

# MATTHEW GIAMOU

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## EDUCATION

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<b>University of Toronto Institute for Aerospace Studies</b> Ph.D. in Aerospace Engineering Cumulative GPA: 4.0/4.0	Expected May 2022
<b>Massachusetts Institute of Technology</b> M.S. in Aeronautics and Astronautics Cumulative GPA: 4.6/5.0	Graduated June 2017
<b>University of Toronto</b> B.A.Sc. with High Honours in Engineering Science, Aerospace Major Robotics and Mechatronics Minor Cumulative GPA: 3.86/4.00	Graduated May 2015

## RESEARCH AND WORK EXPERIENCE

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<b>University of Toronto Institute for Aerospace Studies</b> <i>Robotics Researcher</i>	January 2018 - Present Toronto, ON
<ul style="list-style-type: none"><li>· PhD student in Prof. Jonathan Kelly's Space and Terrestrial Autonomous Robotic Systems laboratory</li><li>· Developing algorithms that utilize convex optimization and machine learning for autonomous perception, state estimation, and motion planning</li><li>· Collaborating with colleagues on projects involving resource-efficient multi-agent SLAM, aerodynamic and inertial parameter estimation, and spatiotemporal sensor calibration</li><li>· Developed and taught ROB311 (Introduction to Artificial Intelligence)</li></ul>	
<b>Department of Aeronautics and Astronautics, MIT</b> <i>Robotics Researcher</i>	September 2015 - June 2017 Cambridge, MA
<ul style="list-style-type: none"><li>· Research assistant in the Aerospace Controls Lab under Professor Jonathan How</li><li>· Developed multi-agent navigation algorithms for wilderness search and rescue using quadrotors in co-operation with NASA Langley Research Center</li><li>· Integrated hardware and custom software for quadrotors; worked with a team to design and conduct indoor and outdoor demonstrations of autonomous navigation algorithms</li></ul>	
<b>University of Toronto Institute for Aerospace Studies</b> <i>Undergraduate Research Assistant</i>	May 2014 - August 2015 Toronto, ON
<ul style="list-style-type: none"><li>· Researched automatic extrinsic calibration algorithms for mobile robots and hand-held mapping devices</li><li>· Assisted with writing papers and conducting field experiments involving mobile robots</li></ul>	
<b>Infinera Canada Inc.</b> <i>Optical Network Design Engineer</i>	May 2013 - April 2014 Ottawa, ON
<ul style="list-style-type: none"><li>· Worked full time as an engineering intern on a team designing coherent optical communication systems</li><li>· Developed, optimized and tested simulations of communication channel models, adaptive filters, and state of-the-art error correcting codes in C/C++ and MATLAB</li><li>· Developed Python and C++ tools for automated cloud computing via Amazon Web Services to run and analyze large scale Monte Carlo simulations of error correcting codes</li></ul>	

**WaveDNA Inc.***Software Engineer*

April 2012 - April 2013

*Toronto, ON*

- Worked full time in the summer followed by part time during the school year as a member of an Agile software development team designing intelligent music composition software
- Designed and implemented statistical tools using Markov chain models to aid musicians in beat composition for the product's "Beat Weaver" application
- Designed and implemented music software features and user interface elements in Java
- Performed user tests and unit tests to ensure software met changing design specifications

**Department of Computer Science, University of Toronto***Undergraduate Research Assistant*

May 2011 - April 2012

*Toronto, ON*

- Worked under the supervision of Professor Gerald Penn on analysis of audio fingerprinting algorithms and their performance on feature length film audio
- Developed a user interface in Java for a named entity retrieval task
- Assisted graduate students in conducting user studies and experiments

**AWARDS AND SCHOLARSHIPS**

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**Best Paper Award Runner-Up***IEEE Int. Conf. on Multisensor Fusion and Integration (MFI)*

September 2021

*Online*

- First runner-up (with co-authors) for a paper on temporal sensor calibration

**Best Workshop Paper Award***IROS workshop on bringing geometric methods to robot learning, optimization and control*

October 2020

*Online*

- Won (with co-authors) €500 prize sponsored by the Bosch Center for AI
- Presented work on our novel distance-geometric approach to inverse kinematics

**Best Student Paper Award***Robotics: Science and Systems*

July 2020

*Online*

- Won (with co-authors) for work on a novel representation for rotations in supervised deep learning

**Royal Bank of Canada Graduate Fellowship***University of Toronto*

September 2019 - August 2021

*Toronto, ON*

- Fellowship from RBC valued at \$50,000 and awarded for research excellence focused on innovation and application of artificial intelligence

**Natural Sciences and Engineering Research Council CGS-D***University of Toronto*

May 2019 - April 2022

*Toronto, ON*

- Scholarship from the government of Canada valued at \$105,000 awarded for academic and research excellence

