KARAN BAIJAL

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Education

Cornell University, Ithaca, NY

- ***Master's in Computer Science***, College of Engineering — GPA: 4.08, Dean's List. Aug 2024 - May 2025
- ***Bachelor's in Physics***, College of Arts & Sciences — GPA: 3.64, Dean's List. Aug 2020 - May 2024
  Minors: Computer Science, Mechanical Engineering

Coursework: Robot Learning, Deep Learning for Robots, Robot Perception, Robot Manipulation, Machine Learning, Reinforcement Learning, Object-Oriented Programming & Data Structures, Functional Programming, Algorithms, Probability & Statistics, Discrete Structures, Statistical Thermodynamics, Mechanics, Electrodynamics, Multivariable Calculus, Linear Algebra, Differential Equations

Experience

Assistive Robotics Lab, Cornell University — Robotics Machine Learning Researcher Feb 2025 - Present

- Implementing Diffusion control policy, image segmentation for perception, and LLM-based planning for robot sandwich-making.

Assistive Robotics Lab, Cornell University — Robotics Machine Learning Researcher June 2024 - Feb 2025

- Architected and implemented an **end-to-end machine learning pipeline** for **material classification** of 20,000 household objects on **multimodal time-series data** with **sensor fusion** from vision, motion, thermal, force & pressure sensors.
- Designed novel ML architectures, including a "Haptic" **Transformer** and **multi-encoder temporal CNNs**, and fine-tuned Vision-Language models (**CLIP, GPT**) using image segmentation techniques. Tested models on different robot manipulators.
- Led large-scale data collection, creating academia's **largest multimodal dataset**, incorporating **feature engineering, speech-to-text recognition**, and **prompt engineering**. Developed **evaluation metrics** pipeline. Submitted paper to RSS conference.

Thom-Levy Lab, Cornell University — Particle Physics Machine Learning Researcher Jan 2023 - May 2024

- Trained **machine learning models** using **boosted decision trees** to differentiate Dark matter (DM) signal from Standard Model background events during proton-proton collisions in CERN particle collider, & identify key features during DM production.
- Developed a **novel isolation metric** to resolve a flaw in CERN's codebase, improving performance by 15%. Wrote Python and C++ code on Fermilab GPU servers as part of a global, multi-collaborative DM search. Aiming to submit paper by April 2025.

Corning Incorporated — Robotics Engineering Intern May 2023 - Aug 2023

- Engineered **computer vision** and **sensor-based** error-proofing system for load-unload of 150lb glass preforms by mobile robot manipulators. **Designed experimentation methods** to test solutions under the factory's intense physical constraints.
- **Resolved longstanding bottleneck** for the factory and my team, achieving potential longtime cost-savings of upto $1,000,000.

Cornell Autonomous Bicycle Project Team — Robot Navigation Software Team Lead Sept 2020 - May 2023

- **Collaborated cross-functionally** with multiple sub-teams to build a self-balancing, self-navigating autonomous bike.
- Led 3-member team on dynamic **obstacle avoidance** using **Reinforcement Learning**. Designed **Gazebo simulation** to train algorithm. Implemented algorithms like **SLAM, VHP***, etc. Used **ROS**. Spearheaded bike testing across different teams.

Computational Astrophysics Lab, Cornell University — Parallel Computing Researcher May 2022 - Dec 2022

- **Parallelized code** for **High-performance computing** on NASA supercomputer to map evolution of physical parameters around dense stars using MPI, Fortran, & Linux. Assisted with data analysis & writing published paper (mentioned in 'Acknowledgements').

Dell Technologies — Software Engineering Intern June 2021 - Aug 2021

- Developed a **product recommendation engine** based on user input for precise product suggestions for small & medium businesses.

Projects

Adaptive Task and Motion Planning, AdaTAMP — Robotics Machine Learning Researcher Oct 2024 - Feb 2025

- Developed novel **LLM based adaptive task & motion planning framework** for dynamic correction & multi-agent cooperation. Outperformed prior methods by 14% on long-horizon, multi-agent simulations. Submitted poster to ICRA Workshop.

Autonomous Fall Detection Wearable, FallUp Band — Founder & Developer Oct 2017 - Sept 2021

- Invented Fallup Healthcare Wearable - an autonomous fall detection and emergency multi-alert wearable for the elderly.
- Awarded **Silver Medal in National Pramerica Community Awards** over 4000+ students and **"Innovator of the Year" Award** for "Creativity and Original Thinking" over 600 students. Interviewed by local radio for building a novel, affordable device.

Skills

Programming Skills: Python, C++, Java, Linux, Git, Machine Learning, Imitation Learning, OpenCV, Numpy, Pandas, PyTorch, TensorFlow, CUDA, Artificial Intelligence, OCaml, SQL, MATLAB, Docker, Mathematica, Robot Operating System (ROS)
Robotics Skills: Arduino, Ansys, RaspberryPi, Embedded Systems, CAD Design (Fusion), First Principles Thinking, 3D Printing