Yuyao Liu

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Education

Yao Class, Institute for Interdisciplinary Information Science (IIIS), Tsinghua University   Beijing, China
Bachelor of Engineering in Computer Science and Technology (AI Track)   *Sep 2021 – Present*
- **GPA:** *3.96/4.00*, **Rank:** *4/89* (last updated: Sep 2024).

Publications

*(*Equal Contribution; †Equal Contribution, order decided by coin-flip.)*

[5] **(Manuscript)** Kaizhe Hu*, Zihang Rui*, Yao He, **Yuyao Liu**, Pu Hua, Huazhe Xu. Stem-OB: Generalizable Visual Imitation Learning with Stem-Like Convergent Observation through Diffusion Inversion. [link]

[4] **(Manuscript) Yuyao Liu***, Jiayuan Mao*, Joshua B. Tenenbaum, Tomás Lozano-Pérez, Leslie Pack Kaelbling. One-Shot Manipulation Strategy Learning by Making Contact Analogies. [link]

[3] **(ICML 2024)** Chenhao Lu, Ruizhe Shi*, **Yuyao Liu***, Kaizhe Hu, Simon S. Du, Huazhe Xu. Rethinking Transformers in Solving POMDPs. [link]

[2] **(ICLR 2024)** Ruizhe Shi†, **Yuyao Liu**†, Yanjie Ze, Simon Shaolei Du, Huazhe Xu. Unleashing the Power of Pre-trained Language Models for Offline Reinforcement Learning. [link]

[1] **(NeurIPS 2023)** Yanjie Ze, **Yuyao Liu**†, Ruizhe Shi†, Jiaxin Qin, Zhecheng Yuan, Jiashun Wang, Huazhe Xu. H-InDex: Visual Reinforcement Learning with Hand-Informed Representations for Dexterous Manipulation. [link]

Research Experiences

Generalization in Visual Imitation Learning   **TEA Lab, IIIS, Tsinghua University**
Advised by Prof. Huazhe Xu   *July 2024 – Oct 2024*
- Developed a novel approach to improve the generalizability of visual imitation learning methods under challenging visual perturbations (e.g., lighting and texture changes) using Diffusion Inversion. **Work submitted to ICLR 2025**.
- Our method leverages pretrained image diffusion model inversion to suppress low-level visual differences while preserving high-level scene structures, achieving robust imitation learning without additional training or data augmentation. Notably, this approach shows substantial improvements in real-world robotic tasks.

Integrated Planning and Learning of Manipulation Strategies   **CSAIL, MIT**
Advised by Prof. Leslie Kaelbling, Prof. Joshua Tenenbaum, and Prof. Tomás Lozano-Pérez   *Feb 2024 – Sep 2024*
- Designed a one-shot manipulation strategy learning pipeline that combines visual foundation models with geometrical analysis. **First-authored work submitted to ICRA 2025**.
- This approach achieves global contact point correspondence through pretrained visual features and local functional alignment using curvature analysis, enabling robust generalization of manipulation strategies to novel objects. It enhances sample efficiency, robustness, and stability across a range of tabletop manipulation tasks.

Investigation of Sequential Models for Reinforcement Learning   **TEA Lab, IIIS, Tsinghua University**
Advised by Prof. Huazhe Xu and Prof. Simon S. Du   *Nov 2023 – Jan 2024*
- Demonstrated theoretically and empirically that Transformers are not the most suitable for Partially Observable RL, while advocating Linear RNN as a promising alternative. **Second-authored work accepted by ICML 2024**.
- We establish that regular languages, which Transformers struggle to model due to their lack of inherent recurrence, are reducible to POMDPs. This casts doubt on the prevalent belief in Transformers as sequence models for RL. Empirical results highlight the sub-optimal performance of Transformers and the considerable strength of Linear RNN.

Offline Reinforcement Learning with Language Models   **TEA Lab, IIIS, Tsinghua University**
Advised by Prof. Huazhe Xu and Prof. Simon S. Du   *Feb 2023 – Sep 2023*
- Leveraged pre-trained Language Models for low-level motion control in offline reinforcement learning. **First-authored work accepted at ICLR 2024**.
- Demonstrated substantial performance gains over Transformer-based and value-based offline RL algorithms, particularly in low-data regimes, underscoring the advantages of cross-domain transfer in sequential modeling for reinforcement learning.

Visual Reinforcement Learning for Dexterous Hands   **TEA Lab, IIIS, Tsinghua University**
Advised by Prof. Huazhe Xu   *Feb 2023 – May 2023*
- Established a dexterous manipulation pipeline utilizing pre-trained hand-informed visual representations with reinforcement learning. **Second-authored work accepted by NeurIPS 2023**.
- Our study has offered valuable insights into the application of pre-trained models for dexterous manipulation, by exploring the direct application of a 3D human hand pose estimation model.

Selected Awards and Scholarships

National Scholarship | **Ministry of Education of China**
Top scholarship; 0.2% domestically | *Oct 2024*

Yao Award (Gold Medal) | **IIIS, Tsinghua University**
Top scholarship; 1 students institute-wide | *Sep 2024*

SenseTime AI Scholarship | **SenseTime**
25 students all over China for excellence in AI research | *June 2024*

Outstanding Comprehensive Scholarship | **Tsinghua University**
Top 20% university-wide | *Sep 2023*

Second Prize of China Undergraduate Mathematical Contest in Modeling | **Competition Committee**
Beijing region | *Nov 2022*

Outstanding Comprehensive Scholarship | **Tsinghua University**
Top 20% university-wide | *Sep 2022*

Skills

Language: Mandarin (native speaker), Fluent in English [TOEFL 110 (Speaking 25), Test Date 2024/09].

Programming: Proficient in Python (with Numpy and PyTorch); wrote in C++, Java, Scala, and TypeScript.

Robotics: Hands-on experience with Franka Emika Panda arm in both simulation environments (PyBullet, SAPIEN) and real-world systems.

Physics: Distinguished performance (First Prize, Hunan) in the Chinese Physics Olympiad during high school.

Extracurricular Activities

Member of Hockey Team | **Tsinghua University**
We won the first prize in Bejing Collegiate Hockey League, 2024. | *Oct 2023 – Present*

Academic Representative | **Yao Class, IIIS, Tsinghua University**
Hosting tutoring sessions before exams. | *Sep 2021 – Sep 2024*

Manager and Team leader of Table Tennis Club | **IIIS, Tsinghua University**
Organizing weekly events and leading our institute's team in competitions. | *Sep 2022 – Sep 2023*

Social Practice | **Anhua County & Sanya City, China**
Conducting fieldwork in social science and tutoring primary school students. | *Winter 2022 & Summer 2022*