

# Marcelo Contreras Cabrera

[marceloj@ualberta.ca](mailto:marceloj@ualberta.ca) | [linkedin.com/in/marcelo-contreras-cabrera/](https://linkedin.com/in/marcelo-contreras-cabrera/) | [marcelocontreras.github.io](https://marcelocontreras.github.io)

## EDUCATION

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### University of Alberta

Edmonton, Canada

#### M.Sc. Mechanical Engineering

May 2024 - Present

- Research topic: "Reliable autonomous navigation"
- **NODE Lab** graduate research assistant, advised by Prof. Ehsan Hashemi

### University of Alberta

Edmonton, Canada

#### Visiting undergraduate student

Jan. 2023 - Apr. 2023

- Research centered-program in dynamic visual odometry with an annexed paper, published in IEEE ITSC 2023
- Funded by Canadian government through the ELAP Scholarship

### Universidad de Ingenieria y Tecnologia

Lima, Peru

#### B.Sc. Mechatronics Engineering

Mar. 2019 - Dec. 2023

- Bachelor's Thesis: "Fuzzy-SSVEPformer: Classification of visual evoked potentials with Neuro-Fuzzy transformer"
- Graduated among the Top 10% of the Program
- Coursework: Robotics, computer vision, non-linear control

### Colegio Champagnat

Lima, Peru

#### High school

Mar. 2017 - Dec. 2018

- International Baccalaureate Diploma: Score 38/45

## EXPERIENCE

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### Graduate Research assistant

Edmonton, Canada

#### Networked Optimization, Diagnosis, and Estimation (NODE) Lab

May.2024 - present

- Extending prior visual odometry systems to full visual SLAM for challenging scenarios
- Deployed a visual navigation system in a Clearpath Husky robot platform for harsh terrains.
- Incorporating visual odometry estimations in a HD Map Visualizer that provides rich visual features for enhanced localization in a digital Twin

### Research assistant

Lima, Peru

#### Universidad de Ingenieria y Tecnologia, BCI Group

Aug. 2022 - present

- Investigated the noise robustness of Neuro-Fuzzy Type 2 block integrated into a Transformer Neural Network for EEG SSVEP classification. Achieved an accuracy improvement of 4% across different datasets
- Designed an efficient learning scheme with Point-process sampling which can reduce up to 50% training time in neural networks for EEG classification without accuracy drop.

### Undergraduate Intern

Edmonton, Canada

#### Networked Optimization, Diagnosis, and Estimation (NODE) Lab

Jan. 2023 - Apr. 2024

- Implemented the robust visual odometry algorithm's front end (OpenCV for feature extraction, PyTorch for dynamic instance filtering) and back end (g2o for graph optimization).
- Trained and tested a cooperative deep learning solution of instance segmentation (YOLACT) and object detection (YOLOv5) to filter dynamic instances with driving data collected from the surroundings of UofA.
- Led a team of 6 CS undergrad students to design a 3D object detector as part of their Deep Learning course

### Control engineer

Lima, Peru

#### Vultur Robotics

Feb. 2022 - Apr. 2023

- Worked on a control algorithm for a 6 DoF robotic arm in Arduino Portenta H6 (ARM Cortex M7 & M5) board.
- Implemented a PID control algorithm for DC motors with I2C command sending for the STM32 platform.
- Designed a payload publisher via TCP/Ethernet from a Linux terminal with ROS to a microcontroller.

## PROJECTS

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**Unified autonomous navigation pipeline for Turtlebot 3** [[code](#)] | *ROS 1, DL, CV* Mar. 2023 – Jul. 2023

- Integrated perception, localization and planning in a single pipeline to get a unified navigation ROS node for Turtlebot 3 adaptable to changing environments
- Designed a twofold map generation that fuses a static map from ORB-SLAM 3 and the projection of RGB-D images with YOLOv5 to detect moving people

**Efficient FPGA multiplier in low-pass FIR Filter** [[code](#)] | *VHDL, Vivado* Jun. 2021 – Jul. 2021

- Implemented Wallace and Booth algorithms (4, 8, and 16-bit multiplication) for FIR filtering in FPGA Basys 3 by VHDL and Vivado
- Analyzed the impact of optimized multiplication policies on resource use and temperature in Basys 3

**CanSat challenge competition** [[page](#)] | *Arduino, Perception* Apr. 2021 – Jul. 2021

- Mission: Gather photos and videos of illegal mining and tree harvesting at Peruvian rain forest by a launched CanSat with a camera on its base.
- Implemented an OV7670 camera module for taking photos with an Arduino Uno as platform
- The live transmission of images was displayed in a serial port reader at 115200 bauds with a resolution of 160 x 120 pxs.

## PROFESSIONAL SERVICE

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### Reviewer for several conferences

- IEEE Intelligent Transportation Systems Conference (ITSC)

### Reviewer for journals

- IEEE Transactions on Vehicular Technology
- IEEE Transactions on Intelligent Vehicles

### Workshop organizer in confereces

- European Conference on Computer Vision (ECCV)

## SKILLS & ACCOMPLISHMENTS

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**Languages:** English (proficient), Spanish (native)

**Technical:** Python, C/C++, ROS 1, Git, MATLAB

**Libraries:** Docker, PyTorch, Eigen, g2o, GTSAM, OpenCV

**Award:** UofA Recruitment Scholarship May/Spring 2024 (5000 CAD)

**Grant:** ELAP Scholarship 2023

## PUBLICATIONS

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- [1] M. Contreras, A. Jain, N. P. Bhatt, A. Banerjee, and E. Hashemi. “A survey on 3D object detection in real time for autonomous driving”. In: *Frontiers in Robotics and AI* 11 (Mar. 2024). DOI: [10.3389/frobt.2024.1212070](https://doi.org/10.3389/frobt.2024.1212070). URL: <https://doi.org/10.3389/frobt.2024.1212070>.
- [2] M. Contreras, N. P. Bhatt, and E. Hashemi. “A Stereo Visual Odometry Framework with Augmented Perception for Dynamic Urban Environments”. In: *2023 IEEE 26th International Conference on Intelligent Transportation Systems (ITSC)*. 2023, pp. 4094–4099. DOI: [10.1109/ITSC57777.2023.10421981](https://doi.org/10.1109/ITSC57777.2023.10421981).
- [3] M. Contreras, N. P. Bhatt, and E. Hashemi. “DynaNav-SVO: Dynamic Stereo Visual Odometry With Semantic-Aware Perception for Autonomous Navigation”. In: *IEEE Transactions on Intelligent Vehicles* (2024), pp. 1–12. DOI: [10.1109/TIV.2024.3414653](https://doi.org/10.1109/TIV.2024.3414653).
- [4] C. Flores, M. Contreras, I. Macedo, and J. Andreu-Perez. “Transfer Learning with Active Sampling for Rapid Training and Calibration in BCI-P300 Across Health States and Multi-centre Data”. In: *IEEE Transactions on Neural Systems and Rehabilitation Engineering* (2024), pp. 1–1. DOI: [10.1109/TNSRE.2024.3420960](https://doi.org/10.1109/TNSRE.2024.3420960).