Ralph Quartiano

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Education

Bachelor's of Science in Aerospace Engineering
Penn State University

Skills

Programming Languages: C & C++, Python, MATLAB, Julia, SQL
Frameworks: PyTorch, ONNX, Tensorflow
Tools: Docker, Github, CUDA, Bash, Simulink

Engineering Experience

❖ *Software Engineer for Advanced Computing (AI Division), Carnegie Mellon Software Engineering Institute* (August 2023 to Present)

- Evaluated compatibility of different machine learning frameworks (**PyTorch, ONNX, Tensorflow**) with open-source hardware description language (HDL) generation libraries
- Trained and accelerated residual neural network (**Resnet**) model to classify between RF-signal modulation types using **I/Q time-series data**
- Tested and benchmarked novel **task-scheduling** software for **heterogeneous computer architectures** with various signal processing and computer vision algorithms

❖ *GNC Engineering Intern (Starshield), SpaceX* (May 2023 to July 2023)

- Performed single & multi-component **fault tolerance testing** of Starshield satellite **attitude determination & control** systems (ADCS) using **Monte Carlo simulation** techniques
- Identified attitudes in which **magnetorquer**-based angular momentum desaturation system is underactuated and orbital trajectories in which **star tracker** attitude determination system has severely reduced visibility using **6 degree of freedom simulations** in **C++**
- Analyzed angular momentum and torque envelopes of Starshield satellites in various **reaction wheel** failure cases in order to update flight computer state transition thresholds with **MATLAB**
- Redesigned, programmed, **unit-tested**, and simulated performance of C++ **flight software** state transition algorithms to better reflect survivability of reaction wheel failure cases.

❖ *Software Developer Intern (AI Division), Carnegie Mellon Software Engineering Institute* (January 2023 to May 2023)

- Deployed YOLO **object detection** algorithm on low-SWaP **FPGA** as tech demonstration for **edge machine learning** applications.
- Implemented **RISCV** processor on handheld Lattice IceStick FPGA using **Verilog HDL**.
- Evaluated and tested structure, size, and performance of YOLO, tinyYOLO, and other single shot detector algorithms in order to determine feasibility on edge platforms.
- Utilized network optimization and **quantization** tools in **Tensorflow** to reduce size of algorithms by over a factor of 4, and to convert models from Python scripts into C++ executables.

❖ *Autonomy & Artificial Intelligence Intern, Palski & Associates* (May 2022 to August 2022)

- Programmed **autonomous** satellites for capture-the-flag in geostationary orbit (GEO) to simulate military rendezvous-proximity operations (RPOs) using the **Julia** programming language.
- Designed simulation environment with realistic **orbital mechanics** and satellite performance, allowing agents to autonomously find desired orbit trajectories and calculate thruster burns required to enter them.
- Utilized **reinforcement learning** algorithms in a Markov Decision Process (MDP) framework to improve agent decision-making through training (i.e. DeepQLearning, Proximal Policy Optimization, and Soft Actor Critic).
- Combined Julia's **multi-processing** capabilities with **Linux virtual machines** running on company servers to reduce training times by over 50% and allow for longer training runs while out of the office.
- Created 3D visualization software to demonstrate agent behavior to engineers and defense stakeholders.

❖ *Dynamics & Controls Researcher, Penn State Air Vehicle Intelligence and Autonomy Laboratory* (January 2022 to January 2023)

- Developed **momentum wheel** based stabilization system for an **inverted pendulum.** Used for live concept demonstration in AERSP 460: Aerospace Control Systems.
- Modeled system dynamics in **Simulink** using both linearized **transfer functions** and direct nonlinear physics simulations.
- Designed and tuned **PID controller** in MATLAB using **root locus method** and other analytical techniques. This controller was implemented in C++ and run on an Arduino Mega.
- Manufactured and assembled inverted pendulum system for testing and operation.

❖ Project Manager and Systems Engineer, NASA BIG Idea Challenge 2020 Finalist (November 2019 to January 2021)

- Lead and managed a team of **20+ engineers** developing a space-grade laser **spectroscopy instrument**.
- **Budgeted $145,000** of NASA funds in order to design, manufacture, and test system.
- Utilized systems-engineering methodology and documentation throughout design life cycle while adhering to strict NASA requirements
- Orchestrated **environmental testing** in order to minimize cost and risk to both equipment and researchers while yielding actionable data

- ❖ *Lab Manager, Penn State Student Space Programs Laboratory* (May 2020 to May 2021)
  - Oversaw daily research operations including equipment maintenance, testing, and proposal writing.
  - Established a systems-engineering based workflow on several research projects.
  - Educated incoming students via direct mechanical, electrical, and software engineering training as well as promoting involvement in ongoing projects.
  - Collaborated with research groups and professors from Penn State, other universities, and national laboratories for manufacturing equipment, testing facilities, and knowledge transfer.

- ❖ *Software Engineer, Sauron* (HackPSU AI and Overall Best Hack Winner, April 2022)
  - Constructed data pipeline for the automated collection, analysis, and distribution of geographical information during humanitarian crises in real time.
  - Utilized Linux-based virtual machines running on Google Cloud Platform for the development and implementation of Python scripts.
  - Wrote anomaly insertion script for verification of computer vision algorithm using OpenCV.
  - Programmed backend server allowing for image upload to MySQL database using Flask.

- ❖ *Mechanical Engineer, Respiraworks Inc* (February 2020 to June 2020)
  - Volunteered for non-profit founded to create an **open source** improvised **ventilator system** for use in rural South America during COVID-19 Pandemic.
  - Evaluated and designed **flow measurement** instruments including linear pneumotachograph, venturi tube, and wire anemometer.
  - Created system requirements and **quality assurance** practices that adhered to national and international safety and reliability standards.