Haocheng Yin

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Research Overview

My research goal is to develop intelligent embodied agents that are **generalizable** on multiple tasks and **adaptable** across various environment domains in the physical world. To address this goal, my current work seeks to cover:

- Understanding the vision latent representations fine-tuned for robot control.
- Constructing the diffusion-based control module that generalizable from simulation to real world.
- Realizing composable generative models to form a world model.

Research Areas: Machine Learning, Robotics

Education

ETH Zürich — **Zürich, Switzerland**
M.S. in Computer Science — *September 2021 - Present*
Major in Machine Intelligence — GPA: 5.35/6.00

University of Illinois Urbana-Champaign (UIUC) — **Urbana-Champaign, IL**
B.S. in Electrical Engineering — *September 2017 - May 2021*
ZJU-UIUC Dual Bachelor's Degree Program — GPA: 3.94/4.00

Zhejiang University — **Hangzhou, China**
B.Eng. in Electrical Engineering & Automation — *September 2017 - June 2021*
ZJU-UIUC Dual Bachelor's Degree Program — GPA: 3.96/4.00

Research Experience

Computational Robotics Lab, supervised by Prof. Heng Yang — **Harvard University**
Master Thesis: *Understand and Improve Diffusion Policy for Robot Control* — *February 2024 - Present*
ICLR 2025 Submission (under review): *Control-oriented Clustering of Visual Latent Representation*

Soft Robotics Lab, supervised by Prof. Robert Katzschmann — **ETH Zürich**
Research Project: *Learning Behavior Priors for Dexterous Manipulation* — *December 2023*

Optimization & Decision Intelligence Lab, supervised by Prof. Niao He — **ETH Zürich**
Research Project: *Bioplausible Meta Reinforcement Learning* — *September 2022*
Research Project: *Inverse Reinforcement Learning from Suboptimal Demonstrations*

AI for Healthcare Lab, supervised by Prof. Zuozhu Liu — **Zhejiang University**
Undergraduate Thesis: *Unsupervised Representation Learning on 3D Medical Images* — *June 2021*

Research Projects

Control-oriented Clustering of Visual Latent Representation — **Harvard University**
ICLR 2025 submission (under review) supervised by Prof. Heng Yang — *September 2024*

- Discovered a control-oriented law of clustering similar to neural collapse in the visual representation space of an end-to-end image-based control pipeline trained from behavior cloning.
- Leveraged and validated such a law of clustering as an algorithmic tool to improve test-time performance when training a policy with a limited amount of expert demonstrations in both simulated and real-world planar pushing task.

Learning Behavior Priors for Human-Like Dexterous Manipulation **ETH Zürich**
Semester project supervised by Prof. Robert Katzschmann *December 2023*

- Proposed a new framework for `RT-1` model that pretrains with out-of-distribution large offline human hand video dataset (`ego4d`) and fine-tunes with limited in-domain robotic hand video dataset.
- Constructed a low-dimensional dexterous dataset metric from raw human hand videos including estimated camera intrinsics (by `COLMAP`), human hand pose parameters (by `FrankMocap`) and camera movements (by `ORBSLAM3`).

Inverse Reinforcement Learning from Suboptimal Demonstrations **ETH Zürich**
Semester project supervised by Prof. Niao He *September 2022*

- Investigated and compared three inverse reinforcement learning algorithms: f`-IRL`, `LOGEL` and `T-REX` on suboptimal demonstrations in multiple MuJuCo simulated environments.
- Proposed an ablation study to test the robustness of `T-REX` model trained under SAC suboptimal policy.

Bioplausible Meta Reinforcement Learning **ETH Zürich**
Semester project in course *Foundations of Reinforcement Learning* *January 2022*

- Transferred a neuro-modulated framework from classification task to reinforcement learning.
- Migrated the neuro-modulated network as a gated function on the meta-learning policy network and update network parameters in bi-level optimization structure.

Publications

(∗ indicates equal contribution)

[1] Han Qi*, **Haocheng Yin***, and Heng Yang. "Control-oriented Clustering of Visual Latent Representation". In: *arXiv preprint* (2024). arXiv: 2410.05063 [cs.LG].

Teaching Experience

ECE 365: Data Science and Engineering **University of Illinois Urbana-Champaign**
Teaching Assistant *Spring 2021*

ECE 385: Digital Systems Laboratory **Zhejiang University**
Teaching Assistant *Fall 2020*

Awards & Honors

Swiss-European Mobility Programme (SEMP) Scholarship **ETH Zürich**
Covered by Swiss State Secretariat for Education, Research and Innovation (SERI) *February 2024*

High Honors at Graduation **University of Illinois Urbana-Champaign**
Receive at least 3.80 GPA at graduation *May 2021*

Dean's List in ECE Department **University of Illinois Urbana-Champaign**
Top 3 GPA of the college class for 4 years *May 2021*

Undergraduate Technology Innovation Award **Government of Zhejiang Province**
Top 7% student research projects of all universities in Zhejiang, China *August 2020*

Provincial Government Scholarship **Government of Zhejiang Province**
Top 3% undergraduate students of all universities in Zhejiang, China *December 2018*

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