**Vector Institute Post-Graduate Affiliate***University of Toronto*

May 2019 - Present

*Toronto, ON*

- Selected by the Vector Institute for research excellence in applications related to machine learning and artificial intelligence
- Awarded \$6,000 and granted access to Vector Institute resources

**Queen Elizabeth II Graduate Scholarship***University of Toronto*

September 2018 - August 2019

*Toronto, ON*

- Scholarship from province of Ontario of \$15,000 awarded for academic and research excellence

**Nominated for ICRA Best Paper Award on Multi-Robot Systems***IEEE Conference on Robotics and Automation (ICRA)*

May 2018

*Brisbane, Australia*

- One of four papers nominated at the largest annual robotics conference (2,586 submissions)
- Presented work on resource-efficient communication for multi-robot SLAM to judges and audience on conference main stage

**Best Student Paper Award***IEEE Int. Conf. on Multisensor Fusion and Integration (MFI)*

September 2016

*Baden-Baden, Germany*

- Won (with co-authors) \$500 prize for work on extrinsic sensor calibration

**Summer Research Fellowship***University of Toronto Institute for Aerospace Studies*

May 2014

*Toronto, ON*

- Academic fellowship award of \$6,000 provided to conduct a summer research project

**Engineering Science Research Opportunities Program***Department of Engineering Science, University of Toronto*

May 2011

*Toronto, ON*

- Academic fellowship award of \$6,000 provided to conduct a summer research project

**TEACHING AND MENTORSHIP**

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**ROB311: Introduction to Artificial Intelligence (Instructor)***University of Toronto*

January 2021 - April 2021

*Ontario, Canada*

- Delivered lectures and tutorials to a class of 77 students; oversaw two TAs responsible for assignments
- Adapted lecture material and assignments to online requirements during COVID-19 restrictions
- Extended the course to include a unit on decision making with uncertainty based on material from Sutton and Barto's *Reinforcement Learning: An Introduction*
- Added an essay on the social and ethical implications of modern AI and its application

**ROB311 (Teaching Assistant)***University of Toronto*

January 2019 - April 2020

*Ontario, Canada*

- Co-developed and co-instructed a new course on artificial intelligence for third year Engineering Science students in the Machine Intelligence major
- Created and delivered lectures and tutorials on state space search, propositional logic, inference, constraint programming, game theory, and game-playing agents
- Developed a course syllabus, reading lists, unique Python assignments, and a midterm examination
- Received a mean score of **4.4/5** over all categories in student evaluations, exceeding the department average of 3.8/5

**Mentoring Undergraduates***University of Toronto*

May 2018 - Present

*Ontario, Canada*

- Supervised an undergraduate student from the summer of 2018 through their 4th year thesis, leading to a publication
- Helped another undergraduate student formulate a winning research award application in January 2019; worked with that student to publish multiple papers

## SELECTED PUBLICATIONS

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**Matthew Giamou\***, Filip Marić\*, David M. Rosen, Valentin Peretroukhin, Nicholas Roy, Ivan Petrović, and Jonathan Kelly. “Convex Iteration for Distance-Geometric Inverse Kinematics.” To appear in *Robotics and Automation Letters (RA-L)*. IEEE, 2022.

Jonathan Kelly, Christopher Grebe, and **Matthew Giamou**. “A Question of Time: Revisiting the Use of Recursive Filtering for Temporal Calibration of Multisensor Systems.” *Intl. Conf. on Multisensor Fusion and Integration for Intelligent Systems (MFI)*. IEEE, 2021.

Filip Marić\*, **Matthew Giamou\***, Adam W. Hall, Soroush Khoubyarian, Ivan Petrović, and Jonathan Kelly. “Riemannian Optimization for Distance-Geometric Inverse Kinematics.” To appear in *Transactions on Robotics (T-RO)*. IEEE, 2021.

Emmett Wise\*, **Matthew Giamou\***, Soroush Khoubyarian, Abhinav Grover, and Jonathan Kelly. “Certifiably Optimal Monocular Hand-Eye Calibration.” *Intl. Conf. on Multisensor Fusion and Integration for Intelligent Systems (MFI)*. IEEE, 2020.

Valentin Peretroukhin, **Matthew Giamou**, David M. Rosen, W. Nicholas Greene, Nicholas Roy, and Jonathan Kelly. “A Smooth Representation of Belief over SO(3) for Deep Rotation Learning with Uncertainty.” *Robotics: Science and Systems (RSS)*. RSS Foundation, 2020.

Filip Marić\*, **Matthew Giamou\***, Soroush Khoubyarian, Ivan Petrović, and Jonathan Kelly. “Inverse Kinematics for Serial Kinematic Chains via Sum of Squares Optimization.” *Intl. Conf. on Robotics and Automation (ICRA)*. IEEE, 2020.

