

Zichao Hu

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Research Statement

My research focuses on leveraging imitation learning, reinforcement learning, LLMs, and diffusion models to empower autonomous robots to understand and carry out human instructions while navigating safely and in compliance with social norms within human environments.

Education

Ph.D. in Artificial Intelligence and Robotics

Advisor: Joydeep Biswas, Autonomous Mobile Robotics Lab

University of Texas at Austin, TX, USA

August 2022 – May 2027 (anticipated)

Research Areas: LLMs for Code Generation, Language-conditioned Diffusion Policies, Social Robot Navigation

B.Science in Computer Engineering

Advisor: Samira Khan, Shift Lab

University of Virginia, VA, USA

August 2018 – May 2022

Research Areas: Simultaneous Localization and Mapping (SLAM), [\[Paper\]](#) [\[Video\]](#)

Work Experience

Amazon Lab126

Applied Scientist Intern

May 2025 – Aug 2025

Sunnyvale, CA, USA

- Developed a **vision-aided whole-body control policy** for humanoid robots (Unitree G1, Booster T1) to push objects of varying mass and friction toward goals using onboard proprioception and depth perception.
- Integrated a pre-trained force-adaptive controller into an RL pipeline with **adversarial motion priors**, **curriculum learning**, and **asymmetric actor-critic** methods to achieve robust pushing behavior in **Isaac-Gym and IsaacLab**.
- Conducted simulations evaluating generalization to novel environments, ablations on vision feedback for stable control, and integration with a planner to demonstrate interactive navigation where the robot clears obstacles from its path.

AAAI 2026 Conference Organizer

Workflow Chair

Sep 2025 – Present

Austin, TX, USA

- **Oversaw reviewer-paper assignments for 29,000+ submissions** across Program Committee, Senior Program Committee, and Area Chairs, managing conflicts of interest, bidding preferences, reviewer loads, and special requests.
- Built automation scripts with the OpenReview API to streamline assignments, constraint handling, and reviewer notifications.
- **Supported infrastructure for the AI-Assisted Peer Review Pilot Program** at AAI 2026.

Research Projects

Composable Diffusion-based Planner for Instruction-Following Navigation

Co-supervised by Joydeep Biswas, Peter Stone

Austin, TX

June 2024 – April 2025

- Generated large-scale synthetic robot trajectory datasets to pre-train a **diffusion model** for producing collision-free trajectories in dynamic environments.
- Applied **reinforcement learning (RL) to finetune diffusion policies** for generating specialized social navigation behaviors, including overtaking and following.
- **Leveraged the compositional properties of diffusion models to synthesize complex navigation behaviors** from specialized behaviors (e.g., deriving merging behavior from overtaking and following) based on instructions at inference time. Conducted both experiments in simu;atoo;pn and realworld
- Published in CoRL 2025, [\[Project Website: https://amrl.cs.utexas.edu/ComposableNav/\]](https://amrl.cs.utexas.edu/ComposableNav/)

LLM-Powered Code Generation for Autonomous Service Robots

Austin, TX

Co-supervised by Joydeep Biswas, Arjun Guha

April 2023 – November 2023

- Developed *CodeBotler*, a system **integrating large language models (LLMs) with the Robot Operating System (ROS)**, enabling end-users to command a service robot through natural language instructions for performing open-world tasks.
- Created *RoboEval*, a robot code generation benchmark that utilizes **linear temporal logic (LTL)** to verify the correctness of robot actions generated by the program.
- Published in RA-L 2024, **[Project Website: <https://amrl.cs.utexas.edu/codebotler/>]**

Fine-tuning Code LLMs for Domain-Specific Robot Code Generation

Austin, TX

Co-supervised by Joydeep Biswas, Arjun Guha, Jessy Junyi Li

December 2023 – May 2024

- Generated synthetic service-robot programs to **fine-tune small open-weight LLMs (e.g., Llama, Qwen, Gemma)**, bridging the code-generation gap with large proprietary models (e.g., GPT, Gemini).
- Proposed *Robo-Instruct*, an extension of Self-Instruct that validates robot-specific constraints on generated programs by **opportunistically inferring world properties and synthesizing a symbolic simulator on the fly during program execution**.
- Published in COLM 2025 **[Project Website: <https://amrl.cs.utexas.edu/robo-instruct/>]**

Social Robot Navigation

Austin, TX

Co-supervised by Joydeep Biswas, Xuesu Xiao, Peter Stone

January 2023 – September 2023

- Conducted **a case study on the Socially Compliant Navigation Dataset (SCAND) using the ROS Navigation Stack on playback data**, discovering that human-demonstrated trajectories only occasionally deviate from general-purpose planner outputs. Addressing these rare deviations is essential for solving social robot navigation.
- Published in ICRA 2024

