

# Alvin Zhu

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## Education

### University of California, Los Angeles (UCLA)

B.S. Computer Engineering | GPA: 3.82

Los Angeles, CA

Sept 2023–Jun 2026

**Relevant Coursework:** Software Construction, Operating Systems, Computer Architecture, Computer Networking, Algorithms, Computer Vision, Applied Numerical Computing, Graduate Deep Learning, Signal Processing, Robotics

## Research Experience

### UCLA Robotics & Mechanisms Laboratory (RoMeLa)

Research Assistant | Advisor: Dennis Hong

Los Angeles, CA

Oct 2023–Current

- **AURA** (Autonomous Upskilling with Retrieval-Augmented Agents) | *Research lead, framework, LLMs*
  - Pioneered prompt-to-policy framework using LLM agents and GPU physics simulation for robot learning
  - Autonomous iterative training improvements via scored vector databases and retrieval-augmented agents
  - Achieved 99% training launch success rate and 25% improvement in locomotion vs DeepMind baselines
- **BRUCE RL**—Mechanism-Aware Curriculum Reinforcement Learning | *Research lead, RL training, sim-to-real*
  - Built physics modeling pipeline that integrates parallel mechanisms, compliance, backlash, and coupling
  - Integrated RL policies onto humanoid BRUCE hardware, enabling robust locomotion in outdoor environments
- **C-QDD**—Cycloidal Quasi-Direct Drive Actuator | *Research Lead, hardware design, DL-architecture*
  - Engineered a compact, efficient, high-torque quasi-direct drive actuator with cycloidal gears for legged robots
  - Innovated actuator torque prediction networks, modeling complex, non-linear dynamics with 99% accuracy
  - GRU-based actuator network that models achieved 43% lower prediction error than baseline MLP models
- **MAGPIE**—Multi-modal Gripper and Integrated Tactile Sensing | *Research lead, DL-architecture, sensors*
  - Created a deep learning framework for 96% reliable 8-axis force estimation in humanoid robot end-effectors
  - Achieved prediction within 3% of full-scale contact force and outputs uncertainty in unseen contact conditions
- **SPLITTER**—Variable Inertia Attitude Control for a Space Jumping Robot | *Role: Simulation, feasibility analysis*
  - Built custom physics simulation for inertial attitude control of limbed robots in low gravity environments
- **BALLU** (Buoyancy Assisted Lightweight Legged Unit) | *Role: DL-architecture, contact sensor modeling, firmware*
  - Developed lightweight MLP to estimate 3-axis contact forces for custom foot sensors with 97% accuracy
- **SCALER Vision**—Computer Vision for Quadrupedal Free-Climbing Robot | *Role: Computer vision*
  - Fused vision transformers with deep learning models for 95% precise instance segmentation for object grasping

### RoMeLa RoboCup Humanoid Soccer Team (Perception Lead Developer)

Jan 2024–Aug 2024

- Built humanoid robot ARTEMIS's full perception stack, integrating vision and proximity for full spatial awareness
- Combined a Yolov8 DL model with point clouds for detection, 3D pose estimation, and trajectory prediction
- Utilized NVIDIA TensorRT deep learning inference SDK and multi-threading to decrease cycle time by over 66%

## Industry Experience

### NVIDIA

Robotics Platform Software Intern

Santa Clara, CA

Jun 2025–Sept 2025

- Developed a VLM-driven action generation framework to enable multi-robot collaboration from natural language
- Produced first end-to-end demonstration of autonomous natural-language-driven multi-robot execution in Isaac

- Built a fleet control framework to coordinate missions over multiple robot embodiments in simulation and hardware
- Created a JSON task schema to abstract high-level tasks from robot specifics, enabling complex fleet operations

**Veqdrive** (Robotics Automation Startup)

**Los Angeles, CA**

*Robotics Research Intern*

*Nov 2024–Current*

- Researching deep RL algorithms and scalable simulations for robot planning in unstructured environments
- Constructing perception methods for mobile manipulators to grasp CNC-machined parts under variable conditions

**Evodyne Robotics**

**Mountain View, CA**

*Robotics & Software Engineer Intern*

*Jun 2022–Sept 2022*

- Developed a quadruped robot with inverse kinematics, machine learning, IMU-based balance, and PID control
- Structured Bezier Curve Pure Pursuit spline pathfinding algorithm for 3D differential drivetrain kinematics
- Designed and manufactured a 3D printed 11:1 gear ratio cycloidal gearbox used for a robotic arm's shoulder joint

## Skills

**Software:** Python, C/C++, Java, Bash, MATLAB, Verilog, ROS2, Git, Docker

**ML/Robotics Frameworks:** PyTorch, JAX, TensorFlow, Isaac Sim/Lab, Mujoco/MJX, TensorRT, Isaac ROS, OpenCV, robosuite, RoboCasa, LangChain, VDA5050, ZED/RealSense SDK

**Hardware Tools:** SolidWorks, Onshape, AutoCAD, FDM/SLA 3D printing, STM32, Arduino, Raspberry Pi, Camera [RealSense (d435i, d455), ZED (2i, mini, X)]

## Publications

Published 8 papers on humanoid robots and intelligent systems with Prof. Dennis Hong, 4 first-author

