MATTHEW GIAMOU

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EDUCATION

University of Toronto Institute for Aerospace Studies Graduated March 2023
Ph.D. in Aerospace Engineering
Cumulative GPA: 4.0/4.0

Massachusetts Institute of Technology Graduated June 2017
M.S. in Aeronautics and Astronautics
Cumulative GPA: 4.6/5.0

University of Toronto Graduated May 2015
B.A.Sc. with High Honours in Engineering Science, Aerospace Major
Robotics and Mechatronics Minor
Cumulative GPA: 3.86/4.00

RESEARCH AND WORK EXPERIENCE

Northeastern University Institute for Experiential Robotics December 2022 - June 2023
Postdoctoral Researcher *Boston, MA*

- Researcher with Prof. Dave Rosen's Robust Autonomy Lab (NEU-RAL)
- Investigating global polynomial optimization for robust formulations of challenging perception and estimation problems in robotics

University of Toronto Institute for Aerospace Studies January 2018 - December 2022
Robotics Researcher *Toronto, ON*

- PhD student in Prof. Jonathan Kelly's Space and Terrestrial Autonomous Robotic Systems laboratory
- Developed algorithms that utilize convex optimization and machine learning for autonomous perception, state estimation, and motion planning
- Collaborated with colleagues on projects involving resource-efficient multi-agent SLAM, aerodynamic and inertial parameter estimation, and spatiotemporal sensor calibration
- Developed and taught ROB311 (Introduction to Artificial Intelligence)

Department of Aeronautics and Astronautics, MIT September 2015 - June 2017
Robotics Researcher *Cambridge, MA*

- Research assistant in the Aerospace Controls Lab under Professor Jonathan How
- Developed multi-agent navigation algorithms for wilderness search and rescue using quadrotors in co-operation with NASA Langley Research Center
- Integrated hardware and custom software for quadrotors; worked with a team to design and conduct indoor and outdoor demonstrations of autonomous navigation algorithms

University of Toronto Institute for Aerospace Studies May 2014 - August 2015
Undergraduate Research Assistant *Toronto, ON*

- Researched automatic extrinsic calibration algorithms for mobile robots and hand-held mapping devices
- Assisted with writing papers and conducting field experiments involving mobile robots

Infinera Canada Inc. May 2013 - April 2014
Optical Network Design Engineer *Ottawa, ON*

- Worked full time as an engineering intern on a team designing coherent optical communication systems

- Developed, optimized and tested simulations of communication channel models, adaptive filters, and state of-the-art error correcting codes in C/C++ and MATLAB
- 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

WaveDNA Inc. April 2012 - April 2013
Software Engineer *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 May 2011 - April 2012
Undergraduate Research Assistant *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

Best Paper Award Runner-Up September 2021
IEEE Int. Conf. on Multisensor Fusion and Integration (MFI) *Online*

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

Best Workshop Paper Award October 2020
IROS workshop on bringing geometric methods to robot learning, optimization and control *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 July 2020
Robotics: Science and Systems *Online*

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

Royal Bank of Canada Graduate Fellowship September 2019 - August 2021
University of Toronto *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 May 2019 - April 2022
University of Toronto *Toronto, ON*

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

Vector Institute Post-Graduate Affiliate May 2019 - Present
University of Toronto *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 September 2018 - August 2019
University of Toronto *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 May 2018
IEEE Conference on Robotics and Automation (ICRA) *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 September 2016
IEEE Int. Conf. on Multisensor Fusion and Integration (MFI) *Baden-Baden, Germany*

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

Summer Research Fellowship May 2014
University of Toronto Institute for Aerospace Studies *Toronto, ON*

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

Engineering Science Research Opportunities Program May 2011
Department of Engineering Science, University of Toronto *Toronto, ON*

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

TEACHING AND MENTORSHIP

ROB311: Introduction to Artificial Intelligence (Instructor) January 2021 - April 2021
University of Toronto *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) January 2019 - April 2020
University of Toronto *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 May 2018 - Present
University of Toronto *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

Matthew Giamou. "Semidefinite Programming Relaxations for Geometric Problems in Robotics." *Doctoral Dissertation*. University of Toronto, 2023.

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, Ziye 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

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 March 2016
Group Leader *Cambridge, MA*

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

HOBBIES

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)