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Miguel Saavedra-Ruiz

Education

Ph.D. Computer Science — Montreal, Canada
Université de Montréal — Sep 2023 - Ongoing
Advisor: Liam Paull - **GPA**: 4.3/4.3

M.Sc. Computer Science — Montreal, Canada
Université de Montréal — Sep 2021 - Sep 2023
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*

PGDip. Artificial Intelligence — Cali, Colombia
Universidad Autonoma de Occidente — Aug 2020 - Jun 2021
GPA: 4.9/5.0

B.Eng. Mechatronics Engineering — Cali, Colombia
Universidad Autonoma de Occidente — Jan 2014 - Apr 2019
Advisor: Victor Romero-Cano - **GPA**: 4.7/5.0
Thesis: *Autonomous landing system for an unmanned aerial vehicle on a terrestrial vehicle*

Research Interest

Lifelong SLAM, artificial intelligence for robot perception, state estimation, graph models, self-supervised representation learning, Lie group theory, robot navigation, uncertainty estimation.

Research Experience

Mila - Quebec AI Institute — Montreal, Canada
Ph.D. student — Sep 2023 - Ongoing
Robotics and Embodied AI Lab (REAL)

- Lifelong SLAM.
- Nonparametric state estimation [J1]

M.Sc student — Sep 2021 - Aug 2023
Robotics and Embodied AI Lab (REAL)

- Nonparametric state estimation and SLAM [W1].
- Self-supervised representation learning for embodied navigation [C2].
- Topological and fully-parametric image-based navigation for embodied agents [C1].

University Autónoma de Occidente — Cali, Colombia
Undergraduate and graduate student — Jul 2017 - Jun 2021
Robotics & Autonomous Systems lab (RAS)

- Autonomous landing system for an unmanned aerial vehicle on a terrestrial vehicle [J2].
- Simulation of a landing system for a UAV in Gazebo [C3].
- Mapping and localization in indoors with Turtlebot 2.
- 3D object detections for self-driving applications [W2].
- Teleoperation system for a car-like robot (inverse kinematics).
- Object detection and recognition using Convolutional Neural Networks.

Work Experience

Whale & Jaguar Cali, Colombia
Machine Learning Engineer Dec 2020 - Jul 2021

Research and development of Machine Learning algorithms for social media analysis (Natural Language Processing).

AirflyD & Romero Cano Ingeniería Cali, Colombia
R&D Robotics Software Engineer Jan 2020 - Sep 2020

Research and development of a flight stack and vision application for a heavy-cargo hexacopter with internal combustion engines for precision agriculture applications.

CRT Ingeniería S.A.S. & Romero Cano Ingeniería Cali, Colombia
Lead Developer Jan 2019 - Dec 2019

Developed, tested and implemented software solutions for security applications using deep neural networks and computer vision techniques. Some of the achievements were an AI-based license plate recognition system, image-based heat maps for crowd flow estimation, and floor segmentation.

Awards

FRQNT doctoral scholarship (B2X) Sep 2023
Les fonds de recherche du Québec - Nature et technologies.

Excelence scholarship Apr 2023
Le Département d'Informatique et de Recherche Opérationnelle (DIRO)

Redaction scholarship Apr 2023
Le Département d'Informatique et de Recherche Opérationnelle (DIRO)

Graduate scholarship Mar 2022
DIRO and Le ministère de l'Enseignement supérieur du Québec

Colfuturo graduate scholarship (Declined) Jul 2021
Government of Colombia, Minister of sciences and Icetex.

Academic distinction Apr 2019
Highest GPA of the engineering faculty and number one graduate position.

Academic Excellence Award Jul 2014
Covered 100% of tuition and fees during undergraduate degree, awarded nine academic periods.

Academic Excellence Scholarship Jan 2014
Covered 80% of tuition and fees throughout my undergraduate degree.

Academic Services and Teaching

Co-organizer - Workshop@IROS about Lifelong SLAM (2024) Oct 2024
Standing the Test of Time: Retrospective and Future of World Representations for Lifelong Robotics

Teaching - Autonomous Vehicles (IFT 6757) Sep 2024
Graduate class taught by professor Liam Paull.

Reviewer - IROS (2024) May 2024
Topics: Localization with NeRFs, VIO.

Reviewer - ICRA (2024) Oct 2023
Topics: SLAM and robot navigation.

Co-organizer - Montreal Robotics Summer School Jun 2023
Helped organizing the event's challenge and prepared the SLAM tutorial.

Volunteering - Conference on Robots and Vision (CRV) Jun 2023
Helped as a volunteer in the event with general tasks and logistics.

Reviewer - IROS (2023) May 2023
Topics: Visual-based navigation, state estimation.

Teaching - Autonomous Vehicles (IFT 6757) Sep 2022
Graduate class taught by professor Liam Paull.

Invited Talk - Colfuturo Sep 2022
Topics: experience as graduate student and research in robotics.

Reviewer - IROS (2021) May 2021
Topics: Multimodal sensor fusion and object tracking.

Skills

- **Languages:** Python, Java, C++, Matlab, HTML, Shell, LaTeX
- **Libraries:** OpenCV, PyTorch, Scikit-Learn, GTSAM, ROS, PCL
- **Technologies:** Gazebo, Docker, Git

Languages

- **Spanish:** Mother-tongue
- **English:** Fluent
  - **IELTS Academic:** 7.5 Overall
- **French:** Intermediate

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", in *IEEE Robotics and Automation Letters (RA-L)*, 2024. (Under review), 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] S. Morin*, **M. Saavedra-Ruiz***, and L. Paull, "One-4-all: Neural potential fields for embodied navigation", in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2023. Project page.

[C2] **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.

[C3] **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] 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.

[W2] G. A. Salazar-Gomez*, **M. Saavedra-Ruiz***, and V. Romero-Cano, "High-level camera-lidar fusion for 3d object detection with machine learning", *LatinX Workshop at CVPR 2021 (Poster Presentation)*, 2021.