Kai Lu

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EDUCATION

University of Oxford — Oxford, UK
Ph.D. Candidate in Computer Science, Supervisor: Prof. Andrew Markham — *Oct. 2020 - Jan. 2025*

- **Machine Learning**: Deep Learning, Reinforcement Learning
- **Robotics**: Robotic Manipulation, Robot Control, Human-Robot Interaction
- **Multi-Modality**: Robotic 3D Vision, VLM/LLM for Embodied Agents

Tsinghua University — Beijing, China
B.E. in Automation with Outstanding Graduate Honor — *Aug. 2016 - Jul. 2020*

- Admission: Selected to Tsinghua Leading Talent Program (Top 1% of all students)
- Projects: RL for Active Perception (R.A. in Computer Science); QP-WBC for Humanoid Robot (Thesis)

University of Illinois Urbana-Champaign & Duke University — Champaign & Durham, USA
Visiting Student at IML Lab in Computer Science, Supervisor: Prof. Kris Hauser — *Jul. 2019 - Sep. 2019*

- Project: Learning-Based Deformable Object Manipulation and Modeling

PUBLICATIONS

Learning Generalizable Manipulation Policy with Adapter-Based Parameter Fine-Tuning — IROS 2024
***Kai Lu**, Kim Tien Ly, William Hebberd, Kaichen Zhou, Ioannis Havoutis, Andrew Markham*

InteLiPlan: Interactive Lightweight LLM-Based Planner for Domestic Robot Autonomy — Tech. Report 2024
*Kim Tien Ly, **Kai Lu**, Ioannis Havoutis*

SpatialPIN: Enhancing Spatial Reasoning Capabilities of Vision-Language Models through Prompting and Interacting 3D Priors — NeurIPS 2024
*Chenyang Ma, **Kai Lu**, Ta-Ying Cheng, Niki Trigoni, Andrew Markham*

Learning to Catch Reactive Objects with a Behavior Predictor — ICRA 2024
***Kai Lu**, Jia-Xing Zhong, Bo Yang, Bing Wang, Andrew Markham*

Decoupling Skill Learning from Robotic Control for Generalizable Object Manipulation — ICRA 2023
***Kai Lu**, Bo Yang, Bing Wang, Andrew Markham*

Dynpoint: Dynamic Neural Point for View Synthesis — NeurIPS 2023
*Kaichen Zhou, Jia-Xing Zhong, Sangyun Shin, **Kai Lu**, Yiyuan Yang, Andrew Markham, Niki Trigoni*

Multi-body SE (3) Equivariance for Unsupervised Rigid Segmentation and Motion Estimation — NeurIPS 2023
*Jia-Xing Zhong, Ta-Ying Cheng, Yuhang He, **Kai Lu**, Kaichen Zhou, Andrew Markham, Niki Trigoni*

Weakly Supervised Descriptor Learning for Pixel-Level Feature Matching — Term Report 2021
***Kai Lu**, Andrew Markham*

Semi-Empirical Simulation of Learned Force Response Models for Heterogeneous Elastic Objects — ICRA 2020
*Yifan Zhu, **Kai Lu**, Kris Hauser*

Deep Reinforcement Learning for Robotic Pushing and Picking in Cluttered Environment *(*: Co-first Author, Equal Contribution)* — IROS 2019
Yuhong Deng, Xiaofeng Guo*, Yixuan Wei*, **Kai Lu***, Bin Fang, Di Guo, Huaping Liu, Fuchun Sun*

A Composite Robotic Manipulator Based on Gripper and Suction Cup — Patent 2019
*Bin Fang, Huaping Liu, Yuhong Deng, Xiaofeng Guo, **Kai Lu**, Yixuan Wei*

PROFESSIONAL SERVICES

Associate Editor: International Journal of Advanced Robotic Systems (IJARS)

Reviewer: ICRA 2024/2025, ICLR 2024/2025, NeurIPS 2023 **Marker**: Oxford Mathematics Admissions Test (MAT)

RESEARCH EXPERIENCES

Research Intern at Mitsubishi Electric Research Labs (MERL), Boston, USA *Oct. 2024 - Jan. 2025*

- Started a project on multi-modal scene understanding for human-robot interaction (HRI) using LLM/VLM.
- Developed machine learning algorithms and systems for robot action generation for HRI from sensing.

