Department of Naval Architecture & Marine Engineering
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Maani Ghaffari

Education

University of Technology Sydney, Engineering (Robotics), Ph.D., 2017

Qazvin Azad University, Mechatronic Engineering, M.Sc., 2012

Qazvin Azad University, Mechanical Engineering, B.Sc., 2009

Professional Career

Assistant Professor — Sep. 2020–
Department of Naval Architecture & Marine Engineering
Robotics Institute, University of Michigan

Assistant Research Scientist — Sep. 2018 to Aug. 2020
Department of Naval Architecture & Marine Engineering
Robotics Institute, University of Michigan

Postdoctoral Research Fellow — May 2017 to Aug. 2018
Department of Naval Architecture & Marine Engineering
University of Michigan

Research Associate — Jan. 2017 to Apr. 2017
Centre for Autonomous System, University of Technology Sydney

Intern — Sep. 2016 to Jan. 2017
FX Palo Alto Laboratory, Inc., Radio inertial indoor positioning systems.

Intern — Sep. 2014 to Apr. 2015
HONDA Research Institute Japan Co., Ltd., Sound-based Study of Autonomous Exploration with Gaussian Processes Probability Maps.

Research Assistant — Aug. 2012 to Sep. 2016
Centre for Autonomous System, University of Technology Sydney

Research Engineer — Sep. 2011 to Aug. 2012
Mechatronics Research Lab., Qazvin Azad University

Research Assistant — Sep. 2006 to Sep. 2011
Mechatronics Research Lab., Qazvin Azad University

Teaching Experience

Co-Developer and Co-Instructor, Undergraduate Course Fall 2020
ROB 101: Computational Linear Algebra
https://robotics.umich.edu/academic-program/course-offerings/rob101/
College of Engineering, University of Michigan

Instructor, Graduate Course Winter 2018–2020
NAVARCH/EECS 568, ROB 530: Mobile Robotics: Methods and Algorithms
http://robots.engin.umich.edu/mobilerobotics/
College of Engineering, University of Michigan

Independent Study Course Fall 2020
ROB 590 Directed Study
- Anviksha Reddy Busa (Informative Motion Planning)
- Li Chen, Pradeep Suresh, Chao Chen (RobotX Autonomous Boat)
- Pouyan Firouzabadi (Robot Museum Docent with UMMA)
- Xi Lin (Continuous Sensor Registration, SLAM)
- Harrison Linfeng Chen (State Estimation for Legged Robots)

College of Engineering, University of Michigan

Independent Study Course Spring/Summer 2020
AUTO 503 Automotive Engineering Project
- Apurva Sontakke (Navigation and Obstacle Avoidance for Autonomous Surface Vehicle)

College of Engineering, University of Michigan

Independent Study Course Winter 2020
ROB 590 Directed Study
- Aishwarya Unnikrishnan (Semantic SLAM)
- Ray Zhang, (Semantic SLAM)
- Xi Lin, Tzu-Yuan Lin (Continuous Sensor Registration)
- Fangtong Liu (Point Cloud Registration)

College of Engineering, University of Michigan

Independent Study Course Fall 2019
NAVARCH 590 Directed Study, Research and Special Problems
- Huiwen Xu (Visual-Inertial Odometry)

ROB 590 Directed Study
- Jiajun Hong, Justin Diep, Tribhi Kathuria, Guankun Su, Zhaoer Li, Jing Wang (Robot Museum Docent with UMMA)
- Madhav Achar (Automatic Camera-LIDAR Calibration)
- Ray Zhang, Kaiduo Fang, (Semantic SLAM)
- Xi Lin, Dingyi Sun, Tzu-Yuan Lin, Chien Erh Lin (Continuous Sensor Registration)
- Fangtong Liu (Point Cloud Registration)
- Chi-Kuan Lin (Point Cloud-based Object Classification)

College of Engineering, University of Michigan

Independent Study Course Spring/Summer 2019
ROB 590 Directed Study
- Justin Diep (Robot Museum Docent with UMMA)
- Jiajun Hong (Robot Museum Docent with UMMA)
- Matthew Marlon Philippi (Robot Museum Docent with UMMA)

College of Engineering, University of Michigan

Independent Study Course Winter 2019
ROB 590 Directed Study
– Sahib Dhanjal (Visual-Radio-Inertial SLAM)
– Shenyu Mou (Visual SLAM)
– Siddharth Ratapani Navin (Multi-Object Detection and Tracking)
– Tzu-Yuan Lin (Cassie Control and Perception Simulation)
– Huiwen Xu (Direct Visual Odometry)
– Peiyan Gong (LIDAR Point Cloud Registration)
– Ray Zhang (Semantic Mapping)
College of Engineering, University of Michigan

