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(Last updated: March 9, 2020.)

## RESEARCH INTERESTS

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Machine Learning for Robotics and Control. Combining models and data in a closed-loop system architecture to improve the safety, performance and reliability of robotic systems. Algorithms that enable robots to safely and effectively operate in increasingly unstructured, uncertain and changing environments, alongside humans, and over long periods of time. Algorithms that enable a seamless interaction between technical systems and the physical world.

## ACADEMIC APPOINTMENTS

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**Assistant Professor (Tenure Track)**, University of Toronto, Canada. since 01/2013  
Institute for Aerospace Studies, Faculty of Applied Science and Engineering.

**Postdoctoral Researcher and Lecturer**, ETH Zurich, Switzerland. 2012  
Institute for Dynamic Systems and Control, with Prof. Raffaello D'Andrea. Five-month appointment.

**Research Assistant**, ETH Zurich, Switzerland. 2008–2012  
Institute for Dynamic Systems and Control, with Prof. Raffaello D'Andrea.

## EDUCATION

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**Dr. sc. (Ph.D.), Robotics and Control**, ETH Zurich, Switzerland. 2013  
Institute for Dynamic Systems and Control, Dept. of Mechanical and Process Engineering.  
Advisor: Prof. Raffaello D'Andrea. Referee: Prof. Andrew Alleyne. Thesis title: "Improving tracking performance by learning from past data." Awards: ETH Medal, Dimitris N. Chorafas Foundation Prize.

**Dipl.-Ing. (M.Sc.), Engineering Cybernetics**, University of Stuttgart, Germany. 2008  
Advisor: Prof. Frank Allgöwer. With highest honors, GPA<sup>1</sup>: 1.0. Thesis title: "Stability of a network of dynamical systems with communication delays." Awards: Professor-Peter-Sagirow Award, German National Academic Foundation Scholarship, Cusanuswerk Scholarship, German Academic Exchange Service Scholarship.

**M.Sc., Engineering Science & Mechanics**, Georgia Institute of Technology, USA. 2007  
Advisor: Prof. Magnus Egerstedt. GPA: 4.0/4.0. Thesis title: "Optimal control of hybrid systems with regional dynamics."

**Abitur**, Max-Born Gymnasium Backnang, Germany. 2002  
High school diploma. Valedictorian, GPA<sup>1</sup>: 1.0. Awards: High School Graduation Awards in Mathematics and the Natural Sciences.

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<sup>1</sup>The German grading scale ranges from 1.0 (excellent, equals A+) to 5.0 (insufficient, equals F). Grades are given out in 0.1 increments. The minimum score required to pass is 4.0.

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## AFFILIATIONS AND LEADERSHIP ROLES

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**Faculty Member**, Vector Institute for Artificial Intelligence, Toronto, Canada. since 09/2019

The Vector Institute is an independent, not-for-profit institution dedicated to advancing the field of artificial intelligence, with a focus on deep learning and machine learning. It is part of Canada's \$125M Pan-Canadian Artificial Intelligence [Strategy](#). Faculty members receive funding and access to computing resources among other things. Previously, I was an Affiliate Faculty Member from 01/2018–08/2019. [[website](#)] [[overview slides](#)]

**Principal Faculty Advisor**, SAE AutoDrive Challenge Team, Toronto, Canada. since 05/2017

I am leading together with T. Barfoot the University of Toronto's student team participating in a three-year self-driving car competition initiated by General Motors and SAE International, and co-sponsored by numerous automotive suppliers. The team consists of 50-60 undergraduate and graduate students from different engineering and computer science programs. [[website](#)]

**Associate Director**, Centre for Aerial Robotics Research and Education, Canada. since 08/2015

I helped to establish and lead this interdisciplinary centre at the University of Toronto. It focuses on aerial robotics and brings together researchers from three Canadian universities, six European and US schools, and a dozen of Canadian startups. [[website](#)]

**Affiliate Faculty Member**, Lassonde Institute for Mining, Toronto, Canada. since 08/2015

The Lassonde Institute at the University of Toronto enables and supports interdisciplinary research in mining. [[website](#)]

**Affiliate Faculty Member**, University of Toronto Robotics Institute, Toronto, Canada. since 01/2013

This interdepartmental institute at the University of Toronto fosters collaborative research and runs educational programs in robotics. [[website](#)]

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## AWARDS AND HONORS

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### Summary

My research contributions have been recognized by several national and international awards and honors:

- **Early-Career Awards (8):** RSS Early Career Spotlight (*international award*), named one of 35 Innovators Under 35 by MIT Technology Review (*international*), IEEE Fellowship in Robotics & Automation Finalist (*international*), Sloan Research Fellowship (*U.S./Canada*), Canada Research Chair (*Canada*), Ministry of Research, Innovation & Science Early Researcher Award (*Canada*), nominated for Canada's Top 40 Under 40 (*Canada*), Connaught New Researcher Award (*University of Toronto*);
- **Other Research-Related Honors (14):** two ICRA Best Paper Award Nominations (*international*), Michael Dukakis Leadership Fellow (*international*), two Best Robotics Paper Awards and one Best Poster Presentation Award at the Conference on Computer and Robot Vision (*international*), \$1M Drones For Good Competition Finalist (*international*), Subject Matter Expert for Flying Car Nanodegree at Udacity Inc (*international*), Canada CIFAR AI Chair (*international*), First Place in the AutoDrive Challenge in 2018 and 2019 (*U.S./Canada*), Principal Investigator of the NSERC Canadian Robotics Network (*Canada*), Faculty Member at the Vector Institute for Artificial Intelligence (*Canada*), MIT Enabling Society Tech Competition First Prize (*M.I.T.*);
- **PhD Awards (2):** Dimitris N. Chorafas Foundation Prize (*international*), ETH Medal (*ETH Zurich*);
- **Leadership & Outreach Awards (3):** Named one of "25 women in robotics you need to know about" (*international*), IEEE Control Systems Society Video Clip Contest Finalist (*international*), Science Leadership Program Fellow (*Canada*).

## Complete List

**Faculty Member**, Vector Institute for Artificial Intelligence, Toronto, Canada. since 2019

The Vector Institute focuses on research in deep learning and machine learning more broadly, working with industry sponsors, universities and public institutions to support the growing artificial intelligence ecosystem in Canada. Selection criteria included: (i) excellence in research at the highest international level (publications and awards); (ii) active academic research in machine learning or extensive innovative use of machine learning in applications; and (iii) extent to which the applicant's research strengthens and supports the vision and mission of the Vector Institute. Faculty members receive funding and access to computing resources among other things. Previously, I was an Affiliate Faculty Member from 01/2018–08/2019. [[website](#)]

**Canada CIFAR AI Chair**, Canadian Inst. for Advanced Research (CIFAR). 2019–2024

The goal of the Chairs Program is to recruit and retain in Canada some of the world's leading researchers in AI and provide them with long-term, dedicated research funding to support their research programs and help them train the next generation of AI leaders. [[more details](#)]

**Canada Research Chair (Tier 2)**, Federal Tri-agency Institutional Programs, Canada. 2018–2023

I hold the *Canada Research Chair in Machine Learning for Robotics and Control*. Canada Research Chairs were established to “attract and retain some of the world's most accomplished and promising minds.” Tier 2 Chairs are intended for “exceptional emerging scholars” (i.e., candidates with less than ten years of experience at the time of nomination). [[website](#)] [[University of Toronto press release](#)]

**Principal Investigator**, NSERC Canadian Robotics Network. 2018–2023

I was selected as the youngest of 14 robotics researchers in Canada to participate in this Canada-wide research network led by Prof. G. Dudek (McGill). The scope of the project includes \$6M in funding from NSERC, the Canadian federal funding agency, and \$4M from a total of 11 partner companies.

**Early Researcher Award**, Ministry of Research, Innovation & Science, Ontario, Canada. 2017–2022

This is one of the premier early-career awards in Canada. [[website](#)]

**First Place Twice in the AutoDrive Challenge**, SAE International, USA. 2018, 2019

AutoDrive is a three-year self-driving car competition initiated by General Motors and SAE International, and co-sponsored by many automotive suppliers (Velodyne, Intel, Continental, Bosch, etc). Students are tasked to turn a Chevrolet Bolt electric vehicle into a fully autonomous passenger vehicle by Year 3. Eight university teams from across North America participate including Texas A&M, Virginia Tech, and Michigan State University. The team I am co-leading won the Year 1 and Year 2 competition, and received US\$41K total. [[competition website](#)] [[team website](#)]

**RSS Early Career Spotlight Award**, Robotics: Science and Systems Conference (RSS). 2019

I was selected (as one of two) to give an Early Career Spotlight Talk at RSS 2019. The award acknowledges the outstanding accomplishments and exceptional potential of early-career researchers in robotics. [[spotlight talk](#)]

**Best Paper Award Robot Vision**, Conference on Computer and Robot Vision (CRV). 2019

Paper: “Point me in the right direction: improving visual localization on UAVs with active gimballed camera pointing”, Patel, Warren, Schoellig. [[paper](#)]

**Best Poster Presentation Award**, Conference on Computer and Robot Vision (CRV). 2019

Paper: “aUToTrack: a lightweight object detection and tracking system for the SAE AutoDrive challenge”, Burnett, Samavi, Waslander, Barfoot, Schoellig. [[paper](#)]

**Two Best Paper Award Nominations**, IEEE Intl. Conf. on Robotics and Automation (ICRA). 2019

Our paper entitled “Fast and in sync: periodic swarm patterns for quadrotors” (Du, Luis, Vukosavljev, Schoellig) was nominated for the *Best Paper Award on Multi-Robot Systems* and the *Best Paper Award on Unmanned Aerial Vehicles*.

**Nominated for Canada's Top 40 Under 40**, Caldwell Partners International Inc. 2019  
 "Since 1995, these awards have been presented to 40 exceptional Canadians under the age of 40, outstanding leaders shaping the country's future." [[website](#)]

**Sloan Research Fellowship**, Alfred P. Sloan Foundation, New York, USA. 2017–2019  
 This award for early-career researchers in the U.S. and Canada is "in recognition of distinguished performance and a unique potential to make substantial contributions to their field." I have been awarded one of 16 Sloan Research Fellowships in the category 'Computer Science'. Out of the 16, two are in the broad area of robotics. [[Sloan website](#)] [[University of Toronto press release](#)]

**Subject Matter Expert for Flying Car Nanodegree**, Udacity Inc. 2017–2018  
 I was selected to teach this online degree together with Profs. Nicholas Roy (MIT) and Sebastian Thrun (Stanford). We had a total of 800 students in the first two cohorts. Udacity is a for-profit educational organization offering massive open online courses (MOOCs). [[course information](#)]

**Michael Dukakis Leadership Fellow**, The Boston Global Forum, USA. 2017–2018  
 The mission of the Michael Dukakis Institute for Leadership and Innovation is to create innovative solutions and initiatives aimed at solving important global issues including Cybersecurity and Artificial Intelligence (AI). I have been named a fellow to contribute to the AI Ethics and Standards initiatives.

**Special Merit Award**, University of Toronto Institute for Aerospace Studies. 2015, 2018  
 Select, merit-based salary increase based on performance during the previous academic year.

**Named one of 35 Innovators Under 35**, MIT Technology Review, USA. 2017  
 This award has recognized innovators *worldwide* for the past 17 years, "whose work has been profoundly influential on the direction of technology that will change the way we work and live," says editor David Rotman. I was selected in the category 'Pioneer'. Previous honorees include the cofounders of Google; Mark Zuckerberg, the cofounder of Facebook; and Jonathan Ive, the chief designer of Apple. [[article](#)] [[University of Toronto press release](#)]

**Connaught New Researcher Award**, University of Toronto. 2015–2017  
 I received this early researcher award for the application entitled "Safety and performance for next-generation robots through continuous online learning." Success rate for this funding level was 32%.

**Distal Fellow**, NSERC Canadian Field Robotics Network (NCFRN). 2013–2017  
 The NCFRN is a Canada-wide initiative in Field Robotics that brings together academic researchers, and industrial and government partners. The fellow program was established to engage with promising, young robotics researchers in Canada. Selection was based on academic achievements by a vote of the NCFRN Scientific Steering Committee.

**First Prize in the MIT Enabling Society Tech Competition**, M.I.T., USA. 2015  
 We received this prize (\$3K) for the project *Waterfly*, a "swarm" of drones for environmental monitoring. This was a collaboration with the MIT SENSEable City Lab. [[project page](#)]

**\$1M Drones For Good Competition Finalist**, Government of the United Arab Emirates. 2015  
 We were one of 19 international finalists among over 800 entries (2.4% success rate) with the project *Waterfly*, a "swarm" of drones for environmental monitoring. This was a collaboration with the MIT SENSEable City Lab. [[project website](#)]

**Video Clip Contest Finalist**, IEEE Control Systems Society (CSS). 2014  
 Our video was among the top seven videos out of 53 submissions. [[video](#)]

**Best Robotics Paper Award**, Conference on Computer and Robot Vision (CRV). 2014  
 Paper: "Speed daemon: experience-based mobile robot speed scheduling", Ostafew, Schoellig, Barfoot, Collier. [[video](#)]

**Science Leadership Program Fellow**, University of Toronto. 2014

I was the youngest of 21 faculty members selected from across in Canada to participate in the 2nd annual program, based on “excellence in research and teaching” and “a passion and capacity to exercise leadership and enthusiasm for communicating science.” [[program details](#)], [[news article](#)]

**Dimitris N. Chorafas Foundation Prize**, Dimitris N. Chorafas Foundation. 2013

This award (\$5K) honors innovative Ph.D. research *worldwide* in a wide range of fields, from life sciences and biotechnology to physics, computer technology, and engineering. I am one of 35 recipients.

**ETH Medal**, ETH Zurich. 2013

The ETH Medal (\$2K) is awarded to the top 8% of Ph.D. dissertations at ETH Zurich.

**Named one of “25 women in robotics you need to know about (2013)”**, Robohub.org. 2013

The 2013 list compiled by Robohub.org, a leading professional robotics online platform, includes robotics researchers such as Daniela Rus (MIT), Manuela Veloso (CMU), and Maja Matarić (USC). [[website](#)]

**Three Student Travel Awards**, different international conference committees. 2010–2012

I received travel awards (US\$500 to US\$1300 each) to present research results at major robotics and controls conferences: ACC 2012, CDC 2010, ICRA 2010.

**IEEE Fellowship in Robotics & Automation Finalist**, IEEE Robotics & Automation Society. 2008

The award aims to support prospective leaders in robotics and automation.

**Three Graduate Scholarships**, federally-funded scholarship organizations, Germany. 2005–2008

I received the following scholarships: from the *German National Academic Foundation* (2005–2008, \$33K, awarded to the top 3% of students from all disciplines), from the *Cusanuswerk* (2005–2008, \$35K), and from the *German Academic Exchange Service* (2006–2007, \$22K, included full tuition for my studies at Georgia Tech).

**Professor-Peter-Sagirow Award**, University of Stuttgart, Germany. 2005

For outstanding performance in the undergraduate program Engineering Cybernetics. Awarded to the top two students out of 70.

**Two High School Graduation Awards**, Max-Born Gymnasium Backnang, Germany. 2002

For outstanding achievements in mathematics and the natural sciences. Awarded to the top student out of 90 graduates.

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## RESEARCH FUNDING

I have obtained funding from the *Natural Sciences and Engineering Research Council of Canada (NSERC)*, the *Canada Foundation for Innovation (CFI)*, the *Ontario Research Fund (ORF)*, and the *Ontario Centres of Excellence (OCE)*. I have also contributed to grant applications to the *Swiss National Science Foundation (SNSF)*. All grants awarded and under review are listed below with their total grant amounts in the corresponding national currency. For joint, non-equipment grants, the amount of my share is provided as well.

## Summary

- Research funding to date exceeds \$5.2M from 37 successful grants, 23 as Principal Investigator.
- This includes \$3.54M of secured operational funding for my research group (for comparison, we budget \$30K/student year) and an additional \$1.71M in secured infrastructure funding (including shared equipment).

## Complete List

### □ *Principal Investigator*

- Canada Research Chair Tier 2 (\$600K)**, Federal Tri-agency Programs, Canada. 2018–2023  
Research program in Machine Learning for Robotics and Control.
- CARTE Seed Funding (\$60K, total: \$120K; applied)**, University of Toronto. 2020–2022  
“Giving robots a sense of touch: safe, high-performance robot manipulation combining novel skin-like sensors with high-rate, learning-based feedback control.” Co-applicants: X. Liu (MIE).
- Elevate Postdoctoral Fellowship (\$120K)**, Mitacs. 2020–2022  
“Multi-agent reinforcement learning for decentralized UAV/UGV cooperative exploration.”
- Early Researcher Award (\$150K)**, ORF. 2017–2022  
“Efficient and safe learning algorithms for enhanced robot capabilities in human-centered environments.”
- DND/NSERC Research Partnership Program (\$227K, total: \$454K)**, NSERC. 2017–2022  
“Visual breadcrumbs for emergency return of unmanned aerial vehicles.” Co-applicants/Collaborators: T. Barfoot (Aero), Drone Delivery Canada Corp, Defence R&D Canada.
- XSeed Funding Program (\$40K, total: \$120K)**, University of Toronto. 2019–2021  
“Active and sample-efficient robot learning with human guidance: algorithm development and robot demonstrations.” Co-applicants: F. Shkurti (Mathematical & Computational Sciences), T. Grossman (CS).
- Collaborative Research and Development Grant (\$195K, total: \$274K)**, NSERC. 2019–2021  
“Networked drones for concrete structure and environmental surveys.” Co-applicants/Collaborators: D. Hooton (CIV), K. Peterson (CIV), Ontario Power Generation.
- Seed Fund (\$37,500, total: \$75K)**, Medicine by Design Program, University of Toronto. 2019–2020  
“Robocell: Functional emergence in tissues and drones.” Co-applicant: P. Zandstra (Biomedical Engineering).
- Research Tools and Instruments Grant (\$150K)**, NSERC. 2018–2020  
“The University of Toronto Robotics Innovation Garage: a collaborative space for interdisciplinary research in mobile robotics.” Co-applicants: K. Esmaeili (Mining), B. McCabe (CIV), M. Broucke (ECE). Success rate: 20%.
- Donation (\$72K)**, Kenneth M. Molson Foundation. 2018–2020  
“Vision-based, aerial inspection in human-centered environments.”
- AutoDrive Challenge (~\$200K; equipment:~\$150K)**, SAE International and partners. 2017–2020  
Selected as one of eight teams in the U.S. and Canada, our self-driving competition team receives monetary support and equipment donations from the Society of Automotive Engineers (SAE), General Motors (GM), and various automotive suppliers. Jointly with T. Barfoot (Aero).
- Dean’s Strategic Fund (\$521K)**, University of Toronto. 2017–2020  
“AutoDrive competition.” Jointly with T. Barfoot (Aero).
- AutoDrive Challenge Donations (\$76K)**, various companies and foundations. 2017–2020  
Our self-driving competition team was sponsored by: Gary Goldberg (\$15K), Krembil Foundation (\$15K), Computer Science Department (\$1K), Fleet Complete (\$25K), Geotab (\$15K), Deeplearni.ng (\$15K). Jointly with T. Barfoot (Aero).
- Discovery Grant (\$186K)**, NSERC. 2014–2020  
“Learning and adaptation for long-term autonomous robotics applications.”

