# Kasra Khosoussi

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## Academic Employment

Research Scientist — January 2019–Present
Department of Aeronautics and Astronautics
Laboratory for Decisions & Information Systems
Massachusetts Institute of Technology
Cambridge, MA, USA.

Postdoctoral Associate — April 2017–December 2018
Department of Aeronautics and Astronautics
Laboratory for Decisions & Information Systems
Massachusetts Institute of Technology
Cambridge, MA, USA.

Postdoctoral Research Associate — Sept. 2016–April 2017
Centre for Autonomous Systems
University of Technology Sydney
Sydney, Australia.

Visiting Research Scholar — Sept. 2015–April 2016
Host and Advisor: Prof. Gaurav S. Sukhatme
Department of Computer Science
University of Southern California
Los Angeles, CA, USA.

## Education

Ph.D. in Engineering (Robotics) — July 2012–April 2017
Thesis: Exploiting the Intrinsic Structures of SLAM
Advisors: A/Prof. Shoudong Huang and Prof. Gamini Dissanayake
University of Technology Sydney
Sydney, Australia.

B.Sc. in Computer Engineering — Sept. 2006–June 2011
Thesis: Monte Carlo Approximation of Non-Gaussian Optimal Proposal Distribution
Advisor: Prof. Hamid D. Taghirad
K. N. Toosi University of Technology
Tehran, Iran.

# Publications

Copies of the following papers and corresponding videos are available on my website and Google Scholar profile.

## *Journal Articles*

1. Distributed Certifiably Correct Pose-Graph Optimization
   Yulun Tian, **Kasra Khosoussi**, David M. Rosen, and Jonathan P. How
   IEEE Transactions on Robotics (**T-RO**) — 2021
   Conditionally Accepted
2. CLEAR: A Consistent Lifting, Embedding, and Alignment Rectification Algorithm for Multi-View Data Association
   Kaveh Fathian, **Kasra Khosoussi**, Yulun Tian, Parker Lusk, and Jonathan P. How
   IEEE Transactions on Robotics (**T-RO**) — 2020
3. A Resource-Aware Approach to Collaborative Loop Closure Detection with Provable Performance Guarantees
   Yulun Tian, **Kasra Khosoussi**, and Jonathan P. How
   International Journal of Robotics Research (**IJRR**) — 2020
   **Invited paper from WAFR 2018**
4. Reliable Graphs for SLAM
   **Kasra Khosoussi**, Matthew Giamou, Gaurav S. Sukhatme, Shoudong Huang, Gamini Dissanayake and Jonathan P. How
   International Journal of Robotics Research (**IJRR**) — 2019
   **Invited paper from WAFR 2016**
5. A Sparse Separable SLAM Back-End
   **Kasra Khosoussi**, Shoudong Huang and Gamini Dissanayake
   IEEE Transactions on Robotics (**T-RO**) — 2016
6. Dimensionality Reduction for Point Feature SLAM Problems with Spherical Covariance Matrices
   Heng Wang, Shoudong Huang, **Kasra Khosoussi**, Udo Frese, Gamini Dissanayake and Bingbing Liu
   **Automatica** — 2015

## *Conference Papers*

1. Non-Monotone Energy-Aware Information Gathering for Heterogeneous Robot Teams
   Xiaoyi (Jeremy) Cai, Brent Schlotfeldt, **Kasra Khosoussi**, Nikolay Atanasov, George J. Pappas, Jonathan P. How
   International Conference on Robotics and Automation (**ICRA**) — 2021
2. NF-iSAM: Incremental Smoothing and Mapping via Normalizing Flows
   Qiangqiang Huang, Can Pu, Dehann Fourie, **Kasra Khosoussi**, Jonathan P. How, John J. Leonard
   International Conference on Robotics and Automation (**ICRA**) — 2021
3. Multi-Robot Distributed Semantic Mapping in Unfamiliar Environments through Online Matching of Learned Representations
   Stewart Jamieson, Kaveh Fathian, **Kasra Khosoussi**, Jonathan P. How, Yogesh Girdhar
   International Conference on Robotics and Automation (**ICRA**) — 2021
4. Resource-Aware Algorithms for Distributed Loop Closure Detection with Provable Performance Guarantees
   Yulun Tian$^\star$, **Kasra Khosoussi**$^\star$ and Jonathan P. How
   International Workshop on the Algorithmic Foundations of Robotics (**WAFR**) — 2019
   WAFR top 15% — **Invited to the International Journal of Robotics Research (IJRR)**
   $\star$ Equal Contribution
5. Near-Optimal Budgeted Data Exchange for Distributed Loop Closure Detection
   Yulun Tian, **Kasra Khosoussi**, Matthew Giamou, Jonathan P. How, and Jonathan Kelly
   Robotics: Science and Systems (**RSS**) — 2018
   Acceptance Rate: 28%
6. Talk Resource-Efficiently to Me: Optimal Communication Planning for Distributed SLAM Front-Ends
   Matthew Giamou$^\star$, **Kasra Khosoussi**$^\star$ and Jonathan P. How
   International Conference on Robotics and Automation (**ICRA**) — 2018
   Acceptance Rate: 40.6%
   **Best Multi-Robot Paper Award Finalist**
   $\star$ Equal Contribution

