Axel Pena Hernandez

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Education

University of Toronto | BASc Mechanical Engineering + PEY Co-op | Minor in Robotics & Mechatronics
Sep 2024 – Apr 2029 (Expected)| GPA: 3.55/4.0 | Dean's List

Skills and Qualifications

- Programming & Analysis: Python (NumPy, Matplotlib, Pandas, PyTorch), MATLAB; C++; C#; Google Colab; Git/GitHub; ROS (Robot Operating System, Noetic); Linux/Ubuntu (WSL); PID control tuning.
- Data Workflows: Data cleaning/wrangling, dataset labeling and data preprocessing; Excel; Minitab.
- Statistics & ML: Regression and classification, convolutional neural networks (computer vision), model evaluation (train/validation/test splits, accuracy/recall), ablation studies, and attention to ethical considerations in ML.
- Research & Communication: Secondary research/literature scanning and synthesis, structured documentation, project management, citation and PowerPoint presentations.
- Engineering (supporting): SolidWorks, Fusion 360, OpenRocket; rapid prototyping (3D printing, laser cutting); arc and gas welding; machining and manufacturing.
- Mechatronics & Electrical: Circuit analysis; Arduino-based prototyping and testing of mechatronic systems; motor control and integration (REV SparkMax, CAN/USB communication); sensor feedback systems; soldering.
- Languages: French B1 certification (fluent), Native Spanish speaker.

Project Experience

University of Toronto Neural Networks and Deep Learning (Member)   **May 2025 – Aug 2025**
- Built a CNN-based computer vision system in PyTorch/Google Colab using 25K balanced images from the Gaze360 dataset; achieved 87% test accuracy and 0.86 recall on a reserved 20% unseen dataset, validating generalization to real-world scenarios.
- Engineered a full machine learning pipeline (data labeling, class balancing, grayscale preprocessing, feature extraction, checkpointing, hyperparameter tuning), reducing worst-case training time from 4+ hours to ~50 minutes through input resizing and architecture optimization.
- Collaborated in a team of 4 to deliver proposal, status report, final report, and final presentation; presented quantitative and qualitative evaluations, ablation studies, and ethical analysis, earning recognition for clarity and technical rigor.

University of Toronto Engineering Strategies and Practice (Member)   **Sep 2024 - May 2024**
- Practiced engineering industry necessities including creating a project requirements and conceptual design specifications documents; and presenting our design's measures of success. This improved the quality of skills including idea generation, prototyping and secondary research.
- Received professional communication education, worked under an engineering manager and operated with project management tools including Gantt Charts and status reports. This enabled members to meet deadlines and provided the necessary communication between the team and a real client.
- Practiced presenting engineering information, using techniques such as non-verbal gestures and varying tone and speaking speed, achieving a final mark of 93% on our presentation of our Measures of Success.

Engineering Design Teams — Member
- Robotics for Space Exploration — Science / Mechatronics   **Sep 2025 – Present**
    - Built foundational Arduino control prototypes and bench-test rigs for end-effector mechatronic components; currently collaborating with robotics arm team on integration of sensors and actuators in SolidWorks and hardware prototypes.
    - Engineered and tuned PID velocity controllers for REV SparkMax motors within a ROS (Noetic) framework on Ubuntu, reducing steady-state velocity error and minimizing oscillations to enable smooth, repeatable joint motion.
    - Designed and modeled protective housings for end-effector circuitry to withstand drilling vibration and debris, optimizing component protection, port accessibility, and user ergonomics.

- University of Toronto Supermileage – Electrical **Oct 2025 – Present**
  - o Assembled and soldered electronic components, supporting development of a current-sensing circuit by implementing amplification and voltage comparison techniques.
- University of Toronto Aerospace Team —Rocketry, Aerodynamics **Sep 2024 – Sep 2025**
  - o Determined fin dimensions via OpenRocket simulations, optimizing for maximum predicted apogee of 2746.9 m to enhance overall vehicle flight performance.
- UCTV — Mechanical **Sep 2024 - Sep 2025**
  - o Redesigned syringe reaction injection system (scotch yoke → crank-slider) in SolidWorks and tested via 3D-printed rapid prototypes; increased injection efficiency by 13%.

International Baccalaureate Physics and Chemistry Extended Essay (Researcher) **Sep 2022 - Dec 2024**
- Explored the relationship between physical features of electrodes and how they affected the conductivity of an electrolyte, using secondary research to form a testable hypothesis.
- Designed experiments to test the alteration of physical features of electrodes. Allowed me to generate three reliable and targeted experiments, obtaining at least 150 unique data points.
- Compiled, graphed and analysed experimental data in Excel. Generated error bars, maximum and minimum curves and regression lines to evaluate and draw conclusions on my findings and achieved coefficients of determinations 0.9452 or higher.

Leadership Experience

Haileybury CubeSat Team (Propulsion Division Leader) **Sep 2023 - Jun 2024**
- Led and managed students varying in experience and age in the propulsion subsystem by allocating work and deadlines. Resulted in the propulsion subsystem having consistent progress towards completing the overall project requirements documents.
- Researched international space regulations for objects allowed in space and the detailed project requirements for satellites. Allowed me to implement relevant information for project requirements for related for the propulsion system for the CubeSat.
- Presented project ensuring communication of technical information through PowerPoint presentations. Resulted in program receiving funding from school governors.

Haileybury College Prefect (Head of House) **Sep 2023 - Jun 2024**
- Oversaw 40+ students as senior house leader, responsible for pastoral care, discipline, and community building.
- Served as a College Prefect (CP), contributing to school-wide decision-making by debating proposals, consulting with leadership, and helping implement changes that improved student life. Organized events and initiatives that strengthened house culture and student engagement.
- Acted as liaison between staff and students, mediating conflicts and supporting peers academically and personally.

Work Experience

Royal Canadian Yacht Club (Banquet Server) **Aug 2024 – Present**
- Delivered high-volume service in a fast-paced environment while upholding RCYC's premium hospitality standards.
- Adapted quickly to dynamic 100+ guest event needs, demonstrating strong teamwork, communication, and problem-solving under pressure.