- Voucher for Innovation and Productivity 1 (VIP 1) (\$35K)**, OCE. 2018–2019  
 “Autonomous vehicle scoring framework.” Collaborator: Geotab Inc.
- Sloan Research Fellowship (US\$60K)**, Alfred P. Sloan Foundation. 2017–2019  
 “Safe and efficient learning for enhanced robot capabilities in human-centered environments.”
- Electric Vehicle Research Centre Fund (\$100K)**, University of Toronto. 2017–2019  
 “Incorporating human feedback into self-driving algorithms.” Collaborator: The Havelaar Group.
- Dean’s Strategic Fund (\$72K, total: \$216K)**, University of Toronto. 2017–2019  
 “Where the rubber meets the road: Seed funding for collaborative self-driving car research between FASE (Robotics) and CS (Artificial Intelligence).” Co-applicants: T. Barfoot (Aero) and others.
- SOSCIP–TalentEdge Postdoctoral Fellowship w/ HQP Accelerator (\$160K)**, OCE. 2017–2019  
 “Safe learning-based control for high-precision assembly robots in advanced aerospace manufacturing.” *Grant also provides access to high-performance cloud computing including GPU platform access.* Collaborator: MDA Robotics (MacDonald, Dettwiler and Associates Ltd).
- John R. Evans Leaders Fund (JELF) (\$135K)**, CFI. 2015–2019  
 “Indoor/outdoor testbed for aerial and ground multi-robot research.” Co-applicants: T. Barfoot (Aero), J. Kelly (Aero).
- Provincial Matching Component for CFI-JELF (\$135K)**, ORF. 2015–2019  
 “Indoor/outdoor testbed for aerial and ground multi-robot research.” Co-applicants: T. Barfoot (Aero), J. Kelly (Aero).
- Engage Grant (\$25K)**, NSERC. 2016–2017  
 “Automatic on-the-ground wind stabilization system for hybrid aerial vehicle.” Collaborator: Solar Ship Inc.
- Connaught New Researcher Award (\$35K)**, University of Toronto. 2015–2017  
 “Safety and performance for next-generation robots through continuous online learning.” Success rate: 32%.
- Research Tools and Instruments Grant (\$150K)**, NSERC. 2015–2017  
 “Aerial vehicle platforms and sensor payloads to support research on autonomous, long-term monitoring of natural and agricultural resources.” Co-applicants: T. Barfoot (Aero), J. Kelly (Aero). Success rate: 33%.
- *Co-Principal Investigator*
- Research Excellence Round 10 (\$1.6M, total: \$6.5M; applied)**, ORF. 2019–2024  
 “All-weather autonomy: securing Ontario’s leadership in the self-driving revolution.” With S. Waslander (PI, Aero), T. Barfoot (Aero), J. Kelly (Aero). Collaborator: General Motors, LG Electronics, Applanix, Algolux.
- Strategic Partnership Grants for Networks (\$250K, total: \$6M)**, NSERC. 2018–2023  
 “NSERC Canadian Robotics Network.” With G. Dudek (PI, from CS, McGill) and 9 others. Collaborators: Applanix, Barrick Gold Corp, Clearpath Robotics, CrossWing Inc, ElementAI, FPInnovations, General Dynamics Land Systems, Huawei, Kinova Robotics; Canadian Space Agency, Defence Research and Development Canada, National Research Council, Open Source Robotics Foundation.
- Innovation Fund 2020 (\$723K; applied)**, CFI. 2021–2022  
 “Flying labs - unmanned aerial systems for high-resolution observations of the biosphere and environmental monitoring.” With I. Ensminger (PI, Biology) and 8 others from U of T Biology, Geography, Chemical and Physical Sciences. Ecology, Mathematical and Computational Sciences and Physics.
- Large Infrastructure Grant (associated with CFI grant) (\$723K; applied)**, ORF. 2021–2022  
 “Flying labs - unmanned aerial systems for high-resolution observations of the biosphere and environmental monitoring.” With I. Ensminger (PI, Biology) and 8 others from U of T Biology, Geography, Chemical and Physical Sciences. Ecology, Mathematical and Computational Sciences and Physics.



- Research Tools and Instruments Grant (\$147K)**, NSERC. 2019–2021  
“Robotic lake and river monitoring.” With T. Barfoot (PI, from Aero).
- Dean’s Strategic Fund (\$456K; applied)** University of Toronto. 2018–2021  
“Connecting the bots: accelerating joint robotics research between UTIAS and UTM” With T. Barfoot (Aero) and others.
- Dean’s Strategic Fund (\$45K, total: \$174K)**, University of Toronto. 2018–2021  
“Better together: moving collaborative robots out of the laboratory and into the real world.” With J. Kelly (Aero) and others.
- Collaborative Research and Training Experience (\$149K, total: \$1.65M)**, NSERC. 2015–2021  
“Research and training program in unmanned aerial vehicles.” With H.H.T. Liu (PI, from Aero) and 9 others. Success rate: 14%.
- Voucher for Innovation and Productivity 2 Grant (\$75, total: \$150K)**, OCE. 2018–2020  
“Real-time mining data acquisition and decision-making using unmanned aerial vehicle systems.” With K. Esmaili (PI, Mining). Collaborator: McEwen Mining.
- Collaborative Research and Development Grant (\$134, total: \$268K)**, NSERC. 2017–2020  
“Development of unmanned aerial vehicle systems for real-time mining data acquisition and decision making.” With K. Esmaili (PI, Mining). Collaborator: McEwen Mining.
- Research Tools and Instruments Grant (\$150K)**, NSERC. 2017–2019  
“Self-driving car perception platform.” With T. Barfoot (PI, from Aero), J. Kelly (Aero).
- Dean’s Strategic Fund (\$52K, total: \$367K)**, University of Toronto. 2015–2018  
“Centre for Aerial Robotics Research and Education.” With H.H.T. Liu (PI, from Aero) and 5 others.
- Research Tools and Instruments Grant (\$147K)**, NSERC. 2014–2016  
“Infrastructure to support research on long-term visual navigation of multiple autonomous robots.” With J. Kelly (PI, from Aero), T. Barfoot (Aero). Success rate: 38%.
- John R. Evans Leaders Fund (JELF) (\$127K)**, CFI. 2014–2016  
“Mobile mapping and manipulation.” With J. Kelly (PI, from Aero), T. Barfoot (Aero).
- Provincial Matching Component for CFI-JELF (\$127K)**, ORF. 2014–2016  
“Mobile mapping and manipulation.” With J. Kelly (PI, from Aero), T. Barfoot (Aero).
- Research Tools and Instruments Grant (\$145K)**, NSERC. 2013–2015  
“Field robot to support research on long-term autonomous navigation.” With T. Barfoot (PI, from Aero), J. Kelly (Aero). Success rate: 23%.

□ *Contributor*

- Project Funding (CHF 529K)**, SNSF. 2012–2014  
“High-performance maneuvers and trajectory generation for quadrotor flying vehicles.” With R. D’Andrea (PI, ETH Zurich).
- Research Equipment (CHF 96K)**, SNSF. 2011–2012  
“Optical motion capture system for robot experiments in real world environments.” With R. D’Andrea (PI, ETH Zurich).



## PUBLICATIONS

Conference papers are full-paper-refereed with *typical acceptance rates of 15% to 40%*. Below students supervised by me are in **bold** and former advisors are underlined. Supplementary material for publications including videos, code, and slides can be found [\[here\]](#).

## Summary

- Career Totals: \*Other publications include refereed abstracts and videos, and invited articles.

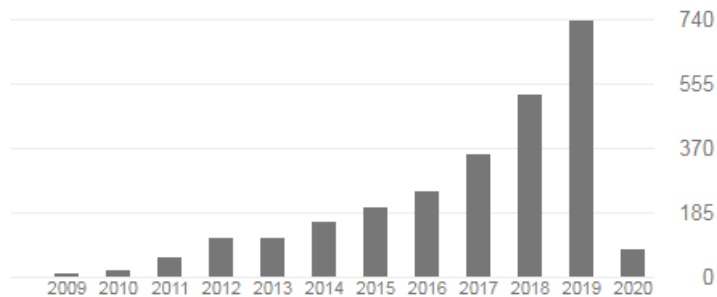
| Total # of Publications      | 105 (+6 submitted) |
|------------------------------|--------------------|
| Refereed journal articles    | 24 (+2 submitted)  |
| Refereed conference articles | 64 (+4 submitted)  |
| Other publications*          | 17                 |

- Citations (according to [Google Scholar](#), 5 March 2020):

| Top Cited Papers |       |       |       |       |       |       |       |       |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Paper:           | [C57] | [J21] | [C52] | [C24] | [J19] | [J24] | [J20] | [C41] |
| Count:           | 368   | 195   | 169   | 155   | 144   | 132   | 118   | 95    |

## Citations Summary

|                  |      |
|------------------|------|
| Total citations: | 2658 |
| h-index:         | 26   |
| i10-index:       | 42   |



## Complete List

□ *Journal Articles (appeared or accepted)*

- [J1] C. E. **Luis**, M. **Vukosavljev**, and A. P. Schoellig, “Online trajectory generation with distributed model predictive control for multi-robot motion planning,” *IEEE Robotics and Automation Letters*, vol. 5, no. 2, pp. 604–611, 2020. [\[pdf\]](#)
- [J2] J. N. **Wong**, D. J. Yoon, A. P. Schoellig, and T. D. Barfoot, “A data-driven motion prior for continuous-time trajectory estimation on SE(3),” *IEEE Robotics and Automation Letters*, vol. 5, no. 2, pp. 1429–1436, 2020. [\[pdf\]](#)
- [J3] C. D. **McKinnon** and A. P. Schoellig, “Estimating and reacting to forces and torques resulting from common aerodynamic disturbances acting on quadrotors,” *Robotics and Autonomous Systems*, 2020, in print. [\[pdf\]](#)
- [J4] M. **Vukosavljev**, A. P. Schoellig, and M. E. Broucke, “A modular framework for motion planning using safe-by-design motion primitives,” *IEEE Transactions on Robotics*, vol. 35, no. 5, pp. 1233–1252, 2019. [\[pdf\]](#)

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- [J5] A. **Hock** and A. P. Schoellig, “Distributed iterative learning control for multi-agent systems,” *Autonomous Robots*, vol. 43, no. 8, pp. 1989–2010, 2019. [\[pdf\]](#)
  - [J6] M. K. **Helwa**, A. **Heins**, and A. P. Schoellig, “Provably robust learning-based approach for high-accuracy tracking control of Lagrangian systems,” *IEEE Robotics and Automation Letters*, vol. 4, no. 2, pp. 1587–1594, 2019. [\[pdf\]](#)
  - [J7] C. D. **McKinnon** and A. P. Schoellig, “Learn fast, forget slow: safe predictive control for systems with unknown and changing dynamics performing repetitive tasks,” *IEEE Robotics and Automation Letters*, vol. 4, no. 2, pp. 2180–2187, 2019. [\[pdf\]](#)
  - [J8] C. E. **Luis** and A. P. Schoellig, “Trajectory generation for multiagent point-to-point transitions via distributed model predictive control,” *IEEE Robotics and Automation Letters*, vol. 4, no. 2, pp. 375–382, 2019. [\[pdf\]](#)
  - [J9] M. **Warren**, M. **Greeff**, B. **Patel**, J. Collier, A. P. Schoellig, and T. D. Barfoot, “There’s no place like home: visual teach and repeat for emergency return of multirotor UAVs during GPS failure,” *IEEE Robotics and Automation Letters*, vol. 4, no. 1, pp. 161–168, 2019. [\[pdf\]](#)
  - [J10] F. **Berkenkamp**, A. P. Schoellig, and A. Krause, “No-regret Bayesian optimization with unknown hyperparameters,” *Journal of Machine Learning Research*, vol. 20, no. 50, pp. 1–24, 2019. [\[pdf\]](#)
  - [J11] K. **Pereida**, D. **Kooijman**, R. R. P. R. **Duivenvoorden**, and A. P. Schoellig, “Transfer learning for high-precision trajectory tracking through adaptive feedback and iterative learning,” *International Journal of Adaptive Control and Signal Processing*, vol. 33, no. 2, pp. 388–409, 2019. [\[pdf\]](#)
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- [A8] C. **McKinnon** and A. P. Schoellig, “Data-driven interaction for quadrotors based on external forces,” Video Submission, *Assn. of the Advancement of Artificial Intelligence (AAAI) AI Video Competition*, 2016. [[video](#)]
- [A9] F. **Berkenkamp**, A. P. Schoellig, and A. Krause, “Safe controller optimization for quadrotors with Gaussian processes,” Abstract and Presentation, in *Proc. of the Second Machine Learning in Planning and Control of Robot Motion Workshop at the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2015. [[pdf](#)]
- [A10] A. P. Schoellig, F. L. **Mueller**, and R. D’Andrea, “Quadrocopter slalom learning,” Video Submission, *AI and Robotics Multimedia Fair, Conf. on Artificial Intelligence (AI), Assn. of the Advancement of Artificial Intelligence (AAAI)*, 2012. [[video](#)]
- [A11] S. Lupashin, A. P. Schoellig, M. Hehn, and R. D’Andrea, “The Flying Machine Arena as of 2010,” Video Submission, in *Proc. of the IEEE International Conference on Robotics and Automation (ICRA)*, 2011, pp. 2970–2971. [[pdf](#)] [[video](#)]
- [A12] A. P. Schoellig and R. D’Andrea, “Learning through experience – Optimizing performance by repetition,” Abstract and Poster, in *Proc. of the Robotics Challenges for Machine Learning Workshop at the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2008. [[pdf](#)] [[poster](#)]

#### □ Book Chapters

- [B1] A. P. Schoellig, H. Siegel, F. **Augugliaro**, and R. D’Andrea, “So you think you can dance? Rhythmic flight performances with quadrocopters,” in *Controls and Art*, A. LaViers and M. Egerstedt, Eds. Springer, pp. 73–105, 2014. [[pdf](#)]
- [B2] P. E. Caines, M. Egerstedt, R. P. Malhamé, and A. P. Schoellig, “A hybrid Bellman equation for bimodal systems,” in *Hybrid Systems: Computation and Control*, ser. Lecture Notes in Computer Science. A. Bemporad, A. Bicchi, and G. Buttazzo, Eds. Springer Berlin Heidelberg, 2007, vol. 4416, pp. 656–659. [[pdf](#)]

#### □ Professional Magazine Articles

- [P1] L. Clement, V. Peretroukhin, M. Giamou, J. Leonard, H. Kress-Gazit, J. How, M. Milford, O. Brock, R. Gariepy, A. P. Schoellig, N. Roy, H. Siegel, L. Righetti, A. Billard, and J. Kelly, “Where do we go from here? Debates on the future of robotics research at ICRA 2019 [From the Field],” *IEEE Robotics and Automation Letters*, vol. 26, no. 3, pp. 7–10, 2019. [[pdf](#)]
- [P2] T. **Bamford**, K. Esmaili, and A. P. Schoellig, “Rock fragmentation analysis using UAV technology,” *Ontario Professional Surveyor (OPS) Magazine*, Assn. of Ontario Land Surveyors, 2016. [[pdf](#)]
- [P3] R. Ritz, M. W. Müller, F. **Augugliaro**, M. Hehn, S. Lupashin, A. P. Schoellig, R. D’Andrea, “An aerial robotics demonstration for controls research at the ETH Flying Machine Arena,” *Swiss Society for Automatic Control Bulletin*, no. 63, p. 2–15, 2012. [[pdf](#)]

□ *Theses*

- [T1] A. P. Schoellig, “Improving tracking performance by learning from past data,” Doctoral Thesis, Diss. ETH No. 20593, ETH Zurich, Switzerland, 2013. **ETH Medal, Dimitris N. Chorafas Foundation Prize.** [\[pdf\]](#)
- [T2] A. P. Schoellig, “Optimal control of hybrid systems with regional dynamics,” Master Thesis, Georgia Institute for Technology, USA, 2007. [\[pdf\]](#)
- [T3] A. P. Schoellig, “Stability of a network of dynamical systems with communication delays (in German),” Master Thesis, University of Stuttgart, Germany, 2006. [\[pdf\]](#)

## INVITED TALKS

**Summary**

- Career Totals (*excluding* conference presentations, since 2010):

| <b>Total # of Invited Talks</b> | <b>91 (10 keynotes, 1 plenary)</b> | <b>in 13 different countries</b> |
|---------------------------------|------------------------------------|----------------------------------|
| Academic audience               | 60 (5 keynotes, 1 plenary)         | in 12 different countries        |
| General public                  | 23 (5 keynotes)                    | in 4 different countries         |
| Professional audience           | 8                                  | in 3 different countries         |

→ This is around *13 invited talks/year* for the period 2013–2019.

- In addition, the University regularly requests talks when hosting visitors from government or industry. I have, for example, given presentations to representatives from DARPA, the Canadian Space Agency, LG, Samsung, TD Insurance, General Motors, Magna, Comac, and Ontario Power Generation.

