Nathan Faraj

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EDUCATION

California State Polytechnic University, Pomona | August 2022 - May 2026
B.S Mechanical Engineering | Minor in Computer Science
Relevant Coursework: Vibrations, Controls, Intermediate Dynamics, Object-Oriented Programming, Data Structures & Algorithms

Research | Tuning Learning Rates with the Cumulative-Learning Constant | December 2024 - April 2025
- Conducted research exploring the relationship between optimal learning rates and dataset size for basic DNN architectures - see here.
- Conducted a guest lecture under Dr. Yizhe Chang on October 20, 2025, on optimization theory for machine learning applications.

Research | GPS-Denied Navigation | January 2025 - June 2025
- Assisted research exploring GPS-denied navigation methods utilizing lidars and stereo cameras, SLAM, and ROS.

WORK EXPERIENCE

Mechatronics Engineering Intern, Zipline | May 2025 - August 2025
- Developed and machined proprietary testing fixtures for validation on several battery components to improve battery reliability.
  - Performed structural calculations and seal calculations to verify design integrity.
  - Developed testing procedures and successfully implemented fixtures to be used by operators during end-of-line testing.
- Created electrical schematics and software for new component-level fatigue testers on the P2 drone to reduce testing time.
- Programmed PLC and Linux system to communicate with each other over ModbusTCP to receive commands, run tests, filter data with lowpass filters, and log data for fatigue testers. Developed software to receive load cell data over UART at 1300 sps.
- Delivered a battery cell impedance tester, leveraging pogo pins to test Li-ion cells, reducing testing time to 3 seconds per cell.
- Implemented several fixtures and testers for rapid in-house testing and assembly of various components for the P2 drone.
- Conducted trade studies and owned investigations and testing for optimal powder coating materials for components on the P2 drone.
  - Concluded that current powder coating materials are insufficient and assisted team in transitioning to more optimal powder coating materials.

UNDERGRADUATE PROJECTS

Dextrous Humanoid Foot Senior Project | May 2025 - Present
- Developing a dextrous humanoid foot utilizing pressure sensors on the sole of the foot with a custom-trained DNN as the main control feedback loop to allow the foot to balance on its toes. Developed dynamic models using Python, Matlab, and ROS2.
- Developed a co-actuated linkage mechanism to maximize torque output and create dexterity that mimics a human gait.
- Configured brushless motors with O drives for precise positional control to enable control system tuning.

AI Home Assistant | June 2025 - Present
- Created a full duplex websocket pipeline with a ChatGPT API using their agents framework on Python.
- Selected speakers/audio drivers, microcontroller, and microphone.
- Developed a wake-word detection AI model and collected generalized training data to obtain a 99.1% accuracy.
- Developed software to allow ChatGPT to reason and communicate with home devices - smart bulbs, smart door locks, and more.
- Modeled in SolidWorks and 3D printed chassis to house all electrical components.

UMBRA (Undergraduate Ballistics, Missiles, and Rocketry Association) | August 2023 - Present
  Project Manager | April 2025 - Present
  - Leading a team of 30 engineers through the design process of a 2-stage rocket.
  - Facilitating and overseeing the design, calculations, manufacturing, and testing of rocket subsystems.
  - Leading drastic design optimizations in subteams to raise the rocket's performance and apogee from 15000 ft to 50000 ft.
  - Developed drawings for manufacturing an aluminum interstage with proper GD&T tolerancing.
  - Conducted FEA investigations to ensure structural integrity on interstage, verified F.O.S = 2.19.

Coding Lead in CE-MARC | July 2024 - June 2025
- Led a team to develop code to control the avionics bay in a glider recovery capsule for an amateur rocket.
- Developed code to acquire imu and GPS data via I2C and record onto SPIFFS.
- Coded data acquisition by leveraging AP created by ESP32 to transmit data to Flask server via HTTP for wireless data acquisition.
- Developed code to actuate servos to control the recovery capsule through hardware PWM using C++ and Simulink.

Developed Autonomous Delivery Drone | August 2022 - May 2023
- Developed a drone chassis and selected carbon fiber, brushless motors, and ESCs suitable for a 45 lb payload capacity.
- Developed python code utilizing PID control and established localization using GPS coordinates. Used YOLO CV and cameras for object detection with a Raspberry Pi.