

Education

M.A.Sc. in Aerospace (Robotics) Engineering

Majored in Robotics

University of Toronto Institute for Aerospace Studies

September 2023 – Present

Principal Investigator: Professor Timothy D. Barfoot
Research Topic: Field Robot State Estimation

B.A.Sc. in Engineering Science

Majored in Robotics; Minored in Artificial Intelligence; Business Certificate

University of Toronto (St. George Campus)

September 2018 – June 2023

Graduated with High Honours; AGPA: 4.00; CGPA: 3.86
Thesis Supervisor: Professor Angela P. Schoellig

Ontario Secondary School Diploma

Ontario Scholar; AP Calculus-AB Certificate; KEY Club Certificate of Membership

Father John Redmond Catholic Secondary School

June 2017 – June 2018

Graduated with 6 Grade 12 Subject Awards
Received the Jack Smith Scholarship Award
Awarded the Professional Engineer Ontario Scholarship

Academic Experience

Autonomous Space Robotics Lab

Master of Applied Science Candidate

September 2023 - Present

University of Toronto Institute for Aerospace Studies

- Investigating more robust sensor modalities in Teach & Repeat to achieve long-term robot autonomy
- Conducting field robot experiments to evaluate localization in off-road challenging environments

Dynamic Systems Lab

Undergraduate Research Student

July 2021 - June 2023

University of Toronto

- Familiarized with inverse reinforcement learning to account for unpredictability in human driving
- Investigated into state-of-the-art prediction datasets to use for inverse reinforcement learning
- Collected ultra-wide band (UWB) time-difference-of-arrival data included in the UTIAS UWB Dataset
- Learned to make customized Bolt quadrotors based on the Bitcraze Crazyflie hardware platform
- Reproduced UWB relative localization in simulation and experiments using Extended Kalman Filter
- Thesis on Multi-Quadrotor Cooperative Flight with UWB-aided Relative State Estimation and Control

Vector Institute for Artificial Intelligence

Summer Research Intern

May 2022 - August 2022

MaRS Discovery District

- Modelled UWB sensor noise as Gaussian Mixture Model (GMM) in dynamic cluttered environments
- Used only IMU and UWB measurements to estimate the GMM noise parameters and the states
- Incorporated bi-level optimization in a slide window filter estimation framework with robust cost functions
- Collected real and simulated trajectory data for training to improve the learning-based odometry prior
- Trained ResNet models to learn the continuous motion model of IMU to alleviate the effects of noise

aUToronto Autonomous Driving Team

Perception Team Member

September 2020 - June 2022

University of Toronto

- Collected, labelled and processed custom dataset collaboratively for the sign detection sub-team
- Implemented Haar Cascade with SVM to achieve a faster sign classifier for the Year 4 new signs
- Trained and benchmarked STOA detection models to ensure its performance on a real vehicle system

Institute of Biomaterials and Biomedical Engineering

Summer Research Student

May 2019 - August 2019

University of Toronto

- Carried out Polymerase Chain Reactions (PCR) followed by Agarose gel Electrophoresis for DNA replication
- Cultivated pig heart cells in Bio-safety cabinets then observed by means of Fluorescent Microscopy
- Read academic publications and studied systematic scientific protocols

Industry Experience

Huawei Technologies Canada Inc.

Human-Computer Interaction Application Assistant Engineer

May 2021 - August 2022

Full-time Continuous

- Located at 19 Allstate Pkwy, Markham, ON L3R 5A4
- Mastered Android mobile application development in Java
- Designed animated User Feedback Interface in XML for Android apps (using Android Studio)
- Set up a Universal Windows Platform for Tobii Eyetracker achieving multi-modal interactions on Android
- Prototyped a Python pipeline to evaluate users' real-time yoga poses, then converted it to an Android app
- Built custom Google Mediapipe Android library packages on Linux to deploy on Android phones
- Trained an online Transfer Learning pipeline for eye-tracking on Android using Tensorflow Lite models
- Delivered complete project demonstrations to the design executive teams in the Huawei headquarters
- Compensated at an hourly rate of 34 CAD for 40 hours per week

Happy Kingdom Playground and Arcade

Cashier and Playground Attendant

May 2019 - August 2019

Part-time

- Located inside Nations Experience, 1980 St Clair Ave W 2nd Floor, Toronto, ON M6N 0A3
- Worked as a cashier and playground attendant to supervise and care for kids to ensure their safety
- Compensated at minimum wage of 14 CAD/hour for around 10 hours per week

Academic Publications

- [1] **Qiao, X.**, Krawciw, A., Lilge, S. and Barfoot, T.D., 2024. Radar Teach and Repeat: Architecture and Initial Field Testing. arXiv preprint arXiv:2409.10491.
- [2] Boxan, M., Krawciw, A., Daum, E., **Qiao, X.**, Lilge, S., Barfoot, T. D., & Pomerleau, F. (2024). FoMo: A Proposal for a Multi-Season Dataset for Robot Navigation in Forêt Montmorency. arXiv preprint arXiv:2404.13166.
- [3] Zhao, W., Goudar, A., Tang, M., **Qiao, X.**, & Schoellig, A. P. (2023, October). Uncertainty-aware gaussian mixture model for UWB time difference of arrival localization in cluttered environments. In 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 5266-5273). IEEE.
- [4] Zhao, W., Goudar, A., **Qiao, X.**, & Schoellig, A. P. (2022). UTIL: An ultra-wideband time-difference-of-arrival indoor localization dataset. The International Journal of Robotics Research, 02783649241230640.

Technical Skills

Programming Languages

Python | C/C# | Java | MATLAB | Verilog FPGA | ARM Assembly | Linux

Areas of Interests

Robotics State Estimation | Android App Dev | Bitcraze CrazyFlie | UWB

Soft Skills

Communications

Proactively engage with teammates to ensure clear information exchange

Problem Solving

Use creativity and thorough analysis to develop innovative functional solutions

Introspection

Reflect on past experiences to foster future personal and professional growth

Lifelong Learning

Committed to continuous learning new knowledge with a strong sense of curiosity

Awards

Didi Graduate Awards

University of Toronto

2023-2024

University Of Toronto Scholar Award

University of Toronto

2018

The Jack Smith Scholarship Award

Father John Redmond

2018

Grade 12 Subject Awards

Father John Redmond

2018

Ontario Scholar Award

Father John Redmond

2018

AP Calculus-AB Certificate

Father John Redmond

2018

PEO Scholarship

Professional Engineer Ontario

2018