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Joshua G. Mangelson

Personal

Degrees

Ph.D.	Robotics University of Michigan, Robotics Institute, Ann Arbor, MI. Advisors: Dr. Ryan M. Eustice and Dr. Ram Vasudevan	2019
M.S.	Robotics University of Michigan, Robotics Institute, Ann Arbor, MI. Advisors: Dr. Ryan M. Eustice and Dr. Jessy Grizzle	2016
B.S.	Electrical Engineering Brigham Young University, Provo, UT. Advisors: Dr. Brent Nelson, Dr. Mike Wirthlin, and Dr. Brad Hutchings	2014

Positions

2020 -	Assistant Professor, Department of Electrical and Computer Engineering, Brigham Young University, Provo, UT.
2019 - 2020	Postdoctoral Investigator, Robotics Institute, Carnegie Mellon University, Pittsburgh, PA.
2019	Postdoctoral Investigator, Department of Naval Architecture and Marine Engineering, University of Michigan, Ann Arbor, MI.
2016	Course Assistant (Perceptual Mobile Robotics), Department of Naval Architecture and Marine Engineering, University of Michigan, Ann Arbor, MI.
2014 - 2019	Graduate Research Assistant, Department of Naval Architecture and Marine Engineering, University of Michigan, Ann Arbor, MI.
2013 - 2014	Digital Systems Teaching Lab Manager, Department of Electrical and Computer Engineering, Brigham Young University, Provo, UT.
2013	R&D Software Engineering Intern, LabVIEW FPGA High Level Synthesis, National Instruments, Austin, TX.
2012 - 2013	Undergraduate Research Assistant, NSF Center for High-Performance Reconfigurable Computing, Brigham Young University, Provo, UT.
2012	Teaching Assistant (Digital Systems), Department of Electrical and Computer Engineering, Brigham Young University, Provo, UT.

2008 - 2009 Teaching Assistant (Calculus, Trigonometry, Algebra), Math Lab, Brigham Young University, Provo, UT.

Honors and Awards

2018 IEEE ICRA Amazon Robotics Multi-Robot Systems Best Paper Award, IEEE International Conference on Robotics and Automation: "Pairwise Consistent Measurement Set Maximization for Robust Multi-robot Map Merging", by J. G. Mangelson, D. Dominic, R. M. Eustice, and R. Vasudevan.

2018 1st Place in OCEANS Student Poster Competition, IEEE OES/MTS OCEANS Conference: "Communication Constrained Trajectory Alignment For Multi-Agent Inspection via Linear Programming,", by J. G. Mangelson, Ram Vasudevan, and R. M. Eustice.

2014 – 2016 University of Michigan, Robotics Institute Fellowship Recipient.

2013 Tau Beta Pi Scholarship Recipient.

2011 – 2013 Raytheon FIRST Robotics Scholarship Recipient.

2009 – 2014 Brigham Young University, Academic Scholarship Recipient.

Teaching

New courses introduced at Brigham Young University

ECEN 522R Introduction to Mobile Robotic Systems
Mobile robotic systems depend on the ability to perceive their environment, determine their location, and build up a model of their surroundings. Furthermore, when operating in the real-world, these tasks must be accomplished simultaneously and in real-time, while taking into account the effects of noisy sensors, incorrect models, and complex unstructured environments. In this course, we will explore fundamental problems central to mobile robotic systems, including localization, mapping, simultaneous localization and mapping (SLAM), and path planning. Students in the course will gain hands-on experience implementing and working with fundamental and state-of-the-art algorithms and methods for solving these problems. Topics include Bayesian filtering; sensor-fusion; sensor models (for a variety of sensing modalities); and applications to autonomous marine ground, and air vehicles.
- This course was adapted from courses taught by Ryan Eustice and Edwin Olson at the University of Michigan and Michael Kaess at Carnegie Mellon University. It will be introduced at BYU Fall 2020.

Courses taught at Brigham Young University

Regular Courses

Course #	Course Title	Teaching Role	Term	Enrolled
ECEN 522R	Introduction to Mobile Robotic Systems	Instructor	Fall 2020	?

