the IEEE International Conference on Robotics & Automation (ICRA 2011)*, pages 5031–5037, Shanghai, China, May 2011.

- [8] A. Raja, G. Alexander, V. Lesser, and **M. Krainin**. *MetaReasoning: Thinking about Thinking*, chapter Coordinating Agent's Metalevel Control, pages 201–216. MIT Press, Cambridge, MA, March 2011.
- [9] P. Henry, **M. Krainin**, E. Herbst, X. Ren, and D. Fox. RGB-D Mapping: Using Depth Cameras for Dense 3D Modeling of Indoor Environments. In *Proc. of the 12th International Symposium on Experimental Robotics (ISER 2010)*, Delhi, India, December 2010.
- [10] **M. Krainin**, B. An, and V. Lesser. An Application of Automated Negotiation to Distributed Task Allocation. In *Proc. of the International Conference on Intelligent Agent Technology (IAT 2007)*, pages 138–145, Fremont, CA, November 2007. (20% acceptance rate).

Awards

- Overall Achievement Award – Department of Computer Science (2009)
- Barry M. Goldwater Scholarship (Fall 2008 – Spring 2009)
- Honorable Mention – CRA Outstanding Undergraduate Award (2008)
- First Place – 22nd Annual Henry Jacob Mathematics Competition (~50 entrants, 2007)
- Second Place – 21st Annual Henry Jacob Mathematics Competition (~50 entrants, 2006)
- Commonwealth College Scholarship (Fall 2005 – Spring 2009)

Professional Presentations

- 2011 IEEE International Conference on Robotics and Automation. *Autonomous Generation of Complete 3D Object Models Using Next Best View Manipulation Planning*. Shanghai, China. May 2011.
- ICRA 2010 Mobile Manipulation Workshop. *Manipulator and Object Tracking for In Hand Object Modeling*. Anchorage, AK. May 2010.
- ICRA 2010 Best Practice in Robotics Workshop. *Manipulator and Object Tracking for In Hand Object Modeling*. Anchorage, AK. May 2010.
- 2007 IEEE/WIC/ACM International Conference on Intelligent Agent Technology. *An Application of Automated Negotiation to Distributed Task Allocation*. Fremont, CA. November 2007.

Academic Service

- Reviewing:
 - International Conference on Robotics and Automation (ICRA) – 2010, 2011, 2012
 - IEEE Transactions on Wireless Communications (TWireless) – 2012
 - International Conference on Intelligent Robots and Systems (IROS) – 2011, 2012
 - Robotics: Science and Systems Conference (RSS) – 2010
 - International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP) – 2009
- Program Committee for the ICRA 2012 Workshop on Semantic Perception and Mapping for Knowledge-enabled Service Robotics
- Volunteer at RSS 2009