**Complete List**□ *Academic Audience*

**Institute for Pure and Applied Mathematics (IPAM), Los Angeles, USA.** 02/2020

Invited Speaker at the workshop ‘Intersections between Control, Learning and Optimization’ (Organizers include M. Diehl, B. Recht, S. Wright, M. Zeilinger).

**Neural Information Processing Systems (NeurIPS) Workshop, Vancouver, Canada.** 12/2019

Invited Speaker at the workshop ‘Robot Learning: Control and Interaction in the Real World’ (Organizers include M. Wulfmeier, R. Calandra, D. Kragic and S. Schaal).

**Conference on Robot Learning (CoRL), Osaka, Japan.** 10/2019

Keynote Speaker at this conference (invited by L. Kaelbling), “Machine learning in the closed loop: safety and performance guarantees for robot learning.”

**University of Pennsylvania, Philadelphia, USA.** 06/2019

Invited Speaker at the Mechanical Engineering and Applied Mechanics (MEAM) Seminar Series (invited by V. Kumar), “Machine learning for robotics: achieving safety, performance and reliability by combining models and data in a closed-loop system architecture.”

**Robotics: Science and Systems (RSS) Conference, Freiburg, Germany.** 06/2019

I gave an Early Career Spotlight talk (invited by S. Srinivasa, P. Newman, L. Kaelbling), “Machine learning in the closed loop: safety and performance guarantees for robot learning.” [[talk video](#)]

**Centre for Vision Research (CVR) Conference on Predictive Vision, Toronto, Canada.** 06/2019

Invited Speaker in the session ‘Visually Guided Control’ (invited by Drs. P. Cavanagh, R. Wildes, R. Allison), “High-performance robot navigation using vision.”

**Learning for Dynamics and Control (L4DC) Conference, Boston, USA.** 05/2019

Invited Speaker at this inaugural conference, “Machine learning for robotics: safety and performance guarantees for learning-based control.” [[talk video](#)]

**Int. Conf. on Robotics and Automation (ICRA) Workshop, Montreal, Canada.** 05/2019

Invited Speaker at the workshop ‘Resilient Robot Teams: Composing, Acting, and Learning’ (Organizers include A. Prorok, V. Kumar and G. Sukhatme), “Adaptation and learning for robot teams.” [[website](#)]

**Int. Conf. on Robotics and Automation (ICRA) Debate, Montreal, Canada.** 05/2019

Panelist at the workshop ‘Debates on the Future of Robotics Research’ (Organizers include J. Kelly and his team). [[summary article](#)]

**Massachusetts Institute of Technology (M.I.T), Boston, USA.** 04/2019

Invited Speaker at the Robotics Seminar series (invited by Drs. A. Rodriguez and S. Kim), “Machine learning for robotics: safety and performance guarantees for learning-based control.”

**Max Planck Institute for Intelligent Systems, Stuttgart/Tübingen, Germany.** 03/2019

Invited seminar talk (invited by M. Black), “Machine learning in the closed loop: safety and performance guarantees for robot learning.”

**IEEE Conference on Decision and Control, Miami Beach, USA.** 12/2018

Invited Speaker at the workshop ‘Learning for Control’ (Organizers: Morari, Pappas, Khargonekar, Gatsis), “Safe model-based learning for robot control.” Presented by my Ph.D. student Felix Berkenkamp because of pregnancy.

**Workshop on Learning and Adaptation for Sensorimotor Control, Lund, Sweden.** 10/2018

Invited speaker at this 3-day workshop organized by Prof. A. Rantzer at Lund University, “Safe model-based learning for robot control.” Presented by my Ph.D. student Felix Berkenkamp because of pregnancy.

**Max Planck Institute for Intelligent Systems, Stuttgart/Tübingen, Germany.** 09/2018

Invited talk at the ‘Special Symposium on Intelligent Systems’ (Organizers: Drs. M. Black, M. Sitti, K. Kuchenbecker, B. Schölkopf), “Machine learning for robotics: achieving safety, performance and reliability by combining models and data in a closed-loop system architecture.”

**International ACM Conference on Automotive User Interfaces, Toronto, Canada.** 09/2018

Keynote Speaker at the 10th International ACM Conference on Automotive User Interfaces and Interactive Vehicular Applications (Dr. B. Donmez), “Self-driving technology today: what we can and cannot (yet) do.” [[website](#)]

**IFAC Conference on Nonlinear Model Predictive Control, Madison, USA.** 08/2018

Keynote Speaker at this conference (invited by Dr. R. Findeisen), “Combining model predictive control with learning-based and adaptive methods to achieve safety, performance and reliability in robotics.”

**Conference on Uncertainty in Artificial Intelligence, Monterey, USA.** 08/2018

Invited Speaker at the workshop ‘Safety, Risk and Uncertainty in Reinforcement Learning,’ “Reinforcement learning for robotics: provable safety and performance guarantees by combining models and data.” [[website](#)]

**TU Munich, Munich, Germany.**

07/2018

Invited talk at the Department of Electrical and Computer Engineering (Dr. K. Diepold), “Machine learning for robotics: achieving safety, performance and reliability by combining models and data in a closed-loop system architecture.”

**Robotics: Science and Systems Conference (RSS) Workshop, Pittsburgh, USA.**

06/2018

Invited Speaker at the workshop ‘New Benchmarks, Metrics, and Competitions for Robotic Learning’ (Organizers include Milford, Goldberg, Corke), “Robotic learning benchmarks: feedback loops and interaction.” [[website](#)]

**Robotics: Science and Systems Conference (RSS) Workshop, Pittsburgh, USA.**

06/2018

Invited Speaker at the workshop ‘Learning and Inference in Robotics: Integrating Structure, Priors and Models’ (Organizers: Mukadam, Byravan, Boots), “Combining models and data for enhanced robot control and decision making.” [[website](#)]

**IEEE/IEIE International Conference on Consumer Electronics Asia, Jeju, Korea.**

06/2018

Plenary Speaker at this conference (Dr. C. Yoo), “Drones and robots that learn to empower us.”

**Vector Institute’s Endless Summer School: Robotics, Toronto, Canada.**

06/2018

Invited Speaker at this one-day event (Dr. S. Fidler), “Machine learning in robotics: characteristics, challenges and opportunities.”

**International Conference on Robotics and Automation, Brisbane, Australia.**

05/2018

Keynote Speaker at the International Conference on Robotics and Automation (ICRA) talking to approximately 800 robotics researchers (Dr. P. Corke), “Machine learning for safe, high-performance control of mobile robots.” [[website](#)]

**Data, Learning and Inference (DALI) Conference, Lanzarote, Canary Islands.**

04/2018

Invited talk at the workshop ‘Autonomous Driving’ (Dr. A. Geiger), “Safe learning-based control for autonomous driving and the aUToronto self-driving competition team.” [[video](#)]

**Princeton University, Princeton, USA.**

04/2018

Invited talk at the School of Engineering and Applied Science (Dr. N. E. Leonard), “Safe learning-based control for mobile robots.”

**Machine Learning Ensemble, Toronto, Canada.**

01/2018

Invited Speaker at this academia-industry event (Dr. I. Givoni, Uber ATG), “Machine learning for safe, high-performance control of mobile robots.” [[website](#)]

**Robotics: Science and Systems Conference (RSS) Workshop, Boston, USA.**

07/2017

Invited Speaker at the workshop ‘Learning Perception and Control for Autonomous Flight: Safety, Memory, and Efficiency’ (Organizers: Karydis, Atanasov, Levine, Roy, Tomlin, Kumar), “Machine learning for safe, high-performance control of mobile robots.”

**Conference on Computer and Robot Vision, Edmonton, Canada.**

05/2017

Invited Symposium Speaker (Dr. S. Waslander and J. Elder), “Machine learning for safe, high-performance control of mobile robots.”

**Duke University, Durham, USA.**

05/2017

Invited Speaker for internal colloquium (Dr. M. Cummings), “Machine learning for safe, high-performance control of mobile robots.”

**University of California, Santa Barbara, USA.**

05/2017

Invited Speaker for internal colloquium (Mechanical Engineering Department), “Machine learning for safe, high-performance control of mobile robots.”

**University of Washington, Seattle, USA.**

04/2017

Distinguished Speaker for Aerospace Engineering Colloquium (Dr. Anthony M. Waas), “Machine learning for robotics: high-performance flight control in unknown and changing conditions.”

**Engineering Science Education Conference, Toronto, Canada.**

01/2017

Invited speaker for the Robotics Major, “Machine learning for mobile robots.”

**Technical University Darmstadt, Germany.**

01/2017

Invited speaker at internal colloquium (Dr. J. Peters), “Safe learning control for mobile robots.”

**Max Planck Institute for Intelligent Systems, Tuebingen, Germany.**

04/2016

Invited speaker at the Intelligent Systems Colloquium (Dr. S. Trimpe), “Safe learning control for mobile robots.” [\[website\]](#)

**Oberwolfach Workshop on Control Theory for Cyber-Physical Systems, Germany.**

02/2015

Invited speaker at the Workshop on ‘Control Theory: A Mathematical Perspective on Cyber-Physical Systems’, “Control of aerial and ground multi-robot systems.”

**University of California, Berkeley, USA.**

12/2014

Invited speaker at the DREAM (Design of Robotics and Embedded Systems, Analysis, and Modeling) Seminar Series (Prof. P. Abbeel), “Improving the performance and autonomy of mobile robots by enabling them to learn from experience.”

**Intelligent Transportation Systems Research Day, University of Toronto, Canada.**

12/2014

Invited speaker at the industry-university symposium (Prof. E. J. Miller), “The role of unmanned aerial vehicles in future urban environments.”

**FLYNET Workshop, ETH Zurich, Switzerland.**

11/2014

Invited speaker and panelist at this workshop on ‘Micro and Nano Aerial Vehicle Networks for Civilian Use’, “High-performance flight control in unknown and changing conditions.” [\[website\]](#)

**University of Illinois at Urbana-Champaign, USA.**

10/2014

Invited speaker at the Coordinated Science Lab Lecture Series (Prof. N. Hovakimyan), “Improving the performance and autonomy of robots by enabling them to learn from experience.”

**Lassonde Institute of Mining Research Day, University of Toronto, Canada.**

10/2014

Invited speaker at this industry-university symposium, “Applications of unmanned aerial vehicles in mining.”

**International Workshop on Multi Unmanned Vehicles Systems, Compiègne, France.**

06/2014

Invited speaker at this workshop (Prof. I. Fantoni-Coichot), “Challenges for robotic (outdoor) air and ground applications.”

**Workshop on Open Problems in Multi-Agent Systems, Portland, USA.**

06/2014

Invited speaker at this workshop held at the American Control Conference (Prof. M. Egerstedt), “Open problems in multi-agent learning: is information sharing between agents beneficial?” [\[website\]](#)

**Concordia University, Montréal, Canada.**

05/2014

Invited speaker at the Engineering Research Seminar (Prof. L. Rodrigues), “Slalom races, flight dances, rover speeding? Planning, control and learning for high-performance robot operations.”

**McGill University, Montréal, Canada.**

12/2013

Invited speaker at the Centre for Intelligent Machines (Prof. G. Dudek), “Enabling high-performance maneuvers of ground and aerial vehicles by incorporating data into mobile robot control.”



**University of Michigan, Ann Arbor, USA.**

11/2013

Invited speaker at the Mechanical Engineering Department Seminar Series (Prof. K. Barton), “Enhanced performance and autonomy for mobile robots through learning from past data.”

**Drones and Aerial Robotics Conference, New York, USA.**

10/2013

Session/interactive speaker, “Are we there yet? Robots that learn from experience, and enhance their performance and autonomy over time.” [[website](#)]

**Université de Technologie de Compiègne, France.**

10/2013

Invited speaker at the Labex MS2T Seminar (Laboratories of Excellence in Control of Systems of Systems), (Prof. I. Fantoni-Coichot), “Are we there yet? Robots that learn from experience, and enhance their performance and autonomy over time.” [[announcement](#), [slides](#)]

**Lakeside Labs and Alpen-Adria-University Klagenfurt, Austria.**

07/2013

Keynote speaker at the 2013 Research Days on Multi-UAV Systems (Prof. C. Bettstetter), “Slalom racing and flight dances – motion planning, control and learning for high-performance quadcopter flight.” [[video of presentation](#)]

**NSERC Canadian Field Robotics Network (NCFRN), Toronto, Canada.**

04/2013

Invited speaker at the 2013 Robot Field Trials (Prof. G. Dudek), “Enhanced performance and autonomy through learning from data: an aerial robotics example.”

**Ontario Society of Professional Engineers (OSPE), Toronto, Canada.**

03/2013

Invited speaker at the Aerospace and Automotive Night, “Extended performance and autonomy through learning from data.”

**Center for Advanced Aerospace Technologies (CATEC), Sevilla, Spain.**

12/2012

Invited speaker at the CATEC Research Seminar (Dr. A. Viguria), “Accomplishing high-performance quadcopter maneuvers through learning from experience.”

**Bio-Robotics Network in Zurich (BiRoNZ), Switzerland.**

11/2012

Invited speaker at the BiRoNZ Talks, “Accomplishing high-performance quadcopter maneuvers through learning from experience.”

**University of Stuttgart, Germany.**

11/2012

Invited speaker at the Colloquium Engineering Cybernetics (Prof. F. Allgöwer), “Improving performance of automated systems through learning from past data.”

**Swiss Association of Aeronautical Sciences (SVFW), Zurich, Switzerland.**

09/2011

Invited speaker at the Annual Meeting, “Enabling quadcopters to learn from repetition.”

**Session on Controls Education, American Control Conference, San Francisco, USA.**

06/2011

Invited speaker at the Special Session on ‘Emerging Control Education Issues, Systems & Control for a Wide Range of the Public’ (Prof. B. Pasik-Duncan), “Flying robots on stage – control and learning for aerial acrobatics.”

**Stanford University, USA.**

06/2011

Invited speaker at the Information Systems Laboratory (Prof. S. Boyd), “Control and learning for aerial vehicles – where optimization is required.”

**Lund University, Sweden.**

04/2010

Invited speaker at the Lund Center for Control of Complex Engineering Systems (LCCC) (Prof. A. Rantzer), “Optimization-based learning.”



**Workshop on Adaptation and Learning in Autonomous Systems, Lund, Sweden.** 04/2010  
Invited speaker at this 3-day workshop organized by Prof. A. Rantzer at Lund University, “Synchronizing motion to music – a rhythmic flight performance.”

**Queensland University of Technology (QUT), Brisbane, Australia.** 01/2010  
Invited speaker at the Smart Systems Seminar (Prof. G. Wyeth), “Learning through experience – improving performance by repetition.”

□ *General Public*

**German Consulate General, Toronto, Canada.** 06/2018  
Invited speaker at the Forth Science Slam, “The promise of robotics and today’s reality: why it is hard to build robots for the real world.”

**biopoetriX conFIGURing AI, Toronto, Canada.** 04/2018  
Invited speaker and panelist on the topic ‘Performing AI, hybrid media & humans in/as technology.’

**Udacity’s Intersect Conference, Mountain View, USA.** 03/2018  
Moderator of the panel ‘The Cities of the Future: Interactive, Responsive, and Optimized.’ [[event page](#)]

**EXCITE Conference, Toronto, Canada.** 03/2018  
Panellist at this student-organized conference on ‘The Future of Transportation.’ I was joined by three members of *aUToronto*, the self-driving competition team I am leading. [[event page](#)]

**EmTech Conference, Boston, USA.** 11/2017  
Invited speaker at this conference on Emerging Technologies organized by MIT Technology Review, “Her algorithms are helping self-driving and self-flying vehicles get around more safely.” [[event page](#)], [[video](#)]

**Workshop on Automatic Control for High School Students, Las Vegas, USA.** 12/2016  
Invited speaker at this workshop on ‘The Power and Beauty of Control, a Field that Spans Science, Technology, Engineering & Mathematics’ held in conjunction with the IEEE Control and Decision Conference, “How flying robots learn to fly.”

**Drone Fair, University of Ontario Institute of Technology, Canada.** 11/2016  
Invited speaker, “Robots and drones that learn to empower us.” [[event page](#)]

**Spring Reunion, University of Toronto, Canada.** 05/2016  
Invited speaker at this alumni event, “Making robots safer by enabling them to learn.”

**Girls’ Leadership in Engineering Experience event, University of Toronto, Canada.** 05/2016  
Keynote speaker at this recruitment event, “Three lessons from my work in engineering.”

**TEDxUofT, Toronto, Canada.** 03/2016  
Invited speaker, “Robots and drones that learn to empower us.” [[video](#)]

**German Consulate General, Toronto, Canada.** 01/2016  
Invited speaker at the Second Science Slam, “Why should you care about robotics?”

**Royal Canadian Institute (RCI) For the Advancement of Science, Toronto, Canada.** 11/2015  
Invited speaker at the Fall Lecture Series, “Revolution in robotics: will the next robot be for you?” [[video](#)]

**Lift China Conference, Shanghai, China.** 06/2015  
Keynote speaker at this Swiss-China event aiming to connect academia and business to facilitate cooperation and innovation, “Expand your abilities with drones.” [[event summary video](#)] [[event page](#)]

**Girls' Leadership in Engineering Experience event, University of Toronto, Canada.** 05/2015  
Keynote speaker at this recruitment event, "How flying robots learn to fly: controls for autonomous aerial vehicles."

**University of Toronto in Your Neighbourhood, Toronto, Canada.** 01/2015  
Invited speaker at this talk series for University of Toronto alumni, "The possibilities of aerial robotics." [[website](#)]

**Workshop on Automatic Control for High School Students, Los Angeles, USA.** 12/2014  
Invited speaker at this workshop on 'The Power and Beauty of Control, a Field that Spans Science, Technology, Engineering & Mathematics' held in conjunction with the IEEE Control and Decision Conference, "Robots that learn from their mistakes." [[website](#)]

**Fall Campus Day, University of Toronto, Canada.** 10/2014  
Invited speaker at this university open-house day, "How flying robots learn to fly."