Invited Educational Talks

- "Perceptual Robotics Lab (PeRL) an overview,", Introduction to Engineering (ENGR 100), University of Michigan, Ann Arbor, Michigan, USA, Mar. 2016.
- "Real World Robotics," CubScouts Pack 3200, Ann Arbor, Michigan, USA, Mar. 2017.
- "Robotic Perception," Introduction to Computers and Programming (ENGR 101), University of Michigan, Ann Arbor, Michigan, USA, Apr. 2017.

Outreach/Other Activities Directly Related to Teaching

- Experience mentoring and working with undergraduate and early PhD students, 2015 – present.
- Exhibiter with Perceptual Robotics Lab at Michigan Robotics Day, University of Michigan, Ann Arbor, Michigan, 2015 – 2016.

Research

Interests

My research interests include robotic perception and mapping, autonomous underwater vehicles, vision, mobile robotics, robotic state estimation, simultaneous localization and mapping (SLAM), machine learning, graph theory, convex optimization, and multi-robot coordination and planning. I'm especially interested in developing methods that provide mathematical guarantees so autonomous systems can be trusted in real world situations.

Publications and Scholarly Presentations

* PDFs of published and submitted papers are accessible on my website.

Refereed Journal Publications

1. J. G. Mangelson, M. G. Jadidi, R. Vasudevan, and R. M. Eustice, "Characterizing the Uncertainty of Jointly Distributed Poses in the Lie Algebra." *IEEE Transactions on Robotics*, 2020.

Journals In Preparation

1. J. G. Mangelson, R. M. Eustice, and R. Vasudevan, "Group-k Consistent Measurement Set Maximization via Maximum Clique over k-Uniform Hypergraphs for Robust Multi-robot Map Merging," *International Journal of Robotics Research*, 2019. In Prep.

Refereed Conference or Symposium Proceedings Papers

1. M. Hsiao, J. G. Mangelson, S. Suresh, C. Debrunner, and M. Kaess, "ARAS: Ambiguity-aware Robust Active SLAM based on Multi-hypotheis State and Map Estimations," in *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems*, Las Vegas, NV, USA, Oct. 2020.
2. E. Dexheimer, J. G. Mangelson, and M. Kaess, "Efficient Multiresolution Scrolling Grid for Stereo Vision-based MAV Obstacle Avoidance," in *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems*, Las Vegas, NV, USA, Oct. 2020.
3. J. Jaekel, J. G. Mangelson, and M. Kaeass, "A Robust Multi-stereo Visual-Inertial Odometry Pipeline," in *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems*, Las Vegas, NV, USA, Oct. 2020.

4. P. Sodhi, S. Choudhury, J. G. Mangelson, and M. Kaess, "ICS: Incremental Constrained Smoothing for State Estimation," in *Proceedings of the IEEE International Conference on Robotics and Automation*, Paris, France, May 2020.

5. S. Suresh, P. Sodhi, J.G. Mangelson, D. Wettergreen, and M. Kaess, "Active SLAM using 3D Submap Saliency for Underwater Volumetic Exploration," in *Proceedings of the IEEE International Conference on Robotics and Automation*, Paris, France, May 2020.

6. J. G. Mangelson, J. Liu, R. M. Eustice, and R. Vasudevan, "Guaranteed Globally Optimal Planar Pose Graph and Landmark SLAM via Sparse-Bounded Sum-of-Squares Programming," in *Proceedings of the IEEE International Conference on Robotics and Automation*, Montreal, Canada, May 2019.

7. J. G. Mangelson, D. Dominic, R. M. Eustice, and R. Vasudevan, "Pairwise Consistent Measurement Set Maximization for Robust Multi-robot Map Merging," in *Proceedings of the IEEE International Conference on Robotics and Automation*, Brisbane, Australia, May 2018. (40.6% Acceptance Rate).
IEEE ICRA Best Paper on Multi-Robot Systems.

8. R. Hartley, J. G. Mangelson, L. Gan, M. G. Jadidi, J. M. Walls, R. M. Eustice, and J. W. Grizzle, "Legged Robot State-Estimation Through Combined Forward Kinematic and Preintegrated Contact Factors," in *Proceedings of the IEEE International Conference on Robotics and Automation*, Brisbane, Australia, May 2018. (40.6% Acceptance Rate).

