Jingzehua Xu

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Education

Massachusetts Institute of Technology	5/2024 – present
MicroM.S. in Statistic and Data Science	*Massachusetts, USA*
Tsinghua University	9/2023 – present
M.S. in Electronic and Information Engineering	*Beijing, China*
Zhejiang University	9/2019 – 6/2023
B.S. in Marine Science	*Hangzhou, China*
Zhejiang University	9/2019 – 6/2023
B.E. in Electronic Science and Technology (Double Degree)	*Hangzhou, China*

- GPA: 3.91/4.00; Ranking: 1st/20

- Courses: Linear Algebra, Complex Function, Partial Differential Equation, Probability Theory and Statistics, Stochastic Process, Object-Oriented Programming, Data Analysis and Algorithm Design, Fundamentals of Numerical Simulation and Machine Learning, Calculation Method, Signals and Systems, Digital Signal Processing, Digital Image Processing, Automatic Control Theory, Underwater Robot Design.

Research

Reinforcement Learning (RL), Large Language Model (LLM), Multi-Agent Systems, Planning and Control

Publications

[1] **Jingzehua Xu***, Guanwen Xie*, Zekai Zhang, Ziqi Zhang, Xiangwang Hou, Dongfang Ma, Shuai Zhang, Yong Ren and Dusit Niyato, *Is FISHER All You Need in The Multi-AUV Underwater Target Tracking Task?*, IEEE Transactions on Mobile Computing, 2024.

[2] **Jingzehua Xu***, Guanwen Xie*, Xinqi Wang, Yimian Ding and Shuai Zhang, *USV-AUV Collaboration Framework for Underwater Tasks under Extreme Sea Conditions*, IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2025.

[3] **Jingzehua Xu**, Zekai Zhang, Jingjing Wang, Zhu Han and Yong Ren, *Multi-AUV Pursuit-Evasion Game in The Internet of Underwater Things: An Efficient Training Framework via Offline Reinforcement Learning*, IEEE Internet of Things Journal, 2024.

[4] **Jingzehua Xu***, Guanwen Xie*, Zekai Zhang, Xiangwang Hou, Shuai Zhang, Yong Ren and Dusit Niyato, *UPEGSim: An RL-Enabled Simulator for Unmanned Underwater Vehicles Dedicated in the Underwater Pursuit-Evasion Game*, IEEE Internet of Things Journal, 2024.

[5] **Jingzehua Xu***, Yimian Ding*, Zekai Zhang, Guanwen Xie, Ziyuan Wang, Yongming Zeng and Gang Li, *Multi-AUV Assisted Seamless Underwater Target Tracking Relying on Deep Learning and Reinforcement Learning*, IEEE World Congress on Computational Intelligence (WCCI), 2024.

[6] **Jingzehua Xu**, Zekai Zhang, Ziyuan Wang, Jingjing Wang and Yong Ren, *VoI and Energy-Aware AUV-Assisted Data Collection for Internet of Underwater Things*, IEEE Wireless Communications and Networking Conference (WCNC), 2024.

[7] **Jingzehua Xu***, Yongming Zeng*, Jintao Zhang, Xuanchen Li, Lingru Meng, Haocai Huang, Jingjing Wang and Yong Ren, *AUV Efficient Navigation Relying on Adaptive Proximal Policy Optimization*, International Conference on Neural Information Processing (ICONIP), 2024.

[8] Zekai Zhang*, **Jingzehua Xu***, Guanwen Xie, Jingjing Wang, Zhu Han and Yong Ren, *Environment- and Energy-Aware AUV-Assisted Data Collection for IoUT Relying on Reinforcement Learning*, IEEE Internet of Things Journal, 2024.

[9] Zekai Zhang*, **Jingzehua Xu***, Jun Du, Weishi Mi, Ziyuan Wang, Zonglin Li and Yong Ren, *UUVSim: Intelligent Modular Simulation Platform for Unmanned Underwater Vehicle Learning*, IEEE World Congress on Computational Intelligence (WCCI), 2024.

[10] Ziyuan Wang, **Jingzehua Xu**, Yuanzhe Feng, Yijing Wang, Guanwen Xie, Xiangwang Hou, Wei Men and Yong Ren, *Fisher-Information-Matrix-Based USBL Cooperative Location in USV-AUV Networks*, Sensors, 2023.

[11] Yi Xia, Zekai Zhang, **Jingzehua Xu**, Pengfei Ren, Jingjing Wang and Zhu Han, *Eye in the Sky: Energy Efficient Model-Based Reinforcement Learning Aided Target Tracking Using UAVs*, IEEE Transactions on Vehicular Technology, 2024.

[12] Yi Xia, Jun Du, Zekai Zhang, Ziyuan Wang, **Jingzehua Xu** and Weishi Mi, *Standoff Target Tracking for Networked UAVs With Specified Performance Via Deep Reinforcement Learning*, IEEE Journal of Selected Topics in Signal Processing, 2024.

PREPRINTS

[1] **Jingzehua Xu***, Yimian Ding*, Yiyuan Yang, Guanwen Xie and Shuai Zhang, *Enhancing Information Freshness: An AoI Optimized Markov Decision Process Dedicated In the Underwater Task*, arXiv preprint arXiv:2409.02424, 2024.