**Canadian Science Writers' Association (CSWA), Toronto, Canada.** 06/2014  
Invited speaker and panellist at the CSWA Annual Conference, "Teaching robots to fly." [[news article](#)]

**Girls' Leadership in Engineering Experience event, University of Toronto, Canada.** 05/2014  
Keynote speaker at this recruitment event, "How flying robots learn to fly: controls for autonomous aerial vehicles." [[news article](#)]

**Toronto Students for the Advancement of Aerospace (TSAA), Toronto, Canada.** 10/2013  
Invited speaker at "The DIY Innovator" Conference, "Unmanned aerial vehicles: research challenges and business opportunities."

**Girls' Leadership in Engineering Experience event, University of Toronto, Canada.** 05/2013  
Keynote speaker at this recruitment event, "How flying robots learn to fly: controls for autonomous aerial vehicles." [[news article](#)]

**Tech Days at High School Rämibühl, Zurich, Switzerland.** 02/2012  
Interactive talk and demonstration for 50 high school students, "Flying robots on stage."

**Workshop on Automatic Control for Middle & High School Students, Atlanta, USA.** 12/2010  
Invited speaker at this workshop on 'Ideas and Technology of Control Systems' held in conjunction with the IEEE Control and Decision Conference, "Flying robots on stage – control and learning for aerial acrobatics."

#### ☐ *Professional Audience*

**CanadianTech@Scale Conference, Toronto, Canada.** 06/2019  
Invited Speaker at this local tech conference (invited by I. Givoni), "Machine learning for robotics."

**Robert Bosch GmbH, Renningen, Germany.** 01/2018  
Invited speaker for an internal research seminar at the Center for Artificial Intelligence (Dr. M. Buerger), "Machine learning for safe, high-performance control of mobile robots."

**Google Brain, Mountain View, USA.** 11/2017  
Invited speaker for an internal research seminar (Dr. A. Faust), "Machine learning for safe, high-performance control of mobile robots."

**MDA Robotics and Automation Corp, Toronto, Canada.** 03/2016  
Invited speaker for an internal research seminar (Dr. P. Jasiobedzki), "Dynamic Systems Lab: Research in robotics, controls and machine learning."

**Clearpath Robotics Inc, Kitchener, Canada.**

08/2015

Invited speaker at the Guest Lecture Series (R. Gariepy, CTO), “Excellence and safety in robotics.”

**Bombardier Aerospace, Toronto, Canada.**

05/2015

Invited speaker at the Lunch & Learn talk series (H. Khimji), “The possibilities of aerial robotics.”

**Defence Research & Development Canada, Suffield, Canada.**

04/2014

Invited talk (J. Collier), “Enabling High-Performance Maneuvers of Ground and Aerial Vehicles by Incorporating Data into Mobile Robot Control.”

**Festo AG & Co. KG, Esslingen, Germany.**

07/2013

Invited visit and presentation (E. Knubben, Dr. Alexander Hildebrandt), “Research at the Dynamic Systems Lab: learning and adaptation for ubiquitous long-term robotics applications.”

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**COLLABORATORS**

A list of current research collaborators from academia and industry can be found here: [[website](#)].

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**STUDENT ADVISING**
**Summary**

- Dynamic Systems Lab Members (since 2013):

|                      | Current          | Graduated/Completed |
|----------------------|------------------|---------------------|
| Postdoc              | 2                | 5 (2 co-advised)    |
| Ph.D.                | 8 (2 co-advised) | 3 (3 co-advised)    |
| Master               | 8 (4 co-advised) | 7 (2 co-advised)    |
| Undergraduate Thesis | 3                | 27                  |
| Summer Intern        | –                | 23                  |
| MEng                 | –                | 3                   |
| Exchange Student     | 1                | 10                  |
| <b>Total</b>         | <b>22</b>        | <b>78</b>           |

- About half of my postdocs and graduate students hold scholarships, which reflects the quality of students my group attracts.
- Past graduates (Masters- and undergraduate-level) have gone on to positions at MIT, Stanford, ETH Zurich, Imperial College London, and other leading international institutions. To find out where former lab members are today, read below and visit our team website! There, under *Former Students of the Dynamic Systems Lab*, you can find links to each student’s LinkedIn profile. [[website](#)]

## Complete List

### □ *Current Students*

#### Postdoctoral Fellows

- [1] Jacopo Panerati. since 01/2020  
**Mitacs Elevate Fellow.** Before Research Associate at the University of Cambridge.
- [2] Karime Pereida. since 11/2019  
Before Ph.D. student in my group and currently waiting to graduate.

#### Ph.D. Students (four-year research and training, including 4 courses)

- [1] Keenan Burnett (coadvised with Prof. T. Barfoot, Aero, University of Toronto). since 09/2019  
Topic: “Development of a self-driving car for the GM/SAE Autodrive Challenge.”
- [2] Alan Li. since 09/2018  
Topic: “Transfer learning in 6D pose estimation of objects from camera images.” Direct transfer to Ph.D. program.
- [3] Wenda Zhao. since 09/2018  
Topic: “Heterogeneous sensor fusion for seamless quadrotor localization indoors and outdoors.” Partially supported by a **Heuckroth Scholarship**.
- [4] Adam Heins. since 09/2017  
Topic: “Safe, probabilistic learning for robots.” Direct transfer to Ph.D. program.
- [5] Melissa Greeff. since 09/2016  
Topic: “Vision-based flight control and motion planning in GPS-denied environments.” Direct transfer to Ph.D. program.
- [6] SiQi Zhou. since 09/2016  
Topic: “Deep learning for robot control.” Direct transfer to Ph.D. program. Partially supported by an **NSERC PGS-D** (Canada Graduate Scholarships – Doctoral Program). **SiQi ranked 6<sup>th</sup> out of 133 (pre-selected) applications in her category nation-wide. Vector Institute for Artificial Intelligence Affiliate.**
- [7] Thomas Bamford (coadvised with Prof. K. Esmaili, CIV, University of Toronto). since 01/2016  
Topic: “Applications of unmanned aerial vehicle technology in the mining industry.” Direct transfer to Ph.D. program. Partially supported by an **NSERC CGS-M** (Canada Graduate Scholarships – Master’s Program) and by the **Queen Elizabeth II/Robert M. Smith Memorial Graduate Scholarship in Science and Technology**.
- [8] Chris McKinnon. since 09/2015  
Topic: “Reliable robot operation in partially unknown or changing conditions.”
- [9] Karime Pereida. since 09/2014  
Topic: “Multi-robot, multi task transfer learning.” Partially supported by **CONACYT**, a Mexican government scholarship. Thesis draft submitted.

#### M.A.Sc. Students (two-year research and training, including 4 courses)

- [1] Wei-Kang Tseng (coadvised with Prof. T. Barfoot, Aero, University of Toronto). since 09/2019  
Topic: “GPS bias estimation in localization of autonomous vehicle using semantic maps”.

- [2] Abhishek Goudar. since 09/2019  
Topic: “State estimation of an aerial vehicle using ultrawide-band”. Partially supported by a **DiDi Graduate Student Award**.
- [3] Sepehr Samavi. since 09/2018  
Topic: “Safe planning and control for an autonomous vehicle.” Partially supported by a **Vector Scholarship in AI** and an **Ontario Graduate Scholarship**.
- [4] Jeremy Wong (coadvised with Prof. T. Barfoot, Aero, University of Toronto). since 09/2018  
Topic: “Vision-based localization of UAVs.” Partially supported by a **Vector Scholarship in AI**.
- [5] Michael Sorocky. since 09/2018  
Topic: “Similarity in knowledge transfer for robotics.”
- [6] Ke Dong. since 09/2018  
Topic: “Interactive learning of mobile manipulators.” Partially supported by a **Vector Scholarship in AI**.
- [7] Adam Hall (coadvised with Prof. J. Kelly, Aero, University of Toronto). since 09/2018  
Topic: “Interactive perception for improved robotic manipulation of articulated objects.” Partially supported by a **Vector Scholarship in AI**.
- [8] Mingliang Tang (coadvised with Prof. K. Esmaili, CIV, University of Toronto). since 09/2018  
Topic: “Monitoring of heap leach facilities with UAVs.”

#### B.A.Sc. Thesis Students (year-long research project, approx. 3 months full time equivalent)

- [1] Ali MahdaviFar, Engineering Science, University of Toronto. since 09/2019  
Topic: “AutoDrive Control Subteam.”
- [2] Samee Mahbub, Engineering Science, University of Toronto. since 09/2019  
Topic: “AutoDrive Planning Subteam.”
- [3] Eric Alexander Boszin, Engineering Science, University of Toronto. since 09/2019  
Topic: “AutoDrive Systems Subteam.”

#### Ph.D. Exchange Students (3- to 6-month research project)

- [1] Juergen Scherer, Information Technology, University Klagenfurt. Spring/Summer 2019  
Topic: “Path planning and coordination of multiple unmanned aerial vehicles (UAVs) with energy and communication constraints.”

#### □ *Former Students*

#### Postdoctoral Fellows

- [1] Mario Vukosavljev. 12/2018–10/2019  
**SOSCIP Postdoctoral Fellow**. Now Research Scientist at MDA.
- [2] Michael Warren. 01/2017–01/2019  
**SOSCIP Postdoctoral Fellow**. Coadvised with Prof. T. Barfoot, Aerospace, University of Toronto. Now Research Scientist, Bosch Center for Artificial Intelligence, Germany.

- [3] Mohammad Nahangi. 09/2016–01/2019  
**NSERC Postdoctoral Fellow.** Coadvised with Prof. B. McCabe, CIV, University of Toronto. Now Principal AI Developer, Kattera, Toronto.
- [4] Zachary Kroeze. 10/2017–10/2018  
 Now Autonomous Driving Engineer, General Motors, Toronto.
- [5] Mohamed Helwa. 01/2016–10/2018  
**SOSCIP Postdoctoral Fellow, Vector Institute for Artificial Intelligence Affiliate.** Now Technical Specialist Research & Technology, Thales, Toronto.

#### Ph.D. Students (four-year research and training, including 4 courses)

- [1] Felix Berkenkamp, Computer Science, ETH Zurich. 2015–2019  
 Topic: “Safe exploration in reinforcement learning: theory and applications in robotics.” Partially supported by **Open Philanthropy Project AI Fellow Program** (international award, acceptance rate <4%, US\$50K/year for duration of the Ph.D.). Coadvised with Prof. A. Krause, Computer Science, ETH Zurich. Now Research Scientist, Bosch Center for Artificial Intelligence, Germany. [[thesis](#)]
- [2] Mario Vukosavljev, ECE, University of Toronto. 2014–2019  
 Topic: “Modular framework for motion planning based on feedback-based motion primitives.” Direct transfer to Ph.D. program. Coadvised with Prof. M. Broucke, ECE, University of Toronto. Now Research Scientist, MDA, Toronto. [[thesis](#)]
- [3] Chris Ostafew, Aerospace, University of Toronto. 2013–2016  
 Topic: “Learning-based control for autonomous mobile robots.” Partially supported by an Ontario Graduate Scholarship. Coadvised with Prof. T. Barfoot, Aerospace, University of Toronto. Now Senior Systems Engineer Autonomous Driving, Nissan, San Francisco. [[thesis](#)]

#### Ph.D. Exchange Students (3- to 6-month research project)

- [1] Andriy Sarabakha, Mechanical & Aerospace Engineering, NTU Singapore. Summer 2018  
 Topic: “Online adaptation with deep neural networks for high-performance autonomous flight.” Continued as Ph.D. Candidate, NTU Singapore.

#### M.A.Sc. Students (two-year research and training, including 4 courses)

- [1] Filip Medinac, Civil Engineering, University of Toronto. 2017–2019  
 Topic: “Pit wall mapping and slope assessment using unmanned aerial vehicle (UAV) technology.” Coadvised with Prof. K. Esmaili, CIV, University of Toronto.
- [2] Keenan Burnett, Aerospace, University of Toronto. 2017–2019  
 Topic: “On the design and development of a self-driving car for the SAE AutoDrive Challenge.” Now Ph.D. student in my group coadvised with Prof. T. Barfoot.
- [3] Bhavit Patel, Aerospace, University of Toronto. 2017–2019  
 Topic: “Visual localization for UAVs in outdoor GPS-denied environments.” Partially supported by an **NSERC CGS-M** (Canada Graduate Scholarships – Master’s Program). [[thesis](#)]
- [4] Carlos Luis, Aerospace, University of Toronto. 2017–2019  
 Topic: “Distributed trajectory generation for multiagent systems.” Now Robotics Engineer, Amazon Prime Air, Paris. [[thesis](#)]

- [5] Rikky Duivenvoorden, Aerospace, University of Toronto. 2014–2016  
Topic: “Quadrotor control in the presence of unknown mass properties.” Now Start-Up Founder. [\[thesis\]](#)
- [6] Kaizad Raimalwala, Aerospace, University of Toronto. 2013–2015  
Topic: “Transfer learning for robotics: can a robot learn from another robot’s data?” Coadvised with Prof. B. Francis, ECE, University of Toronto. Now Junior Robotics Engineer, Mission Control Space Services. [\[thesis\]](#)
- [7] Chris McKinnon, Aerospace, University of Toronto. 2013–2015  
Topic: “Data-driven, force-based interaction for quadrotors.” Now Ph.D. Candidate, Aerospace, University of Toronto, in my group. [\[thesis\]](#)

#### M.Sc. Thesis (6-month, full-time research project)

- [1] Michael Jakob, Mechatronics, University of Stuttgart. Summer 2018–Fall 2018  
Topic: “Position and force control with redundancy resolution of mobile manipulators.” Now Development Engineer, Festo, Germany.
- [2] Andreas Schimpe, Electrical Engineering, TU Munich. Fall 2017–Spring 2018  
Topic: “Predictive and reactive planning and control designs for self-driving cars.” Now Research Associate, Institute for Automotive Technology, Technical University of Munich.
- [3] Julian Förster, Robotics, ETH Zurich. Fall 2017  
Topic: “Hybrid model predictive control& and learning-based disturbance prediction for crosswind stabilization of hybrid airships.” Now Ph.D. Candidate, Mechanical and Process Engineering, ETH Zurich.
- [4] Dave Kooijman, Systems and Control, Eindhoven University of Technology. Spring 2017  
Topic: “High-accuracy tracking in changing environments through adaptive feedback and iterative learning.” Now Engineer, AKOtech, Netherlands.
- [5] Yassine Nemmour, Robotics, ETH Zurich. Spring 2017  
Topic: “Safe exploration in robotics using Gaussian process models.” Now Ph.D. Candidate, Max Planck Institute for Intelligent Systems, Tübingen, Germany.
- [6] Andreas Hock, Engineering Cybernetics, University of Stuttgart. Spring 2016  
Topic: “Distributed iterative learning control for multi-agent systems.” Now Self-Driving Car Engineer, Bosch GmbH, Germany.
- [7] Felix Berkenkamp, Mechanical Engineering, ETH Zurich. Fall 2014  
Topic: “Learning-based robust control: robustness guarantees for learning systems.” Now Research Scientist, Bosch Center for Artificial Intelligence, Germany.
- [8] Fabian L. Mueller, Robotics, ETH Zurich. Spring 2011  
Topic: “Implementation and evaluation of iterative learning algorithms for precise quadrocopter trajectory tracking.” Now Assistant Manager, PwC Switzerland.
- [9] Federico Augugliaro, Robotics, ETH Zurich. Spring 2011  
Topic: “Dancing quadrocopters: trajectory generation, feasibility, and user interface.” **2012 Willi Studer Prize** for best ETH master degree in Robotics. **2012 Hans-Eggenberger Award** for outstanding Master thesis research (CHF 5K prize, CHF 100K for follow-up research project). Continued as Ph.D. student at ETH Zurich, Mechanical Engineering, graduated 2015. Now Head of Live Events, Verity Studios AG, Switzerland.
- [10] Philippe Goffin, Robotics, ETH Zurich. Spring 2009  
Topic: “Can we do better than humans do? Learning aerobatic maneuvers from observation.” Continued as Ph.D. student at ETH Zurich, Building Systems, graduated 2014. Now Business Unit Manager Building Control, BS2, Zurich.



### M.Eng. Project (semester-long research project, time effort equivalent to one graduate course)

- [1] Jingyuan Hou, Mechanical Engineering, University of Toronto. Summer 2018  
Topic: "C++ Simulator for the Crazyflie quadrotors: overview, implementation and usage." Continued as M.Eng. Student, Mechanical Engineering, University of Toronto.
- [2] Calvin Ngan, Aerospace, University of Toronto. Spring 2018  
Topic: "Crazyflie drone platform and simulator." Now Robot Software Engineer, Magazino GmbH, Germany.
- [3] Michael Burghardt, Aerospace, University of Toronto. Summer 2015  
Topic: "State estimation for indoor-to-outdoor flight of a quadrotor UAV." Now Autonomy and Navigation Systems Engineer, Joby Aviation, Santa Cruz, California.

### Master Semester Project (semester-long research project, approx. 7 weeks full-time equivalent)

- [1] Nicolas Degen, Robotics, ETH Zurich. Fall 2013  
Topic: "Analytic comparison of norm-optimal iterative learning schemes." Now Software Engineer, Kapanu AG (augmented reality), Switzerland.
- [2] Clemens Wilsche, Electrical Engineering, ETH Zurich. Spring 2011  
Topic: "Precise synchronized periodic quadrocopter motion in three dimensions based on feed-forward parameter identification." Now Deployment Strategist, Palantir Technologies, UK.
- [3] Raphael Wüest, Robotics, ETH Zurich. Fall 2010  
Topic: "New synchronized quadrocopter motions: bounce motions in 2D." Now Co-Founder, Phree Mobile Solutions AG, Switzerland.
- [4] Federico Augugliaro, Robotics, ETH Zurich. Spring 2010  
Topic: "A platform for dance performances with multiple quadrocopters: graphical user interface and demonstration." Continued as Ph.D. student at ETH Zurich, Mechanical Engineering, with Prof. Raffaello D'Andrea. Now R&D Engineer and Head of Productions, Verity Studios AG, Switzerland.
- [5] Javier Alonso-Mora, Robotics, ETH Zurich. Spring 2009  
Topic: "Extending iterative learning control to multi-agent systems." **2010 Willi Studer Prize** for best ETH master degree in Robotics. Now **Assistant Professor**, TU Delft.
- [6] Sonja Stüdl, Electrical Engineering, ETH Zurich. Spring 2009  
Topic: "Fly! Iterative learning control for quadrocopters." **Now Conjoint Fellow, University of Newcastle, Australia.**

### B.A.Sc. Thesis (3-month to year-long research project, approx. 3 months full time equivalent)

- [1] Mollie Bianchi, Engineering Science, University of Toronto. Fall 2018–Spring 2019  
Topic: "Development of a simulation environment for testing autonomous vehicles." Coadvised with Prof. T. Barfoot, Aero, University of Toronto. Now MAsC Candidate, Aerospace Engineering, University of Toronto.
- [2] Nian Jia Hua, Engineering Science, University of Toronto. Fall 2018–Spring 2019  
Topic: "Implementing dynamic object detection and tracking." Coadvised with Prof. T. Barfoot, Aero, University of Toronto.
- [3] Tianchang Shen, Engineering Science, University of Toronto. Fall 2018–Spring 2019  
Topic: "Video lane segmentation with temporal fusion." Coadvised with Prof. T. Barfoot, Aero, University of Toronto.

