Abraham Alpuerto

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Computer and Systems Engineering undergraduate student continuing into the masters program spring 2025 with hand-on research in deep learning, large language models (LLMs), and agent-based systems. Experience in developing and fine-tuning models using PyTorch and TensorFlow. Seeking to apply a strong foundation in ML, data engineering, and hardware-software integration to solve complex problems.

Education

Masters in Science in Computer and Systems Engineering | *Rensselaer Polytechnic Institute* *2026*
Planned Relevant Coursework: Algorithm Design & Modern ML, Detection & Estimation Theory, Computer Vision, Stochastic Processes & Modeling
Bachelors in Computer and Systems Engineering | *Rensselaer Polytechnic Institute* GPA: 3.4/4
Relevant Coursework: Machine Learning, Deep Learning, Reinforcement Learning Data Structures & Algorithms, Computer Architecture, Database Systems, Probability & Statistics, Linear Algebra.

Experience

Research Assistant | Columbia Secure FinAI Lab January 2025 - Present

- **Authored paper** ("Orchestration Framework for Financial Agents..") **accepted** for poster presentation at a **NeurIPS 2025** (Top AI/ML Conference) Workshop.
- **Engineered** a novel **Retrieval-Augmented Generation** (RAG) agent to autonomously reason over a dynamic **Neo4j knowledge graph**, enabling complex data retrieval and relationship mapping.
- **Architected** and fine-tuned a specialized LLM agent using **LoRA** (PEFT), training on a custom-built dataset of over 25,000 Q&A pairs I generated and curated.
- **Connected** AI Agents within orchestration using **MCP and A2A** protocols to streamline communications between them.

ML Researcher | Time-Series Forecasting Model September 2024 - Present

- **Architected** and backtested a novel time-series forecasting model using **LSTM and Attention** mechanisms to identify and predict price changes.
- **Engineered** a data pipeline to aggregate, clean, and preprocess over a decade of daily time-series data for 50+ equities, performing feature engineering to create 18 distinct predictive indicators..

Projects

Comparative Image Classification for Canines

- **Developed** and benchmarked multiple machine learning models (KNN, GMM, FCNN, and CNN) to perform 3-class image classification on a custom-built dataset of over 2,000 images of my own dogs.
- **Implemented** Principal Component Analysis (PCA) for dimensionality reduction and feature extraction, which enabled a *k=1* KNN model to achieve **93.03% test accuracy.** Also trained a custom 5-layer CNN in PyTorch , achieving a **97.02% test accuracy**.
- **Analyzed** model performance, comparing the CNN's high accuracy against the KNN's high efficiency and ease of implementation.

Image Captioning Transformer

- **Developed** an end-to-end image-to-text pipeline using Vision Transformer (ViT) encoder and a Transformer decoder, achieving a strong BLEU-4 score on the Flickr8K dataset.
- **Implemented** mixed-precision training to accelerate convergence and reduce GPU memory consumption , developing skills in model optimization for resource-constrained (edge) platforms.

Smart Wheelchair Fitness Platform - Backend Developer

- **Developed** a scalable Flask backend to ingest and analyze real-time sensor data from IoT devices, demonstrating software-hardware integration.
- **Designed** a relational MySQL database schema to efficiently manage user profiles, workout sessions, and large-scale time-series sensor readings.
- **Built** secure RESTful API endpoints with JWT-based authentication for user management, bulk data ingestion, and retrieval of analytics, enabling a gamified mobile app experience with leaderboards and progress tracking.
- **Managed** all backend development for a client-facing project, utilizing an Agile framework to present and deploy new features in weekly sprints.

Skills

Languages: Python, MATLAB, C/C++, SQL, JavaScript, Bash, Cypher, VHDL
Frameworks: PyTorch, TensorFlow, Transformers, Scikit-learn, Pandas, NumPy, Matplotlib, LLMs (RAG, MCP, A2A)
Backend & Tools: Linux, Git, REST APIs, AWS, Flask, MySQL, PostgreSQL, Neo4j, JWT, VirtualBox