Independent Study Course Fall 2018
ROB 590 Directed Study
– Shenyu Mou (Visual SLAM)
– Siddharth Ratapani Navin (Multi-Object Detection and Tracking)
College of Engineering, University of Michigan

Independent Study Course Spring/Summer 2018
AUTO 503 Automotive Engineering Project
– Ashish Sajwan (Automated Driving Mapping)
College of Engineering, University of Michigan

Teaching Assistant, Graduate Course Aug. 2015 - June 2016
49274 - Advanced Robotics
with A/Prof. Shoudong Huang
Faculty of Engineering and IT, University of Technology Sydney

Teaching Assistant, Undergraduate Course Mar. 2013 - Sep. 2014, Aug. 2015 - June 2016
48650 - Mechanical Design 2
with Dr. Nathan kirchner and Dr. Teresa Vidal Calleja
Faculty of Engineering and IT, University of Technology Sydney

Teaching Assistant, Undergraduate Course Mar. 2013 - June 2014
48610 - Introduction to Mechanical and Mechatronic Engineering
with Dr. Terry Brown and Dr. Nathan kirchner
Faculty of Engineering and IT, University of Technology Sydney

Instructor, Extracurricular
MATLAB (30 hours) 2009 - 2012
Omni-directional Mobile Robots; modeling and control (30 hours) 2010 - 2012
MATLAB Simulink (30 hours) Fall 2009
Computer Modelling and Analysis with CATIA V5 (30 hours) Fall 2009
Faculty of Engineering, Qazvin Azad University

Ph.D. committees chaired/co-chaired

1. Ross Hartley, "Contact-Aided State Estimation on Lie Groups for Legged Robot Mapping and Control," Ph.D. dissertation, Robotics Institute, University of Michigan, Ann Arbor, MI, USA, May 2019. Co-Chair with Prof. Jessy W. Grizzle. (Next position: Applied Scientist II at Amazon Robotics)

Grants and Contracts

1. University of Michigan, Diversity, Equity, and Inclusion 2020-2021 Faculty Grant, $10,000.

2. Toyota Research Institute, "Robust Semantic-Aware Integrated Mapping, Planning, and Control for Autonomous Navigation in Unstructured and Semi-Structured Environments", $undisclosed. April 2021–. PI: Jessy Grizzle, Co-PI: Ghaffari.

Publications

Journal Articles

1. J. G. Mangelson, M. Ghaffari, R. Vasudevan, R. M. Eustice, "Characterizing the Uncertainty of Jointly Distributed Poses in the Lie Algebra," *IEEE Transactions on Robotics* (T-RO), Accepted.

2. L. Gan, R. Zhang, J. W. Grizzle, R. M. Eustice, M. Ghaffari, "Bayesian Spatial Kernel Smoothing for Scalable Dense Semantic Mapping," *IEEE Robotics and Automation Letters* (RA-L), 5(2), pp. 790-797, 2020.

3. R. Hartley, M. Ghaffari, R. M. Eustice, J. W. Grizzle, "Contact-Aided Invariant Extended Kalman Filtering for Robot State Estimation," *The International Journal of Robotics Research* (IJRR), 39 (4), pp. 402-430, 2020.

4. M. Ghaffari Jadidi, J. Valls Miro, G. Dissanayake, "Sampling-based Incremental Information Gathering with Applications to Robotic Exploration and Environmental Monitoring," *The International Journal of Robotics Research* (IJRR), 38(6), pp. 658-685, 2019.

5. S. Parkison, M. Ghaffari, L. Gan, R. Zhang, A. Ushani, R. M. Eustice, "Boosting Shape Registration Algorithms via Reproducing Kernel Hilbert Space Regularizers," *IEEE Robotics and Automation Letters* (RA-L), 4(4), pp. 4563-4570, 2019.

6. M. Ghaffari Jadidi, J. Valls Miro, G. Dissanayake, "Gaussian Process Autonomous Mapping and Exploration for Range-sensing Mobile Robots," *Autonomous Robots* (AURO), 42(2), pp. 273-290, 2018.

7. M. Ghaffari Jadidi, J. Valls Miro, G. Dissanayake, "Warped Gaussian Processes Occupancy Mapping with Uncertain Inputs," *IEEE Robotics and Automation Letters* (RA-L), 2(2), pp. 680-687, 2017.