- [4] Zheng Yao, Engineering Science, University of Toronto. Fall 2018–Spring 2019  
Topic: “Autonomous parking in angled spaces: path planning and control.” Coadvised with Prof. T. Barfoot, Aero, University of Toronto.
- [5] Zichen Huang, Engineering Science, University of Toronto. Fall 2018–Spring 2019  
Topic: “System architecture of autonomous vehicle operating in urban environment.” Coadvised with Prof. T. Barfoot, Aero, University of Toronto. Now Masters Candidate, Business, Carnegie Mellon University.
- [6] Jingxing Qian, Engineering Science, University of Toronto. Fall 2018–Spring 2019  
Topic: “Motion planning for autonomous vehicles in urban driving environments.” Coadvised with Prof. T. Barfoot, Aero, University of Toronto. Now M.Sc. in Robotics Candidate, Carnegie Mellon University.
- [7] Arkady Arkhangorodsky, Engineering Science, University of Toronto. Fall 2018–Spring 2019  
Topic: “Designing a system for real-time traffic light and traffic sign detection.” Coadvised with Prof. T. Barfoot, Aero, University of Toronto. Now NLP Research Engineer, DiDi, Los Angeles.
- [8] Xintong Du, Engineering Science, University of Toronto. Fall 2018–Spring 2019  
Topic: “An integrated motion planning and control approach for self-driving urban vehicles.” Coadvised with Prof. T. Barfoot, Aero, University of Toronto. Now M.Sc. Candidate, AeroAstro, Massachusetts Institute of Technology.
- [9] Zheng Chen, Engineering Science, University of Toronto. Fall 2018–Spring 2019  
Topic: “Optimal turn-by-turn directions on road networks.” Coadvised with Prof. T. Barfoot, Aero, University of Toronto.
- [10] Omar Rasheed, Mechanical and Industrial Engineering, University of Toronto. Fall 2018–Spring 2019  
Topic: “auToronto autonomous vehicle – mechanical and electrical hardware design and assembly.” Coadvised with Prof. T. Barfoot, Aero, University of Toronto. Now E-commerce/Online Store Owner.
- [11] Adam El-Masri, Computer Science, University of Toronto. Fall 2017–Spring 2018  
Topic: “Simulation and experimentation systems for the AutoDrive challenge.” Now Principal Engineer, Betterplace, Toronto.
- [12] Zane Huang, Computer Science, University of Toronto. Fall 2017–Spring 2018  
Topic: “Implementing a mapping application for self-driving cars.” Now Software Engineer, Algorithmic Trading, ITG.
- [13] Ashkan Amirghassemi, Engineering Science, University of Toronto. Fall 2017–Spring 2018  
Topic: “A robust stop line tracking algorithm for autonomous vehicles.” Now Field Application Engineer, Oxbotica, UK.
- [14] Yushi Guan, Engineering Science, University of Toronto. Fall 2017–Spring 2018  
Topic: “Location searching and road path planning for autonomous vehicles with improved intersection considerations.”
- [15] Stewart Jamieson, Engineering Science, University of Toronto. Fall 2017–Spring 2018  
Topic: “Deep learning for robust vision in realtime autonomous driving.” Now PhD Candidate, AeroAstro, Massachusetts Institute of Technology.
- [16] Kevin Jen, Engineering Science, University of Toronto. Fall 2017–Spring 2018  
Topic: “Robust systems design for autonomous vehicles.” Now Director of Operations, You’re Next Career Network, Toronto.
- [17] Chengzhi Liu, Engineering Science, University of Toronto. Fall 2017–Spring 2018  
Topic: “Trajectory planning for autonomous vehicles in structured urban environments.” Now Software Engineer, Zoox Inc, Silicon Valley (autonomous driving).

- [18] Sepehr Samavi, Engineering Science, University of Toronto. Fall 2017–Spring 2018  
Topic: “Lane detection for an autonomous vehicle.” Now Master Candidate, Aerospace, University of Toronto, in my group.
- [19] Aakash Goel, Engineering Science, University of Toronto. Fall 2016–Spring 2017  
Topic: “Ballbot – an autonomous robotic platform for the retrieval and delivery of tennis balls.” Now Product Manager, Ecobee, Toronto (home automation).
- [20] SiQi Zhou, Engineering Science, University of Toronto. Fall 2015–Spring 2016  
Topic: “Transformation between kinematic point and unicycle model for leader-follower formation problems.” Now Ph.D. Candidate, Aerospace, University of Toronto, in my group.
- [21] Rakibur Rahman, Engineering Science, University of Toronto. Fall 2015–Spring 2016  
Topic: “Analysis of the Capabilities of the Intel RealSense Camera.” Now Infrastructure Analyst, Accenture, Toronto.
- [22] Masha Itkina, Engineering Science, University of Toronto. Fall 2015–Spring 2016  
Topic: “Towards multi-agent learning.” Now Ph.D. Candidate, AeroAstro, Stanford University.
- [23] Spencer Richards, Engineering Science, University of Toronto. Fall 2015–Spring 2016  
Topic: “Sensor fusion and state estimation for indoor-outdoor flight of an octocopter.” Continued as M.Sc. student at ETH Zurich, Robotics, Systems and Control. Now Ph.D. Candidate, AeroAstro, Stanford University.
- [24] YihTang Yeo, Engineering Science, University of Toronto. Fall 2015–Spring 2016  
Topic: “Controller design for quadrotors with cable-suspended payload for fire-fighting missions.” Now UAV Engineer, Drone Delivery Canada, Toronto.
- [25] Adrian Esser, Engineering Science, University of Toronto. Fall 2015–Spring 2016  
Topic: “Development of a programmable unmanned aerial vehicle for nuclear reactor face surveying.” Now M.Sc. Candidate, Robotics, Systems and Control, ETH Zurich.
- [26] Tristan Laidlow, Engineering Science, University of Toronto. Fall 2014–Spring 2015  
Topic: “A framework for real-time motion generation for aerial vehicles in response to musical signals.” Now Ph.D. Candidate, Imperial College London.
- [27] Xingbo Wang, Engineering Science, University of Toronto. Fall 2013–Spring 2014  
Topic: “Physically interactive flying robots.” Now Autopilot Systems Engineer, SkyX Systems, Toronto.
- [28] Andreas Pfrunder, Mechanical Engineering, ETH Zurich. Spring 2013  
Topic: “Visual teach and repeat for autonomous quadrotor flight.” Coadvised with Profs. Tim Barfoot and Roland Siegwart. Now Operations Lead and Co-Founder, Sevensense Robotics AG, Switzerland.
- [29] Raphael Schottenhaml, Mechanical Engineering, ETH Zurich. Spring 2011  
Topic: “Extensions to the rhythmic side-to-side motion.” Continued as M.Sc. Candidate, Mechanical Engineering, ETH Zurich.
- [30] Benjamin Troxler, Mechanical Engineering, ETH Zurich. Spring 2009  
Topic: “Generation of acrobatic trajectories for quadcopters.” Now Senior Risk Modeller, SwissRe, Zurich.
- [31] Fabian L. Mueller, Mechanical Engineering, ETH Zurich. Spring 2009  
Topic: “An automated testing platform for learning algorithms.” Now Assistant Manager, PwC Switzerland.
- [32] Federico Augugliaro, Mechanical Engineering, ETH Zurich. Spring 2009  
Topic: “Synchronizing motion and music beat – a dancing quadrocopter.” Continued as Ph.D. student at ETH Zurich, Mechanical Engineering, with Prof. Raffaello D’Andrea. Now R&D Engineer and Head of Productions, Verity Studios AG, Switzerland.

### Studies on Mechatronics (semester-long literature study)

- [1] Timon Heinis, Mechanical Engineering, ETH Zurich. Spring 2011  
Topic: “Exploring software tools for music analysis.” Now Research Associate, Product Development Group; ETH Zurich.
- [2] Robert Stettler, Mechanical Engineering, ETH Zurich. Spring 2010  
Topic: “Interaction and information sharing between multiple systems.” Now Project Lead; MECOS AG, Switzerland.
- [3] Benjamin Troxler, Mechanical Engineering, ETH Zurich. Spring 2009  
Topic: “A quadcopter learns acrobatic maneuvers – trajectory generation and control methods.” Now Risk Modeller, SwissRe, Zurich.
- [4] Fabian L. Mueller, Mechanical Engineering, ETH Zurich. Spring 2009  
Topic: “Swing-up of a pendulum: a benchmark problem.” Now Assistant Manager, PwC Switzerland.
- [5] Federico Augugliaro, Mechanical Engineering, ETH Zurich. Spring 2009  
Topic: “Synchronizing motion and music beat.” Continued as Ph.D. student at ETH Zurich, Mechanical Engineering, with Prof. Raffaello D’Andrea. Now R&D Engineer and Head of Productions, Verity Studios AG, Switzerland.

### Professional Experience Year Student (year-long internship)

- [1] Xintong Du, Engineering Science. 2017–2018  
Topics: the Crazyflie, multi-vehicle flight testbed. Now M.Sc. Candidate, AeroAstro, Massachusetts Institute of Technology.

### Undergraduate Summer Internship (four-month summer research)

- [1] Muralidhar Andoorvedu, Engineering Science. 2019  
Partially supported by an NSERC Undergraduate Student Research Award.
- [2] Stephanie Marton, Civil Engineering. 2018  
Coadvised with Prof. Brenda McCaba, CIV, University of Toronto.
- [3] Qiyang Li, Engineering Science. 2017  
Partially supported by Kenneth Carless Smith Engineering Science Research Fellowship.
- [4] Yizhou Huang, Engineering Science. 2017  
Partially supported by an Engineering Science Research Opportunities Program (ESROP) Award.
- [5] Quinlan Sykora, Engineering Science. 2017  
Partially supported by an Engineering Science Research Opportunities Program (ESROP) Award.
- [6] Xintong Du, Engineering Science. 2017  
Supported by a University of Toronto Excellence Award.
- [7] Adrian Esser, Engineering Science, University of Toronto. 2016
- [8] Qiyang Li, Engineering Science, University of Toronto. 2016  
Supported by First Year Summer Research Fellowship from the Faculty.
- [9] Zining Zhu, Engineering Science, University of Toronto. 2016  
Partially supported by an Engineering Science Research Opportunities Program (ESROP) Award.
- [10] Xuchan Bao, Engineering Science, University of Toronto. 2016  
Partially supported by a Kenneth Carless Smith Engineering Science Research Fellowship.

- [11] Jingxing Qian, Engineering Science, University of Toronto. 2016  
Partially supported by a UTIAS Summer Research Fellowship.
- [12] Adrian Esser, Engineering Science, University of Toronto. 2015  
Supported by a University of Toronto Excellence Award.
- [13] Yilun Wu, Engineering Science, University of Toronto. 2015  
Supported by an Undergraduate Summer Research Fellowship from the Faculty.
- [14] Yuqing Tang, Engineering Science, University of Toronto. 2014  
Partially supported by an NSERC Undergraduate Student Research Award.
- [15] SiQi Zhou, Engineering Science, University of Toronto. 2014  
Partially supported by an NSERC Undergraduate Student Research Award.  
Coadvised with Prof. Bruce Francis, University of Toronto, ECE.
- [16] Natasha Dalal, Computer Science, University of Toronto. 2014
- [17] Rikky Duivenvoorden, Engineering Science, University of Toronto. 2014
- [18] Tristan Laidlow, Engineering Science, University of Toronto. 2014
- [19] Xingbo Wang, Engineering Science, University of Toronto. 2014  
Partially supported by an NSERC Undergraduate Student Research Award.
- [20] Jai Bansal, Engineering Science, University of Toronto. 2013
- [21] Ahmed Khan, Engineering Science, University of Toronto. 2013  
Partially supported by an NSERC Undergraduate Student Research Award.
- [22] Behzad Abghari, Engineering Science, University of Toronto. 2013  
Supported by an Undergraduate Summer Research Fellowship from the Faculty.
- [23] Tristan Laidlow, Engineering Science, University of Toronto. 2013  
Partially supported by an NSERC Undergraduate Student Research Award.

#### □ Faculty Advisor for Student Competition Teams

**SAE/GM AutoDrive Challenge**, Principal Faculty Advisor. since 04/2017

A team of 50 undergraduate and graduate students from the University of Toronto compete in this 3-year self-driving car competition. I am the Principal Faculty Advisor of this interdisciplinary team with T. Barfoot. [[team website](#)]

**University of Toronto Aerospace Team (UTAT)**, Faculty Advisor. since 2015

The Aerospace Team is a student club participating in 6 national and international aerospace competitions each year and engaging nearly 100 active undergraduate and graduate students. UTAT has won more than 35 awards in the past five years alone, including recognition from NASA, the UN, and six annual domestic and international competitions. I am a *Faculty Advisor for the Unmanned Aerial Vehicles Division* (multirotor and fixed-wing drones). [[team website](#)]

## TEACHING EXPERIENCE

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### Summary

- Instructor for third-year undergraduate courses in the Engineering Science program and graduate courses in the Aerospace program at the University of Toronto, including *two original, newly-developed undergraduate course* (ROB310, AER1517), *newly-designed labs for a second undergraduate course* (AER372), and *contributions to a third and fourth newly-developed graduate course* (AER1216, AER1217).

- Invited lectures at three international, graduate summer schools and for an online course (with Udacity Inc), both related to my research.

## Complete List

### □ *Instructor*

**AER1517: Control for Robotics**, University of Toronto. Spring 2019

Graduate course, English; 3 hours lecture/week, 3 marked assignments, design project. *Newly-developed course*.

- Course covers optimal, adaptive and learning control principles from the perspective of robotics applications including discrete-time and continuous-time optimal control, model predictive control, reinforcement learning and other recent learning-based control techniques. [\[syllabus\]](#)
- Enrollment: approx. 30 students.

**ROB310: Mathematics for Robotics**, Engineering Science, University of Toronto. Fall 2015–19

Third-year undergraduate course, English; 4 hours lecture/week, 10 marked assignments, midterm and final exam. *Newly-developed course*.

- Course covers advanced mathematical concepts that are particularly relevant for robotics (including concepts from optimization, probability theory, linear algebra and numerical methods). [\[syllabus\]](#) [\[detailed reading list\]](#)
- Enrollment and instructor rating<sup>2</sup> for 2015–2019: 32, 83, 73, 43, 73 students; 4.0, 4.4, 4.3, 4.5, 4.6 (Faculty average 3.7, 3.8, 3.8, 3.8, 3.7 out of 5).

**AER1216: Fundamentals of UAVs**, University of Toronto. Spring 2016, Fall 2016,17,18

Graduate course, English; 3 hours lecture/week, 5 marked assignments, design project. Co-lecturer for section on Quadrotor Dynamics & Control (3 hours lecture and 1 assignment). *Newly-developed course*.

- Course covers UAV configurations (fixed-wing, multi-rotor), aerodynamics, performance (range, endurance, climb rate, etc), propulsion (propellers, motors, etc), stability/control, structures. [\[syllabus\]](#)
- Enrollment: approx. 30 students.

**AER1217: Development of Autonomous UAVs**, University of Toronto. Spring 2017,18

Graduate course, English; 3 hours lecture/week, 4 marked assignments, 4 UAV labs, UAV project. Co-lecturer for section on Quadrotor Dynamics & Control (3 hours lecture and 1 assignment). *Newly-developed course*.

- Course covers quadrotor dynamics and control, navigation for UAVs, path planning for UAVs, computer vision for UAVs, instrumentation and sensor payloads for UAVs. [\[syllabus\]](#)
- Enrollment: approx. 30 students.

**AER372: Control Systems**, Engineering Science, University of Toronto. Spring 2014,15,16

Third-year undergraduate course, English; 4 hours lecture/week, 3 sets of practice problems (not marked), 2 midterm exams, final exam, 4 labs (3 hours each). *Newly-developed labs*.

- Course provides an introduction to feedback control (including modelling of physical systems, analysis of dynamic behavior, concept of stability and performance, design of feedback controllers for single-input single-output systems). [\[syllabus\]](#)
- Enrollment and instructor rating for 2014–2016: 54, 60, 59 students; 4, 3.7, 3.2 (Faculty average 3.6, 3.7, 3.7 out of 5).

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<sup>2</sup>Instructor ratings refer to the Institutional Composite Mean (mean of 5 questions related to the learning experience and the quality of the instructor) of the anonymous, online course evaluations filled out by students at the end of the semester.

**151-0563-01: Dynamic Programming and Optimal Control, ETH Zurich.**

Fall 2012

Graduate course, English; 3 hours lecture/week, 4 assignments (not marked), 2 midterms, 2 marked programming exercises, final exam.

- Course covers dynamic programming algorithm, deterministic systems and shortest path problems, infinite horizon problems, value/policy iteration, deterministic continuous-time optimal control. [[syllabus](#)] [[course website](#)]
- Enrollment: 140 students.

