Bo Ai

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Research Interests

I study the role of embodiment in building general-purpose intelligent agents. My research focuses on how agents can learn from, generalize across, and optimize physical embodiments for complex manipulation tasks. 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, mobile 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 Publications

[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] 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

[4] **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

[5] **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

[6] **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
- 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

Teaching

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

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

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, IROS '22 '23 '24
- *Society Memberships:* ACM '20 '21, IEEE '21 '22

Skills

- **Programming:** Python, C, Java, JavaScript, TypeScript, Elixir, HTML, LaTeX, R, SAS
- **Robotics & Simulation:** ROS, ROS2, Isaac Lab, MuJoCo
- **Machine Learning:** PyTorch, PyTorch Geometric, TensorFlow, Keras, scikit-learn, OpenCV, Open3D
- **DevOps & HPC:** Git, Docker, Kubernetes, Slurm
- **Hardware:** Laser cutting, 3D printing, welding
- **Robots:** Boston Dynamics Spot, Franka Panda, LEGO Mindstorms, Arduino
- **Languages:** English (fluent), Chinese (native)