Alvin Zhu

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Education

University of California, Los Angeles (UCLA) — **Los Angeles, CA**
B.S. Computer Engineering | GPA: 3.8 — *Sept 2023–Jun 2026*
Relevant Coursework: Software Construction, Operating Systems, Foundations of Computer Vision, Applied Numerical Computing, Algorithms, Graduate Neural Networks and Deep Learning, Signals and Systems

Research Experience

UCLA Robotics & Mechanisms Laboratory (RoMeLa) — **Los Angeles, CA**
Research Assistant | Advisor: Dennis Hong — *Oct 2023–Current*

- **AURA** (Autonomous Upskilling with Retrieval-Augmented Agents) | *Research lead, simulation, 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 research*
  - 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 — **Santa Clara, CA**
Robotics Platform Software Intern — *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) <div align="right">**Los Angeles, CA**</div>
Robotics Research Intern <div align="right">*Nov 2024–Current*</div>
- 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 <div align="right">**Mountain View, CA**</div>
Robotics & Software Engineer Intern <div align="right">*Jun 2022–Sept 2022*</div>
- 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 (d435, d455), ZED (2i, mini, X)]

Publications

Published 7 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, submitted 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)

Presentations and Posters

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

- **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
- 3× UCLA Dean's Honors List Recipient
- Rank 22/784 at 2022 The American Rocketry Challenge National Competition
- The President's Volunteer Service Award - 1× Gold, 2× Bronze

Professional Activities

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
- Mr. Dave Elliot: NVIDIA, Director, Enterprise Robotics. Email: delliott@nvidia.com
- Dr. Yusuke Tanaka: ETH Zurich, Postdoctoral Scholar. Email: yusuketanaka@g.ucla.edu
- Dr. Gabriel Fernandez: Veqdrive, CEO. Email: gabriel808@g.ucla.edu