□ *Invited and Online Teaching Activities***Flying Car Nanodegree, Udacity Inc.**

09/2017–07/2018

Online degree, English; 5 modules, each having a significant programming assignment. Taught together with Profs. Nicholas Roy (MIT), Sebastian Thrun (Stanford), and Raffaello D'Andrea (ETH). I was responsible for the parts on quadrotor control and sensors. *Newly-developed content.* [[course website](#)]

- Course covers 3D motion planning, controls, estimation, multi-rotor and fixed-wing aircraft. [[syllabus](#)]
- Enrollment: >1,000 students to date, enrollment ongoing.

**AER521: Mobile Robotics, University of Toronto.**

03/2018

Guest lecturer for this course (fourth-year undergraduate course and graduate course), 2-hour lecture on “Safe learning-based control for mobile robots.”

**ESC301: Engineering Science Praxis, University of Toronto.**

Spring 2013,15, Fall 2016-19

Invited speaker at this lecture series for third-year undergraduate Engineering Science students, 2-hour lecture on “Dynamic Systems Lab: Research in robotics, control and machine learning.”

**Summer School on Decision Making and Uncertainty, Magdeburg, Germany.**

08/2017

Invited speaker at the 5th Summer School of the International Max Planck Research School (IMPRS) for Advanced Methods in Process and Systems Engineering, 4-hour lecture on “Using Bayesian models to make informed and safe decisions under uncertainty.”

**Summer School on Autonomous Micro Aerial Vehicles, Sankt Augustin, Germany.**

08/2015

Invited speaker at this summer school, an activity of the European Project TRADR, held at the Faunhofer Institute for Intelligent Analysis and Information Systems, 3-hour lecture and programming exercises on “Controls for multi-rotor vehicles: from model-based to learning-enabled approaches.”

**DRM486/DRA3907: Digital Dramaturgy in Performance Course, Univ. of Toronto.**

03/2015

Invited speaker at this course offered by the Centre for Drama, Theatre and Performance Studies, 1-hour lecture on “Robots on stage?!”

**Summer School on Autonomous Micro Aerial Vehicles, Zurich, Switzerland.**

07/2011

Invited speaker at the robotics summer school organized by Prof. R. Siegwart and team at ETH Zurich, 1-hour lecture on “Coordination and synchronization for a rhythmic flight performance.”

□ *Teaching Assistant***151-0566-00: Recursive Estimation, ETH Zurich.**

Spring 2010, 2011

Graduate course, approx. 80 students, English. My responsibilities included teaching weekly recitation classes, developing problem sets and exams, grading, offering student office hours, maintaining the class website, and overall class administration. I helped develop this new course taught first time in Spring 2010. Lecturer: Prof. Raffaello D'Andrea.



**151-0563-01: Dynamic Programming and Optimal Control**, ETH Zurich. Fall 2008, 2009  
 Graduate course, approx. 80 students, English. My responsibilities included teaching weekly recitation classes, developing problem sets and exams, grading, offering student office hours, maintaining the class website, and overall class administration. I helped develop this new course taught first time in Spring 2008. Lecturer: Prof. Raffaello D'Andrea.

**Control Theory I**, University of Stuttgart. Spring 2006  
 Graduate course, approx. 30 students, German. I supervised students during their practical laboratory work. Lecturer: Prof. Frank Allgöwer.

**Thermodynamics I**, University of Stuttgart. Spring 2005  
 Undergraduate course, approx. 10 students, German. Guided undergraduate students in their project work focusing on a practical problem in the field of thermodynamics: the generation of energy through warm water heated by the sun. Lecturer: Prof. Hans Hasse.

**Advanced Mathematics I**, University of Stuttgart. Fall 2004  
 Undergraduate course, approx. 25 students, German. Taught weekly student exercise classes. Lecturer: Prof. Klaus Hölzig.

**Engineering Mechanics I**, University of Stuttgart. Fall 2003, Spring 2004  
 Undergraduate course, approx. 50 students, German. Taught weekly student exercise classes. Lecturer: Prof. Peter Eberhard.

#### □ *Teaching Innovation*

**Pilot Project: Integrating Feedback into Your Teaching**, University of Toronto. Fall 2016  
 With my course 'Mathematics for Robotics', I am participating in this pilot project initiated by the Centre for Teaching Support & Innovation (CTSI) at the University of Toronto.

**Gradescope for Online Marking**, University of Toronto. 01/2016  
 I introduced Gradescope at the University of Toronto for faster, fairer and collaborative marking online. I used it for the course 'Control Systems' in Spring 2016 for the first time. [[website](#)]

**EduApp for Real-Time Classroom Feedback**, ETH Zurich. 09/2012  
 I used ETH's EduApp in the graduate course 'Dynamic Programming and Optimal Control' to ask 2-3 questions related to the key learning objectives. Those questions are answered by the students using their internet-capable devices and the results can be displayed during the class or in the next class. [[website](#)]

#### □ *Instructional Development Activities*

**Workshop: Best Practices in Graduate Supervision**, University of Toronto. 11/2014  
 I attended this one-day workshop offered by the Centre for Teaching Support and Innovation (CTSI) focusing on setting up your students for success.

**Workshop: Building Your Portal Course**, University of Toronto. 01/2014  
 I attended this half-day workshop on the university's online course management system offered by the Centre for Teaching Support and Innovation (CTSI).

**Several Teaching Workshops**, ETH Zurich. 2009–2012  
 I participated in various several-day workshops focusing on didactic skills including 'Didactic Workshop for Newcomers', 'Implementation of Computerized Exercises and Exams', and 'Alignment of Learning Objectives, Performance Assessment and Teaching Methods'.

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PROFESSIONAL ACTIVITIES

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□ *Editor Positions*

- IEEE Int. Conf. on Robotics and Automation (ICRA).** Associate Editor. since 2018
- IEEE Control Systems Society Video Clip Contest,** Chair of Jury. 2017, since 2019
- Robotics: Science and Systems Conference (RSS),** Area Chair. 2016–2017
- Mechatronics Journal,** Associate Editor. 2013–2016
- IEEE/RSJ Int. Conf. on Intelligent Robots & Systems (IROS),** Associate Editor. 2015

□ *Workshop Organization*

- Workshop on Reinforcement Learning for Robot Control.** 2019–2020  
 Proposer of this workshop on ‘Reinforcement Learning for Robot Control in Unstructured Environments: Open Challenges and Solutions’ with Profs. D. Merger, G. Dudek and I. Sharf (McGill) to be held at the 2020 IEEE International Conference on Robotics and Automation (ICRA).
- Fourth Series of Invited Sessions on Learning-Based Control.** 2019  
 Organizer of three invited sessions at the interface of control theory and machine learning together with Dr. S. Trimpe (Max Planck Institute for Intelligent Systems, Stuttgart), Dr. M. Mueller (University of Stuttgart) and Prof. M. Zeilinger (ETH Zurich) held at the 2019 IEEE Conference on Decision and Control (CDC). [[event page](#)]
- Workshop on Algorithms & Architectures for Learning in-the-Loop Systems.** 2019  
 Organizer of this workshop with Dr. A. Faust (Google Brain), Prof. V. J. Reddi (Harvard) and Dr. S. Tang (UPenn and Nuro Inc) held at the 2019 IEEE International Conference on Robotics and Automation (ICRA). [[event page](#)]
- Third Invited Session on Learning-Based Control.** 2018  
 Organizer of this session at the interface of control theory and machine learning together with Dr. S. Trimpe (Max Planck Institute for Intelligent Systems, Stuttgart), Dr. M. Mueller (University of Stuttgart) and Prof. M. Zeilinger (ETH Zurich) held at the 2018 IEEE Conference on Decision and Control (CDC). [[event page](#)]
- Second Invited Session on Learning-Based Control.** 2017  
 Organizer of this session together with Prof. M. Zeilinger (ETH Zurich) and Dr. S. Trimpe (Max Planck Institute for Intelligent Systems, Tuebingen) held at the 2017 IEEE Conference on Decision and Control (CDC). [[event page](#)]
- First Invited Session on Learning-Based Control.** 2016  
 Organizer of this session together with Prof. M. Zeilinger (ETH Zurich) and Dr. S. Trimpe (Max Planck Institute for Intelligent Systems, Tuebingen) held at the 2016 IEEE Conference on Decision and Control (CDC). [[event page](#)]
- Second Workshop on Machine Learning in Planning and Control of Robot Motion.** 2015  
 Held at the 2015 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). [[website](#)]
- International Workshop on Multi Unmanned Vehicles Systems (MUVS).** 2014  
 Held in Compiègne, France. Second workshop after a first successful one held in [Austria](#) in 2013. [[website](#)]
- Workshop on Machine Learning in Planning and Control of Robot Motion.** 2014  
 Held at the 2014 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). Biggest workshop at IROS 2014. [[website](#)]

□ *Technical/Program Committees*

**Techn. Committee on Intelligent Control, IEEE Control Systems Society (CSS).** since 2017

My responsibilities include attending program committee meetings and contributing to initiatives that foster intelligent control research. [[website](#)]

**Techn. Committee on Control Education, Int. Fed. of Automatic Control (IFAC).** since 2014

My responsibilities include organizing outreach workshops and special sessions on controls education, and engaging the other technical committees in controls education issues and activities. [[website](#)]

**Techn. Committee on Control Education, IEEE Control Systems Society (CSS).** since 2011

My responsibilities include organizing workshops for school teachers and students. [[website](#)]

**Techn. Committee on Control Education, American Automatic Control Council.** since 2011

My responsibilities include organizing outreach workshops and special sessions on controls education, and engaging the other technical committees in controls education issues and activities. [[website](#)]

**ICRA Best UAV Paper Award Committee.** 2018

I served on this committee, which selected the best unmanned aerial vehicle (UAV) paper at the IEEE International Conference on Robotics and Automation (ICRA) 2018.

**IFAC International Conference on Nonlinear Model Predictive Control.** 2018

I was a member of the international program committee. [[website](#)]

**Third Workshop on Machine Learning in Planning and Control of Robot Motion.** 2018

I was a member of the international program committee of this workshop held at the 2018 IEEE International Conference on Robotics and Automation (ICRA). [[website](#)]

**Conference on Field and Service Robotics (FSR).** 2017

I served on the International Program Committee.

**IFAC World Congress Invited Track for Live Robotic Demonstrations.** 2016–2017

My responsibilities included reviewing submitted proposals for robotics demonstrations to be exhibited during the IFAC World Congress.

**AAAI (Assoc. for the Advancement of Artificial Intelligence) Video Competition.** 2014–2016

I was a judge of this yearly competition showing the latest results in AI and robotics in video.

**Conference on Field and Service Robotics (FSR).** 2015

I was the Technical Tour Chair for the 2015 conference in Toronto, Canada. My responsibilities included organizing the technical tour and robot demonstrations as well as giving a short talk about the activities at our institute.

**IEEE Control Systems Society Video Clip Contest.** 2015

I was a jury member of this yearly competition featuring videos that promote the field of automatic control. [[website](#)]

**DroNet Workshop at MobiSys.** 2015

Workshop on ‘Micro Aerial Vehicle Networks, Systems, and Applications for Civilian Use’ held at the International Conference on Mobile Systems, Applications, and Services (MobiSys). My responsibilities included reviewing submitted papers. [[website](#)]

**International Conference on Computer and Robot Vision (CRV).** 2015

My responsibilities included reviewing submitted papers. [[website](#)]

**Internat. Workshop on Wireless Sensor, Actuator & Robot Networks (WiSARN).** 2014–2015

My responsibilities included reviewing submitted papers.

## □ *Advisory Boards*

**Board of Technology Advisors, Bergstrom Inc,** Rockford, USA. since 05/2018

I am the youngest member of Bergstrom Inc.'s Board of Technology Advisors. [\[website\]](#)

**Advisory Committee, Autonomous Vehicle Innovation Network,** Ontario, Canada. since 01/2018

I am part of the Advisory Committee for this network established by the Ontario Centres of Excellence, which funds research and provides access to testing grounds. [\[website\]](#)

**Autonomous Systems Advisory Board, Udacity Inc,** Mountain View, USA. 05–10/2018

As members of the board, we advise Udacity Inc on new directions and growth opportunities for their online course offerings in the area of autonomous systems and provide feedback on existing content. [\[website\]](#)

## □ *Grant Proposal Reviewing*

**Canada Foundation for Innovation (CFI),** John R. Evans Leaders Fund. 2016

**European Robotics Challenges,** short proposals for admission to Stage II. [\[website\]](#) 2015

**European Research Council,** Consolidator Grant. 2014

**Mitacs Accelerate, Canada.** [\[website\]](#) 2014

## □ *Journal and Conference Reviewing*

**Journal Papers** since 2008

Automatica ◦ Autonomous Robots ◦ Control Engineering Practice ◦ IEEE Transactions on Aerospace and Electronic Systems ◦ IEEE Transactions on Automatic Control ◦ IEEE Transactions on Robotics ◦ International Journal of Robotics Research ◦ Mechanical Systems and Signal Processing ◦ Mechatronics ◦ SIAM Journal on Control and Optimization

**Conference Papers** since 2008

American Control Conference (ACC) ◦ Conference on Neural Information Processing Systems (NIPS) ◦ Conference on Robot Learning (CoRL) ◦ European Control Conference (ECC) ◦ IEEE Conference on Decision and Control (CDC) ◦ IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) ◦ IEEE International Conference on Rehabilitation Robotics (ICORR) ◦ IEEE International Conference on Robotics and Automation (ICRA) ◦ IEEE Multi-Conference on Systems and Control (MSC) ◦ IFAC World Congress ◦ Robotics: Science and Systems (RSS).

## □ *External Ph.D. Committee Membership*

### **Current**

*Defence committee (total: 1):* Felix Kong (supervisor: Manchester, Australian Centre for Field Robotics, University of Sydney, Australia)

### **Previous**

*Defence committee (total: 1):* Milan Erdelj (supervisor: Razafindralambo, INRIA, Lille, France; graduated 2014)  
◦ Jing Yang (Jenkin, York University, Canada; graduated 2014)

## □ Professional Memberships

**The Association of German Engineers (Verein Deutscher Ingenieure),** Member. since 2011

**Institute of Electrical and Electronics Engineers (IEEE),** Member. since 2008

*Societies:* IEEE Robotics and Automation Society, IEEE Control Systems Society, IEEE Women in Engineering, IEEE Young Professionals.

## UNIVERSITY SERVICE

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I have served on committees both at the university level (University of Toronto; short: U of T), at the Faculty level (Faculty of Applied Science & Engineering, University of Toronto; short: FASE), and at the departmental level (University of Toronto Institute for Aerospace Studies; short: UTIAS).

## □ University-Level Service

**Canada Research Chair (CRC) Review College, U of T.** since 10/2018

I am serving on the Vice-President Research and Innovation's Review College that will assess submissions to the [Special Call for U of T CRC Applicants from Federally Designated Groups](#). This special call is a unique initiative through which the University aims to augment the excellence and diversity of its Chairholder community and thereby strengthen the quality, relevance and impact of research and training across the University.

**President's International Council (PIC) for Europe and the U.K., U of T.** since 01/2018

The Presidential International Councils (PICs) serve an advisory function to the leadership of the International portfolio – and through that leadership, to the President of the University – and to staff and partners during implementation, refinement and updating of the University of Toronto International Strategic Plan (includes Recruitment, Academic Partnerships, International Student Experience, Reputation, etc.).

**Presentation to Governing Council, U of T.** 10/2017

The AutoDrive team presented their self-driving project to all members of the Governing Council of the University and received very positive feedback including some monetary sponsorships.

## □ Faculty-Level Service

**Student Recruitment, FASE.** since 02/2013

I am supporting the Faculty in recruiting top high-school students for our undergraduate programs; in particular, top female students. For details, please refer to Outreach Activities and Public Lectures above. As a result of these and many other efforts of the Faculty, we have a record number of 30.6% female first-year students in our engineering programs in Fall 2015 compared to an average of about 20% in North America.

**Faculty Search Committee Electrical Engineering, FASE.** 2018–2019

I was part of the search committee for a new faculty member in Controls and Robotics at the Department of Electrical and Computer Engineering.

**Faculty Partnerships Promotional Video, FASE.** 10/2018

For a film team hired by the Faculty to create a video promoting industry partnerships with the University, we prepared several robot live demonstrations. In the one-minute video, *ten video segments* are from our lab: [\[video\]](#)

**Canadian Engineering Accreditation Board (CEAB) Visit, FASE.** 10/2018

As an instructor in the Engineering Science program, I participated in the CEAB visit that was part of the program's accreditation review.

**EngSci Alumni Machine Intelligence Bootcamp, University of Toronto.** 09/2018

We showcased our self-driving car to alumni of the Engineering Science (EngSci) program at the University of Toronto who came to celebrate the launch of the new EngSci major in Machine Intelligence and to learn about how this new technology is advancing engineering and society, and about opportunities to propel their own career and business.

**Canada Research Chair (CRC) Nomination Committee, FASE.** 08–10/2018

I was a member of the Faculty's newly established CRC Nomination Committee. The CRC Nomination Committee was tasked with ensuring the consistency and compliance with CRC's Equity, Diversity, and Inclusion Action Plan and implementing a transparent and equitable process for the selection of CRC nominations.

**Faculty Search Committee Electrical Engineering, FASE.** 2017–2018

I am part of the search committee for a new faculty member in Controls and Robotics at the Department of Electrical and Computer Engineering.

**Robotics Strategic Planning Committee, FASE.** 2017

The mandate is to evaluate existing robotics activities and initiatives at the University of Toronto and offer a unified plan for the future.

**Robotics Talk for Advancement Staff, FASE.** 02/2017

I gave a presentation on the field of robotics and robotics research efforts at the University to staff from University Advancement, to help them understand the field and approach potential donors.

**UTIAS Director Advisory Committee, FASE.** 2016

I was part of the committee advising on UTIAS' new director.

**Curriculum Design for Robotics Option, FASE.** 2014–2015

I helped to design the curriculum for the new undergraduate major in Robotics offered to students in the Engineering Science undergraduate program.

#### □ *Department-Level Service*

**Aerial Robotics Seminar Series Organizer, UTIAS.** since 09/2016

I am a co-organizer of the CARRE (Centre for Aerial Robotics Research and Education) Aerial Robotics Seminar Series, which invites one speaker per month on average.

