

RUIZHE SHI

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Education

University of Washington, Seattle, USA

Feb. 2024 – Present

Research Visitor at Paul G. Allen School of Computer Science

Tsinghua University, Beijing, China

Sept. 2021 – Present

Undergraduate at Special Pilot Class in Computer Science (Yao class)

Overall GPA: 3.93/4.00

- Major: *Computer Science and Technology*
- Minor: *Chinese Language and Literature*

Publications

(* indicates equal contribution.)

[3] Chenhao Lu, Ruizhe Shi*, Yuyao Liu*, Kaizhe Hu, Simon S. Du, Huazhe Xu.

Rethinking Transformers in Solving POMDPs.

International Conference on Machine Learning, 2024.

[2] Ruizhe Shi*, Yuyao Liu*, Yanjie Ze, Simon S. Du, Huazhe Xu.

Unleashing the Power of Pre-trained Language Models for Offline Reinforcement Learning.

International Conference on Learning Representations, 2024.

[1] 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.

Annual Conference on Neural Information Processing Systems, 2023.

Research Experience

Language Model Steering

Dec. 2023 – May 2024

Supervised by Prof. Simon S. Du

CSE, University of Washington

- In preparation for **NeurIPS 2024**.

Representation Theory of Transformer for Reinforcement Learning

Nov. 2023 – Jan. 2024

Supervised by Prof. Huazhe Xu

IIIS, Tsinghua University

- We challenge the common wisdom and prove theoretically and empirically that Transformers are not 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, are reducible to POMDPs. This poses a significant challenge for Transformers in learning POMDP-specific inductive biases, due to their lack of inherent recurrence found in other models like RNNs, with empirical results highlighting the sub-optimal performance of the Transformer and considerable strength of LRU.

Tuning Language Model for Offline Reinforcement Learning

June 2023 – Sept. 2023

Supervised by Prof. Huazhe Xu

IIIS, Tsinghua University

- We leverage the power of pre-trained Language Models for low-level motion control in offline reinforcement learning. First-authored work accepted by **ICLR 2024**.
- We demonstrate the superiority of LaMo over DT-based and value-based offline RL algorithms. Specifically, we find that LaMo could successfully handle the challenging low-data regime while DT could not. This highlights the great potential of our cross-domain pre-training for sequential modeling.

Visual Representation for Reinforcement Learning

Mar. 2023 – May 2023

Supervised by Prof. Huazhe Xu

IIIS, Tsinghua University

- We propose H-InDex, a hand-informed visual representation for dexterous manipulation with reinforcement learning. Second-authored work accepted by **NeurIPS 2023**.
- We show the effectiveness of our framework on 12 challenging visual dexterous manipulation tasks, comparing with recent strong foundation models such as VC-1. 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

Awards & Honors

Jiang Nanxiang Scholarship

Tsinghua University

Nov. 2023

top scholarship; 1 student per major

China National Endeavor Scholarship

Beijing Education Bureau

Oct. 2022

1 student per major

Xue Tang Scholarship of Tsinghua University

Tsinghua University

Oct. 2021 – Present

First Prize in College Student Mathematics Competition (Beijing)

Chinese Mathematical Society

Oct. 2022

First Prize in National High School's Mathematics Competition of China (Jiangsu)

Chinese Mathematical Society

Oct. 2020

top 20

Service

Workshop Program Committee

FMDM 2023 at NeurIPS

Oct. 2023

Online

Drop-in Tutoring for STEM Courses

Volunteering at Tsinghua University

Oct. 2022 – Present

Beijing, China

I have 157 hours of officially recorded volunteering work.

Selected Courses

Mathematics and Theory: Calculus (**A**⁺), Linear Algebra (**A**), Abstract Algebra (**A**), Introduction to Complex Analysis (**A**), Probability and Statistics (**A**), Basic Topology (**93**), Introduction to Optimization (**A**), Theory of Computation (**A**), Physics of Information (**A**);

Programming and AI: Introduction to Programming in C/C++ (**A**⁺), Intelligent Unmanned System (**A**⁺), Type-safe Modern System Practice (**A**), Machine Learning (**A**), Artificial Intelligence: Principles and Techniques (**A**), Natural Language Processing (**A**).

Technical Skills

Programming Skills: Python, C/C++, L^AT_EX, Bash, Scala, Matlab.

Language Skills: Chinese Mandarin (native), English (CET-6, TOEFL 104 [R30/L26/S23/W25]).