Haocheng Yin

Harvard School of Engineering and Applied Sciences
Science and Engineering Complex (SEC) 3.407-01
Allston, MA 02134

Email: hcyin@seas.harvard.edu
Website: haochengyin.github.io

Research Overview

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

- Analyzing visual representations for robust robot control.
- Designing the generalizable control module for sim-to-real transfer.
- Realizing compositional generative models for effective world modeling.

Research Areas: Machine Learning, Robotics

Education

ETH Zürich — **Zürich, Switzerland**
M.S. in Computer Science — *September 2021 - October 2024*
Major in Machine Intelligence — GPA: 5.27/6.00

University of Illinois Urbana-Champaign (UIUC) — **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

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].

Research Experience

Computational Robotics Lab, supervised by Prof. Heng Yang — **Harvard University**
Master Thesis: *Understand and Improve Diffusion Policy for Robot Control* — *March 2025 (expected)*
ICLR 2025 Submission (under review): *Control-Oriented Clustering of Visual Latent Representation*
RSS 2025 Manuscript: *Tree Search Planning-Aware Diffusion Policy*

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*

Research Projects

Tree Search Planning-Aware Diffusion Policy — **Harvard University**
RSS 2025 manuscript supervised by Prof. Heng Yang & Prof. Yilun Du — *January 2025 (expected)*

- Proposed a novel tree search method that achieves a 20% performance improvement by diffusing both future states and action sequences, then selecting the rollout path that maximizes the reward.
- Developed an action-conditional diffusion network to learn environment dynamics and fine-tuned the action policy under planning loss in an extra self-play training phase.

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

- Unveiled a control-oriented clustering phenomenon similar to *Neural Collapse* in the visual latent representation space under normal vision-based imitation training for various robotic tasks.
- Pre-trained the vision encoder under these control-oriented clustering metrics could improve test-time performance by 10% to 35% in the low-data regime.

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

- Proposed to pre-train the model *robotics transformer* `RT-1` on large-scale human dexterous demonstrations (`ego4d`) and fine-tune with limited in-domain robotic dexterous demonstrations.
- Designed a memory-efficient dexterous dataset metric from raw human dexterous videos including estimated camera intrinsics (by `COLMAP`), camera trajectories (by `ORBSLAM3`) and low-dimensional hand pose parameters (by `FrankMocap`).

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

- Investigated and compared state-of-the-art inverse reinforcement learning algorithms on suboptimal demonstrations in `MuJoCo` environments.
- Revealed the strong robustness of model *Trajectory-ranked Reward EXtrapolation* (`T-REX`) trained under `SAC` suboptimal policy ablated from `PPO` expert policy.

Bioplausible Meta Reinforcement Learning **ETH Zürich**
Semester project supervised by Prof. Niao He *January 2022*

- Transferred a neuro-modulated framework from image classification to reinforcement learning.
- Migrated the neuro-modulated network as a gated function to the *model-agnostic meta-learning* (`MAML`) policy network to selectively update network parameters in bi-level optimization.

Teaching Experience

ECE 365: Data Science and Engineering **University of Illinois Urbana-Champaign**
Teaching Assistant (remote) *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*