**Planning Committee, UTIAS.** since 01/2013

I am helping to define the long-term strategy of the institute.

**Providing Input to Faculty Search Committee, Computer Science.** 2017–2018

The computer science department had a search for *three robotics positions (assistant-professor- and associate-professor-level)*. I met with all invited candidates and provided my feedback to the search committee.

**Appeals Committee, UTIAS.** 2017–2018

I am helping to address student appeals.

**Three Faculty Search Committees, UTIAS.** 2015, 2017–18

I was part of *three* search committees at UTIAS for faculty positions in Robotics and Combustion, and for the Faculty's interdisciplinary search.

**Aerial Robotics International Research Symposium, UTIAS.** 2017

I am one of the co-organizers for this two-day symposium featuring high-profile speakers such as Prof. Siegwart (ETH Zurich), Prof. Floreano (EPF Lausanne), Prof. How (MIT) and Prof. Singh (CMU) as well as a panel with industry representatives moderated by Hallie Siegel. [[website](#)]

**Fundraising Committee, UTIAS.**

2013–2017

I am helping to raise funds from industry and private donors.

**CARRE Research Symposium, UTIAS.**

2016

I helped organizing this annual event of the Centre for Aerial Robotics Research and Education (CARRE), which includes student and industry talks, and networking activities.

**Undergraduate Lab Review Committee, UTIAS.**

2015

I am part of a team conducting a broad review of the laboratory components of our undergraduate courses and making recommendations for improving both the quality and the efficiency of the labs offered by UTIAS.

□ *Internal Ph.D. Examination Committee Membership***Current**

*Defence committee (total: 1):* Ashton Roza (supervisor: Maggiore, ECE)

*Thesis committee (total: 12):* Trevor Ablett (supervisor: Kelly, UTIAS) ◦ Oliver Limoyo (Kelly, UTIAS) ◦ Valentin Peretroukhin (Kelly, UTIAS) ◦ Lee Clement (Kelly, UTIAS) ◦ Tianhang Teng (Grant, UTIAS) ◦ Peter Berczi (Barfoot, UTIAS) ◦ Qingrui Zhang (Liu, UTIAS) ◦ Kirk MacTavish (Barfoot, UTIAS) ◦ Mona Gridseth (Barfoot, UTIAS) ◦ Yuhang Jiang (Damaren, UTIAS) ◦ Esmail Sharifi (Damaren, UTIAS) ◦ Ahmad Khanlari (Evans, ChemEng)

**Previous**

*Defence committee (total: 1):* Melkior Ornik (supervisor: Broucke, ECE; graduated 2017)

*Thesis committee (total: 2):* Adam Sniderman (supervisor: D’Eleuterio, UTIAS; graduated 2017) ◦ Patrick McGarey (Barfoot, UTIAS) ◦ Michael Paton (Barfoot, UTIAS)

**OUTREACH**

In addition to our participation in major science exhibitions and outreach events (see below), we have produced more than 50 videos of our research available on our Youtube channel [\[link\]](#). The science promotion events below are complemented by *numerous invited talks for a general audience listed in the ‘Invited Talks’ section above* and by *various media coverage, see section ‘Select Media Coverage’ below*.

□ *Exhibitions***TED Global, Edinburgh, UK.**

06/2013

Demonstration of the Flying Machine Arena<sup>3</sup> during Raffaello D’Andrea’s TED talk followed by a five-day live demonstration during the remaining days of the TED conference.

**Zurich Minds, Zurich, Switzerland.**

12/2012

Zurich Minds is a flagship conference in Switzerland with a similar concept as the TED conferences. Raffaello D’Andrea used the Flying Machine Arena research in his talk to demonstrate the principles of feedback control. More than 500 invited guests attended.

**Google I/O, San Francisco, USA.**

06/2012

The Flying Machine Arena team was invited to showcase its research at Google’s yearly developers conference. The event was attended by more than 1K people.

<sup>3</sup>My Ph.D. research was conducted in the Flying Machine Arena. For more details about the Flying Machine Arena aerial robotics testbed, visit <http://flyingmachinearena.org/>.



**Hannover Messe**, Hannover, Germany.

04/2012

The Hannover Messe is a leading, annual showcase for industrial technology. Over five days, we provided 25 flight shows reaching more than 5K visitors.

#### □ *STEM Promotion Events*

**Numerous live demonstrations of our robotics research**, University of Toronto. since 01/2013

We regularly show live demonstrations of our robotics research to visitors. We had an average of 500 visitors/year since 2015. Visitors included *politicians and government officials* (including the Canadian Minister of Science and Sport, various Members of Parliament, representatives from Industry Canada, and delegations from Brazil, China and Singapore), *journalists and science writers* (from Canada, USA, Austria, Japan, UK, Italy, and Belgium), *technology experts* (for example, 80 attendees of the Tenth Conference on Field and Service Robotics and representatives from NASA Ames), *industry representatives, donors*, and many *high-school, undergraduate and graduate student groups* from Canada and abroad. This is what visitors get to see: [[video of robot demonstrations as of 09/2018](#)]

**Open House Myhal Centre**, University of Toronto.

09/2018

We showed our robots during the official Open House of the new Myhal Centre for Engineering Innovation & Entrepreneurship at the University. [[article](#)]

**Elevate, Smart City Track**, Toronto, Canada.

09/2018

Elevate is a week-long, city-wide tech and innovation festival with over 10,000 guest and 300 speakers including Eric Schmidt (Alphabet), Tobias Lütke (Shopify) and Minister Navdeep Bains (Minister of Innovation, Science and Economic Development). We brought our self-driving car and talked about the SAE AutoDrive competition we participate in. [[event page](#)]

**University of Toronto Students' Union (UTSU) Street Fest**, University of Toronto.

09/2018

During this event, we showcased our self-driving car to new student from all programs at the University and to anyone else visiting the Street Fest. We used the event to recruit members for our self-driving team as well as sponsors.

**aUToronto Sponsorship Event**, University of Toronto.

08/2018

We invited everyone who supported our self-driving competition team in the past year (alumni, donors and collaborators) as well as others interested in the technology. Visitors enjoyed a ride in our self-driving vehicle.

**Media Tour of the Myhal Centre**, University of Toronto.

08/2018

We showed our self-driving car during the media tour of the new Myhal Centre for Engineering Innovation & Entrepreneurship at the University. Various media representatives as well as alumni and donors were invited.

**International Youth Drone Competition**, Toronto, Canada.

Summer 2017, 2018

I am one of the competition committee members of this Chinese-Canadian engineering outreach event. [[event page](#)]

**Go North Youth Event**, Toronto, Canada.

06/2018

Over 1,100 Ontario students in Grades 4 to 8 visited the University of Toronto to attend this event and learn about STEM. Our Centre for Aerial Robotics Research and Education (CARRE) participated with an interactive flying vehicle demonstration. [[event page](#)]

**Science Rendezvous**, Toronto, Canada.

05/2018

Annual science festival attracting 200,000 visitors Canada-wide. Our Centre for Aerial Robotics Research and Education (CARRE) showcased our flying vehicles. [[video of our exhibition](#)]

**Canadian National Exhibition (CNE) Innovation Garage**, Toronto, Canada.

08/2017

I was on the panel on 'Artificial Intelligence' with Ryan Gariepy, CTO of Clearpath Robotics Inc., and Kristjan Sigurdson from the Creative Destruction Lab.



**NSERC International Day of Women and Girls in Science Panel**, Toronto, Canada. 02/2017

I was on the panel with The Honourable Kirsty Duncan, Canada's Minister of Science, The Honourable Maryam Monsef, Canada's Minister of Status of Women, the CEO of Actua and a representative of Facebook's Oculus team. [\[news article\]](#)

**Doors Open**, Toronto, Canada. 05/2016

Around 400 visitors came to the institute for a tour during this two-day event and saw a demonstration of our flying robots. [\[event page\]](#)

**Science Rendezvous**, Toronto, Canada. 05/2016

Annual science festival attracting 200,000 visitors Canada-wide. My team gave a science talk and showcased our robots during the festival. [\[event page\]](#)

**Engineering Showcase**, Toronto, Canada. 06/2015

Robot demonstration as part of festivities around the ground-breaking of the new engineering building at the University of Toronto, the Centre for Engineering Innovation & Entrepreneurship (CEIE).

**Summer STEM Camp**, Toronto, Canada. 07/2014

Question-and-answer session with around 50 attendees.

**Promotional Video for Engineering**, University of Toronto, Canada. 10/2013

I participated in a video promoting Engineering at the University and aiming to attract students. [\[video\]](#)

**Google[x] Fiesta**, Palo Alto, USA. 05/2013

One-day live demo on "Aerial Robotics for Photo and Videography" with Z. Marom, S. Lupashin and D. Kanesh.

**Numerous demonstrations in the Flying Machine Arena**, Zurich, Switzerland. 2009–2012

We demonstrated our aerial robotics research at ETH Zurich to numerous visitors ranging from academic guests, groups of students to prominent engineers, businessmen and government officials. Attracted nearly 1K visitors (around 30 demonstrations and 300 visitors per year). [This video introduces the Flying Machine Arena: \[video\]](#)

**Week on Science and Technology**, Zurich, Switzerland. 02/2012

Day-long interactive presentation of our research at this high school event at the Literargymnasium Rämibühl. Attended by around 100 students.

**Maturandentage**, ETH Zurich, Switzerland. 2009–2011

Annual open house day at ETH Zurich for high school seniors with information sessions presenting study programs and research projects.

**National Daughter's Day (later: National Future Day)**, Zurich, Switzerland. 2008–2011

Swiss nation-wide initiative showing 10-13 year-old boys and girls gender-untypical fields of work with the goal of fostering equal career opportunities for men and women. Around 40 visitors each year.

**TecNight@Kanti**, Zurich, Switzerland. 11/2011

An initiative of the Swiss Academy of Engineering Sciences (SATW) to bring innovative projects, people, and companies to Swiss high schools during a science night; participated in the science talk "Switzerland needs engineers."

**Researchers' Night**, Zurich, Switzerland. 2008–2009

Yearly, city-wide exhibition in Zurich presenting innovative projects and latest research results to the public; attracted more than 25K visitors each year. [\[video\]](#)

**Promotional Video**, ETH Zurich, Switzerland. 07/2008

I managed the group's activities for a promotional video aimed at incoming ETH engineering students.

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## SELECT MEDIA COVERAGE

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### Summary

- Making our research widely accessible – through academic outlets as well as various media outlets – is an important aspect of our work.
- As an example, in the 15 months from May 2017 through August 2018, our research has garnered *38 individual pieces of coverage across print, digital and broadcast media*, including top mainstream and specialty outlets such as The Globe & Mail, CBC, Engadget, TechCrunch, MIT Technology Review and Forbes. This coverage has generated *25 million impressions (2 million/month)*, a measure of reach that reflects the number of viewers, readers or listeners for each outlet.<sup>4</sup>
- The University of Toronto Engineering News as reported about my team in 35 original articles (six per year) here: [[website](#)].

### Select List

#### □ Television

**CBC Téléjournal Ontario**, Video, “Défi AutoDrive: l’Université de Toronto en première place.” 05/2018  
The Canadian crown corporation (CBC) serves as the national public radio and television broadcaster. This piece reports about our first place at the SAE/GM AutoDrive Challenge 2018, a U.S./Canada-wide, self-driving competition. Aired 12/05/2018. [[video](#)]

**CBC Toronto**, Video, “AutoDrive Challenge: University of Toronto students take first place.” 05/2018  
CBC reports about our first place at the SAE/GM AutoDrive Challenge 2018, a U.S./Canada-wide, self-driving competition. Aired 12/05/2018. [[video](#)]

**Discovery Channel Canada**, Demonstration, “The Canadian Field Robotics Network.” 05/2017  
Discovery Channel covers the robotics field trials of our NSERC Canadian Field Robotics Network as part of the show *Daily Planet*. We show the use of unmanned aerial vehicles in mining applications: an aerial vehicle that can help with fragmentation analysis in mining. Aired 03/05/2017.

**CBC News**, Interview and Demonstration, “Defibrillator-equipped drones.” 11/2016  
This piece features our collaborative work with medical and operations researchers studying the feasibility of drone delivered defibrillators. This story was featured later in *more than 40 newspapers and radio shows* reaching *more than 6M people* (according to typical media analyses). Outlets included CBC Radio 1, CBC News [[article](#)], Toronto Star [[article](#)], The Globe and Mail [[article](#)], and several German newspapers. Aired 15/11/2016. [[media summary](#)]

**TVO**, Interview, “Here come the robots.” 03/2016  
TVO is a Canadian publicly funded educational television station founded 1970. I was interviewed about our research, the state of the art in robotics, and the potential impact of robotics on society. [[video](#)]

**BBC Click**, Video, “The swarming drones that can float on water.” 04/2015  
UK’s public-service broadcaster BBC covered our drone project *Waterfly*, a joint project with the MIT SENSEable City Lab. [[video](#)]

**CP24 Live**, Interview, “Amazon drone testing in Canada.” 03/2015  
The Canadian news channel interviewed me about the opportunities for drone research and development in Canada. Aired 31/03/2015.

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<sup>4</sup>Data obtained from the University of Toronto Engineering Communication Office’s media provider Cormex.

- City TV**, Interview and Demonstration, “Live at the University of Toronto.” 09/2014  
We gave a brief demonstration of our aerial robotics research as part of the Breakfast Television show. Aired 03/09/2014. [[video](#)]
- n-tv**, Interview and Flight Demonstration, “What do drones get to do?” 12/2012  
German news channel. As part of the show *n-tv Ratgeber*. Aired 06/08/2013. [[video and online article](#)]
- ZDF**, Flight Demonstration, “The world of robots: Eric controls flying robots.” 04/2012  
German, public-service television. As part of the show *pur+*. Aired 28/04/2012.
- Discovery Channel Canada**, Flight Demonstration. 01/2012  
As part of the show *Daily Planet*. Aired 30/01/2012.
- PRO7**, Flight Demonstration. 08/2011  
As part of the show *Galileo*. Aired 29/08/2011 in Germany, Austria and Switzerland.
- 3sat**, Flight Demonstration, “Quadrokoetter extrem.” 02/2011  
As part of the show *neues*. Aired 25/02/2011 in Germany, Austria and Switzerland.
- SF Swiss Television**, Flight Demonstration. 02/2011  
As part of the show *Einstein*. Aired 10/02/2011.
- Discovery Channel Canada**, Flight Demonstration and Interview, “Robots today.” 01/2011  
As part of the show *Daily Planet*. Aired 20/01/2011.
- NZZ Format**, Flight Demonstration, “Die Intelligenz der Roboter – The intelligence of robots.” 08/2010  
TV show in German-speaking public TV. Aired 04/08/2010 in Germany, Austria and Switzerland.
- SF Swiss Television**, Flight Demonstration, “Roboterballet im Warenlager.” 03/2009  
As part of the show *Einstein*. Aired 05/03/2009.

#### □ Radio

- CBC News**, Interview, “AutoDrive Challenge: University of Toronto students take first place.” 05/2018  
CBC reports about our first place at the SAE/GM AutoDrive Challenge 2018, a U.S./Canada-wide, self-driving competition. Aired 12/05/2018. [[English version](#)] [[French version](#)]
- talkRADIO London, U.K.**, Interview, “Udacity’s Flying Car Nanodegree” 01/2018  
This national talk radio station, as part of the *Paul Ross Show*, reported about the online course focusing on autonomous flight and flying cars I have co-developed with Nicholas Roy (MIT) and Sebastian Thrun (Stanford). Aired 25/01/2018.
- CBC News**, Interview, “Udacity’s Flying Car Nanodegree” 01/2018  
CBC, as part of *Here and Now*, reported about the online course I have co-developed with Nicholas Roy (MIT) and Sebastian Thrun (Stanford) focusing on autonomous flight and flying cars. Aired 24/01/2018.
- CBC Metro Morning**, Interview, “MIT Technology Review Innovators Under 35 recognition” 08/2017  
CBC interviewed me about the recognition I received, being named an ‘Innovator under 35’ by MIT Technology Review. Aired 17/08/2017. [[link to audio](#)]
- CBC Radio One**, Interview, “Pilotless planes.” 06/2017  
I gave a total of 15 interviews for local CBC radio stations on Boeing’s announcement of pilotless planes. Aired 08/06/2017.

