

Mengdi Xu

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in mengdixu-bella

Education

Carnegie Mellon University

Ph.D. in SafeAI Lab, Mechanical Engineering

2019–present

MS in Machine Learning, Machine Learning Department

2021–present

Advisor: Ding Zhao

The Johns Hopkins University

Robotics MSE, Laboratory of Computational Sensing and Robotics

2017–2019

Advisor: Gregory Chirikjian

Tsinghua University

BS, Automotive Engineering, School of Vehicle and Mobility

2013–2017

Advisor: Jianqiang Wang, Excellent Graduate Award

BS, Management, School of Economics and Management

2013–2017

Research Interests

I am broadly interested in reinforcement learning, robotics, and cognitive science. My research vision is to enable **Trustworthy Machine Learning** for applications akin to everyday life (e.g., autonomous driving, household robots) by designing learning theories and algorithms for *robustly generalizing to challenging new environments*. I research from two perspectives: (1) proposing methods to enhance both generalization and robustness and (2) laying theoretical foundations for those two aspects.

Theories: Reinforcement Learning, Probabilistic Graphical Model, Game Theory, Lie Group Theory

Applications: Robotics, Human-Robot Interaction, Intelligent Mobility

Employment

MIT-IBM Watson AI Lab

Research intern in Machine Learning, Mentor: Chuang Gan

2022.5–now

Toyota Research Institute

Research intern, Machine Learning Engineering team, Mentor: Chao Fang

2021.6–2021.8

Honors and Awards

ICML Participation Grant

2022

Travel Grant of Workshop on Security and Safety in Machine Learning Systems, ICLR

2021

Best Poster Award of Robotics Track in ME PhD Research Symposium, Carnegie Mellon University

2021

Graduate Student Assembly/Provost Conference Funds

2019

Department Fellowship of Mechanical Engineering, Johns Hopkins University

2017

Excellent Bachelor Thesis, 5%, Tsinghua University

2017

National Motivational Scholarship, 5%, Tsinghua University

2014, 2015, 2016

Qualcomm Scholarship for excellent student researchers, 0.3%, Tsinghua University

2016

Cummins Dr. Lin Scholarship for excellent female students, Tsinghua University

2014, 2015

Publications

Conference Publications

1. [NeurIPS'22] Peide Huang, **Mengdi Xu**, Jiacheng Zhu, Laixi Shi, Fei Fang, Ding Zhao, "Curriculum Reinforce-

ment Learning using Optimal Transport via Gradual Domain Adaptation", Thirty-sixth Conference on Neural Information Processing Systems, (NeurIPS), 2022.

2. [ICML'22] **Mengdi Xu**, Yikang Shen, Shun Zhang, Yuchen Lu, Ding Zhao, Josh Tenenbaum and Chuang Gan, "Prompting Decision Transformer for Few-shot Policy Generalization", Thirty-ninth International Conference on Machine Learning (ICML), 2022.
3. [IROS'22] **Mengdi Xu**, Peide Huang, Fengpei Li, Jiacheng Zhu, Xuewei Qi, Kentaro Oguchi, Zhiyuan Huang, Henry Lam, and Ding Zhao, "Accelerated Policy Evaluation: Learning Adversarial Environments with Adaptive Importance Sampling", IROS. 2022.
4. [IJCAI'22] Peide Huang, **Mengdi Xu**, Fei Fang, Ding Zhao, "Robust Reinforcement Learning as a Stackelberg Game via Adaptively-Regularized Adversarial Training", International Joint Conference on Artificial Intelligence (IJCAI), 2022.
5. [ICRA'21] Baiming Chen, Zuxin Liu, Jiacheng Zhu, **Mengdi Xu**, Wenhao Ding, Liang Li and Ding Zhao, "Context-Aware Safe Reinforcement Learning for Non-Stationary Environments", IEEE International Conference on Robotics and Automation (ICRA), 2021.
6. [NeurIPS'20] **Mengdi Xu**, Wenhao Ding, Jiacheng Zhu, Zuxin Liu, Baiming Chen, and Ding Zhao, "Task-Agnostic Online Reinforcement Learning with an Infinite Mixture of Gaussian Processes", Thirty-fourth Conference on Neural Information Processing Systems (NeurIPS), 2020.
7. [ICRA'20] Wenhao Ding, **Mengdi Xu**, and Ding Zhao, "CMTS: A Conditional Multiple Trajectory Synthesizer for Generating Safety-Critical Driving Scenarios", IEEE International Conference on Robotics and Automation (ICRA), 2020.
8. [CASE'19] **Mengdi Xu**, Shengnan Lyu, Yingtian Xu, Can Kocabalkanli, Brian K. Chirikjian et al. "Mosquito staging apparatus for producing PfSPZ malaria vaccines", IEEE 15th International Conference on Automation Science and Engineering (CASE), 2019.
9. [CASE'19] Hongtao Wu, Jiteng Mu, Ting Da, **Mengdi Xu**, Russell H. Taylor, Iulian Iordachita, and Gregory S. Chirikjian, "Multi-mosquito object detection and 2D pose estimation for automation of PfSPZ malaria vaccine production", IEEE 15th International Conference on Automation Science and Engineering (CASE), 2019.
10. [IDETC'18] **Mengdi Xu**, and Gregory S. Chirikjian, "Recovering a Rotation Matrix From Three Direction Cosines", ASME 2018 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, 2018.
11. [LivingMachine'22] Wenhuan Sun, **Mengdi Xu**, Jeffrey P. Gill, Peter J. Thomas, Hillel J. Chiel and Victoria A. Webster-Wood, "GymSlug: Deep Reinforcement Learning toward Bio-inspired Control based on *Aplysia californica* Feeding", Living Machines, 2022.