7. Designing Sparse Reliable Pose-Graph SLAM: A Graph-Theoretic Approach
   **Kasra Khosoussi**, Gaurav S. Sukhatme, Shoudong Huang and Gamini Dissanayake
   International Workshop on the Algorithmic Foundations of Robotics (**WAFR**) — 2016
   WAFR top 25% — **Invited to the International Journal of Robotics Research (IJRR)**
   arXiv:1611.00889 [cs.RO]
8. Tree-Connectivity: Evaluating the Graphical Structure of SLAM
   **Kasra Khosoussi**, Shoudong Huang and Gamini Dissanayake
   International Conference on Robotics and Automation (**ICRA**) — 2016
   Acceptance Rate: 34.7%
9. Exploiting the Separable Structure of SLAM
   **Kasra Khosoussi**, Shoudong Huang and Gamini Dissanayake
   Robotics: Science and Systems (**RSS**) — 2015
   Acceptance Rate: 26%
10. Novel Insights into the Impact of Graph Structure on SLAM
    **Kasra Khosoussi**, Shoudong Huang and Gamini Dissanayake
    IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**) — 2014
    Acceptance Rate: 47%
11. Towards a Reliable SLAM Back-End
    Gibson Hu, **Kasra Khosoussi** and Shoudong Huang
    IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**) — 2013
    Acceptance Rate: 43%
12. Monte Carlo Sampling of Non-Gaussian Proposal Distribution in Feature-Based RBPF-SLAM
    Nina Marhamati, Hamid D. Taghirad and **Kasra Khosoussi**
    Australasian Conference on Robotics and Automation (ACRA) — 2012

### *Peer-Reviewed Workshop Papers*

1. Good, Bad and Ugly Graphs for SLAM
   **Kasra Khosoussi**, Shoudong Huang and Gamini Dissanayake
   Robotics: Science and Systems (RSS) Workshop on The Problem of Mobile Sensors — 2015

### *Theses*

1. Exploiting the Intrinsic Structures of the Simultaneous Localization and Mapping Problem
   Ph.D. Thesis — 2016
   School of Electrical, Mechanical and Mechatronics Systems
   Faculty of Engineering and IT
   University of Technology Sydney
   Sydney, Australia
2. Developing New RBPF-SLAM Algorithms with Non-Gaussian Optimal Proposal Distribution
   B.Sc. Thesis — 2011
   Department of Electrical and Computer Engineering
   K. N. Toosi University of Technology
   Tehran, Iran

### *Technical Reports*

1. Block-Coordinate Minimization for Large SDPs with Block-Diagonal Constraints
   Yulun Tian, **Kasra Khosoussi**, and Jonathan P. How
   arXiv:1903.00597 [math.OC] — 2019
2. On the Expected Value of the Determinant of Random Sum of Rank-One Matrices
   **Kasra Khosoussi**
   arXiv:1702.08247 [cs.DS] — 2017
3. Maximizing the Weighted Number of Spanning Trees: Near-$t$-Optimal Graphs
   **Kasra Khosoussi**, Gaurav S. Sukhatme, Shoudong Huang and Gamini Dissanayake
   arXiv:1604.01116 [cs.DS] — 2016

4. Graph Structure and the Achievable Accuracy in Full SLAM
   **Kasra Khosoussi**
   Centre for Autonomous Systems
   University of Technology Sydney — 2013
5. Monte Carlo Sampling of Non-Gaussian Proposal Distribution in Feature-Based RBPF-SLAM
   **Kasra Khosoussi**, Nina Marhamati and Hamid D. Taghirad
   Department of Electrical and Computer Engineering
   K. N. Toosi University of Technology — 2011

