Ricardo Gonzalo Cruz Castillo

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EDUCATION

Tecnológico de Monterrey – ITESM

B.Sc. in Robotics and Digital Systems – GPA: 94/100

I made the Dean's Honor List and had the highest GPA in my class.

Aug 2020 – Dec 2024

Important Coursework: Machine Learning, Computer Vision, Embedded Systems

EXPERIENCE

Machine Learning Intern– Robotics Institute, Carnegie Mellon University

Pittsburgh, USA • Jun 2024 – Aug 2024

SafeAir: Safety-informed Tree Search for Robust Navigation under Distribution Shifts in General Aviation. Working Paper – Poster - Video

- Applied machine learning models within the Pytorch Lightning framework in human-centered, muti-agent scenarios involving autonomous robots.
- Used a general aviation dataset for training a LLM, a transformer-based (TF) trajectory prediction model.
- Implemented remediation techniques enhancing safety and collision avoidance and improved performance by 70%.
- Ensured safe, long-horizon navigation by leveraging Monte Carlo Tree Search biased by a TF model.

Embedded Systems Intern - MACRObotics Research Group, McGill University

Montreal, CA • Aug 2023 – Dec 2023

Acoustic Tactile Sensing for Mobile Robot Wheels. Working Paper – Video

- Established a communication architecture, enabling integration of ROS2, TCP/IP, and SPI protocols within a system.
- Developed scripts in C++, C, and Python for the Arduino and BeagleBone microcontrollers and signal processing.
- Generated a dataset from acoustic data with the purpose of training a self-supervised NLP model.
- Enabled real time visualization with ROS2 using python's 'matplotlib' library.

Software Engineer - VANTTEC, Robotics Team of ITESM Monterrey, MEX • Aug 2022 – Jun 2023

Research and Development of Autonomous Vehicles: Unmanned Underwater Vehicle (UUV) Hydrophones Team Captain

- Implemented Radio Localization Algorithms and signal analysis for the perception of the UUV.
- Delved Adaptive Filter Algorithms such as Kalman Filtering and Recursive Least Squares for improved position accuracy.
- Used MATLAB and Python/C++ with ROS for signal processing and vehicle localization.

SKILLS

Programming Languages		Technologies	Languages	
4 Years:	C++, C, Python	Windows/Linux environment, Free-RTOS,	*Spanish:*	Native
2 Years:	MATLAB/SIMULINK	ARM-Cortex, Pytorch, TensorFlow,	*English:*	Fluent
1 Year:	Java, R-Studio, SQL	SKLearn, SciPy, Jupyter, Pandas, Keras, Numpy OpenCV, ROS, Docker, Git.	*French:*	Basic

MAJO R PROJECTS

Manchester Robotics, Puzzlebot 2 Mar 2024 – Jun 2024

Research kit for autonomous vehicle development: Obstacle Avoidance and Payload Delivery

- Avoided obstacles detected with a LiDAR using the Bug 0 algorithm.
- Used ArUco marker camera-based localization an extended Kalman Filter for robust localization.
- Defined a gRPC-ROS2 architecture for image visualization on the web and task offloading.
- Designed and mounted a gripper for payload transportation.

Manchester Robotics, Puzzlebot 1 Feb 2023 – Jun 2023

Research kit for autonomous vehicle development: Computer Vision and Trajectory Planning

- Coursed through an educational program designed by MCR that delves into ROS, Computer Vision, Math, and Kinematics.
- Generated a dataset by capturing, curating, and classifying images personally for training a computer vision model in PyTorch.
- Implemented YOLOv8 and other algorithms for trajectory planning based on traffic-signs and road recognition.

John Deere, Smart Tire Pressure System Aug 2022 – Dec 2022

With John Deree as a training partner, learned about RTOS and environmentally responsive embedded systems.

- Developed a hardware system integrating a STM32 microcontroller, John Deere units, and various peripherals, facilitating communication via protocols such as CAN, I2C, and SPI
- Simulated a tractor wheel by building a pressurized air container, incorporating a PID controller for a better performance.
- Created an HTML website that served as an HMI for sending a pressure setpoint to the air container.

VOLUNTEER WORK

MapaTec, An Inclusion Oriented Interactive Map

Mar 2023 – Jun 2023

Complementary project for the "Implementacion de Robotica Inteligente" course

- Created a demo of a real-time map of our home institution.
- Incorporated features oriented at helping people with motor disabilities such as highlighting accessibility points e.g. wheelchair ramps and elevators and showing how busy halls and buildings are.

STEM Tutor, Sin miedo a la Corriente

Jun 2022 – Aug 2022

A social program that brings closer robotics and STEM fields to the youth enrolled in public schools.

- Conducted hands-on workshops on circuit board assembly and Arduino programming for junior high school students.
- Fostered a community of learning and collaboration by creating a sentiment of belonging by chatting with my students.
- Helped create better opportunities for underprivileged children.