Publications

Journals

- **Zichao Hu**, Francesca Lucchetti, Claire Schlesinger, Yash Saxena, Anders Freeman, Sadanand Modak, Arjun Guha, Joydeep Biswas. “Deploying and Evaluating LLMs to Program Service Mobile Robots”, *Robotics and Automation Letters*, (RA-L 2024). [\[Paper\]](#)
- Jeahn Han, **Zichao Hu**, Seonmo Yang, Minji Kim, Pyojin Kim. “SoMaSLAM: 2D Graph SLAM for Sparse Range Sensing with Soft Manhattan World Constraints”, *Robotics and Automation Letters*, (RA-L 2025). [\[Paper\]](#)

Conference Proceedings

- **Zichao Hu**, Chen Tang, Michael J. Munje, Yifeng Zhu, Alex Liu, Shuijing Liu, Garrett Warnell, Peter Stone, Joydeep Biswas. “ComposableNav: Instruction-Following Navigation in Dynamic Environments via Composable Diffusion”, *Conference on Robot Learning (CoRL 2025)*. [\[Paper\]](#)
- **Zichao Hu**, Junyi Jessy Li, Arjun Guha, Joydeep Biswas. “Robo-Instruct: Simulator-Augmented Instruction Alignment For Finetuning CodeLLMs”, *Conference on Language Modeling (COLM 2025)*. [\[Paper\]](#)
- Amir Hossain Raj*, **Zichao Hu***, Haresh Karnan, Rohan Chandra, Amirreza Payandeh, Luisa Mao, Peter Stone, Joydeep Biswas, Xuesu Xiao. “Rethinking Social Robot Navigation: Leveraging the Best of Two Worlds”, *IEEE International Conference on Robotics and Automation (ICRA 2024)*. *Joint first Author*. [\[Paper\]](#)
- Michael J. Munje, Chen Tang, Shuijing Liu, **Zichao Hu**, Yifeng Zhu, Jiaxun Cui, Garrett Warnell, Joydeep Biswas, Peter Stone. “SocialNav-SUB: Benchmarking VLMs for Scene Understanding in Social Robot Navigation”, *Conference on Robot Learning (CoRL 2025)*. [\[Paper\]](#)

- Hanzhi Zhou*, **Zichao Hu***, Sihang Liu, Samira Khan. “Efficient 2D Graph SLAM for Sparse Sensing”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2022)*. Joint first Author. [Paper]

Under Review

- Yunhao Yang, William Ward, **Zichao Hu**, Joydeep Biswas, Ufuk Topcu. “Joint Verification and Refinement of Language Models for Safety-Constrained Planning”, *Under Review*.

Workshops & Symposiums

- **Zichao Hu**, Chen Tang, Michael J. Munje, Yifeng Zhu, Alex Liu, Shuijing Liu, Garrett Warnell, Peter Stone, Joydeep Biswas. “ComposableNav: Instruction-Following Navigation in Dynamic Environments via Composable Diffusion”, *Workshop Human-Centered Robot Learning (ICRA 2025)*. **Spotlight Paper** [Paper]
- **Zichao Hu**, Francesca Lucchetti, Claire Schlesinger, Yash Saxena, Anders Freeman, Sadanand Modak, Arjun Guha, Joydeep Biswas. “Deploying and Evaluating LLMs to Program Service Mobile Robots”, *Vision-Language Models for Navigation and Manipulation Workshop (ICRA 2024)*. **Spotlight Paper** [Paper]
- **Zichao Hu**, Francesca Lucchetti, Claire Schlesinger, Yash Saxena, Anders Freeman, Sadanand Modak, Arjun Guha, Joydeep Biswas. “Deploying and Evaluating LLMs to Program Service Mobile Robots”, *AAAI 2024 Spring Symposium*. [Paper]
- Divyanshu Saxena, et al. “On a Foundation Model for Operating Systems”, *Machine Learning for Systems Workshop (NeurIPS 2023)*. [Paper]

Technical skills

Programming Languages	Python, C++
Libraries, Frameworks, Softwares	Pytorch, Huggingface, IsaacGym/IsaacLab, ROS1/2, ROS Navigation Stack, AWS EC2, Docker, Git
Algorithms	Imitation Learning, Reinforcement Learning, RLAIIF, Diffusion Models, Planning Algorithms (A*, RRT), Control Algorithms (DWA, MPC)

Services and Professional Activities

Reviewer	RA-L, ICLR, CoRL, ICRA, IROS, HRI.
Community Outreach	Robot demo and public engagement at South by Southwest Conference & Festivals (SXSW).
NSF Expedition in Computing	Graduate student researcher as a part of the Learning Directed Operating System (LDOS) project under the NSF Expedition in Computing.
Undergraduate Mentorship	Mentored Alex Liu in completing his undergraduate research thesis.