## Invited Talks

1. Reliable Graphs for SLAM
   Marine Robotics Group
   CSAIL, MIT — April 2016
2. Overlooked Structures of SLAM
   Autonomous Systems Lab
   ETH Zürich — July 2015
3. The past, present and future of SLAM
   **Kasra Khosoussi** and Hamid D. Taghirad
   RSI/ISM International Conference on Robotics and Mechantronics (ICRoM) — 2013
   Sharif University of Technology — Tehran, Iran

## Honors and Awards

- ICRA Best Multi-Robot Paper Award Finalist (2018)
- UTS Faculty of Engineering and IT (FEIT) Graduate Students Publication Award (2016)
- UTS FEIT Graduate Students Research Collaboration Experience Award (2015)
- ICRA and IROS Student Travel Award (2014, 2016)
- Australian Research Council Discovery Project Scholarship (2012–2016)
- UTS International Research Scholarship (2012–2016)

## Teaching Experience

### Massachusetts Institute of Technology

Co-creator & Co-instructor

- 16.485 Visual Navigation for Autonomous Vehicles (graduate) — Fall 2019
- 16.S398 Visual Navigation for Autonomous Vehicles (graduate) — Fall 2018

### University of Technology Sydney

Teaching Assistant (Tutor)

- Advanced Robotics (graduate) — Spring 2012–2014
- Control of Mechatronic Systems (graduate) — Spring 2012–2014

## Student Supervision and Mentoring

- Yulun Tian — Master's and PhD (MIT AeroAstro)
  Topic: Resource-aware Collaborative SLAM for Multi-Robot Search and Rescue
- Matthew Giamou — Master's (MIT AeroAstro)
  Topic: Distributed Place Recognition
- Can Pu — PhD (MIT AeroAstro)
  Topic: Approximate Non-Gaussian Inference

- Kristopher Frey — Master's (MIT AeroAstro)
  Topic: Sparsity and Computation Reduction for High-Rate Visual-Inertial Odometry
- Xiaoyi (Jeremy) Cai —PhD (MIT AeroAstro)
  Topic: Fuel-Aware Multi-Robot Information Gathering
- Christopher Fourie — PhD (MIT AeroAstro)
  Topic: Semantic SLAM
- Shayegan Omidshafiei (served as a reader on PhD committee) — PhD (MIT AeroAstro)
  Topic: Decentralized Teaching and Learning in Cooperative Multiagent Systems

## Research Grants

- Drafted over five successful proposals under Prof. Jonathan P. How (PI)

## Professional Service and Activities

Associate Editor (Member of Editorial Board)

- IEEE Robotics and Automation Letters (RA-L) 2020-present
- IEEE International Conference on Robotics and Automation (ICRA) 2020
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2020

Program Committee Member

- IEEE ETFA 2019 (Track: Intelligent Robots & Systems)
- Multimodal Robot Perception Workshop at ICRA 2018

Reviewer

- International Journal of Robotics Research (IJRR)
- IEEE Transactions on Robotics (T-RO)
- Journal of Field Robotics (JFR)
- IEEE Robotics and Automation Letters (RA-L)
- Robotics and Autonomous Systems
- Robotics: Science and Systems (RSS)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- Australian Control Conference (AUCC)

MIT Department of Aeronautics and Astronautics

- Coordinator of MIT AeroAstro Open House

Affiliations

- MIT AeroAstro Aerospace Controls Laboratory (ACL), 2017–Present
- MIT Laboratory for Decisions & Information Systems (LIDS), 2017–Present
- Centre for Autonomous Systems (CAS), University of Technology Sydney, 2012–2017
- Robotic Embedded Systems Lab (RESL), University of Southern California, 2015–2016
- Centre of Excellence in Industrial Control, K. N. Toosi University of Technology, 2008–2012
- Advanced Robotics and Automated Systems (ARAS), K. N. Toosi University of Technology, 2008–2012

## Selected Software and Datasets

- **Resource-aware collaborative loop closure detection toolbox** (Matlab / Python)
- **CLEAR:** Multi-view matching algorithm (C++, Python, and Matlab)
- **g2o-vp:** Sparse SLAM back-end for g2o based on Sparse Variable Projection (C++)
- **Atlas:** Synthetic SLAM benchmark
- Contributions to the Mobile Robotic Programming Toolkit (MRPT) and g2o

# References


Professor Jonathan P. How
Richard Cockburn Maclaurin Professor
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Massachusetts Institute of Technology
Cambridge, MA, USA.
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Professor Gaurav S. Sukhatme
Fletcher Jones Endowed Chair in Computer Science
Executive Vice Dean of Viterbi School of Engineering
University of Southern California
Los Angeles, CA, USA.
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Professor John J. Leonard
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