Conference Papers Refereed Via Extended Abstract

1. J. G. Mangelson, R. Vasudevan, and R. M. Eustice, "Communication Constrained Trajectory Alignment For Multi-Agent Inspection via Linear Programming," in *Proceedings of the IEEE/MTS OCEANS Conference and Exhibition*, Charleston, SC, October 2018.
1st Place in IEEE OCEANS Student Poster Competition

2. J. G. Mangelson, R. W. Wolcott, P. Ozog, and R. M. Eustice, "Robust Visual Fiducials for Skin-to-Skin Relative Ship Pose Estimation," in *Proceedings of the IEEE/MTS OCEANS Conference and Exhibition*, Monterey, CA, September 2016.

Invited Talks

1. "Robotics in the Real World: Developing Reliable Field-Robotic Systems via Mathematical Guarantees and In-Field Testing", Oregon State University, Corvallis, Oregon, Feb. 2019.

2. "Robotics in the Real World: Developing Reliable Field-Robotic Systems via Mathematical Guarantees and In-Field Testing", Worcester Polytechnic Institute, Worcester, Massachusetts, Feb. 2019.

3. "Robotics in the Real World: Developing Reliable Field-Robotic Systems via Mathematical Guarantees and In-Field Testing", Brigham Young University, Provo, Utah, Feb. 2019.

4. "Robotics in the Real World: Developing Robust Field-Robotic Systems via Mathematical Guarantees and In-Field Testing", Stevens Institute of Technology, Hoboken, New Jersey, Jan. 2019.

5. "Robust Multi-agent Search", Unmanned Maritime Systems Technology, Program Review, Office of Naval Research, Miramar Beach, Florida, Jan. 2019.

6. "Robust Cooperative Mapping for Multi-Vehicle Ship Hull Inspection", (On Behalf of Ryan Eustice), Unmanned Maritime Systems Technology, Program Review, Office of Naval Research, Miramar Beach, Florida, Jan. 2018.

7. "Perception and Planning for In-Water Autonomous Ship Hull Inspection", (On Behalf of Ryan Eustice), Workshop on Perception and Planning for Robotic Inspection, IEEE/RSJ International Conference on Intelligent Robots and Systems, Vancouver, BC, Canada, Sept. 2017.

Workshop Presentations

1. J. G. Mangelson, "Convex Optimization Techniques for Multi-Agent Autonomous Underwater Inspection," in *Robotics Science and Systems Conference Pioneers*, Pittsburgh, PA, Jun. 2018.
2. J. G. Mangelson, "Robust Multi-Agent Autonomous Underwater Inspection with Guarantees," in *Australian Centre for Robotic Vision, Robotic Vision Summer School*, Kioloa, Australia, Feb. 2018.
3. J. G. Mangelson, D. Dominic, R. M. Eustice, and R. Vasudevan, "Pairwise Consistent Measurement Set Maximization for Robust Multi-robot Map Merging," in *Multi-robot Perception-Driven Control and Planning at the IEEE International Conference on Robotics and Automation*, Singapore, Jun. 2017.
4. J. G. Mangelson, D. Dominic, R. M. Eustice, and R. Vasudevan, "Choosing Consistent Measurement for Robust Multi-robot Map Merging," poster presentation in *Midwest Robotics Workshop*, Chicago, IL, May. 2017.
5. S. A. Parkison, V. Bichucher, J. G. Mangelson, and R. M. Eustice, "Feature Learning for Estimation, A Look at Supervised Dictionary Learning for Covariance Prediction," poster presentation in *Midwest Robotics Workshop,* Chicago, IL, Mar. 2016.

