

Kai Lu

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EDUCATION

University of Oxford

Oxford, UK

Ph.D. Candidate in Computer Science, Supervisor: Prof. Andrew Markham

Oct. 2020 - Present

- **Robotics:** Robotic Manipulation, Mobile Manipulators, Robot Control
- **Machine Learning:** Deep Learning, Reinforcement Learning
- **Multi-Modality:** Robotic 3D Vision, Tactile Sensing, LLM for Robots

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 Hebbard, Kaichen Zhou, Ioannis Havoutis, Andrew Markham

SpatialPIN: Enhancing Spatial Reasoning Capabilities of Vision-Language Models through Prompting and Interacting 3D Priors

Tech. Report 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

Reviewer: ICRA 2024, NeurIPS 2023, ICLR 2023

Marker: Oxford Mathematics Admissions Test (MAT)

SKILLS

Machine Learning: Python, C++/C#, Matlab, PyTorch, Tensorflow

Robotics Related: Isaac Gym, SAPIEN/ManiSkill, RL-Games, ROS, V-REP, Klampt, Open3D

Robots: UR Series, Toyota HSR, UBTECH Walker, Franka Panda, Unitree Aliengo & Z1; RealSense/STM32/Arduino

RESEARCH EXPERIENCES

- Collaboration with Meta Research, San Francisco, USA (Remote)** *Jun. 2024 - Present*
- Proposed a human-robot interaction framework based on multi-agent communication for open-ended robotic task proposal and execution, 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 in IROS 2024 (oral presentation, my role: first author), submitted a paper to CoRL 2024 (my role: second author).
- Visiting Scholar at vLAR lab, PolyU, Hong Kong, China** *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.*

MISC

- Board Member**, UK Tsinghua Alumni Association (UKTA) *2021 - Present*
- Student Ambassador**, Department of Computer Science, University of Oxford *2021 - 2023*
- Member**, Student Science Society, Department of Automation, Tsinghua University *2017 - 2019*
- Organizer**, C Language Programming Competition, Department of Automation, Tsinghua University *2018*
- Volunteer School Teacher**, Teaching Support Program in Underdeveloped Areas (Taiping Village, China) *2017*