[2] Guanwen Xie*, **Jingzehua Xu***, Yiyuan Yang, Yimian Ding and Shuai Zhang, *Large Language Models as Efficient Reward Function Searchers for Custom-Environment Multi-Objective Reinforcement Learning*, arXiv preprint arXiv:2409.02428, 2024.

[3] Ziqi Zhang*, **Jingzehua Xu***, Jinxin Liu, Zifeng Zhuang, Donglin Wang, Miao Liu and Shuai Zhang, *Context-Former: Stitching via Latent Conditional Sequence Modeling*, arXiv preprint arXiv:2401.16452, 2024.

[4] Ziqi Zhang*, Zifeng Zhuang*, **Jingzehua Xu***, Donglin Wang, Miao Liu and Shuai Zhang, *ADR-BC: Adversarial Density Weighted Regression Behavior Cloning*, arXiv preprint arXiv:2405.20351, 2024.

EXPERIENCES

Tsinghua University, Department of Electronic Engineering   12/2022 – present

Graduate Researcher   *Advisor: Prof. Yong Ren*

- **Environment-Aware Reinforcement Learning:** Proposed environment-aware reinforcement learning (RL), a new paradigm for RL utilizing large language model (LLM), diffusion model, and the physics-informed neural network (PINN). Specifically, I first used PINN to simulate the environmental information around the agent, then I introduced the information into the state space for RL training and LLM-enabled agent optimization. After several iterations, the policy and optimization of the agent reached expert level. Then we utilized it to generate the offline dataset, which was further used as input for diffusion model. Finally, with PINN's inversion function, the agent achieved superior performance and environment-aware capability.

- **Multi-AUV Collaboration via Reinforcement Learning:** Developed a simulator with reinforcement learning environment to realize efficient multi-AUV training in the extreme ocean conditions. Then I designed an efficient multi-AUV training framework to improve the collaboration between each AUV, taking the factors of ocean turbulence into consideration. The framework consists of two stages: policy improvement and offline training. Utilized imitation learning and offline reinforcement learning algorithms as the optimization method for multiple objectives. Finally superior performance was achieved in the multi-AUV collaboration data collection task, and target tracking task.

New Jersey Institute of Technology, Department of Data Science   01/2024 – present

Research Assistant   *Advisor: Prof. Shuai Zhang*

- **Large Language Model-driven Multi-task Reinforcement Learning:** Utilized the large language model to produce interpretable and free-form dense reward functions while realizing iterative refinement with human feedback. Finally, we applied generated reward functions in the multi-AUV underwater data collection task to realize policy improvement, which can be modeled as a multi-task reinforcement learning problem. Experiment results demonstrated the superior performance and robustness of reward functions generated by large language model.

- **AoI Optimized Markov Decision Process:** Proposed an AoI optimized Markov decision process (AoI-MDP) to improve the performance of underwater tasks. Specifically, AoI-MDP models observation delay as signal delay through statistical signal processing, and includes this delay as a new component in the state

space. Additionally, AoI-MDP introduced wait time in the action space, and integrated AoI with reward functions to achieve joint optimization of information freshness and decision-making for AUVs leveraging reinforcement learning for training.

IBM Research, IBM T. J. Watson Research Center $\hfill$ 03/2024 – 09/2024

Research Assistant $\hfill$ *Advisor: Prof. Miao Liu*

- **Adversarial Density Weighted Regression Behavior Cloning:** Proposed ADR-BC, an enhanced Behavior Cloning (BC) method that improves policy optimization by utilizing density-based action support. ADR-BC aligns closely with expert distributions while avoiding suboptimal ones. Experimental results demonstrate that ADR-BC outperforms the state-of-the-art IL methods in Gym-Mujoco tasks.
- **ContextFormer: Stitching via Expert Calibration:** Developed ContextFormer, which combines contextual imitation learning and sequence modeling to stitch trajectory fragments by emulating expert trajectories. Our evaluation shows that ContextFormer achieves competitive results on D4RL benchmarks and outperforms various Decision Transformer variants, demonstrating its superior performance.

PROFESSIONAL ACTIVITIES

Conference Session Chair $\hfill$ 2024
- IEEE Wireless Communications and Networking Conference (WCNC)
- OCEANS

Conference Reviewer $\hfill$ 2025
- International Conference on Learning Representations (ICLR)
- IEEE / CVF Computer Vision and Pattern Recognition Conference (CVPR)

Conference Reviewer $\hfill$ 2024
- IEEE International Conference on Robotics and Automation (ICRA)
- International Conference on Artificial Neural Network (ICANN)
- International Joint Conference on Neural Networks (IJCNN)

SELECTED HONORS

First-Class Scholarship *(awarded to top graduate students at Tsinghua University)*	2024
Outstanding Graduate *(awarded to top undergraduates at Zhejiang University)*	2023
National Encouragement Scholarship *(3% at Zhejiang University)*	2022
Zhejiang Province Robot Competition *(the second prize)*	2022
Zhejiang University Underwater Robot Design Competition *(the first prize)*	2022
Top Ten College Student *(0.6% in LanTian Community of Zhejiang University)*	2021
Nandu First-Class Scholarship *(0.2% at Zhejiang University)*	2021
Zhejiang Provincial Government Scholarship *(3% at Zhejiang University)*	2021

SKILLS

Languages	Chinese (native), English (IELTS: 7.0, Speaking: 6.5)
Programming	Python (Pytorch), MATLAB/Simulink, ROS, C/C++, Ansys Fluent