**Deutschlandradio Kultur**, Interview, “Autonomous flying vehicles.” 08/2015  
National German public broadcasting radio. Aired 25/08/2015. [[link to audio](#)]

**WDR 5 Radio**, Interview, “Drone swarms.” 06/2015  
German public-broadcasting institution, as part of the science show *Leonardo*. Aired 11/06/2015. [[link to audio](#)]

□ *Print*

**Universities Canada**, Article, “Canadian excellence, global recognition.” 02/2018  
A national publication profiling the winners of top international research awards. [[article](#)]

**MIT Technology Review**, Article, “Innovators under 35.” 08/2017  
A technology magazine dedicated to explaining the innovations that are changing the world, published (but not owned) by the Massachusetts Institute of Technology (circulation of 172K worldwide). [[article](#)]

**Swissquote Magazine**, Article/Interview, “How drones are changing the world.” 07/2016  
Switzerland’s largest business publication. [[article](#)]

**Technology Review Germany**, Article/Interview, “Daring more autonomy.” 05/2016  
Technology magazine. [[article](#)]

**Skulematters Magazine**, Article/Interview, “The future of health-care engineering.” 02/2015  
U of T Engineering alumni magazine (circulation of 33K worldwide). [[online magazine](#)] [[full magazine pdf, on page 39](#)]

**The Globe and Mail**, Article/Interview, “A drone maker flies high.” 06/2015  
Nationally distributed Canadian newspaper. [[article](#)]

**Skulematters Magazine**, Article/Interview, “Eight women shaping the future of engineering.” 02/2015  
U of T Engineering alumni magazine (circulation of 33K worldwide). [[online magazine](#)] [[full magazine pdf, on page 27](#)]

**The Boston Globe**, Article, “MIT’s entry in Dubai’s ‘Drones For Good’ contest is...” 02/2015  
American newspaper. Article about the collaborative project *Waterfly* with the MIT SENSEable City Lab. [[article](#)]

**University of Toronto Engineering**, Article, “Year in Review 2012–2013.” 07/2013  
University-internal producer. [[article](#)]

**SonntagsZeitung**, Article, “Die Dressur der Drohnen.” 11/2012  
Swiss weekly newspaper. [[article](#)]

**c’t**, Article, “Flugzirkus.” 07/2012  
German computer magazine. [[article](#)]

**Le Matin**, Article, “Ici. On dompte les robots volants.” 04/2011  
Swiss daily newspaper (in French). [[article](#)]

□ *Online Video*

**Research2Reality**, Interview. 07/2016  
Social media initiative promoting Canadian scientists who are engaged in innovative and leading-edge research. [[video](#)]

**University of Toronto Engineering**, Interview, “A Professor’s perspective.” 10/2013  
University-internal producer. [[video](#)]

**University of Toronto**, Interview, “Academic appointment interview.” 05/2013  
University-internal producer. [\[video\]](#)

□ *Online Articles*

**CBC News**, Article, “This drone has a camera that can tell it where to fly: no GPS required.” 02/2019  
CBC reports about our research on vision-based emergency return flights when GPS fails. [\[article\]](#)

**CBC ICI Toronto**, Article, “Défi AutoDrive: l’Université de Toronto en première place.” 05/2018  
CBC reports about our first place at the SAE/GM AutoDrive Challenge 2018, a U.S./Canada-wide, self-driving competition. [\[article\]](#)

**Universities Canada**, Article “Embracing robotic technology to empower and elevate people.” 02/2018  
Organization supporting Canadian universities. [\[article\]](#)

**The Varsity**, Article/Interview, “Promoting women in STEM from an early age.” 02/2017  
The University of Toronto’s student newspaper (since 1880). [\[article\]](#)

**Research2Reality**, Interview. 07/2016  
Social media initiative promoting Canadian scientists who are engaged in innovative and leading-edge research. [\[article\]](#)

**University of Toronto Engineering News**, Article/Interview, “Eight women shaping the future of engineering.” 02/2016  
Article about our work on using drones for environmental monitoring. [\[online article\]](#)

**NSERC Canada Chair for Women in Science and Engineering**, Online Feature. 06/2015  
Online article “Special Feature: Women in Aerospace.” [\[website\]](#)

**CBC**, Interview, “Amazon tests delivery drones at a secret site in Canada – here’s why.” 03/2015  
Article about the feasibility of drone development and testing in Canada. [\[article\]](#)

**Popular Science**, Article, “Project Breadcrumb helps lost drones find their way home.” 03/2015  
Article about our research collaboration with the UAV startup *PrecisionHawk*. [\[article\]](#)

**NBC News**, Article, “Eco-drones aid researchers in fight to save the environment.” 02/2015  
American commercial broadcast television and radio network. Article about the collaborative project *Waterfly* with the MIT SENSEable City Lab. [\[article\]](#)

**Wired Germany**, Article, “Zukunft der Musik / Diese Drohne ist ein fliegendes Schlagzeug.” 02/2015  
Article about the collaborative project *Flying Drum Machine* with WaveDNA Inc. [\[article\]](#)

**CNN**, Article, “These drones have a higher calling.” 02/2015  
American news channel. Article about the collaborative project *Waterfly* with the MIT SENSEable City Lab. [\[article\]](#)

**Daily Commercial News**, Interview, “Drones could keep watchful eye on construction sites.” 01/2015  
Article about potential applications of UAVs in the construction industry. [\[article\]](#)

**Market Wired**, Article, “Intelligent drones, the evolution of depression and ...” 01/2015  
Article about an equipment grant I won. [\[article\]](#)

**Fast Company**, Article, “Drone plus drum machine equals this flying musical instrument.” 12/2014  
Article about the collaborative project *Flying Drum Machine* with WaveDNA Inc. [\[article\]](#)

- Next City**, Article, “The technology that everyone thinks is evil can do good in cities.” 11/2014  
Article about the collaborative project *Waterfly* with the MIT SENSEable City Lab. [\[article\]](#)
- U of T Engineering News**, Article, “Teaching flying robots to learn.” 05/2014  
University-internal producer. [\[article\]](#)
- New Scientist**, Article and Video, “Slaloming robot minicopter learns from its mistakes.” 12/2012  
Article about our robot learning results. [\[article\]](#)
- Robohub**, Article, “Quadrocopter learns from its mistakes, perfects air racing.” 11/2012  
Professional robotics news website. Article about our research on enabling robots to learn through practice by repeating a task many times. [\[article\]](#)
- BotJunkie**, Article, “Quadrotors learn new dance.” 09/2010  
Robotics news website. Article about our *Dancing Quadrotors* research project, where we aim to fly a swarm of drones in the rhythm of the music. [\[article\]](#)
- BotJunkie**, Article, “Autonomous quadrotors dance together.” 06/2010  
Robotics news website. Article about our *Dancing Quadrotors* research project, where we aim to fly a swarm of drones in the rhythm of the music. [\[article\]](#)

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## ROBOTICS FIELD EXPERIMENTS

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- Mcity**, Ann Arbor, USA. 05-06/2019  
*Research Project:* We demonstrated our self-driving car’s capabilities including point-to-point navigation, handling intersections, and respecting traffic signs in this urban environment proving ground during the year-two SAE Auto-Drive Challenge, which we won. *Project Partners:* General Motors, SAE International, various automotive suppliers. *Duration:* 5 days. [\[website of test facility\]](#)
- Bald Mountain**, Nevada, USA. 04/2019  
*Research Project:* We deployed a DJI Inspire 2 multi-rotor platform and a DJI Matrice 600 to gather data for blast evaluation, mine planning and efficiency, and pit wall mapping. We flew under the existing licence of the mine. *Project Partners:* Kinross Gold. *Duration:* 10 days.
- Tasiast Gold Mine**, Mauritania (Northwest Africa). 11/2018  
*Research Project:* We deployed a DJI Inspire 2 multi-rotor platform to gather data for highwall mapping and fragmentation measurement. The latter is used to train a machine learning model. We had the permission from the Mauritanian military to fly drones in this area. *Project Partners:* Kinross Gold. *Duration:* 3 days.
- University of Toronto Institute for Aerospace Studies**, Toronto, Ontario, Canada. 10-11/2018  
*Research Project:* We deployed a DJI Matrice 600 Pro multi-rotor platform to test vision-based aerial navigation in long-term experiments. We had a Standing (Blanket) Special Flight Operations Certificate for Ontario to enable this work. *Project Partners:* Drone Delivery Canada, Defence R&D Canada. *Duration:* 2 months.
- Milton Quarry**, Milton, Ontario, Canada. 03-06/2017, 07/2018  
*Research Project:* We deployed three different drones, a DJI Matrice 600 Pro, a DJI Phantom and a Parrot Bebop 2, to gather data for highwall mapping and fragmentation measurement. We had a location-dependent Special Flight Operations Certificate Exemption to enable this work. *Project Partners:* Dufferin Aggregates. *Duration:* 8 days.
- Silo #5 Downtown Montreal**, Montreal, Quebec, Canada. 09/2018  
*Research Project:* We deployed a DJI Matrice 600 Pro multi-rotor platform to test closed-loop, vision-based navigation in realistic environments and close to infrastructure. We had a Special Flight Operations Certificate for this area to enable the work. *Project Partners:* Drone Delivery Canada, Defence R&D Canada. *Duration:* 5 days.



**General Motors' Desert Proving Grounds, Yuma, Arizona, USA.**

04-05/2018

*Research Project:* We demonstrated our self-driving car's capabilities including lane following, stop sign detection & stopping, and obstacle avoidance & lane changes at the proving grounds during the year-one SAE AutoDrive Challenge, which we won. *Project Partners:* General Motors, SAE International, various automotive suppliers. *Duration:* 5 days. [[news article](#)]

**El Gallo Gold Mine, Sinaloa State, Mexico.**

12/2017, 04/2018

*Research Project:* We deployed a Parrot Bebop 2 and a DJI Matrice 600 Pro to gather data for our UAVs in Mining project and, in particular, for blast monitoring, highwall mapping, leach pad monitoring, and fragmentation measurement. We had an ATA Carnet to enable this work. *Project Partners:* McEwen Mining. *Duration:* 7 days.

**Bowmanville Quarry, Bowmanville, Ontario, Canada.**

03-09/2018

*Research Project:* We deployed three different drones, a DJI Matrice 600 Pro, a DJI Phantom and a Parrot Bebop 2, to gather data for our UAVs in Mining project. We particularly tested the quality of highwall mapping and fragmentation measurement using drone-based sensors. We had a location-dependent Special Flight Operations Certificate and later a Standing (Blanket) Special Flight Operations Certificate (Ontario) to enable this work. *Project Partners:* St Marys Cement Group, McEwen Mining. *Duration:* 7 days.

**Military Base, Suffield, Alberta, Canada.**

06/2018

*Research Project:* We deployed a DJI Matrice 600 Pro multi-rotor platform to test our closed-loop, vision-based navigation algorithms at high speeds and in various wind conditions. We had a Special Flight Operations Certificate for this area to enable the work. *Project Partners:* Drone Delivery Canada, Defence R&D Canada. *Duration:* 7 days.

**Rockcliffe Airport, Ottawa, Ontario, Canada.**

05/2017

*Research Project:* We deployed a Parrot Bebop 2 multi-rotor platform during the NSERC Canadian Field Robotics Network's Robot Field Trials to gather data for our UAVs in Mining project. We tested our UAV-based, automated fragmentation analysis in realistic conditions. We had a joint Special Flight Operations Certificate for the area to enable the work. *Project Partners:* McEwen Mining. *Duration:* 3 days.

**CSA Mars Emulation Terrain, Montreal, Quebec, Canada.**

05/2014

*Research Project:* We brought our 900 kg Clearpath Grizzly robot to the site. We tested vision-based, autonomous, off-road driving in long-term experiments, and used both a non-learning and a learning-based model predictive controller. *Project Partners:* MDA, Defence R&D Canada. *Duration:* 5 days.

**Military Base, Suffield, Alberta, Canada.**

10/2013

*Research Project:* We transferred our learning-based control algorithms onto a 600 kg, off-road vehicle (Ackermann steering) from Defence R&D Canada. We tested our vision-based driving controller with and without learning being enabled at range of different speeds. *Project Partners:* MDA, Defence R&D Canada. *Duration:* 5 days.

**EXTENDED RESEARCH VISITS****NCFRN Robot Field Trials, Ottawa, Canada.**

05/2017

Yearly, week-long event of the NSERC Canadian Field Robotics Network. The event includes talks from researchers, and industry and government representatives as well as robot demonstrations in realistic, outdoor environments.

**Interdisciplinary Workshop on Autonomous Systems, Austin, USA.**

04/2016

Two-day, by-invitation-only workshop on "the integration of control theory, formal methods, learning and human factors for autonomous systems". [[website](#)]

**NCFRN Robot Field Trials, Kelowna, Canada.**

06/2015

Yearly, week-long event of the NSERC Canadian Field Robotics Network. The event includes talks from researchers, and industry and government representatives as well as robot field testing in realistic, outdoor environments.



**NCFRN Robot Field Trials**, Montréal, Canada.

05/2014

Yearly, week-long event of the NSERC Canadian Field Robotics Network. The event includes talks from researchers, and industry and government representatives as well as robot field testing in realistic, outdoor environments.

**MIT SENSEable City Lab**, Boston, USA.

03–04/2014

First milestone demonstration of our collaborative project *Waterfly* to external stakeholders (representatives of the US Environmental Protection Agency, and of the cities of Boston and Cambridge). My team was responsible for the algorithms enabling autonomous multi-vehicle flight. We demonstrated an aerial-imaging drone and a drone landing on water. Main collaborators: Yaniv Turgeman and Chris Green.

**Focus Period on Learning and Adaptation**, Lund University, Sweden.

04/2010

I attended this 3-week focus period on ‘Adaptation and Learning in Autonomous Systems’ at the Lund Center for Control of Complex Engineering Systems. Main organizer: Prof. Anders Rantzer. [[website](#)]

**Graduate School on Networked Control Systems**, Paris, France.

03/2009

I attended the week-long HYCON-EECI (Hybrid Control – European Embedded Control Institute) Graduate School on ‘Networked Control Systems’. Main organizers: Profs. Richard Murray (California Institute of Technology) and Vijay Gupta (University of Notre Dame).

**IDEAL Research Summer School**, Imperial College, London, UK.

07/2008

This week-long summer school included workshops on international researcher development and was organized by the IDEA League, a network of leading European universities of science and technology including ParisTech, Imperial College London, TU Delft, RWTH Aachen, and ETH Zurich.

**Summer Course on Aspects of Cognitive Robotics**, South Tyrol, Italy.

09/2004

This 2-week summer school included talks by experts and participants, and robot experimentation. It was organized by the universities of Munich, Stuttgart, and Erlangen, Germany.

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**PAST RESEARCH AND INDUSTRY EXPERIENCE**


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**Research Assistant**, ETH Zurich, Switzerland.

2008–2012

I worked on two projects during my Ph.D., which were both demonstrated on aerial vehicles in the Flying Machine Arena: [[website of testbed](#)].

- Iterative Trajectory Learning: I developed algorithms that enable autonomous systems to improve through practice. I performed research into computationally efficient learning algorithms and applied them to state-of-the-art experimental platforms such as highly agile flying vehicles. Advisor: Prof. Raffaello D’Andrea. Outcome: 2 journal papers, 6 conference papers, doctoral thesis, 12 invited talks. Videos featuring select research results are found here: [[research videos](#)].
- Rhythmic Multi-Vehicle Flight Performances: I created rhythmic flight performances of multiple quadcopters to music, and performed research in multi-vehicle coordination, control and synchronization. Advisor: Prof. Raffaello D’Andrea. Outcome: 1 journal paper, 1 book chapter, 5 conference papers, doctoral thesis, 3 invited talks, 4 public exhibitions. Videos featuring select research results are found here: [[videos](#)].

**Internship Student**, EADS Astrium GmbH, Friedrichshafen, Germany.

Fall 2007

At the European Aeronautic Defense and Space Company (EADS), I was part of the group ‘Future Programmes & Missions, Science Missions & Systems’ and worked on Distributed Control and Estimation for the LISA (Laser Interferometer Space Antenna) project. I analyzed and further developed a distributed control and estimation method reducing the signal-to-noise ratio when aiming to measure gravitational waves. Advisor: Dr. Peter Gath. Outcome: 1 conference paper.

**Research Assistant**, Georgia Institute of Technology, Atlanta, USA. Spring 2007  
 I worked on Optimal Control of Hybrid Systems and, in particular, studied systems with regional dynamics. I derived a hybrid Bellman equation for solving the optimal control problem for such systems. Advisor: Prof. Magnus Egerstedt. Outcome: Master thesis, 1 book chapter, 1 conference paper, 1 invited talk.

**Research Assistant**, University of Stuttgart, Germany. Summer 2006  
 I worked on Stability of Networked Systems and, in particular, explored stability analysis methods for time-delay systems and their applicability for analyzing the dynamic behavior of networked systems with communication delays. Advisors: Dr. Ulrich Münz, Prof. Frank Allgöwer. Outcome: semester project thesis, 1 conference paper.

**Internship Student** Dürr Systems GmbH, Bietigheim-Bissingen, Germany. Summer 2002  
 I worked on Robot Painting Applications and helped to optimize the performance of robots used for serial painting of car and airplane bodies.

## ADDITIONAL COURSES

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**Leadership Workshops**, ETH Zurich, Switzerland. 2009–2012  
 I participated in various several-day workshops focusing on presentation and management skills:

- *Presentation skills*: Presentation Skills Course for Scientists; Speaking to Large Audiences; The Success Factor Voice; Strengthen your Voice; Developing a Comprehensive Skills' Profile.
- *Management skills*: Work Methodology and Time Management; Giving Feedback as a Management Tool.

**Venture Challenge**, ETH Zurich, Switzerland. Spring 2009  
 This semester-long course of tailored educational modules aimed at promoting start-up companies and raising awareness for entrepreneurship at ETH Zurich. It was offered by *VentureLab* in cooperation with Swiss universities. Modules included: Business Opportunity, Business Strategy, New Product Development, Marketing, Communications, Sales and Negotiation, Accounting and Finance, Writing the Business Plan, Intellectual Property, and Legal Issues and Taxes.

**Science Communication Workshops**, ETH Zurich, Switzerland. 11/2008  
 I participated in two courses related to presenting research to the general public: 'Science and its Public – Understanding your Audience' (discussing ways to improve the dialog between scientists and the public), and 'Writing Clear Messages' (discussing ways to improve writing techniques for non-specialist audiences).

**Interdisciplinary and Societal Workshops**, Cusanuswerk. 09/2005, 10/2007  
 I participated in a week-long workshop on 'Public Appearance – Ways to Improve your Personal Presentation' and in the 2-week summer school on 'Sociology of the Family'. The Cusanuswerk is the scholarship body of the Catholic Church in Germany and awards government scholarships to exceptionally gifted students in all branches of academic study. [[website](#)]

**Mathematics Seminar**, Max-Born Gymnasium Backnang, Germany. 1999–2000  
 I participated in a mathematics seminar on 'Strategies for Solving Mathematical Problems' limited to particularly talented students, offered by my high school.

## VOLUNTEER EXPERIENCE

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**Teaching flute.** 2000–2006  
**Orchestra musician**, Musikverein Burgstetten, Germany. 2000–2006  
**Managing youth group**, Roman Catholic Church St. Michael Burgstetten, Germany. 1999–2006  
**Musician at the high school's orchestra**, Max-Born Gymnasium Backnang, Germany. 2000–2002  
**Vocalist in Parents-Teachers-Students-Choir**, Max-Born Gymn. Backnang, Germany. 2000–2002

**Trainer of gymnastics group, SKG Erbstetten, Germany.**

1995–2002

PERSONAL INFORMATION 

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**Languages**

German (native), English (fluent), French (good knowledge), Italian (basic knowledge), Latin (Großes Latinum).

**Sport**

Ocean Sailing (sailing license for inland waters), Skiing, Yoga, Running.

**German citizen**