8. D. Valiente, M. Ghaffari Jadidi, J. Valls Miro, A. Gil, O. Reinoso, "Information-based View Initialization in Visual SLAM with a Single Omnidirectional Camera," *Robotics and Autonomous Systems* (RAS), 72, pp. 93-104, Oct. 2015.

9. E. Hashemi, M. Ghaffari Jadidi, N. Ghaffari Jadidi, "Model Based PI-Fuzzy Control of Four Wheeled Omni-Directional Mobile Robots," *Robotics and Autonomous Systems* (RAS), 59(11), pp. 930-942, 2011.

Book Chapters

1. E. Hashemi, M. Ghaffari Jadidi, "Dynamic Modeling and Control Study of the NAO Biped Robot with Improved Trajectory Planning," Book chapter, *Materials with Complex Behaviors II*, Springer, 2011.

Theses

1. M. Ghaffari Jadidi, Gaussian Processes for Information-theoretic Robotic Mapping and Exploration. Ph.D. thesis, University of Technology Sydney, May 2017.

2. M. Ghaffari Jadidi, Optimal Preview Control of Nao Humanoid Robots together with Kinematic and Dynamic Modeling. M.Sc. thesis, Qazvin Azad University, February 2012 (in Persian).

Preprints

1. W. Clark, M. Ghaffari, A. Bloch, "Nonparametric Continuous Sensor Registration," arXiv preprint.
2. X. Lin, D. Sun, T. Lin, R. M. Eustice, M. Ghaffari, "A Keyframe-based Continuous Visual SLAM for RGB-D Cameras via Nonparametric Joint Geometric and Appearance Representation," arXiv preprint.
3. T. Lin, W. Clark, R. M. Eustice, J. W. Grizzle, A. Bloch, M. Ghaffari, "Adaptive Continuous Visual Odometry from RGB-D Images," arXiv preprint.
4. J. Huang, M. Ghaffari, R. Hartley, L. Gan, R. M. Eustice, J. W. Grizzle, "LiDARTag: A Real-Time Fiducial Tag using Point Clouds," arXiv preprint.
5. L. Gan, M. Ghaffari Jadidi, Steven A. Parkison, R. M. Eustice, "Sparse Bayesian Inference for Dense Semantic Mapping," arXiv preprint.

Refereed Conference Papers

1. M. Zhu, M. Ghaffari, Y. Zhong, P. Lu, Z. Cao, R. M. Eustice, H. Peng, "Monocular Depth Prediction through Continuous 3D Loss," in Proc. IEEE/RSJ Int. Conf. Intell. Robots Syst. (IROS), 2020.
2. S. Dhanjal, M. Ghaffari, R. M. Eustice, "DeepLocNet: Deep Observation Classification and Ranging Bias Regression for Radio Positioning Systems," in Proc. IEEE/RSJ Int. Conf. Intell. Robots Syst. (IROS), 2019, pp. 3802-3809.
3. M. Ghaffari, W. Clark, A. Bloch, R. M. Eustice, J. W. Grizzle, "Continuous Direct Sparse Visual Odometry from RGB-D Images," in Proc. Robotics: Science and Systems Conference (RSS), Freiburg, Germany, June 2019.
4. R. Hartley, M. Ghaffari Jadidi, L. Gan, J. Huang, J. W. Grizzle, R. M. Eustice, "Hybrid Contact Preintegration for Visual-Inertial-Contact State Estimation within Factor Graphs," in Proc. IEEE/RSJ Int. Conf. Intell. Robots Syst. (IROS), 2018, pp. 3783-3790.
5. S. A. Parkison, L. Gan, M. Ghaffari Jadidi, R. M. Eustice, "Semantic Iterative Closest Point through Expectation-Maximization," in Proc. British Machine Vision Conference (BMVC), 2018, pp. 1-17.
6. M. Ghaffari Jadidi, M. Patel, J. Valls Miro, G. Dissanayake, J. Biehl, A. Girgensohn, "A Radio-Inertial Localization and Tracking System with BLE Beacons Prior Maps," IEEE Int. Conf. Indoor positioning and indoor navigation (IPIN), 2018, pp. 1-8.
7. R. Hartley, M. Ghaffari Jadidi, J. W. Grizzle, R. M. Eustice, "Contact-Aided Invariant Extended Kalman Filter for Legged Robot State Estimation," in Proc. Robotics: Science and Systems Conference (RSS), Pittsburgh, Pennsylvania, USA, June 2018.
8. R. Hartley, J. Mangelson, L. Gan, M. Ghaffari Jadidi, J. M. Walls, R. M. Eustice, J. W. Grizzle, "Legged Robot State-Estimation Through Combined Forward Kinematic and Preintegrated Contact Factors," in Proc. IEEE Int. Conf. Robot. Automat. (ICRA), 2018, pp. 4422-4429.
9. M. Ghaffari Jadidi, M. Patel, J. Valls Miro, "Gaussian Processes Online Observation Classification for RSSI-based Low-cost Indoor Positioning Systems," in Proc. IEEE Int. Conf. Robot. Automat. (ICRA), 2017, pp. 6269-6275.
10. B. Emery, M. Ghaffari Jadidi, K. Nakamura, and J. Valls Miro, "An Audio-visual Solution to Sound Source Localization and Tracking with Applications to HRI," in Proc. Australasian Conf. on Robot. and Automat. (ACRA), 2016.
11. M. Ghaffari Jadidi, E. Hashemi, "Optimal Preview Control of the Nao Biped Robot using a UKF-based State Observer," in Proc. IEEE/ASME Conf. Advanced Intell. Mechat. (AIM), 2016, pp. 52-57.
12. M. Ghaffari Jadidi, J. Valls Miro, G. Dissanayake, "Mutual Information-based Exploration on Continuous Occupancy Maps," in Proc. IEEE/RSJ Int. Conf. Intell. Robots Syst. (IROS), 2015, pp. 6086-6092.

