YIQING XU

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My research focuses on *translating* human objectives into signals for robotic optimization. I develop *compositional and hierachical structures as intermediate representations* and design *reward learning algorithms* to better align robotic agents with human goals, especially when expert data is scarce or under-specified.

Keywords: Imitation Learning, Goal Specification for Robotics, IRL, Neuro-Symbolic Representation.

RESEARCH HIGHLIGHT

In my latest works, "**SetItUp**" (IJRR) and "**StackItUp**" (CoRL), I explore how robots can act on human goals conveyed through ambiguous but intuitive inputs — like language commands or freehand sketches. Both works share a neuro-symbolic architecture that maps these inputs into **abstract relation graphs**, then grounds them into feasible physical configurations via **compositional diffusion models**. This approach preserves task structure, supports generalization, and learns from surprisingly few demonstrations by reusing local relational priors.

I'm excited to extend this framework in two directions. First, toward **flexible skill chaining** from mixed-modality input — combining coarse, abstract instructions with precise but partial demonstrations to infer symbolic task skeletons and modular reward functions that can be composed and optimized jointly. Second, toward **interactive multi-modal goal specification**, where robots engage with users via language, gaze, and motion to resolve ambiguity through active dialogue and inference. Across both directions, the goal remains the same: to make goal specification more expressive, adaptable, and aligned with how humans actually communicate intent.

EDUCATION

National University of Singapore — Aug, 2020 - Dec, 2025 (Expected)
Ph.D in Computer Science, advised by *Prof. David Hsu* — GPA: 5.00

National University of Singapore — Aug, 2016 - Jun, 2020
B.A. in Computer Science — GPA: 4.81
B.A. in Applied Mathematics — GPA: 4.89

RESEARCH EXPERIENCE

Visiting Ph.D Student — Sep, 2023 - Feb, 2024
CSAIL MIT, Prof. Leslie Kaelbling and Prof. Tomás Lozano-Pérez

Developed *"Set It Up!"*, a neuro-symbolic system that interprets and optimizes under-specified instructions for table-top arrangements using very few demonstrations. Published at RSS 2024.

SELECTED PUBLICATIONS / PREPRINTS

1. "Set It Up": Functional Object Arrangement with Compositional Generative Models [Link]
   Yiqing Xu, Jiayuan Mao, Linfeng Li, Yilun Du, Tomás Lozano-Pére, Leslie Kaelbling, David Hsu
   International Journal of Robotics Research (IJRR), 2025.
2. "Stack It Up": 3D Stable Structure Generation from 2D Hand-drawn Sketch [Link]
   Yiqing Xu, Linfeng Li, Cunjun Yu, David Hsu
   Conference on Robot Learning (CoRL), 2025.
3. On the Effective Horizon for Inverse Reinforcement Learning [Link]
   Yiqing Xu, Finale Doshi-Velez, David Hsu
   International Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2025.
4. "Set It Up!": Functional Object Arrangement with Compositional Generative Models [Link]
   Yiqing Xu, Jiayuan Mao, Yilun Du, Tomás Lozano-Pére, Leslie Kaelbling, David Hsu
   Robotics: Science and Systems (RSS), 2024
5. Differentiable Particles for General-Purpose Deformable Object Manipulation [Link]
   Siwei Chen, Yiqing Xu, Cunjun Yu, Linfeng Li, David Hsu
   In submission.

6. Grounding Common-sense Objective for Tabletop Object Rearrangement [Link]
   Yiqing Xu, David Hsu
   Robotics: Science and Systems (RSS), 2023, Lang2Rob Workshop

7. Learning Reward for Physical Skills using Large Language Models [Link]
   Yuwei Zeng, Yiqing Xu
   Conference on Robot Learning (CoRL), 2023, the 2nd Lang2Rob Workshop

8. Benchmarking Deformable Object Manipulation with Differentiable Physics [Link]
   Siwei Chen, Yiqing Xu*, Cunjun Yu*, Linfeng Li, David Hsu*
   International Conference on Learning Representations (ICLR): **Notable Top 5%**, 2023

9. Receding Horizon Inverse Reinforcement Learning [Link]
   Yiqing Xu, Wei Gao, David Hsu
   Advances in Neural Information Processing Systems (NeurIPS), 2022

10. Coach: Cooperative robot teaching [Link]
    Cunjun Yu, Yiqing Xu, Linfeng Li, David Hsu
    Conference on Robot Learning (CoRL), 2022

PROFESSIONAL SERVICE

Workshop Organizer

- Task Specification Workshop at RSS 2024 [Website] July 2024
- Second LEAP Workshop at CoRL 2024 [Website] November 2024

Reviewer: ICRA, RSS, AAMAS, AAAI, NeurIPS, ICLR, ICML

SKILLS

Programming Language: Python, Java, C.

Software: PyTorch, Tensorflow, Jax, Mujoco, IssacSim, Pybullet.