

AARON JAMES WILHELM

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EDUCATION

- PhD Candidate, Electrical Engineering — Cornell University (GPA: 4.09/4.30 Spring 2026)
- BS, Electrical Engineering, Summa Cum Laude — University of California, Los Angeles (GPA: 3.92/4.00, June 2020)

HONORS AND AWARDS

- Participant, ICRA 2025 PhD Consortium, May 2025
- McMullen Fellowship, Fall 2025
- Lester Eastman Fellowship, Fall 2023
- Cornell ECE Outstanding TA Award, 2021-2022

EXPERIENCE

PhD Research — Napp Lab at Cornell University

Fall 2020-present

- “Improved Bag-of-Words Image Retrieval with Geometric Constraints for Ground Texture Localization”, ICRA 2025
 - Proposed an improved Bag-of-Words (BoW) image retrieval system for higher precision and recall for ground texture localization
 - Utilized better BoW vocabularies and exploited ground texture localization problem constraints to improve the mean average precision from 0.026 to 0.559 for global localization
 - Able to identify almost 3x as many loop closures for simultaneous localization and mapping (SLAM) applications
- “Frozen Assets: Leveraging Ice, Water, and Phase Transitions in Robots”, IROS 2024
 - Demonstrated the utility of leveraging ice and water phase transitions to augment the capabilities of diverse robotic systems, including rovers, modular robots, and soft robots
 - Engineered multiple robotic platforms that exploit melting, fracturing, and freezing for in-situ reconfiguration, actuation, and environmental adaptation
 - Performed a scaling analysis to formalize the feasible operational envelopes for ice-based structural elements, considering both mechanical stress and thermal melting constraints
- “Lightweight Ground Texture Localization”, ICRA 2024
 - Developed an algorithm to localize a mobile robot using images of the ground texture
 - Used image feature matching and spatial filtering to achieve submillimeter localization precision on areas covering more than 100 m²
 - High accuracy version improved state-of-the-art, lightweight version halved execution time, enabling localization frequencies of ~4Hz on a Raspberry Pi 4
 - Applications include warehouse robots, autonomous driving, and underwater vehicles
- Current Work
 - Developing deep learning feature detector tailored to ground texture by leveraging rotation-equivariant convolutional filters
 - Prototyping robot capable of micrometer-level localization using inexpensive hardware

Artificial Intelligence/Computer Vision Intern — EpiSys Science Inc.

Fall 2019-2020

- Proposed a novel reinforcement learning algorithm for an agent to exploit partial environment information while learning POMDP environments
- Decreased sPOMDP model generation times by 31-63% while improving robustness

Research Assistant — Interconnected and Integrated Bioelectronics

Lab

Fall 2016 - Spring 2020

- Designed and manufactured a skin health monitor and a bladder monitor
- Collaborated on a device that uses photoplethysmography (PPG) to detect blood clots after surgery
- Engineered a device that non-invasively extracts sweat to determine blood glucose levels for diabetics

Capstone Project — UCLA ECE 183DB Design of Robotic Systems

Spring 2019

- Worked as a team to build a multi-robot system that used RFID tags for spatial communication
- Observed a 3x mapping speed increase for robots using the spatial communication method vs. without

PUBLICATIONS/CONFERENCES

- “Improved Bag-of-Words Image Retrieval with Geometric Constraints for Ground Texture Localization”, ICRA (2025)
- “Frozen Assets: Leveraging Ice, Water, and Phase Transitions in Robots”, IROS (2024)
- “Lightweight Ground Texture Localization”, ICRA (2024)
- “Inexpensive, Automated Pruning Weight Estimation in Vineyards”, ICRA (2024)
- Textbook chapter: “Wearable Chemical Sensors” in *Wearable Bioelectronics* (2020)
- Best Research Poster: UCLA Electrical Engineering Annual Research Review (2019)
- “Emerging wearable technologies for personalized health and performance monitoring”, SPIE Defense and Commercial Sensing Conference (2018)
- Best Undergraduate Research Poster: UCLA Electrical Engineering Annual Research Review (2018)

TEACHING EXPERIENCE

Teaching Assistant — ECE 3140 Embedded Systems Spring Semesters

2021-2024

- Led a team of teaching assistants in the delivery of weekly discussion sections for a lower-level undergraduate embedded systems course
- Developed novel course content, including live hardware demonstrations, to provide students with hands-on learning experiences
- Achieved consistently high ratings on mid-semester and end-of-semester student evaluations

OUTREACH

- Volunteer Firefighter at Cayuga Heights Fire Department, Spring 2022 - Fall 2023
- “Write A Researcher” Mentor, Fall 2021 - Summer 2023

SKILLS

- Localization, Mapping, SLAM, Computer Vision, Machine Learning, AI, ROS, Python, C++, C