Jay Paek

jpaek@ucsd.edu | https://jpaek1002.github.io

EDUCATION

University of California, San Diego La Jolla, CA — GPA: 3.8/4.0
Masters of Science in Electrical & Computer Engineering — September 2024 - Present
Master's Thesis: Low Dimensional Solutions to Optimal Sensor Scheduling

University of California, San Diego La Jolla, CA — GPA: 3.671/4.0
Bachelors of Science in Electrical & Computer Engineering — August 2022 - September 2024

RELEVANT COURSEWORK

- DSC 291: Mathematical Aspects of Deep Learning
- ECE 250: Random Processes
- ECE 269: Linear Algebra and Application
- ECE 271A: Statistical Learning
- ECE 272A: Linear Systems
- ECE 273: Convex Optimization
- ECE 275A: Parameter Estimation
- ECE 276AB: Robotics
- MATH 100AB: Abstract Algebra
- MATH 140ABC: Foundations of Real Analysis
- MATH 144: Intro to Fourier Analysis
- MATH 216C: Mathematical Methods in Data Science
- MATH 217: Calculus of Variations
- MATH 240ABC: Real Analysis
- MATH 277A: Nonsmooth Optimization
- MATH 294: Mathematics of Finance

TEACHING APPOINTMENTS

University of California, San Diego *Electrical and Computer Engineering Department* — La Jolla, CA

- Fall 2022: ECE 5 Introduction to Electrical Engineering — *Lab TA*
- Winter 2023: ECE 5 Introduction to Electrical Engineering — *Lab TA*
- Spring 2023: ECE 5 Introduction to Electrical Engineering — *Lab TA*
- Summer 2023: ECE 5 Introduction to Electrical Engineering — *Lab TA*
- Fall 2023: ECE 5 Introduction to Electrical Engineering — *Lab TA*
- Fall 2023: ECE 196 Engineering Hands-on Group Project — *Lab TA*
- Winter 2024: ECE 109 Engineering Probability & Statistics — *Undergraduate TA*
- Spring 2024: ECE 45 Circuits & Systems — *Undergraduate TA*
- Summer 2024: ECE 5 Introduction to Electrical Engineering — *Lab TA*
- Fall 2024: ECE 109 Engineering Probability & Statistics — *Graduate TA*
- Winter 2025: ECE 276A Sensing & Estimation Robotics — *Graduate TA*
- Spring 2025: ECE 45 Circuits & Systems — *Graduate TA*

WORK EXPERIENCE

Audi Automated Driving Development — San Jose, CA
Co-op R&D Software Engineer — August 2025 - Present

- Researched state-of-the-art sensor calibration algorithms across multiple LiDARs, cameras, GPS, and IMUs.
- Developed novel algorithms for a convenient and robust camera to LiDAR calibration ROS2 package in C++ with comparable results and accuracy to state-of-the-art methods that use machine learning, Gaussian splats, and complex targets.
- Improved 3D mapping and reprojection accuracy by 3% with newly configured sensor extrinsics.
- Applied modern LiDAR-odometry algorithms and matrix optimization techniques for GPS-LiDAR calibration.
- Assisted design of MPPI controller and EKF localization module for prototype car.

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 Engineer / Curriculum Developer — December 2024 - March 2025

- Researched modern methods in robotics to incorporate into graduate course curriculum.
- 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 - June 2025

- 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.

Undergraduate Teaching 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
Graduate Student Researcher March 2025 - Present
- Working with Professor Nikolay Atanasov and PhD student Yinzhuang Yi to prove new results and develop novel algorithms in probabilistic robotics.

Adaptive Hybrid Dynamics Lab La Jolla, CA
Undergraduate Student Researcher March 2023 - September 2024
- Conducted independent research under the supervision of Professor Jorge Poveda in dynamical systems.

ACADEMIC PROJECTS

Entropy-centric Sensor Scheduling Optimal Control *[link to report]* June 2025 – Present
- Considered optimal control problem with the probability distribution as a state, Bayesian update as motion model, and AWGN observation model for the sensor scheduling problem.
- Showed monotonicity of entropy with respect to sensor noise and developed greedy and combinatorial algorithm with provable optimality guarantees. Verified results after extensive simulations.
- Researching nonlinear parameterizations of state distributions to generalize results for finite-variance observation models

First-step Optimal Control for Gaussian Flow Estimation *[link to presentation]* March 2025 – June 2025
- Used Gaussian flow to prove relationship between optimal first control input and range measurement estimate.
- Proved that, on average, perpendicular movement maximizes the decrease in entropy, thus proving physical intuition.
- Presented results to graduate seminar in optimal transport theory hosted by the math department.

NAGD as a NE Seeking Algorithm for Quadratic Games *[link to report]* June 2023 – September 2024
- Use ODE scheme of **Nesterov's accelerated gradient descent** to show that it is naturally a **Nash-equilibrium** seeking algorithm for quadratic games with psudo-gradient of cost matrix.
- Proved necessary and sufficient conditions for Lyapunov stability and derived convergence rates.
- Verified results through extensive simulations on MATLAB.

TECHNICAL PROJECTS

Safe Trajectory Tracking with Optimal Control *[link to report]* March 2024 – June 2024
- 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.

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.

AWARDS, HONORS, GRANTS

Summer Research Program June 2025
- Awarded $5000 to pursue research in probabilistic robotics under Professor Nikolay Atanasov.

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