

Kai Gao

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EDUCATION

Rutgers, the State University of New Jersey

Aug. 2019 – Present

Robotics PhD advised by Dr. Jingjin Yu

Piscataway, USA

- IROS 2023 Finalist of Best RoboCup Paper Award. (Top 6% among accepted papers)
- Invited to publish in IJRR RSS special issue based on my RSS paper. (Top 30% among accepted papers)

University of Science and Technology of China(USTC)

Aug. 2015 – Jun. 2019

Bachelor in Mathematics

Hefei, China

- Outstanding Graduates(2019)
- Outstanding Student Scholarship (2015-2016) (2017-2018)
- Gold Award of China Undergraduate Mathematical Contest in Modeling in Anhui Province(2017)(1/65 in USTC)

WORK EXPERIENCE

Advanced Robotics Intern

May. 2022 – Sep. 2022

Siemens Corporation

Berkeley, USA

- Developed model-free approaches for efficiently packing irregularly-shaped objects.
- Created a prototype pick-and-pack system with a UR5 robot, integrating the proposed packing strategy and Siemens' advanced grasping technology.
- Created demonstration videos and experimental results of the packing strategy for potential customers to showcase its effectiveness and efficiency.

RESEARCH EXPERIENCE

Task and Motion Planning

Mar. 2020 – Present

Research Assistant

Algorithmic Robotics and Control Lab(ARCL), Rutgers University, USA

- Implemented various complete perception-planning-control pipelines utilizing different robotic arms.
- Developed efficient algorithms and analyzed structural characteristics with mathematical proofs for various manipulation scenarios.
- Applied deep learning models for perception and stability prediction of object placement.
- Performed extensive experimentation and demonstration utilizing various simulation platforms, including PyBullet, Issac Gym, Drake, and ROS+Gazebo.

Multi-Robot Path Planning

Jul. 2018 – Sep. 2018

Research Intern

Algorithmic Robotics and Control Lab(ARCL), Rutgers University, USA

- Designed fast algorithms to solve multi-robot path planning problems with different objectives.
- Designed an efficient algorithm to solve the perimeter guarding problem.
- Proved some lemmas and theorems on the efficiency of the algorithms.

Image Registration

Sep. 2017 – Jun. 2019

Research Assistant

Graphics&Geometric Computing Laboratory(GCL), USTC, China

- Developed a highly efficient non-rigid image registration algorithm that is able to handle noise and outliers effectively.
- Implemented the algorithm with C++ and employed OpenGL for visualization.

SELECTED CERTIFICATES & AWARDS

IROS 2023 Finalist of Best RoboCup Paper Award. <i>RoboCup Federation</i>	Oct 2023 Detroit, MI
Gold Award of China Undergrad. Math. Contest in Modeling in Anhui Province (1/65 in USTC) <i>China Society for Industrial and Applied Mathematics</i>	2017 Hefei, China
Reinforcement Learning Specialization. <i>University of Alberta, Alberta Machine Intelligence Institute</i>	July 2023 Coursera
Outstanding Graduates(2019) <i>University of Science and Technology of China</i>	Jun. 2019 Hefei, China
Outstanding Student Scholarship (2015-2016) (2017-2018) <i>University of Science and Technology of China</i>	2016, 2018 Hefei, China

SKILLS

Programming Languages : Python, C++, Matlab

Tools : Git, ROS, PyBullet, Gazebo, OpenCV, PyTorch, Gurobi, Drake, Isaac Gym

INVITED TALKS

Fast High-Quality Tabletop Rearrangement in Bounded Workspace. <i>TRIPODS/DATA-INSPIRE Graduate Student Workshop</i>	March 2022 Virtual
On Minimizing the Number of Running Buffers for Tabletop Rearrangement <i>TRIPODS (Transdisciplinary Research in Principles of Data Science) Seminar</i>	May 2021 Virtual

PUBLICATIONS

- **K. Gao**, J. Yu, T. S. Punjabi, and J. Yu. "Effectively Rearranging Heterogeneous Objects on Cluttered Tabletops." 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2023).
- Andy Xu*, **K. Gao***, S. W. Feng*, and J. Yu. "Optimal and Stable Multi-Layer Object Rearrangement on a Tabletop." 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2023).
- **K. Gao**, S. W. Feng, B. Huang, and J Yu. "Minimizing Running Buffers for Tabletop Object Rearrangement: Complexity, Fast Algorithms, and Applications." The International Journal of Robotics Research (IJRR).
- **K. Gao**, and J. Yu. "On the Utility of Buffers in Pick-n-Swap Based Lattice Rearrangement." 2023 IEEE International Conference on Robotics and Automation (ICRA 2023).
- **K. Gao** and J. Yu. "Toward Efficient Task Planning for Dual-Arm Tabletop Object Rearrangement." 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2022).
- **K. Gao**, D. Lau, B. Huang, K. E. Bekris and J. Yu. "Fast High-Quality Tabletop Rearrangement in Bounded Workspace." 2022 IEEE International Conference on Robotics and Automation (ICRA 2022).
- E. R. Vieira, D. Nakhimovich, **K. Gao**, R. Wang, J. Yu and K. E. Bekris. "Persistent Homology for Effective Non-Prehensile Manipulation" 2022 IEEE International Conference on Robotics and Automation (ICRA 2022).
- R. Wang, **K. Gao**, J. Yu and K. E. Bekris. "Lazy Rearrangement Planning in Confined Spaces." the 32nd International Conference on Automated Planning and Scheduling (ICAPS 2022).

- **K. Gao** and J. Yu. "Capacitated Vehicle Routing with Target Geometric Constraints." 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2021).
- **K. Gao**, S. W. Feng, and J Yu. "On Minimizing the Number of Running Buffers for Tabletop Rearrangement." 2021 Robotics: Science and Systems (RSS 2021).
- R. Wang*, **K. Gao***, D. Nakhimovich*, J. Yu, and K. E. Bekris. "Uniform Object Rearrangement: From Complete Monotone Primitives to Efficient Non-Monotone Informed Search." 2021 IEEE International Conference on Robotics and Automation (ICRA 2021).
- S. W. Feng, **K. Gao**, J. Gong, and J. Yu. "Sensor Placement for Globally Optimal Coverage of 3D-Embedded Surfaces." 2021 IEEE International Conference on Robotics and Automation (ICRA 2021).
- S. W. Feng, S. D. Han, **K. Gao**, and J. Yu. "Efficient Algorithms for Optimal Perimeter Guarding." 2019 Robotics: Science and Systems (RSS 2019).