

Miguel Saavedra-Ruiz

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EDUCATION

Ph.D. Computer Science

Université de Montréal

Advisor: Liam Paull - GPA: 4.3/4.3

Montreal, Canada

Sep 2023 - Ongoing

M.Sc. Computer Science

Université de Montréal

Advisor: Liam Paull - GPA: 4.3/4.3 - *Liste d'honneur du recteur*

Thesis: *Leveraging Self-Supervision for Visual Embodied Navigation with Neuralized Potential Fields*

Montreal, Canada

Sep 2021 - Sep 2023

PGDip. Artificial Intelligence

Universidad Autonoma de Occidente

GPA: 4.9/5.0

Cali, Colombia

Aug 2020 - Jun 2021

B.Eng. Mechatronics Engineering

Universidad Autonoma de Occidente

Advisor: Victor Romero-Cano - GPA: 4.7/5.0

Thesis: *Autonomous landing system for an unmanned aerial vehicle on a terrestrial vehicle*

Cali, Colombia

Jan 2014 - Apr 2019

RESEARCH INTEREST

Dynamic scene understanding, diffusion/flow models, robotics perception, state estimation, graph models, self-supervised learning, Lie group theory, robot navigation.

RESEARCH EXPERIENCE

Mila - Quebec AI Institute

Ph.D. student

Robotics and Embodied AI Lab (REAL)

Montreal, Canada

Sep 2023 - Ongoing

- Modelling of dynamic environments and Semi-Static SLAM [P1], [C1], [W1].
- Nonparametric state estimation [J1].

NVIDIA - Seattle Robotics Lab (SRL)

Research Intern

Advisor: Fabio Ramos

Seattle, U.S.

Summer 2026

- Diffusion and Flow models.
- Uncertainty quantification.

Mila - Quebec AI Institute

M.Sc student

Robotics and Embodied AI Lab (REAL)

Montreal, Canada

Sep 2021 - Aug 2023

- Nonparametric state estimation and SLAM [W2].
- Self-supervised learning for embodied navigation [C3].

- Topological and fully-parametric image-based navigation for embodied agents [C2].

University Autónoma de Occidente

Undergraduate and graduate student
Robotics & Autonomous Systems lab (RAS)

Cali, Colombia
Jul 2017 - Jun 2021

- Autonomous landing system for an unmanned aerial vehicle on a terrestrial vehicle [J2].
- Simulation of a landing system for a UAV in Gazebo [C4].
- Mapping and localization in indoors with Turtlebot 2.
- 3D object detections for self-driving applications [W3].
- Teleoperation system for a car-like robot (inverse kinematics).
- Object detection and recognition using Convolutional Neural Networks.

PUBLICATIONS

* denotes equal contribution.

Journal Publications

- [J1] **M. Saavedra-Ruiz**, S. A. Parkison, R. Arora, J. R. Forbes, and L. Paull, “The harmonic exponential filter for nonparametric estimation on motion groups”, *IEEE Robotics and Automation Letters*, vol. 10, no. 2, pp. 2096–2103, 2025, [Project page](#).
- [J2] **M. Saavedra-Ruiz**, A. M. Pinto-Vargas, and V. Romero-Cano, “Monocular visual autonomous landing system for quadcopter drones using software in the loop”, *IEEE Aerospace and Electronic Systems Magazine*, vol. 37, no. 5, pp. 2–16, 2022.

Conference Proceedings

- [C1] **M. Saavedra-Ruiz**, S. B. Nashed, C. Gauthier, and L. Paull, “Perpetua: Multi-hypothesis persistence modeling for semi-static environments”, in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, IEEE, 2025, [Project page](#).
- [C2] **M. Saavedra-Ruiz***, S. Morin*, and L. Paull, “One-4-all: Neural potential fields for embodied navigation”, in *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, IEEE, 2023, 9375–9382. [Project page](#).
- [C3] **M. Saavedra-Ruiz***, S. Morin*, and L. Paull, “Monocular robot navigation with self-supervised pretrained vision transformers”, in *2022 19th Conference on Robots and Vision (CRV)*, 2022, 197–204. [Project page](#).
- [C4] **M. Saavedra-Ruiz**, A. M. P. Vargas, and V. R. Cano, “Detection and tracking of a landing platform for aerial robotics applications”, in *2018 IEEE 2nd Colombian Conference on Robotics and Automation (CCRA)*, 2018, pp. 1–6.