**Matthew Giamou**, Ziyi Ma, Valentin Peretroukhin, and Jonathan Kelly. “Certifiably Globally Optimal Extrinsic Calibration from Per-Sensor Egomotion” *Robotics and Automation Letters (RA-L)*. IEEE, 2019.

Kasra Khosoussi, **Matthew Giamou**, Gaurav S. Sukhatme, Shoudong Huang, Gamini Dissanayake, and Jonathan P. How. “Reliable graph topologies for SLAM.” *Intl. J. of Robotics Research (IJRR)*. Sage, 2018.

**Matthew Giamou\***, Kasra Khosoussi\*, and Jonathan P. How. “Talk Resource-Efficiently to Me: Optimal Communication Planning for Distributed SLAM Front-Ends.” *Intl. Conf. on Robotics and Automation (ICRA)*. IEEE, 2018.

**Matthew Giamou**, Yaroslav Babich, Golnaz Habibi, Jonathan P. How. “Stable laser interest point selection for place recognition in a forest.” *Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE, 2017.

Jacob Lambert, Lee Clement, **Matthew Giamou**, and Jonathan Kelly. “Entropy-Based Sim(3) Calibration of 2D Lidars to Egomotion Sensors.” *Intl. Conf. on Multisensor Fusion and Integration for Intelligent Systems (MFI)*. IEEE, 2016.

Beipeng Mu, **Matthew Giamou**, Liam Paull, Ali-akbar Agha-mohammadi, John Leonard, Jonathan How. “Information-based active SLAM via topological feature graphs.” *55th Conference on Decision and Control*. IEEE, 2016.

Valentin Peretroukhin, Lee Clement, **Matthew Giamou**, and Jonathan Kelly. “PROBE: Predictive robust estimation for visual-inertial navigation.” *Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE, 2015.

\* Denotes joint first authorship.

## LEADERSHIP AND VOLUNTEERING

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### **Debates on the Future of Robotics Research III**

June 2021

*Organizing Committee*

*Online*

- Planned and structured three formal debates for a half-day virtual workshop at ICRA
- Aided in successful lobbying to organizers of future iterations of ICRA for keynote or plenary debates as part of the main conference proceedings

### **Debates on the Future of Robotics Research II**

June 2020

*Co-organizer*

*Online*

- Planned and structured three formal debates for a half-day virtual workshop at ICRA on topics including the role of datasets and benchmarks, and the failure of consumer-facing robots to apply results of human-robot interaction research

### **Crisis Text Line Powered by Kid's Help Phone**

May 2020 - Present

*Crisis Responder*

*Toronto, ON*

- Received 30+ hours of online training in suicide prevention and supporting people of all ages in crisis
- Helped over 100 at-risk individuals from across Canada via text message in weekly four hour shifts

### **Debates on the Future of Robotics Research I**

May 2019

*Co-Chair*

*Montreal, QU*

- Conceived of a novel debate-oriented workshop addressing high-level and structural challenges facing the robotics community
- Planned and structured three formal debates and a series of lightning talks at a full-day ICRA workshop

### **UTIAS Aerospace Students' Association**

September 2018 - September 2019

*Social Coordinator*

*Toronto, ON*

- Elected as social coordinator and council member by fellow graduate students
- Attending council meetings and organizing all UTIAS social events
- Captaining and organizing intramural soccer team for 2018-2019

### **Gradlife Advisory Committee**

September 2018 - April 2019

*Graduate Student Representative*

*Toronto, ON*

- Attended monthly committee meetings as a representative for U. of T.'s graduate student body
- Evaluated and provided feedback on programming and resources available to graduate students on topics ranging from mental health support to navigating career opportunities

### **FIRST Robotics**

2015 - 2019

*Competition Judge*

*Toronto, ON*

- FRC Dean's List Judge at York University District 2018
- FRC Machine, Creativity and Innovation Judge at Durham District 2018
- FIRST Lego League Robot Design Judge at Ontario Championships 2015
- Programming mentor to Martingrove Collegiate Institute's FRC team in the Winter of 2019

### **MIT Faculty Committee on the Library System**

September 2016 - May 2017

*Graduate Student Representative*

*Cambridge, MA*

- Attended monthly meetings as one of two representatives for MIT's graduate student body
- Read policy briefs and plans for library strategy and projects
- Met with diverse internal and external stakeholders to discuss the future of MIT's library system

## MITxplore Math Day

*Group Leader*

March 2016

*Cambridge, MA*

- Supervised a group of children aged 5-12 throughout a day of math activities
- Taught teamwork, communication, and math concepts

## HOBBIES

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Soccer, winter sports, spelunking, and tennis

Reading novels (mostly classics, experimental, and Russian literature)

Video games (strategy, puzzles, and narrative-driven)

Jamming with friends and family (guitar, bass, and terrible singing)