Asher J. Hancock

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My research focuses on enhancing the performance, robustness, and generalization capabilities of vision-language-action (VLA) models in complex and unstructured environments. My approach is twofold: I develop test-time compute methods to improve the out-of-distribution (OOD) performance of VLAs, and train novel VLAs by treating robot actions as a form of language, unlocking the latent reasoning capabilities of foundation models for downstream control. I validate my work through rigorous real-world deployment, maintaining a close feedback loop between algorithmic development and hardware performance.

Education

Ph.D. in Mechanical and Aerospace Engineering, ***Princeton University*** 2028 (Expected)

Master of Philosophy in Engineering, ***University of Cambridge*** 2023
Thesis: *On Relaxation Systems in Network and Systems Theory*

Bachelor of Science in Mechanical Engineering, ***University of Pittsburgh*** 2022

Experiences

Graduate Researcher, ***Princeton University*** 2023 – Present
I work in the Intelligent Robot Motion (IRoM) Lab advised by Prof. Anirudha Majumdar. My work centers on improving the performance and reliability of robot foundation models (VLAs). In particular, I focus on enhancing the generalization and reasoning capabilities of VLAs, enabling them to handle novel, out-of-distribution (OOD) scenarios.

Graduate Researcher, ***University of Cambridge*** 2022 – 2023
I worked in the Controls Group advised by Prof. Rodolphe Sepulchre. My work focused on modeling biophysical (neuronal) systems using nonlinear control and operator theory.

Pathways Intern, ***National Aeronautics and Space Administration (NASA)*** 2020-2022
Conducted structural dynamics modeling and analysis for the Mars Ascent Vehicle (MAV), assessing vehicle integrity under critical flight loads. Designed and implemented control policies to improve the performance and autonomy of satellites. Performed trajectory design and optimization for future deep-space missions, modeling orbital mechanics to define efficient flight paths.

Ongoing Projects

Cross-Embodiment Policy Learning with Natural Language 2025–Present
This project aims to tackle the data bottleneck in robotics by achieving zero-shot or few-shot cross-embodiment policy transfer. By representing actions as natural language, we are creating robot policies decoupled from specific hardware. This allows for a VLA trained on one set of robots to adapt to a novel embodiment with minimal new data.

Enhancing Long-Horizon Reasoning in VLAs 2025–Present
This work addresses a key limitation in current robot learning: while vision-language models (VLMs) demonstrate sophisticated reasoning, their vision-language-action (VLA) counterparts often fail to inherit this capability for complex, multi-step tasks. To bridge this gap, we leverage our 'actions as language' paradigm, combining synthetic data generation with reinforcement learning (GRPO). The goal is to produce more robust and accurate long-horizon motion plans for dexterous manipulation.

Semantic Guardrails and Alignment for Vision-Language-Action Models 2025–Present

This project addresses the issue of semantic safety in VLAs, which can follow instructions that are syntactically correct but socially biased or unsafe (e.g., acting on harmful stereotypes from web data). We are developing a framework to enable VLAs to identify and refuse such instructions by reasoning about their underlying ethical implications. The goal is to create policies that are not only capable but also aligned with human values, ensuring they can be safely deployed in human-centric environments.

Publications

[5] Actions as Language: Fine-Tuning VLMs into VLAs Without Catastrophic Forgetting
A.J. Hancock, X. Wu, L. Zha, O. Russakovsky, A. Majumdar. *Submitted*, 2025.

[4] Is Your Imitation Learning Policy Better Than Mine? Policy Comparison with Near-Optimal Stopping
D. Snyder, A.J. Hancock, A. Badithela, E. Dixon, P. Miller, R.A. Ambrus, A. Majumdar, M. Itkina, H. Nishimura. *Robotics: Science and Systems (RSS)*, 2025.

[3] Run-time Observation Interventions Make Vision-Language-Action Models More Visually Robust
A.J. Hancock, A.Z. Ren, A. Majumdar. *International Conference on Robotics and Automation (ICRA)*, 2025.

[2] Blending Data-Driven Priors in Dynamic Games
J. Lidard*, H. Hu*, A.J. Hancock, Z. Zhang, A.G. Contreras, V. Modi, J. DeCastro, D. Gopinath, G. Rosman, N.E. Leonard, M. Santos, J.F. Fisac. *Robotics: Science and Systems (RSS)*, 2024.

[1] PAC-Bayes Generalization Certificates for Learned Inductive Conformal Prediction
A. Sharma, S. Veer, A.J. Hancock, H. Yang, M. Pavone, A. Majumdar *Conference on Neural Information Processing Systems (NeurIPS)*, 2023.

* denotes equal contribution.

Peer-Reviewed Workshops

[W3] Is Your Imitation Learning Policy Better Than Mine? Policy Comparison with Near-Optimal Stopping
D. Snyder, A.J. Hancock, A. Badithela, E. Dixon, P. Miller, R.A. Ambrus, A. Majumdar, M. Itkina, H. Nishimura. *Robot Evaluation for the Real World, RSS*, 2025.

[W2] Run-time Observation Interventions Make Vision-Language-Action Models More Visually Robust
A.J. Hancock, A.Z. Ren, A. Majumdar. *Safely Leveraging Foundation Models in Robotics (**Oral**), ICRA*, 2025.

[W1] Blending Data-Driven Priors in Dynamic Games
J. Lidard*, H. Hu*, A.J. Hancock, Z. Zhang, A.G. Contreras, V. Modi, J. DeCastro, D. Gopinath, G. Rosman, N.E. Leonard, M. Santos, J.F. Fisac. *Northeast Systems and Control Workshop (**Oral**)*, 2024.

* denotes equal contribution.

Awards and Honors

- **NSF Graduate Research Fellowship (GRFP),** ***National Science Foundation*** 2022
  The GRFP provides three years of funding for graduate research.
- **Churchill Scholarship,** ***The Winston Churchill Foundation of the USA*** 2022
  The Churchill Scholarship provides funding for one year of Master's study at the University of Cambridge.
- **Goldwater Scholarship,** ***Barry Goldwater Foundation*** 2021
  National award for undergraduate researchers in STEM.

Academic Service

Reviewing

- International Conference on Learning Representations (ICLR) 2025 - Present
- Robotics: Science and Systems (RSS) Conference 2024 - Present
- IEEE Robotics and Automation Letters (RA-L) 2024 - Present
- IEEE International Conference on Robotics and Automation (ICRA) 2024 - Present

Undergraduate Research Mentoring

- Micah Baker (MAE), Princeton 2025 - Present
- Hugh Salva (ME), Harvard Summer 2025

Teaching Experience

Teaching Assistant

- Fall 2025, MAE 345 Introduction to Robotics, Princeton MAE Department.
- Spring 2023, 3F2 Systems and Control Theory, Cambridge Information Engineering Department

Key Skills

Robotics: Dynamics, Motion Planning, Feedback Control
Machine Learning Architectures: Neural Networks, CNNs, RNNs, Transformers, Diffusion Models, Large Language Models (LLMs), Vision-Language Models (VLMs), Vision-Language-Action Models (VLAs)
Machine Learning Paradigms: Supervised Learning, Self-Supervised Learning, Reinforcement Learning (RL), Imitation Learning (IL)
Machine Learning Techniques Fine-Tuning, Low-Rank Adaptation (LoRA), Prompt Engineering

Software: Python, PyTorch, Jax, Git, Unix scripting, High-Performance Computing (HPC), Robot Operating System (ROS), Weights & Biases (W&B).

References

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