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   *2021–2022*
Advisor: Ding Zhao, GPA: 4.0/4.0

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: Trustworthy ML, Robotics, Human-Robot Interaction, Intelligent Mobility

Work Experience

MIT-IBM Watson AI Lab
Research intern in Machine Learning, Mentor: Chuang Gan   *2022.5–2022.12*

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. [ICLR'23] **Mengdi Xu**, Yuchen Lu, Yikang Shen, Shun Zhang, Ding Zhao, and Chuang Gan. "Hyper-Decision Transformer for Efficient Online Policy Adaptation". Eleventh International Conference on Learning Representations (ICLR), 2023.

2. [AISTATS'23] **Mengdi Xu**, Peide Huang, Yaru Niu, Visak Kumar, Jielin Qiu, Chao Fang, Kuan-Hui Lee, Xuewei Qi, Henry Lam, Bo Li and Ding Zhao, "Group Distributionally Robust Reinforcement Learning with Hierarchical Latent Variables", The 26th International Conference on Artificial Intelligence and Statistics (AISTATS), 2023.

3. [EACL'23] William Han*, Jielin Qiu*, Jiacheng Zhu, **Mengdi Xu**, Michael Rosenberg, Emerson Liu, Douglas Weber, and Ding Zhao, "Transfer Knowledge from Natural Language to Electrocardiography: Can We Detect Cardiovascular Disease Through Language Models?", The 17th Conference of the European Chapter of the Association for Computational Linguistics (EACL), 2023

4. [NeurIPS'22] Peide Huang, **Mengdi Xu**, Jiacheng Zhu, Laixi Shi, Fei Fang, Ding Zhao, "Curriculum Reinforcement Learning using Optimal Transport via Gradual Domain Adaptation", Thirty-sixth Conference on Neural Information Processing Systems, (NeurIPS), 2022.

5. [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.

6. [IROS'22] **Mengdi Xu**, Peide Huang, Fengpei Li, Jiacheng Zhu, Xuewei Qi, Kentaro Oguchi, Zhiyuan Huang, Henry Lam, and Ding Zhao, "Scalable Safety-Critical Policy Evaluation with Accelerated Rare Event Sampling", IROS. 2022.

7. [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.

8. [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.

9. [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.

10. [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.

11. [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.

12. [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.

13. [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.

14. [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

15. [Neurocomputing'21] Baiming Chen, **Mengdi Xu**, Liang Li, and Ding Zhao, "Delay-Aware Model-Based Reinforcement Learning for Continuous Control", Elsevier Neurocomputing, 2021.

16. [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

17. **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.

18. Shiqi Liu*, **Mengdi Xu***, Peide Huang, Yongkang Liu, Kentaro Oguchi and Ding Zhao. "Continual Reinforcement Learning with Group Symmetries". In submission.

19. 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.

20. Baiming Chen, **Mengdi Xu**, Zuxin Liu, Liang Li, and Ding Zhao, "Delay-Aware Multi-Agent Reinforcement Learning".

21. Jielin 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.

    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", United States Patent 11,503,819, Filed Aug. 17, 2020, Issued Nov. 22, 2022.

Academic Service and Volunteering

Conference Reviewer: IEEE/CVF Computer Vision and Pattern Recognition Conference (CVPR), International Conference on Learning Representations (ICLR), 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)
Journal Reviewer: Transactions on Intelligent Transportation Systems (T-ITS)
Program Committee: Workshop on Trustworthy and Socially Responsible Machine Learning (TSRML), NeurIPS 2022
Mentor: 2020 CMU Robotics Institute Summer Scholars Program (RISS)
Organization: Breakout session leader at 3rd Women in Machine Learning Un-Workshop, ICML 2022
Assistant to Associate Chief Editor, the Journal of Robotica, 2018.09-2019.05

Teaching

Teaching Assistant:
- 24-784 Trustworthy Intelligent Autonomy at Carnegie Mellon University, Spring 2023.
- 24-677 Linear Control Systems at Carnegie Mellon University, Fall 2021.
- EN.530.646 Robot Devices, Kinematics, Dynamics, and Control at The Johns Hopkins University, Spring 2019.
- 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.