# Mohammed A. **Shalaby**

## Perception Software Engineer | Ph.D.

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Roboticist with over 6 years of experience in research and industry. Co-authored 19 peer-reviewed publications with over 160 citations. Currently leading perception and navigation development for off-road autonomous vehicles at Provectus Robotics.

## Skills

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|---|---|
| **Programming** | Python · Embedded C · C++ · Matlab · Julia |
| **Miscellaneous** | ROS · Gazebo · Docker · FreeRTOS · git · Linux · LaTeX |
| **Mathematical Tools** | State Estimation · Perception · Probability Theory · Path Planning · Control Theory · SLAM · Machine Learning · Computer Vision |

## Education

**2023** **Doctorate of Philosophy** in Robotics, McGill University
**Advisors** : Prof. James Richard Forbes and Prof. Jérôme Le Ny
**Major awards** : Masters-to-PhD Fast-Track Award, FRQNT Doctoral Scholarship, McGill Engineering Doctoral Award

**2019** **Bachelor of Engineering** in Mechanical Engineering, McGill University
**Major awards** : James McGill Scholarship, Enriched Educational Opportunities Scholarship, Dean's Honour List

## Work Experience

**March 2024 – Present** | **Perception Software Engineer, Provectus Robotics, Ottawa, Canada**
Research, implement, and test novel perception solutions for challenging off-road scenarios. Contributions include a terrain mapper and a lidar-radar-based object tracker.
C++ · Perception · State Estimation · SLAM · Computer Vision

**January 2023 – April 2023** | **Lecturer in Navigation Systems, Polytechnique Montreal, Montreal, Canada**
Instructed a graduate course on autonomous robot navigation to 25 graduate students.
State Estimation · Probability Theory · SLAM · Optimization

**May 2019 – August 2019** | **Human Brain Project Research Assistant, Technische Universität München, Munich, Germany**
Learned from data the friction model of a moving ground vehicle for traction-control applications.
Matlab · C++ · Probability Theory · Machine Learning

**September 2018 – April 2019** | **Data Science & Machine Learning Intern, Pratt & Whitney, Montreal, Canada**
Developed an unsupervised learning algorithm on engine reliability data for maintenance forecasting.
Python · C · Machine Learning

**September 2017 – August 2018** | **Modelling & Optimization Engineering Intern, ExxonMobil, Edmonton, Canada**
Implemented linear-programming tools for decision making in crucial operational tasks for a refinery.
Python · Optimization

## Highlighted Publications

**Multi-Robot Relative Pose Estimation and IMU Preintegration Using Passive UWB Transceivers** T-RO 2024
M. A. Shalaby, C. C. Cossette, J. Le Ny, J. R. Forbes Paper Video

**Decentralized State Estimation : An Approach Using Pseudomeasurements and Preintegration** IJRR 2024
C. C. Cossette, M. A. Shalaby, D. Saussié, J. R. Forbes Paper

**Calibration and Uncertainty Characterization for Ultra-Wideband Two-Way-Ranging Measurements** ICRA 2023
M. A. Shalaby, C. C. Cossette, J. R. Forbes, J. Le Ny Paper Video Code

**Cascaded filtering using the sigma point transformation (Best Paper Finalist)** RA-L/ICRA 2021
M. A. Shalaby, C. C. Cossette, J. Le Ny, J. R. Forbes Paper Video

**Relative position estimation in multi-agent systems using attitude-coupled range measurements** RA-L/ICRA 2021
M. A. Shalaby, C. C. Cossette, J. R. Forbes, J. Le Ny Paper Video

## Other Publications

**Reducing two-way ranging variance by signal-timing optimization** TAES 2024
M. A. Shalaby, C. C. Cossette, J. R. Forbes, J. Le Ny Paper

**Ultra-Wideband Teach and Repeat** Preprint
M. A. Shalaby, C. C. Cossette, J. Le Ny, J. R. Forbes Paper Video

**DIVE : Deep Inertial-Only Velocity Aided Estimation for Quadrotors** RA-L/IROS 2024
A. Bajwa, C. C. Cossette, M. A. Shalaby, J. R. Forbes Paper

**navlie : A Python Package for On-Manifold State Estimation** IROS 2023
C. C. Cossette, M. Cohen, V. Korotkine, A. del C. Bernal, M. A. Shalaby, J. R. Forbes Paper Code

**Optimal multi-robot formations for relative pose estimation using range measurements** IROS 2022
C. C. Cossette, M. A. Shalaby, D. Saussié. J. Le Ny, J. R. Forbes Paper

**Relative position estimation between two UWB devices with IMUs (Best Paper Nomination)** RA-L/ICRA 2021
C. C. Cossette, M. A. Shalaby, D. Saussié. J. R. Forbes, J. Le Ny Paper

**Heading Estimation Using Ultra-Wideband Received Signal Strength and Gaussian Processes** RA-L/IROS 2021
D.Lisus, C. C. Cossette, M. A. Shalaby, J. R. Forbes Paper News

**Localization with Directional Coordinates** IROS 2021
C. C. Cossette, M. A. Shalaby, D. Saussié, J. R. Forbes Paper

## Notable Awards and Achievements

2022 **FRQNT Personal Doctoral Scholarship** ($88K). "Real-time decentralized localization for multi-robot systems using ultra-wideband range measurements".
2022 **NSERC Alliance Grant** ($440K). "Infrastructure inspection using a team of unmanned aerial vehicles." Co-authored with James Forbes, Jérôme Le Ny, Charles Cossette, David Saussié, Gunes Kurt & ARA Robotique.
2021 **Best Paper Finalist at ICRA 2021**. Top 3 papers among 4056 submissions.
2021 **McGill Engineering Doctoral Award** ($111K).
2020 **Master's to Ph.D. Fast-Track Award**. "An award to fund and attract high-calibre students to Ph.D. programs".
2019 **McGill Engineering Undergraduate Student Masters Award** ($61K).
2019 **Graduate Excellence Fellowship** ($5K).
2019 **Dean's Honour List**. Designation assigned to the top 10% of the graduating class at McGill University.
2017 **Louis C Ho SURE Award** ($7.5K).
2016 **John Howard Ambrose Scholarship** ($5K).
2015 **Outstanding Cambridge Learner Award**. Multiple top-in-the-world rankings in A-Level and IGCSE subjects.
Other **James McGill Scholarship, Peter Sebestyen Award, TUM Practical Research Experience Scholarship, Enhanced Educational Opportunities Scholarship** ($20K).

## Volunteering and Other Experience

2023 **Talk at the University of Toronto Robotics Institute** - "Multi-Robot Relative Pose Estimation Using UWB".
2022 **Teaching assistant in System Dynamics and Control (MECH 412)** - McGill University.
2021-2022 **Session chair/co-chair at ICRA and IROS** - Localization and mapping.
2020 **Talk at GERAD Student Research Day** - "3D Position estimation for multi-robot systems using range and attitude measurements".
2020 - present **Reviewer** - Reviewed papers for RA-L, ICRA, IROS, L-CSS, CDC, ACC, TIE, etc.
2018 **Robotics Lab Educator** - Telus World of Science in Edmonton, Canada.
2016 **Steering Systems Leader** - Part of the Dynamics Group at the McGill Racing Team.

## Projects

**Dataset Collection**

I have collected datasets for

1. research (left),
2. to help others (middle, at UofT),
3. and for fun (right).

ROS Docker Python Embedded C C++ Computer Vision