Bo Ai

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Research Interests

I study cross-embodiment learning. My research seeks to understand how agents can learn from, generalize across, and optimize physical embodiments for robotic tasks. Research questions that interest me include: What action or state abstractions can unify control across diverse robots? What fundamental invariants underlie control problems across embodiments and enable transfer? Which factors in data, models, or algorithms shape cross-embodiment generalization? I approach these questions from both model-based and model-free perspectives.

Education

University of California San Diego (UCSD) *Sep 2024 - Present*
Ph.D. in Computer Science and Engineering. Advisors: Hao Su and Henrik I. Christensen
Research interest: cross-embodiment robot learning, world model learning, manipulation

National University of Singapore (NUS) *Aug 2019 - June 2023*
Highest Distinction, B.Comp. in Computer Science with a Second Major in Statistics
Turing Program. Advisor: David Hsu
Thesis: Scaling Robot Learning: Generalization Through Invariant Representations
NUS Outstanding Undergraduate Researcher Prize, NUS School of Computing Innovation Prize

Experience

Boston Dynamics AI Institute *June 2025 – Sep 2025*
Research Intern with Pang Tao and Jiuguang Wang Boston, MA
- Developing algorithms and systems for whole-body, contact-rich manipulation.

Agency for Science, Technology and Research (A*STAR) *Dec 2023 – Sep 2024*
Research Engineer with Cheston Tan Singapore
- Led projects in world model learning and large language model reasoning.

Stanford Vision and Learning Lab, Stanford University *June 2023 – Dec 2023*
Research Intern with Yunzhu Li *and* Jiajun Wu Stanford, CA
- Developed a framework that learns world models with visual and tactile sensing from real-world interactions and integrates the learned models with planning for manipulating objects with unknown physical properties.
- Demonstrated the manipulation system to distinguished lab visitors.

Adaptive Computing Lab, National University of Singapore *Dec 2020 – May 2023*
Undergraduate Research Assistant with David Hsu Singapore
- Developed learning-based controllers and robotic systems that enable kilometer-scale visual navigation.
- Demonstrated systems to renowned faculty, senior industry executives, and government officials during lab visits.

Selected Papers

[1] **Bo Ai**, Stephen Tian, Haochen Shi, Yixuan Wang, Tobias Pfaff, Cheston Tan, Henrik I. Christensen, Hao Su, Jiajun Wu, Yunzhu Li
A Review of Learning-Based Dynamics Models for Robotic Manipulation
Science Robotics, 2025

[2] **Bo Ai***, Liu Dai*, Nico Bohlinger*, Dichen Li*, Tongzhou Mu, Zhanxin Wu, K. Fay, Henrik I. Christensen, Jan Peters, Hao Su
Towards Embodiment Scaling Laws in Robot Locomotion
Conference on Robot Learning (**CoRL**), 2025

[3] Zihao He*, **Bo Ai***, Tongzhou Mu, Yulin Liu, Weikang Wan, Jiawei Fu, Yilun Du, Henrik I. Christensen, and Hao Su
Scaling Cross-Embodiment World Models for Dexterous Manipulation
Ongong project; abridged version appeared at the CoRL 2025 Workshop on Dexterous Manipulation [link]

[4] Tongxuan Tian*, Haoyang Li*, **Bo Ai**, Xiaodi Yuan, Zhiao Huang, Hao Su
Diffusion Dynamics Models with Generative State Estimation for Cloth Manipulation
Conference on Robot Learning (**CoRL**), 2025

[5] **Bo Ai***, Stephen Tian*, Haochen Shi, Yixuan Wang, Cheston Tan, Yunzhu Li, Jiajun Wu
RoboPack: Learning Tactile-Informed Dynamics Models for Dense Packing
Robotics: Science and Systems (**RSS**), 2024

[6] **Bo Ai**, Zhanxin Wu, David Hsu
Invariance is Key to Generalization: Examining the Role of Representation in Sim-to-Real Transfer for Visual Navigation
International Symposium on Experimental Robotics (**ISER**), 2023

[7] **Bo Ai**, Wei Gao, Vinay, David Hsu
Deep Visual Navigation under Partial Observability
International Conference on Robotics and Automation (**ICRA**), 2022

Selected Awards and Honors

- UCSD CSE Department Fellowship 2024
- NUS School of Computing Dean's List (5%, Department-Wide) 2022
- NUS Outstanding Undergraduate Researcher Prize (35 Recipients Annually, University-Wide) 2022
- NUS School of Computing Innovation Prize (2 Recipients Annually, Department-Wide) 2022
- Certificate of Distinction in Artificial Intelligence 2022
- Commendation for Top students × 3 2021 - 2022
- NUS Science and Technology Scholarship (∼ 200K USD) 2018 - 2023

Mentoring

- Shresth Grover (Master's student, UC San Diego) 2025
- Zihao He (Undergraduate, Shanghai Jiao Tong University) 2025
- Chen Si (Master's student, UC San Diego) 2025
- Dichen Li (Master's student, UC San Diego) 2024 - 2025
- Tongxuan Tian (Master's student, Virginia Tech) 2024 - 2025

Teaching

- Teaching Assistant, NUS CS5478 Intelligent Robots: Algorithms and Systems *Spring 2023*
- Teaching Assistant, NUS CS3244 Machine Learning *Fall 2022*
- Teaching Assistant, NUS CS1101S Programming Methodology *Fall 2020*

Invited Talks

- **Integrating Learning and Planning for Robot Navigation**
  - Stanford Intelligent Systems Lab *July 2023*
- **Deep Learning for Robot Navigation with a Floor Map**
  - NUS Smart System Institute *Feb 2022*

Professional Activities

- *Journal Reviewer:* IEEE RA-L '22 '23 '24 '25; RAM '25
- *Conference Reviewer:* ICRA '22 '23 '25 '26, IROS '22 '23 '24

Skills

- **Programming:** Python, C, Java, JavaScript, TypeScript, Elixir, HTML, LaTeX, R, SAS
- **Robotics & Simulation:** ROS, ROS2, Isaac Lab, MuJoCo
- **Robots:** Boston Dynamics Spot, Franka Panda, LEGO Mindstorms, Arduino
- **Languages:** English (fluent), Chinese (native)