Advised Students

Phd Students Advised as a Postdoctoral Investigator at CMU

1. Montiel Abello (Current Position: PhD Student at CMU)
2. Sudharshan Suresh (Current Position: PhD Student at CMU)
3. Allie Chang (Current Position: PhD Student at CMU)
4. Paloma Sodhi (Current Position: PhD Student at CMU)
5. Ming Hsiao (Current Position: Research Scientiest at Facebook Reality Labs)
6. Eric Westman (Current Position: Robotics Software Engineer at Argo AI)

Masters Students Advised as a Postdoctoral Investigator at CMU

1. Allison Wong (Current Postion: Masters Student at CMU)
2. Chenfeng Tu (Current Postion: Masters Student at CMU)
3. Eric Dexheimer (Current Position: Masters Student at CMU)
4. Joshua Jaekel (Current Position: Software Engineer at Argo AI)

Other

AUV (Autonomous Underwater Vehicle) and Marine Field Testing Deployments and Experiments

1. Multi-Vehicle Bluefin HAUV hull inspection mapping of the *USNS Curtiss*, San Diego, California, Nov. 2018.
2. Multi-Vehicle Bluefin HAUV testing at Field Robotics Center, Carnegie Mellon University, Pittsburgh, PA, Jun. 2018.

3. Multi-Vehicle Bluefin HAUV hull inspection mapping of the *USNS Curtiss*, San Diego, California, Mar. 2018.
4. Multi-Vehicle Bluefin HAUV hull inspection mapping of the *USCGC Spencer*, Boston, Massachusetts, Jul. 2017.
5. Multi-Vehicle Bluefin HAUV hull inspection mapping of the *USS Mercy*, San Diego, California, Mar. 2017.
6. Bluefin HAUV initial vehicle testing after vehicle upgrade, Quincy, MA, Feb. 2017.
7. Bluefin HAUV hull inspection mapping of the *USNS Curtiss*, San Diego, California, Aug. 2016.
8. Ship motion estimation field trial on board the *USNS John Glenn* and the *USNS Bob Hope* off the coast of Oceanside, California as part of the Environmental Ship Motion Forcasting (ESMF) project, Nov. 2015.
9. Bluefin HAUV testing at Marine Hydrodynamics Laboratory, University of Michigan, Ann Arbor, Michigan, Nov. 2017.
10. Bluefin HAUV hull inspection mapping of the *USNS Curtiss*, San Diego, California, Jun. 2015.
11. UMich Iver2 AUV cooperative acoustic navigation testing, University of Michigan Biological Station, Douglas Lake, Pellston, Michigan, Jul. 2014.

Service

Service to Community

- Cub Scout Den Leader, Boy Scouts of America, Southern Shores Field Service Council, Pack 3200, 2014 – 2017.

Service to the Department, College, and/or University

- Member, University of Michigan College of Engineering Graduate Student Advisement Council, Robotics Rep, 2014 – 2016.
- Co-Founder, Robotics Graduate Student Council, 2014.

Service to Government or Professional Organizations

Conference/Workshop Organizing Committees

- RSS Pioneers 2019 Organizing Committee, Local Arrangements Chair
- RSS Pioneers 2019 Organizing Committee, Program Committee Member

Reviewer for International Journals

- IEEE, Transactions on Robotics (TRO) - 2019, 2020.
- IEEE, Robotics and Automation Letters (RAL) - 2019, 2020.
- Autonomous Robots (AURO) - 2019, 2020.

Reviewer for International Conferences and Workshops

- IEEE, International Conference on Robotics and Automation (ICRA) - 2016, 2017, 2018, 2019, 2020.

- IEEE, International Conference on Intelligent Robots and Systems (IROS) - 2017, 2018, 2019, 2020.
- Robotics: Science and Systems (RSS) - 2019.
- Robotics: Science and Systems Pioneers - RSS Pioneers, 2018.

Professional Membership

- Member, Institute of Electrical and Electronics Engineers (IEEE), 2019 – Present.
- Student Member, Institute of Electrical and Electronics Engineers (IEEE), 2013 – 2019.
- Member, IEEE Robotics and Automation Society (RAS), 2014 – Present.
- Member, IEEE Control Systems Society (CSS), 2014 – Present.
- Member, IEEE Signal Processing Society (SPS), 2016 – Present.
- Member, IEEE Eta Kappa Nu Honor Society (HKN), 2013 – Present.
- Member, Tau Beta Pi Engineering Honor Society (TBP), 2012 – Present.

Media

- IEEE OES (Ocoeanic Engineering Society) Beacon, Dec. 2018.
- MTS (Marine Technology Society) Currents, Dec. 2018.
- "Speaking like dolphins, a robot fleet takes on underwater tasks", The Michigan Engineer, Nov. 2018.

Last updated: July 15, 2020