

# YUHONG DENG

Tsinghua Shenzhen International Graduate School, Tsinghua University, P.R. China

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## EDUCATION

### Tsinghua Shenzhen International Graduate School, Tsinghua University

Shenzhen, China

Master of Engineering in Artificial Intelligence

Aug. 2020 – present

- GPA: 3.85/4.00
- Selected Courses: Artificial Neural Network (A, top 5%), Introduction to Statistical Learning Theory (A, top 5%), Introduction to Probability theory (A-)

Thesis Title: Precise and dexterous manipulation of deformable objects

### Department of Mechanical Engineering, Tsinghua University

Beijing, China

Bachelor of Engineering in Mechanical Engineering

Aug. 2016 – Jul. 2020

- GPA: 3.52/4.00
- Selected Courses: Programming Fundamentals (A-), System Dynamic and Control (A-), Students Research Training (A+, Honor Level)

Thesis Title: Transmission cable length identification system based on feature matching

## AWARDS

Comprehensive Scholarship (Top 5%), Tsinghua University	Oct. 2022
Academic Rising Star Nominee Award (Top 0.5%), Tsinghua University	Apr. 2021
Scholarship of Achievement in Science and Technology, Tsinghua University	Nov. 2019
Scholarship of Academic Performance, Tsinghua University	Nov. 2019
The First Prize in the 37th Challenge Cup, Tsinghua University	Oct. 2019
The First Prize of Robotic Innovation Competition, Chinese Association for Artificial Intelligence	Oct. 2018

## PUBLICATIONS

### Journals

- [1] H.P. Liu, **Y.H. Deng**, D. Guo, B. Fang, F.C. Sun and W. Yang. An Interactive Perception Method for Warehouse Automation in Smart Cities, *IEEE Transactions on Industrial Informatics*, vol. 17, no. 2, pp. 830-838, Feb. 2021. (IF:11.648, Q1, DOI: [10.1109/TII.2020.2969680](https://doi.org/10.1109/TII.2020.2969680))

### Conference

- [2] **Y.H. Deng**, C.K. Xia, X.Q. Wang and L.P. Chen. Deep Reinforcement Learning Based on Local GNN for Goal-Conditioned Deformable Object Rearranging, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2022.
- [3] **Y.H. Deng**, C.K. Xia, X.Q. Wang and L.P. Chen. Graph-Transporter: A Graph-based Learning Method for Goal-Conditioned Deformable Object Rearranging Task, *IEEE International Conference on Systems, Man and Cybernetics (SMC)*, 2022.
- [4] **Y.H. Deng**, D. Guo, X.F. Guo, N.F. Zhang, H.P. Liu, and F.C. Sun. MQA: Answering the Question via Robotic Manipulation, *Robotics: Science and System (RSS)*, 2021. (DOI: [10.15607/rss.2021.xvii.044](https://doi.org/10.15607/rss.2021.xvii.044))
- [5] **Y.H. Deng**, X.F. Guo, Y.X. Wei, K. L. B. Fang, D. Guo, H.P. Liu, and F.C. Sun. Deep Reinforcement Learning for Robotic Pushing and Picking in Cluttered Environment, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2019, pp. 619-626. (DOI: [10.1109/IROS40897.2019.8967899](https://doi.org/10.1109/IROS40897.2019.8967899))

## RESEARCH INTERESTS

- Vision-based robotic manipulation policies learning
- Reinforcement learning and imitation learning
- Intelligent embodied agents

## RESEARCH EXPERIENCE

### Intern, Tencent Robotics X Lab

Shenzhen, China

Advisor: Lipeng Chen, Researcher of Tencent Robotics X Lab

Jan. 2022 – Oct. 2022

Vision-Based Goal-Conditioned Rearrangement Tasks of 1D (rope) and 2D (cloth) Deformable Objects

- Proposed an efficient representation strategy based on dynamic graphs that can accurately parameterize the object configuration and capture the deformable dynamics

- Proposed a light local Graph Neural Network (GNN) learning to update representation graphs and infer the optimal manipulation sequence of pick and place actions with two dynamically updated graphs
- Conducted physical and simulation experiments to verify the performance of our model on rearrangement tasks. The average success rate is beyond 90% both in simulation and reality
- Trained the local Graph Neural Network in multi-task learning and got comparable performance with single-task learning
- Published the paper [2] and submitted a paper to Complex & Intelligent Systems

#### Precise Manipulation of Grape with Dual-Arm Manipulator

- Designed a planning algorithm to control the ABB dual-Arm manipulator to insert a grape with a needle
- Optimized path planning in action space to avoid joint singularity and improved task success rate
- Maintained and optimized ROS-based projects

**Master Student, Tsinghua Artificial Intelligence and Robot Laboratory, Tsinghua University** Shenzhen, China

Advisor: Xueqian Wang, Professor of Automation, Tsinghua University

Sep. 2020 – present

#### 1D deformable object (rope) manipulation task

- Proposed a method to represent the configurations of deformable objects with graph structure defined by handcrafted rules
- Improved a deformable object manipulation planning framework based on Full Convolution Network (FCN) with graph representation and Graph Convolution Network (GCN)
- Established a dataset and quantitative metrics to evaluate the performance of our framework on several tasks
- Published the paper [3]

**Research Assistant, Department of Computer Science, Tsinghua University**

Beijing, China

Advisor: Huaping Liu, Professor of Computer Science, Tsinghua University

Sep. 2017 – May. 2021

#### Intelligent Robotic Grasping in Cluttered Scene

- Designed a new composite robotic hand with suction cup and gripper
- Trained the deep Q-network that can actively explore (push) cluttered scene in simulation and transferred the deep Q-network to reality. Robots with active exploration capabilities have a 25% increase in grasping success
- Published the paper [5] and the paper [1]

#### A Novel Question Answering Task via Robotic Manipulation

- Proposed and formulated a novel task, Manipulation Question Answering (MQA), where the robot performs manipulation actions to actively explore the environment in order to answer a given question
- Established a novel MQA dataset in V-rep simulator and established a corresponding benchmark
- Provided a baseline model for MQA task, the baseline model was composed of a natural language processing module, a computer vision module and an action planning module
- Improved the baseline model with a dynamic scene graph to represent scene semantics and a GRU-based structure to tackle manipulation sequence planning task
- Published the paper [4] and submitted a paper to ACM/IEEE International Conference on Human-Robot Interaction

#### Paper Reviewer

- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

#### Conference Attended

- 2021 Robotics: Science and System (RSS), Virtual Conference
- 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Macau, China
- 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Virtual Conference

## SKILLS

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**Programming Language:** Proficient in Python, C++, Matlab

**Design/ CAD:** Proficient in Mechanical Design (Solidworks, AutoCAD)

**Robotics Related:** Proficient in Microcontroller (STM32, Arduino) and manipulators of UR series and ABB series; Frequent user of ROS, Pybullet, Mujoco and V-rep

**Machine Learning Related:** Frequent user of PyTorch and Tensorflow; Proficient in deep learning and reinforcement learning