Workshop Publications

- [W1] **M. Saavedra-Ruiz***, F. Argenziano*, S. Morin, D. Nardi, and L. Paull, “Dynamic objects relocalization in changing environments with flow matching”, in *Perception and Planning for Mobile Manipulation in Changing Environments @ IROS*, 2025, [Best paper award finalist](#).
- [W2] S. A. Parkison, **M. Saavedra-Ruiz**, R. Arora, J. R. Forbes, and L. Paull, “The harmonic exponential filter for recursive nonparametric estimation on motion groups”, in *Robotic Perception and Mapping: Frontier Vision & Learning Techniques @ IROS 2023*, 2023.
- [W3] **M. Saavedra-Ruiz***, G. A. Salazar-Gomez*, and V. Romero-Cano, “High-level camera-lidar fusion for 3d object detection with machine learning”, *LatinX Workshop at CVPR 2021*, 2021.

Preprints

- [P1] **M. Saavedra-Ruiz***, C. Gauthier*, K. Gupta, S. Shahfar, K. Ellis, S. Parkison, and L. Paull, “Predictive spatio-temporal scene graphs for semi-static scenes”, 2026, [Under review](#).

WORK EXPERIENCE

Whale & Jaguar

Machine Learning Engineer

Cali, Colombia

Dec 2020 - Jul 2021

Developed a banking chatbot for handling customer inquiries and built NLP-based tools for social media analysis (Transformers, BERT, GPT-2).

AirflyD & Romero Cano Ingeniería

R&D Robotics Software Engineer

Cali, Colombia

Jan 2020 - Sep 2020

Researched and developed a flight stack (navigation and planning) and vision system (image segmentation) for a heavy-cargo hexacopter powered by internal combustion engines for precision agriculture applications.

CRT Ingeniería S.A.S. & Romero Cano Ingeniería

Lead Developer

Cali, Colombia

Jan 2019 - Dec 2019

Developed, tested, and deployed software solutions for security applications using deep neural networks and computer vision. Key achievements include an AI-based license plate recognition system (object detection and segmentation), crowd flow estimation via image-based heat maps, and a floor segmentation model for robot navigation.

AWARDS

FRQNT doctoral scholarship (B2X)

Les fonds de recherche du Québec - Nature et technologies.

Sep 2023

Excellence scholarship

Le Département d’Informatique et de Recherche Opérationnelle (DIRO)

Apr 2023

Redaction scholarship

Le Département d’Informatique et de Recherche Opérationnelle (DIRO)

Apr 2023

Graduate scholarship

DIRO and Le ministère de l’Enseignement supérieur du Québec

Mar 2022

Colfuturo graduate scholarship (Declined)

Government of Colombia, Minister of sciences and Icetex.

Jul 2021

Academic distinction

Highest GPA of the engineering faculty and number one graduate position.

Apr 2019

Academic Excellence Award

Covered 100% of tuition and fees during undergraduate degree, awarded nine academic periods.

Jul 2014

Academic Excellence Scholarship

Covered 80% of tuition and fees throughout my undergraduate degree.

Jan 2014

ACADEMIC SERVICES AND TEACHING

Co-organizer - Workshop@IROS about Lifelong Perception

Sep 2026

Long-Term Perception for Human-Centric Autonomy (LTP): Towards Undo for the Physical World.

Organizer Robot Learning Seminar @ Mila - Quebec AI Institute

Sep 2024 - May 2026

Organize *weekly talks* connecting the Montreal robotics community with leading researchers.

Co-organizer - Workshop@IROS about Lifelong SLAM <i>Standing the Test of Time: Retrospective and Future of World Representations for Lifelong Robotics.</i>	Oct 2024
Teaching Assistant - Autonomous Vehicles (IFT 6757) Graduate class taught by professor Liam Paull.	Sep 2024
Co-organizer - Montreal Robotics Summer School Helped organizing the event's challenge and prepared the SLAM tutorial.	Jun 2023
Volunteering - Conference on Robots and Vision (CRV) Helped as a volunteer in the event with general tasks and logistics.	Jun 2023
Teaching Assistant - Autonomous Vehicles (IFT 6757) Graduate class taught by professor Liam Paull.	Sep 2022
Invited Talk - Colfuturo Topics: experience as graduate student and research in robotics.	Sep 2022
Reviewer Venues: IROS'21, IROS'23, ICRA'24, IROS'24, RA-L'24, IROS'25, RA-L'25, ICRA'25, IROS'26	2021 - Ongoing

SKILLS

- **Languages:** Python, C++, HTML, Shell, L^AT_EX
- **Libraries:** PyTorch, JAX, OpenCV, Scikit-Learn, GTSAM, ROS, ROS2
- **Technologies:** Gazebo, Docker, Git, some Isaac Lab and Ai2-THOR

LANGUAGES

- **Spanish:** Mother-tongue
- **English:** Fluent
- **French:** Fluent