Collaboration with Meta Research (FAIR), San Francisco, USA (Remote) *Jun. 2024 - Nov. 2024*

- Proposed a human-robot interaction framework based on multi-agent communication for value alignment and open-ended robotic task proposal and execution using LLM/VLM, working with the Meta Habitat team.
- Developed a multimodal perception method for human intention detection and a feedback optimization method.

Collaboration with Oxford Robotics Institute (ORI), Oxford, UK *Jan. 2024 - Jun. 2024*

- Proposed an adapter-based reinforcement learning (RL) method for generalizing learned skills from a disembodied hand to various whole-body robots, such as A2Single, Aliengo-Z1, and Toyota HSR.
- Integrated adapter techniques that are LoRA and Residual Adapter into robotic RL and introduced a feedback reward from robotic control, showing the effectiveness of cross-embodiment generalization.
- Published a paper at IROS 2024 (oral presentation, my role: first author), submitted a paper to ICRA 2025 (my role: second author).

Visiting Scholar at vLAR lab, Hong Kong Polytechnic University, Hong Kong *Mar. 2022 - Oct. 2022*

- Proposed a skill learning method for generalizable manipulation of various 3D articulated objects (SAPIEN).
- Proposed a prediction-based RL approach for dynamic catching with a mobile robotic manipulator (Isaac Gym).
- Published a paper in ICRA 2023 and a paper in ICRA 2024 (oral presentation, my role: first author).

Bachelor Thesis at Robot Locomotion Lab, Tsinghua University, Beijing, China *Dec. 2019 - Jul. 2020*

- Developed a quadratic programming (QP) based whole-body control (WBC) method for humanoid robots.
- Applied the method to adult-size torque-control Humanoid Robot Tsinghua Walker, realizing balancing, dancing, and ball kicking (my role: thesis author).

Research Intern at IML Lab, Duke & UIUC, Durham & Champaign, USA *Jul. 2019 - Sep. 2019*

**The IML Lab was transitioned from Duke University to UIUC during my internship.*

- **UIUC, Champaign, USA:** Developed a semi-empirical method for simulating contact with elastically deformable objects and co-authored a paper published in ICRA 2020. *Aug. 2019 - Sep. 2019.*
- **Duke University, Durham, USA:** Collected and analyzed data on the robotic poking of heterogeneous elastic objects using various probes. *Jul. 2019 - Aug. 2019.*

Tsinghua Team Member in RoboCup 2019 Humanoid League, Sydney, Australia *Sep. 2018 - Jul. 2019*

- Won the 2nd place in Technical Challenge and Drop-in Contest, the 3rd place in 2v2 Soccer Competition.
- Applied YOLO and particle filter algorithm for vision-based localization (my role: main developer).

Research Assistant at State Key Lab in CS, Tsinghua University, Beijing, China *Apr. 2017 - Jun. 2019*

- Proposed a robot-picking algorithm using Deep RL and affordance map to facilitate the robot actively exploring the environment and picking objects. Published a paper in IROS 2019 (my role: co-first author).
- Won the first prize in the 37th Tsinghua Challenge Cup, and gave an oral presentation at the International AI Educational Conference's Tsinghua Exhibition (my role: first author).

HONORS

Outstanding Graduate Honor, Department of Automation, Tsinghua University *2020*

First Prize (Top 1% of all students), The 37th Tsinghua Challenge Cup Technical Competition *2019*

Second Place, Adult-Size Technical Challenge, Humanoid League, RoboCup 2019 World Final *2018*

Champion, Robotic Innovation Contest, The 20th Chinese Robotics and Artificial Intelligence Competition *2018*

Tsinghua Leading Talent Program (Top 1% of all students), Tsinghua University *2016*

First Prize (Top 10 in Province), Chinese Physics Olympiad (CPhO) *2015*

First Prize (Top 10 in Province), Chinese Mathematical Olympiad (CMO) *2014*

Bronze Medal, China Western Mathematical Olympiad (CWMO) *2014*

**CMO, CPhO, and CWMO are the highest-level academic competitions in China.*

SKILLS

Machine Learning: Python, C++/C#, Matlab, PyTorch, Tensorflow
Robotics Related: Isaac Gym, Habitat, SAPIEN/ManiSkill, RL-Games, ROS, V-REP, Klampt, Open3D
Real Robots: UR Series, Toyota HSR, UBtech Walker, Franka Panda, Unitree Aliengo & Z1, and related sensors