Jay Paek

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EDUCATION

University of California, San Diego La Jolla, CA   GPA: 3.9/4.0
Masters of Science in Electrical & Computer Engineering   September 2024 - Present
University of California, San Diego La Jolla, CA   GPA: 3.7/4.0
Bachelors of Science in Electrical & Computer Engineering   August 2022 - September 2024

RELEVANT COURSEWORK

Engineering: Computer Vision (graduate), Robotics (graduate), Control Theory, Convex Optimization, Linear Systems, Optimal Control, Machine Learning, Deep Learning, Stochastic Processes, Parameter Estimation (graduate)
Mathematics: Abstract Algebra, Linear Algebra, Real Analysis, Fourier Analysis, Probability, Measure Theory (graduate), Functional Analysis (graduate), Distribution Theory (graduate), Optimal Transport (graduate)

TEACHING APPOINTMENTS

University of California, San Diego   La Jolla, CA
Electrical and Computer Engineering Department
- Fall 2022: ECE 5 Introduction to Electrical Engineering   *Lab Tutor*
- Winter 2023: ECE 5 Introduction to Electrical Engineering   *Lab Tutor*
- Spring 2023: ECE 5 Introduction to Electrical Engineering   *Lab Tutor*
- Summer 2023: ECE 5 Introduction to Electrical Engineering   *Lab Tutor*
- Fall 2023: ECE 5 Introduction to Electrical Engineering   *Lab Tutor*
- Fall 2023: ECE 196 Engineering Hands-on Group Project   *Lab Tutor*
- Winter 2024: ECE 109 Engineering Probability & Statistics   *Tutor*
- Spring 2024: ECE 45 Circuits & Systems   *Tutor*
- Summer 2024: ECE 5 Introduction to Electrical Engineering   *Teaching Assistant*
- Fall 2024: ECE 109 Engineering Probability & Statistics   *Teaching Assistant*
- Winter 2025: ECE 276A Sensing & Estimation Robotics   *Teaching Assistant*
- Spring 2025: ECE 45 Circuits & Systems   *Teaching Assistant*

WORK EXPERIENCE

Scale AI   San Francisco, CA
GenAI Technical Advisor Intern / Prompt Engineer   December 2024 - Present
- Making challenging problems for LLMs, mostly in real analysis, probability, and robotics at the graduate level.
- Develop and verify test cases for coding competition prompts to consider edge cases.

Existential Robotics Lab   La Jolla, CA
Software Development Engineer / Curriculum Developer   December 2024 - March 2025
- Recruited to design and implement new projects for graduate level robotics classes ECE276.
- Researched state-of-the-art methods to incorporate into curriculum such as discrete manifold fitting in ICP, direct methods, visual odometry, optical flow feature tracking, object tracking, scene recognition.
- Generated usable datasets from parsing and preparing raw IMU and stereo camera data in Python for student usage.
- Implemented feature tracking and correspondences between stereo camera over time stamps and extended Kalman filter for visual-inertial sensor fusion SLAM on the Kimera dataset.

Jacobs School of Engineering   La Jolla, CA
Graduate Teaching Assistant   August 2024 - Present
- Graded assignments and exams, held office hours, hosted discussions.

Teaching Assistant   July 2024 - August 2024
- Helped prepare and operate optical tools for high-school students part of extracurricular program.

Instructional Assistant   September 2022 - June 2024
- Instructed courses in first-year projects, signals and LTI systems, probability theory, senior design projects.
- Helped students debug and calibrate motors, cameras, sensors, microcontrollers, and other hardware equipment to proceed with engineering projects; assist students usage of laser cutters, 3D printers, oscilloscopes, and soldering.

RESEARCH EXPERIENCE

Existential Robotics Lab La Jolla, CA
Researcher March 2025 - Present
- Awarded $5000 stipend to research sampling-based algorithms for active bayesian inference in robotics.
- Implementing particle flow filterings method for non-linear state estimation problems.

Adaptive Hybrid Dynamics Lab La Jolla, CA
Researcher March 2025 - Present
- Conducting independent research under the supervision of Professor Jorge Poveda in dynamical systems
- Currently inspecting instability of Nesterov's accelerated gradient descent modeled as a partial differential equation as a Nash equilibrium seeking dynamics and mathematically proving results for linear time-varying systems.

PROJECT WORK

Spectral Methods for Dimensionality Reduction *[link to presentation and report]* March 2024 − June, 2024
- Affiliated with the UCSD Mathematics Directed Reading Program. Mentored by Qihao Ye.
- Read about spectral analysis of graphs and Markov chains and its application to dimensionality reduction techniques such as Laplacian eigenmaps and diffusion maps.
- Perform numerical experiments and presented visualization via Python.

Safe Trajectory Tracking with Optimal Control *[link to report]* Month, Year − Month, Year
- Used Python to implement optimal control algorithms to trace the trajectory without colliding into the obstacles given a moving trajectory and location of obstacles.
- Set-up and solved certainty equivalent control with nonlinear program solver and implemented generalized policy iteration/reinforcement learning methodologies for a discretized configuration space with parallelization.

Visual-Inertial SLAM *[link to report]* January 2024 − March 2024
- Filtered linear and angular velocity, pixel coordinates of different visual features from two stereo cameras over time.
- Triangulated landmark points using intrinsic camera calibration matrix and relative positions of cameras and IMU.
- Performed SLAM via extended Kalman filter and sensor fusion with Python; optimized trajectory of robot and landmarks using projected and triangulated pixel coordinates and linearization via computing Riemannian gradient.

Quaternion-based Orientation Optimization *[link to report]* January 2024 − March 2024
- Processed raw linear acceleration and angular velocity as voltage values, camera pictures over time stamps.
- Use Numpy and JAX to preprocess data, formulate a nonlinear optimization problem, and solve for most optimal orientation trajectory. Stitched together a panorama based on pictures taken at different poses.

PUBLICATIONS

Humanity's Last Exam *[link to paper]* April 2025
- Collaborated with Scale AI to develop complex mathematics questions for the world's hardest LLM benchmark.

[DRAFT] Nesterov's Gradient Descent as a Nash-Equilibrium Seeking Algorithm... *[link to paper]*
- Applied the differential equation scheme of Nesterov's gradient descent algorithm to quadratic games.
- Analyzed Lyapunov stability of algorithm and convergence rates to the Nash-equilibrium.

AWARDS

Best Tutor Award May 2024
- Nominated as best undergraduate tutor of Fall 2023 quarter based on student reviews.