Journal Publications

12. [Neurocomputing'21] Baiming Chen, **Mengdi Xu**, Liang Li, and Ding Zhao, "Delay-Aware Model-Based Reinforcement Learning for Continuous Control", Elsevier Neurocomputing, 2021.
13. [J. Insect Physiol.'18] Jieliang Zhao*, **Mengdi Xu***, Youjian Liang, Shaoze Yan, and Wendong Niu, "Influence of hydrodynamic pressure and vein strength on the super-elasticity of honeybee wings", Journal of Insect Physiology, 2018. (*equal contribution)

Workshop Papers and Preprints

14. **Mengdi Xu***, Zuxin Liu*, Peide Huang*, Wenhao Ding, Zhepeng Cen, Bo Li and Ding Zhao. "Trustworthy Reinforcement Learning Against Intrinsic Vulnerabilities: Robustness, Safety, and Generalizability". In submission to ACM Computing Surveys: Special Issue on Trustworthy AI.
15. Shiqi Liu*, **Mengdi Xu***, Peide Huang, Yongkang Liu, Kentaro Oguchi and Ding Zhao. "Continual Reinforcement Learning with Group Symmetries". In submission to ICRA 2023.
16. **Mengdi Xu**, Yuchen Lu, Yikang Shen, Shun Zhang, Ding Zhao, and Chuang Gan. "Hyper-Decision Transformer for Efficient Online Policy Adaptation". In submission.

17. **Mengdi Xu**, Peide Huang, Yaru Niu, Visak Kumar, Jieliu Qiu, Chao Fang, Kuan-Hui Lee, Xuewei Qi, Henry Lam, Bo Li and Ding Zhao, "Group Distributionally Robust Reinforcement Learning with Hierarchical Latent Variables", ICML 2022 workshop on Principles of Distribution Shift. In submission.
18. Jiacheng Zhu, Aritra Guha, **Mengdi Xu**, Yingchen Ma, Rayleigh Lei, Vincenzo Loffredo, XuanLong Nguyen, and Ding Zhao, "Functional Optimal Transport: Mapping Estimation and Domain Adaptation for Functional data", AAAI OT-SDM 2022 workshop (**spotlight**). In submission to JMLR.
19. Baiming Chen, **Mengdi Xu**, Zuxin Liu, Liang Li, and Ding Zhao, "Delay-Aware Multi-Agent Reinforcement Learning".
20. Jieliu Qiu, Jiacheng Zhu, **Mengdi Xu**, Frank Dernoncourt, Trung Bui, Zhaowen Wang, Bo Li, Ding Zhao and Hailin Jin, "MHMS: Multimodal Hierarchical Multimedia Summarization". In submission.
21. William Han*, Jieliu Qiu*, Jiacheng Zhu, **Mengdi Xu**, Douglas Weber, Bo Li and Ding Zhao, "An empirical exploration of cross-domain alignment between language and electroencephalogram". In submission.

Patents

22. Russell H Taylor, Gregory Chirikjian, Iulian Iordachita, Henry Phalen, Hongtao Wu, **Mengdi Xu**, Shengnan Lyu, Michael Aaron Pozin, Jin Seob Kim, Can Kocabalkanli, Balazs Vagvolgyi, Brian K Chirikjian, Joshua Davis, DA Ting, John S Chirikjian, Sumana Chakravarty and Stephen Hoffman, "Apparatus and Method of Use for an Automated Mosquito Salivary Gland Extraction Device", US Patent App. 16/995,164

Teaching

Teaching Assistant:

- o EN.530.646 Modern Control at Carnegie Mellon University, Fall 2021.
- o EN.530.646 Robot Devices, Kinematics, Dynamics, and Control at The Johns Hopkins University, Spring 2019.
- o EN.530.645 Kinematics at The Johns Hopkins University, Fall 2018.

Guest Lecturer for EN.530.645 Kinematics on "Recovering a Rotation Matrix From Three Direction Cosines" at The Johns Hopkins University, Fall 2018.

Academic Service

Mentor: 2020 CMU Robotics Institute Summer Scholars Program (RISS)

Conference Reviewer: Conference on Artificial Intelligence and Statistics (AISTATS), Conference on Neural Information Processing Systems (NeurIPS), International Conference on Machine Learning (ICML), Association for the Advancement of Artificial Intelligence (AAAI)

Assistant to Associate Chief Editor, the Journal of Robotica, 2018.09-2019.05