Haodi (Woody) Hu

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Summary

Ph.D. in embodied AI and learning-based control, specializing in reinforcement learning, vision-language-action (VLA) models, and world models for long-horizon robotic manipulation. Experienced in residual RL recovery, cross-embodiment collaborative planning, and real-world robot learning across simulation, benchmarks, and physical robots, with publications in CoRL, ICRA, T-RO, and RA-L.

Core Strengths

Research Areas	Reinforcement learning, VLA models, world models, learning-based control, long-horizon mobile manipulation, embodied decision-making, multi-agent and cross-embodiment collaboration
Systems / Scale	Residual RL fine-tuning, VLM-guided reward design, ViT and diffusion dynamics models, JEPA-style latent dynamics, benchmark evaluation, real-world robot deployment, autonomous data collection
Frameworks / Tools	PyTorch, ROS2, Isaac Sim, OpenPI / $\pi_{0.5}$, PPO, RGB-D perception, CUDA, Linux, SQL, MATLAB
Programming	Python, C++, MATLAB, SQL

Experience

Research Scientist Intern **Jan 2026 – Present**
Mitsubishi Electric Research Laboratories (MERL) *Boston, MA*

- Developed ReCoVLA, a failure-conditioned residual RL framework that freezes a fine-tuned $\pi_{0.5}$-family base policy and learns corrective actions from VLA latent features.
- Designed a Qwen3-VL-guided reward compiler that converts failure descriptors into stage-gated rewards, improving simulation success from 36.7% to 66.7% and Q-score from 0.56 to 0.83.
- Achieved 61.7% success and 0.75 Q-score in zero-shot physical Fetch experiments across sorting, disposal, and contact-rich toolbox recovery.
- Prototyped an effect-centric JEPA world-model approach for Fetch and small humanoid robot collaboration, using shared scene-effect tokens, robot-specific feasibility heads, and short-horizon planning to create Fetch-solvable handoff states.

Machine Learning Engineer Intern **Jun 2025 – Dec 2025**
SanDisk *San Jose, CA*

- Designed and deployed PPO-based RL systems for large-scale sequential decision-making under uncertainty in supply chain optimization, improving performance by 24% over prior baselines.
- Built scalable RL and LLM training/inference pipelines, reducing latency by 41% and improving factual grounding by 13% with retrieval-augmented generation.
- Built core components of an RL-based inventory control system with estimated business impact exceeding $20M.

Research Highlights

ReCoVLA: VLM-Guided Reward Compilation for VLA Recovery **Jan 2026 – Present**
MERL *Embodied AI, Robotics*

- Built a residual VLA recovery system combining frozen $\pi_{0.5}$-style execution, Qwen3-VL failure interpretation, and PPO-style residual correction in the VLA latent space.
- Constructed a semantic failure catalog and reward compiler that grounds VLM descriptors into object-state reward components with stage-aware gates.
- Evaluated ReCoVLA on vegetable sorting, soda-can disposal, and contact-rich toolbox organization, achieving the strongest simulation and physical Fetch results among tested methods.

World Models for Cross-Embodiment Collaboration **April 2026 – Present**
MERL *World Models, Multi-Robot Systems*

- Imported a humanoid robot into OmniGibson and proposed a JEPA-style shared latent world model for Fetch-humanoid collaboration under asymmetric manipulation capabilities.
- Proposed embodiment-invariant effect tokens that represent scene changes rather than robot-specific actions, aligning behaviors such as nudging, exposing, staging, grasping, and transporting across robots.
- Designed partner-affordance planning objectives that reward the small robot for creating handoff states that increase Fetch feasibility under clutter, occlusion, and constrained-access conditions.

Real-World Robotic Loco-manipulation on Difficult Terrain **2021 – Present**
USC RoboLAND *Los Angeles, CA*

- Built autonomous data-collection and RGB-D perception pipelines with gantry-based and quadrupedal robot platforms for terrain-mediated manipulation.
- Trained ViT-based models to predict granular media avalanche responses from legged excavation actions and RGB-D terrain observations.
- Developed diffusion-based granular dynamics predictors and control policies for quadrupedal robots to reposition rocks through strategic sand avalanches and improve locomotion on granular slopes.

Selected Publications

- **Haodi Hu**, Chung-Ta Huang, Jing Liu, Ye Wang, Kei Suzuki, Matthew Brand, Toshiaki Koike-Akino. "ReCoVLA: VLM-Guided Reward Compilation for Failure Recovery in Vision-Language-Action Policies." *Submitted to CoRL 2026.*
- **Haodi Hu**, Yue Wu, Daniel Seita, Feifei Qian. "Granular Loco-manipulation: Repositioning Rocks Through Strategic Sand Avalanche." *Conference on Robot Learning (CoRL)*, 2025.
- **Haodi Hu**, Xingjue Liao, Wuhao Du, Feifei Qian. "Multi-robot Connection Towards Collective Obstacle Field Traversal." *IEEE International Conference on Robotics and Automation (ICRA)*, 2025.
- **Haodi Hu**, Feifei Qian, Daniel Seita. "Learning Granular Media Avalanche Behavior for Indirectly Manipulating Obstacles on a Granular Slope." *Conference on Robot Learning (CoRL)*, 2024.
- **Haodi Hu**, Feifei Qian. "Obstacle-Aided Trajectory Control of a Quadrupedal Robot Through Sequential Gait Composition." *IEEE Transactions on Robotics (T-RO)*, 2024.
- Kaustav Chakraborty, **Haodi Hu**, Matthew Kvalheim, Feifei Qian. "Planning of Obstacle-Aided Navigation for Multi-Legged Robots Using a Sampling-Based Method Over Directed Graphs." *IEEE Robotics and Automation Letters (RA-L)*, 2022.

Education

University of Southern California **May 2026**
Ph.D. in Electrical Engineering *Los Angeles, CA*

- Research focus: embodied AI, VLA systems, world models, reinforcement learning, long-horizon mobile manipulation, and multi-agent collaboration.

University of Southern California **May 2021**
M.S. in Electrical Engineering *Los Angeles, CA*
Northeast Forest University **Jun 2019**
B.S. in Electrical Engineering *Harbin, China*

Honors, Teaching & Service

- IEEE Access Exceptional Reviewer Recognition, 2026; USC Viterbi Ph.D. Student Fellowship Award, 2021; USC Viterbi CURVE Mentor Award, 2022–2025; NEFU Excellent Graduate Award, 2019.
- Co-organizer, 5th Workshop on Representations and Manipulating Deformable Objects, ICRA 2025.
- Teaching Assistant for Robot Mobility (EE599), Deep Learning (EE541), and MOS VLSI Circuit Design (EE477L), 2022–2025.
- Mentored USC CURVE and student researchers on robotics projects, research preparation, and conference presentation.