Zichen "Charles" Zhang

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Education

Macalester College, St. Pual, MN *Sep. 2019 - Dec. 2022*

GPA 3.95/4.0 **Major GPA** 4.0/4.0 *Mathematics, C.S.*

- Charles J. Turck Presidential Honor Scholarship (Four-year scholarship); School Dean's List (2019 - 2022)

Research Interest

My primary research interest lies in the development of autonomous agents that can effectively operate in dynamic environments, solving real-world puzzles for social good. I am interested in both generalist and specialist agents, with a focus on developing elegant, generalizable, and effective approaches that can be applied across a wide range of tasks and scenarios.

A Generalist can specialize, and a Specialist can generalize.

Research Experience

Predoctoral Young Investigator (PYI)

Seattle, WA

PRIOR team, Allen Institute for AI (AI2) *Dec. 2022 - Present*

- Co-lead Unified-IO 2, a large multimodal generation model unifying over 200 understanding and generation tasks across vision, language, audio, and action, trained from scratch and open-sourced everything.
  - Main contributions in designing and augmenting the pretraining and instruction finetuning tasks of all modalities; investigating model architectures and training pipelines; large-scale evaluations for all modalities; conversion from tensorflow & jax/flax pipeline to torch for open-sourcing and embodiment evaluations.
- Lead to extend the autonomous RL work with minimal human intervention training by online RL with real robots in the real world.
- Lead the project of *Universal Visual Decomposer (UVD)*, with the collaboration of people in Upenn and UW.
  - Proposed and implemented the idea of iterative decomposition using pretrained visual representations; designed and established the benefit of UVD as the "free-lunch" generalizations for IL and the optimally monotonic implicit reward for RL; helped improve the data collection and online evaluation processes for real-world experiments.

Research

Remote

NVIDIA & Stanford Vision and Learning Lab (SVL) & UT Robot Perception and Learning Lab *May. 2022 - Oct. 2022*

- Join the research with people from NVIDIA and Stanford Vision & Learning (SVL), supervised by Linxi "Jim" Fan and Yuke Zhu.
- Develop and improve the novel multi-modal prompt-driven robotic manipulation tasks suite, VIMABench. Take part in a variety of foundation model implementations for sequence modeling, initial experiments, ablations, and baselines for VIMA.
- Participate in developing skill primitives in MineDojo; collaborate with the project for few-shot imitation learning (significantly speed up the training infrastructure; propose the idea using contrastive learning for analogy making)

Research (Intern)

Seattle, WA

PRIOR team, Allen Institute for AI (AI2) *Sep. 2021 - Dec. 2022*

- Lead the project for Autonomous RL (aka. reset-free RL) supervised by *Luca Weihs*. After identifying the main problem is the near-irreversible (NI) states, we build the agent towards only request intervention (reset) when necessary, while nailing generalizations.
- Contribute to the modular and flexible learning framework *AllenAct*.

Summer Research

St. Paul, MN

Advised by Professor Lisa Naples, Macalester College *Jun. 2021 - Aug. 2021*

- After answering the Traveling Salesman Problem (TSP) in mathematics, develop and prove theorems and lemmas to extend the characterization of geometric measures that are carried by rectifiable curves in the dyadic cube system.

Research

Beijing, China

R & D Department, Thorough Images (Now Thorough Future) *Jan. 2021 - May 2021*

- Lead the project of automated scoring systems for human epidermal growth factor receptor 2 (HER-2) after immunohistochemical (IHC) staining mentored by co-CEO & CTO *Shuhao Wang*.

Summer Research

St. Paul, MN

Advised by Prof. Esra Kadioglu Urtis, Macalester College *Jun. 2020 - Aug. 2020*

- Develop Q-learning-based and graph-based algorithms with simulations for UAVs coverage.

Publications / Preprints

* indicates equal contribution, † indicates equal advising

Universal Visual Decomposer: Long-Horizon Manipulation Made Easy
Z. Zhang*, *Y. Li**, O. Bastani, A. Gupta, D. Jayaraman, Y. Ma†, and L. Weihs†, in submission, 2023, Learning Effective Abstractions for Planning workshop (**oral, Best Paper Award**) at CoRL, 2023*
An off-the-shelf method immediately enables RL from vision without reward engineering and compositional generalizations in IL for long-horizon manipulation tasks in sim and real, without any extra training, task knowledge, and costs.

When Learning Is Out of Reach, Reset: Generalization in Autonomous Visuomotor Reinforcement Learning
***Z. Zhang** and L. Weihs, in submission, Embodied AI workshop at CVPR, 2023, Out-of-Distribution Generalization in Robotics workshop at CoRL (**lightning talk**), 2023*
General and effective unsupervised irreversible transition measurements and a single-policy random-goal training framework, allowing agents to learn with much fewer resets and better generalize in positional, cosmetic, and structural variations in both (mobile, continuous) manipulation and navigation domains.

VIMA: General Robot Manipulation with Multimodal Prompts
Y. Jiang, A. Gupta, **Z. Zhang***, G. Wang*, Y. Dou, Y. Chen, L. Fei-Fei, A. Anandkumar, Y. Zhu†, and L. Fan†, ICML 2023, Foundation Models for Decision Making (**oral**) @ NeurIPS, 2022*
A transformer that ingests multimodal prompts and controls a robot arm for a wide range of manipulation tasks.

Automated Scoring System of HER2 in Pathological Images under the Microscope
***Z. Zhang**, L. Wang, and S. Wang, 18th European Congress on Digital Pathology (ECDP), 2022*
Research paper for automatically recognizing and scoring HER-2 status under pathological images with interpretable procedures.

Characterization of Rectifiable Measures Carried by Lipschitz Curves
***Z. Zhang**, Y. Wu, and L. Naples, JMM Contributed Paper Session, AMS-PME Poster Session, 2022*
Accepted for Joint Mathematics Meeting (JMM) 2022, AMS Contributed Paper Session on Functions of Complex Variables, Measure, and Integration Theory (**1** of **6** presenters), and America Mathematical Society-Pi Mu Epsilon (AMS-PME) Poster Session.

Service

Conference/Workshop Reviewer

ICRA 2024, CVPR 2024, NeurIPS 2023, CoRL 2023

Talks

04/2023 "Autonomous Visuomotor Reinforcement Learning" at Ranjay Krishna group.

Teaching Assistant at Macalester College

Fall 2022	COMP 484: Intro to Artificial Intelligence
Spring 2022	MATH 378: Complex Analysis
Fall 2021	STAT/COMP 112: Intro to Data Science
Spring 2021	COMP 394 Topics Course: Reinforcement Learning design and write code implementations for homework and class materials
Fall 2020	COMP 128: Data Structure
Spring 2020	STAT/COMP 112: Intro to Data Science

References

Alphabetical order

Abhishek Gupta, *Assistant Professor, University of Washington, abhgupta@cs.washington.edu*
Jiasen Lu, *Research Scientist, Allen Institute for AI, jiasenl@allenai.org*
Linxi "Jim" Fan, *Senior Research Scientist, NVIDIA, linxif@nvidia.com*
Luca Weihs, *Research Manager, Allen Institute for AI, lucaw@allenai.org*
Shuhao Wang, *CTO, co-CEO, Thorough Future, eric.wang@thorough.ai*
Yuke Zhu, *Assistant Professor, UT Austin, yukez@cs.utexas.edu*
Susan Fox, *DeWitt Wallace Professor and Department Chair, Macalester College, fox@macalester.edu*