

# Kai Gao

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## EDUCATION

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### Rutgers, the State University of New Jersey

*Robotics PhD Candidate*

Aug. 2019 – Present

Piscataway, USA

- GPA:3.919/4.0
- Related courses: Computer Vision, Machine Learning

### University of Science and Technology of China(USTC)

*Bachelor in Mathematics*

Aug. 2015 – Jun. 2019

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)
- Related courses: Computer Graphics

## RESEARCH EXPERIENCE

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### Object Rearrangement

*Research Assistant*

Mar. 2020 – Present

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

- Implemented a complete perception-planning-control pipeline utilizing the UR-5e robotic arm.
- Developed efficient algorithms and analyzed structural characteristics with mathematical proofs for various manipulation scenarios.
- Applied deep learning models for perception and employed DQN for push planning tasks.
- Performed extensive experimentation and demonstration utilizing various simulation platforms, including PyBullet, Issac Gym, MuJoCo, and ROS+Gazebo.

### Object Packing Problem

*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 developed packing strategy and Siemens' advanced grasping technology.

### Image Registration

*Research Assistant*

Sep. 2017 – Jun. 2019

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, surpassing the state of the arts.
- Implemented the algorithm with C++ and employed OpenGL for visualization.

## PUBLICATIONS

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- **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." submitted to 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).

## OTHER SUBMITTED WORKS

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- **K. Gao**, S. W. Feng, B. Huang and J. Yu. “Minimizing Running Buffers for Tabletop Object Rearrangement: Complexity, Fast Algorithms, and Applications.” submitted to The International Journal of Robotics Research (IJRR).
- R. Wang, **K. Gao**, Y. Miao, J. Yu and K. E. Bekris. “Improving Feasibility, Efficiency and Quality for Rearranging Uniform Objects in Confined Spaces.” submitted to IEEE Transactions on Robotics (T-RO).

## INVITED TALKS

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### **Fast High-Quality Tabletop Rearrangement in Bounded Workspace.**

*TRIPODS/DATA-INSPIRE Graduate Student Workshop*

March 2022

Virtual

### **On Minimizing the Number of Running Buffers for Tabletop Rearrangement**

*TRIPODS (Transdisciplinary Research in Principles of Data Science) Seminar*

May 2021

Virtual

## SKILLS

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**Programming Languages** : Python, Matlab, C++

**Tools** : Git, ROS, PyBullet, Gazebo, OpenCV, Gurobi