Zhuoran Li

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EDUCATION

National University of Singapore (NUS), *Singapore*

Bachelor of Science (Honors) in Data Science and Analytics   *Aug. 2019 – Jun. 2024*

- **GPA:** 4.77/5.00   **Honors:** Highest Distinction
- **Highlight Courses:** CS4246: AI Planning and Decision Making (A+, graduate-level), CS4243: Computer Vision and Pattern Recognition (A+, graduate-level), CS4248: Natural Language Processing (A, graduate-level), CS4278: Intelligent Robots: Algorithms and Systems (A, graduate-level), ST4234: Bayesian Statistics (A), CS3244: Machine Learning (A+)

RESEARCH INTERESTS

My research lies at the intersection of **robotics**, **computer vision**, and **machine learning**. Specifically, I focus on **Embodied AI** and aim to develop novel algorithms that enable robots to better perceive, understand, and learn from multimodal information in their interactions with the physical world, and autonomously acquire the perception and manipulation skills necessary to execute complex tasks, ultimately achieving human-level performance in various scenarios, ranging from industrial applications to daily life assistance.

PUBLICATIONS

* **indicates equal contribution**

[1] D^{3}Fields: Dynamic 3D Descriptor Fields for Zero-Shot Generalizable Rearrangement
Yixuan Wang*, Mingtong Zhang*, **Zhuoran Li***, Tarik Kelestemur, Katherine Driggs-Campbell, Jiajun Wu, Li Fei-Fei, Yunzhu Li
The Conference on Robot Learning (CoRL), 2024
Oral Presentation
Project Page, Paper, Code

[2] RoboEXP: Action-Conditioned Scene Graph via Interactive Exploration for Robotic Manipulation
Hanxiao Jiang, Binghao Huang, Ruihai Wu, **Zhuoran Li**, Shubham Garg, Hooshang Nayyeri, Shenlong Wang, and Yunzhu Li
The Conference on Robot Learning (CoRL), 2024
Best Paper Nomination at *IEEE International Conference on Robotics and Automation (ICRA)* 2024 Workshop on Vision-Language Models for Manipulation
Oral Presentation at *Conference on Computer Vision and Pattern Recognition (CVPR)* 2024 Workshop on Vision and Language for Autonomous Driving and Robotics
Project Page, Paper, Code

RESEARCH EXPERIENCES

Stanford Vision and Learning Lab (SVL), *Stanford University*

Undergraduate Visiting Research Intern, advised by Prof. Jiajun Wu and Prof. Yunzhu Li   *Apr. 2023 – Sep. 2023*

- Designed an ideal scene representation for embodied AI by leveraging foundation models (e.g., DINOv2, Grounded-SAM, and XMem), which is a 3D, dynamic, and semantic representation that supports zero-shot generalizable robotic manipulation.
- Developed various meaningful household robotic manipulation tasks (e.g., organizing utensils, serving food, and organizing shoes) in an advanced simulator for embodied AI research, BEHAVIOR (OmniGibson).
- Evaluated the system extensively in both real-world and simulation experiments, where our representation was applied to a broad spectrum of household robotic manipulation tasks in a zero-shot manner and achieved impressive results.

Robotic Perception, Interaction, and Learning Lab (RoboPIL), *University of Illinois Urbana-Champaign*

Undergraduate Research Assistant, advised by Prof. Yunzhu Li   *Oct. 2023 – Feb. 2024*

- Designed a novel robotic exploration system, incorporating the large multimodal model (LMM) and an explicit memory design, which incrementally constructs an action-conditioned scene graph that captures the underlying environment's structure through the robot's autonomous interactive exploration of the environment.
- Assisted with the deployment and evaluation of the system in embodied AI simulators like BEHAVIOR (OmniGibson) and SAPIEN, and assisted with the comprehensive visualization design of the system.

Group of Learning and Optimization Working in AI (GLOW.AI), *National University of Singapore*

Undergraduate Research Assistant, advised by Prof. Bryan Kian Hsiang Low   *Sep. 2023 – May. 2024*

- Worked on my undergraduate honors thesis about leveraging the large language models (LLMs) for decision-making and planning under uncertainty, with applications in autonomous driving and robotics. Awarded the highest distinction for the honors thesis.
- Designed a closed-loop LLM-driven autonomous driving framework that outperforms state-of-the-art reinforcement learning methods for driving. Designed an LLM-driven robotic manipulation system that achieves decent performance in household manipulation tasks in a zero-shot manner. Conducted extensive quantitative and qualitative experiments to evaluate the systems.
- Identified the advantages and limitations of using LLMs for decision-making and planning under uncertainty.

Adaptive Computing Lab (AdaComp), *National University of Singapore*
Undergraduate Research Assistant, advised by Prof. David Hsu   *Jan. 2021 – Aug. 2021*

- Assisted with the design of a control and system architecture for autonomous long-horizon visual navigation on a Boston Dynamics Spot robot (i.e., an agile mobile robot).
- Conducted a large-scale navigation data collection for robot imitation learning, which included various kinds of scenarios in real-world navigation such as taking elevators, obstacles and pedestrians avoidance. Algorithms like DAGGER were applied during the collection process.
- Deployed MinIO on data servers for cloud data storage, and used Alluxio for data transfer between MinIO data servers and a local cluster of machines. Deployed the Determined AI framework on the cluster for fast containerized distributed model training.
- Assisted with real-world experiments to evaluate our visual navigation architecture.

TEACHING EXPERIENCES

CS3244: Machine Learning
Teaching Assistant, NUS   *Aug. 2021 – Dec. 2021*

- Conducted weekly tutorial sessions for a group of 25 NUS undergraduate students. Prepared slides and exercises for the students to learn and practice, where the teaching topics included generalized linear models, SVM, tree-based methods, EM, deep learning, etc.

CS2040: Data Structures and Algorithms
Teaching Assistant, NUS   *Aug. 2020 – Dec. 2020*

- Conducted weekly lab sessions for a group of 22 NUS undergraduate students. Prepared challenging coding questions for the students to practice. The topics covered basic data structures (e.g., linked lists, stacks, queues, hash tables, binary heaps, trees, and graphs), searching and sorting algorithms, and basic analysis of algorithms.

SELECTED HONORS & AWARDS

- **Certificate of Oustanding Performance & Top Students** in CS4243: Computer Vision and Pattern Recognition (graduate-level course), NUS
- **Certificate of Best Project Award** in CS4246: AI Planning and Decision Making (graduate-level course), NUS
- **Dean's List**, NUS
- **The Science & Technology Undergraduate Scholarship** (an undergraduate full scholarship offered to support outstanding students), NUS and Singapore Ministry of Education

SKILLS

Mathematics: Linear Algebra, Multivariable Calculus, Optimization, Probability Theory, Bayesian Statistics
Programming: Python, C/C++, Java, JavaScript, MATLAB
Softwares and Libraries: PyTorch, JAX, OpenCV, ROS, Blender
Simulators: BEHAVIOR (OmniGibson), SAPIEN, Nimble, Mujoco, Gymnasium, CARLA