13. M. Ghaffari Jadidi, J. Valls Miro, R. Valencia, J. Andrade-Cetto, "Exploration on Continuous Gaussian Process Frontier Maps," in Proc. IEEE Int. Conf. Robot. Automat. (ICRA), 2014, pp. 6077-6082.

14. M. Ghaffari Jadidi, J. Valls Miro, R. Valencia, J. Andrade-Cetto, and G. Dissanayake, "Exploration using information-based reaction-diffusion process," in Proc. Australasian Conf. on Robot. and Automat. (ACRA), 2013.

15. E. Hashemi, M. Ghaffari Jadidi et al., "Particle Filter Based Localization of the Nao Biped Robot," in Proc. the 44th IEEE Southeastern Symp. on Syst. Theory, 2012, pp. 168-173.

16. M. Ghaffari Jadidi et al., "Three-Dimensional Dynamic Modeling of the Nao Biped Robot with Simplified Equations of Motion in Sagittal and Frontal Planes," in Proc. Joint Int. Conf. on Multibody System Dynamics, 2012.

17. E. Hashemi, M. Ghaffari Jadidi, "Discrete Time Linear Quadratic Tracking Controller For Omni-directional Mobile Robots," in Proc. ASME/IEEE Int. Conf. on Mechat. and Embedded Syst. Applications (MESA), 2011, pp. 419-426.

18. E. Hashemi, M. Ghaffari Jadidi et al., "In-plane Path Planning for Biped Robots Based on Bezier Curve," In Proc. IEEE/ASME Conf. Advanced Intell. Mechat. (AIM), 2011, pp. 796-801.

19. E. Hashemi, M. Ghaffari Jadidi, "Dynamic Modeling and Control Study of the NAO Biped Robot with Improved Trajectory Planning," In Proc. of the 4th Int. Conf. on Advanced Computational Engineering and Experimenting, 2010.

20. M. Ghaffari Jadidi et al., "Optimized Trajectory Generation for the NAO Biped Robot Using Particle Swarm Optimization and Genetic Algorithm," in Proc. the Int. Conf. on Advanced Computational Engineering and Experimenting, 2010.

21. M. Ghaffari Jadidi, E. Hashemi, M. A. Zakeri, H. Sadjadian, "Kinematic Modeling Improvement and Trajectory Planning of the NAO Biped Robot," in Proc. the Joint Int. Conf. on Multibody Syst. Dynamics, Finland, 2010.

22. E. Hashemi, M. Ghaffari Jadidi, O. Bakhshandeh B., "Trajectory Planning Optimization with Dynamic Modeling of Four Wheeled Omni-Directional Mobile Robots," in Proc. the IEEE Int. Symp. on Comput. Intell. in Robot. and Automat., Daejeon, Korea, 2009.

23. E. Hashemi, M. Ghaffari Jadidi, M. Yaghobi, "Rescue Robot Localization and Trajectory Planning Using ICP and Kalman Filtering Based Approach," in Proc. the 7th Int. Conf. on Robot., Vision, Sig. Process., and Power Applications, 2009.

Refereed Workshop Papers

1. R. Luo, S. Benge, N. Vasher, G. VanderVliet, M. Ghaffari, J. Yang, "Towards an Interactive Docent: Estimating Museum Visitors' Comfort Level with Art," RSS Workshop on AI and Its Alternatives for Shared Autonomy in Assistive and Collaborative Robotics, FreiburgimBreisgau, Germany, 2019.