1. **Zhu, A.\***, Tanaka, Y.\*, Goldberg, A., & Hong, D. "AURA: Autonomous Upskilling with Retrieval-Augmented Agents." **Presented at CoRL 2025 Workshops. Accepted to IEEE ICRA 2026.** ([page](#))
2. **Zhu, A.\***, Tanaka, Y.\*., Wang, Q., & Hong, D. "Mechanical Intelligence-Aware Curriculum Reinforcement Learning for Humanoids with Parallel Actuation." **Presented at IEEE-RAS Humanoids 2025.** ([page](#))
3. **Zhu, A.\***, Tanaka, Y.\*., Rafeedi, F., & Hong, D. "Cycloidal Quasi-Direct Drive Actuator Designs with Learning-Based Torque Estimation for Legged Robotics." **Presented at IEEE ICRA 2025.** ([page](#))
4. **Zhu, A.\***, Tanaka, Y.\*., Lin, R., Mehta, A., & Hong, D. "Mechanisms and Computational Design of Multi-Modal End-Effector with Force Sensing using Gated Networks. **Presented at IEEE ICRA 2025.** ([page](#))
5. Tanaka, Y., **Zhu, A.**, Hong, D. "Tethered Variable Inertial Attitude Control Mechanisms through a Modular Jumping Limbed Robot." **Presented at IEEE AeroConf 2025.** ([page](#))
6. Tanaka, Y., Schperberg, A., **Zhu, A.**, Hong, D. "SCALER-B: A Multi-Modal Versatile Robot for Simultaneous Locomotion and Grasping." **Presented at IEEE ICRA@40 2024.** ([page](#))
7. Fernandez, G. I., Liu, Y., Togashi, C., Gillespie, K., **Zhu, A.**, Wang, Q., Wang, Y., Nam, H., Wang, S., Hou, R., Zhu, M., Navghare, A., Xu, A., Zhu, T., Sung Ahn, M., Flores Alvarez, A., Quan, J., Hong, E., Hong, D. W. "RoboCup 2024 Adult-Sized Humanoid Champions Guide for Hardware, Vision, and Strategy." In **Robot World Cup XXVII (RoboCup 2024)**. Springer, 2024. ([page](#))
8. Wang, Q., Zhu, M., Hou, R., Gillespie, K., **Zhu, A.**, Wang, S., Wang, Y., Fernandez, G. I., Liu, Y., Togashi, C., Nam, H., Navghare, A., Xu, A., Zhu, T., Sung Ahn, M., Flores Alvarez, A., Quan, J., Hong, E., Hong, D. W. "A Hierarchical, Model-Based System for High-Performance Humanoid Soccer." arXiv preprint, 2025. ([page](#))

## Presentations and Posters

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1. **AURA: Autonomous Upskilling with Retrieval-Augmented Agents** — CoRL Workshops 2025 (presenting author, poster and spotlight talk)
2. **Mechanical Intelligence-Aware Curriculum Reinforcement Learning for Humanoids with Parallel Actuation** — IEEE-RAS Humanoids 2025 (co-presenter, poster)
3. **Cycloidal Quasi-Direct Drive Actuator Designs with Learning-based Torque Estimation for Legged Robotics** — IEEE ICRA 2025 (presenting author, oral and poster)
4. **Mechanisms and Computational Design of Multi-Modal End-Effector with Force Sensing using Gated Networks** — IEEE ICRA 2025 (co-presenter, oral and poster)
5. **Tethered Variable Inertial Attitude Control Mechanisms through a Modular Jumping Limbed Robot** — IEEE AeroConf 2025 (co-presenter, oral)
6. **SCALER-B: A Multi-Modal Versatile Robot for Simultaneous Locomotion and Grasping** — IEEE ICRA@40 (poster)

## Awards

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- **Notable Robotics Awards:**
  - 2024 RoboCup Humanoid Adult-Size Division World Champions at Eindhoven, Netherlands
  - Captain of 2 year international tournament qualifying and 3 year NorCal qualifying and finalist team
- **Olympiads:**
  - 2020-2022 American Invitational Mathematics Examination (AIME) Qualifier – high score: 9/15
  - 2022 USA Physics Olympiad (USAPhO) Semi-Finalist - Top 400 competitor
  - USA Computing Olympiad (USACO) Gold Division
- Rank 22/784 at 2022 The American Rocketry Challenge National Competition
- The President's Volunteer Service Award - 1× Gold, 2× Bronze

## Professional Activities

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### Academic Reviewer .....

- IEEE Conference on Robotics and Automation (ICRA): 2025
- Conference on Robot Learning (CoRL): 2025
- IEEE-RAS Conference on Humanoid Robots (Humanoids): 2025

### Media .....

- UCLA Newsroom: An article on project SPLITTER, Apr 2025. ([page](#))
- Tech Xplore Featured: Project SPLITTER Interview, Feb 2025. ([page](#))
- IEEE Spectrum Video Friday for MOBIUS (SCALER-B), Sept 2024. ([page](#))
- UCLA Newsroom: RoboCup World Champions, Jul 2024. ([page](#))

### References .....

- Dr. Dennis Hong: UCLA, Professor. Email: [dennishong@g.ucla.edu](mailto:dennishong@g.ucla.edu)
- Mr. Dave Elliott: NVIDIA, Director, Enterprise Robotics. Email: [delliott@nvidia.com](mailto:delliott@nvidia.com)
- Dr. Yusuke Tanaka: ETH Zurich, Postdoctoral Scholar. Email: [yusuketanaka@g.ucla.edu](mailto:yusuketanaka@g.ucla.edu)
- Dr. Gabriel Fernandez: Veqdrive, CEO. Email: [gabriel808@g.ucla.edu](mailto:gabriel808@g.ucla.edu)