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

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. Added a terrain mapper and a lidar-radar-based object tracker in my first 5 months.
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