2. M. Ghaffari Jadidi, L. Gan, S. A. Parkison, J. Li, R. M. Eustice, "Gaussian processes semantic map representation," RSS Workshop on Spatial-Semantic Representations in Robotics, Cambridge, MA, USA, 2017.

3. M. Ghaffari Jadidi, J. Valls Miro, R. Valencia, J. Andrade-Cetto, G. Dissanayake, "Exploration in Information Distribution Maps," RSS'13 Workshop on Robotic Exploration, Monitoring, and Information Content, Berlin, Germany, 2013.

Invited Talks

University of Michigan — Feb. 2020
"New approaches to real-time robotic mapping and information gathering"

Yale University — Feb. 2020
"New approaches to real-time robotic mapping and information gathering"

NASA Jet Propulsion Laboratory — Nov. 2019
"Highly Dynamic Biped Locomotion in Unknown, Loosely Structured Environments"

Massachusetts Institute of Technology — Oct. 2019
"Wild Wild Autonomy in the Midwest"

FX Palo Alto Laboratory, Inc. — Aug. 2019
"Wild Wild Autonomy in the Midwest"

University of Michigan — Nov. 2016
"Gaussian Processes for Information-theoretic Robotic Mapping and Planning"

Oregon State University — Dec. 2016
"Gaussian Processes for Information-theoretic Robotic Mapping and Planning"

Awards

- IEEE Robotics and Automation Society IROS 2015 travel grants, $750.
- University of Technology Sydney IRS and CAS Scholarships, 2012-2016.
- 1st place in B.Sc. entrance exam, Dept. of Mech. Eng., Qazvin Azad University, 2005.
- 1st Place in Standard Platform League and 2nd Place in Research Innovation Award, IranOpen RoboCup; Tehran, Iran, 2012.
- 3rd Place in IranOpen RoboCup Standard Platform League; Tehran, Iran, 2011.
- 1st Place in the Best-In-Class Autonomy in Thailand Rescue Robot Championship; Bangkok, Thailand, 2008.
- 1st Place in the First Khwarizmi Robotic Competitions; Tehran, Iran, 2008.
- 1st Place in IranOpen RoboCup Rescue Robot League and Technical Challenge; Tehran, Iran, 2007 - 2008.
- 2nd Place in Rescue Robot League and 3rd Place in the Best-In-Class Mobility, RoboCup competitions; Suzhou, China, 2008.

Professional and Synergistic Activities

Editorial Activities

- Associate Editor, Int. Conf. on Ubiquitous Robots, 2020.
- Guest Editor, IEEE Access Special Section on Real-Time Machine Learning Applications in Mobile Robotics.

Reviewing Activities

- Int. Journal of Robotics Research (IJRR)
- IEEE Transactions on Robotics (TRO)
- IEEE Robotics and Automation Letters (RA-L)
- IEEE Int. Conf. on Robotics and Automation (ICRA)
- IEEE/RSJ Int. Conf. on Intelligent Robots and Systems (IROS)
- Robotics: Science and Systems (RSS)
- Autonomous Robots (AURO)

- Robotics and Autonomous Systems (RAS)
- Journal of Field Robotics (JFR)
- IEEE Robotics & Automation Magazine (RAM)
- IEEE Int. Conf. on Automation Science and Engineering (CASE)
- Int. Symposium on Robotics Research (ISRR)
- ACM Multimedia (ACM MM)
- ACM Transactions on Embedded Computing Systems (TECS)
- Int. Journal of Advanced Robotic Systems

Technical Committees

- Member of IEEE RAS Technical Committee on Cognitive Robotics, 2019 - present.
- Technical Committee member of the RoboCup Iran Open SPL, 2010 - 2012.

Media Coverage

- UM Robotics Institute and UMMA Collaboration, "U-M MUSEUM OF ART BRINGS ROBOTS TO THE ART WORLD", October 4, 2019.
- Filmed by The Discovery Channel, "Cassie Blue Hones Her Segway Riding Skills", May 9, 2018.
- Filmed by The Discovery Channel, "Cassie Blue Plays in the Sand", May 9, 2018.
- UTS Newsroom, "Robots to the rescue", June 01, 2015

Professional Membership

- IEEE Robotics and Automation Society (RAS), 2018 - present
- IEEE Young Professionals, 2014 - 2015
- Student Member, Institute of Electrical and Electronics Engineers (IEEE), 2014 - 2015