

# JINGTIAN YAN

Pittsburgh, PA

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## Experience

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**Carnegie Mellon University (CMU)**, Pittsburgh, PA **May 2023 – present**

*Research Assistant, Robotics Institute | Supervisor: Dr. Jiaoyang Li*

*Pittsburgh, PA*

*Funded by the Manufacturing Futures Institute (MFI), CMU*

- Developing multi-agent planning algorithms, building simulations, and deploying these algorithms for mobile robots in an autonomous assembly factory

## Education

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**Carnegie Mellon University (CMU)**, Pittsburgh, PA **Sep 2021 – May 2023**

*Master of Science in Electrical and Computer Engineering*

*Overall GPA: 4.0/4.0 – Major GPA: 4.0/4.0*

**Zhejiang University (ZJU)**, Zhejiang, China **Sep 2016 – Jun 2020**

*Bachelor of Engineering in Automation*

*Overall GPA: 3.87/4.0 – Major GPA: 3.96/4.0*

## Publications

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- **Yan, Jingtian**, and Jiaoyang Li. “Multi-Agent Motion Planning with Bézier Curve Optimization under Kinodynamic Constraints.” arXiv. (Under review for IEEE Robotics and Automation Letters)
- **Yan, Jingtian**, Xingqiao Lin, Zhongqiang Ren, Shiqi Zhao, Jieqiong Yu, Chao Cao, Peng Yin, Ji Zhang, and Sebastian Scherer. “MUI-TARE: Cooperative Multi-Agent Exploration With Unknown Initial Position.” IEEE Robotics and Automation Letters 8, no. 7 (2023): 4299-4306
- Liu, Zihang, Chunhui Zhao, Yan Lu, Yu Jiang, and **Jingtian Yan**. “Multi-scale graph learning for ovarian tumor segmentation from CT images.” Neurocomputing 512 (2022): 398-407
- Zhuang, Zhuokai, **Jingtian Yan**, Chenglang Sun, Haiqiang Wang, Yuejun Wang, and Zhongbiao Wu. “The numerical simulation of a new double swirl static mixer for gas reactants mixing.” Chinese Journal of Chemical Engineering 28, no. 9 (2020): 2438-2446

## Projects

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**Multi-Agent Motion Planning using Non-constant Motion** **Sep 2023 – present**

*Research Assistant | Supervisor: Dr. Jiaoyang Li*

*CMU, Pittsburgh, PA*

- Developing a multi-agent motion planner, aimed at coordinating hundreds of agents, with a focus on surpassing current state-of-the-art methods in terms of scalability and solution quality
- Designed an incremental partial expansion method to speed up the search process
- Introduced an optimization-based method to improve solution quality, ensuring the trajectories have smooth speed profile while guaranteeing the completeness of the method
- Developing a time window mechanism to support lifelong path-finding task

**Multi Agent Path Finding and Robust Execution in Autonomous Factory** **Jun 2023 – present**

*Research Assistant | Supervisor: Dr. Jiaoyang Li*

*CMU, Pittsburgh, PA*

- Building a multi-agent path planning and execution system for mobile robots in an autonomous assembly factory
- Developed a multi-agent path planner, based on Conflict-Based Search (CBS), to create collision-free paths for mobile robots handling kit transportation. Incorporated the Action Dependency Graph to ensure the robust and reliable execution of these plans
- Created an assembly factory simulation environment using Gazebo, which is used for testing and evaluating the performance of the algorithms
- Collaborating with other teams to integrate and deploy this system on real robots

**Multi-Agent Motion Planning with Bézier Curve Optimization** **Mar 2023 – Sep 2023**

*Research Assistant | Supervisor: Dr. Jiaoyang Li*

*CMU, Pittsburgh, PA*

- Developed PSB, a multi-agent motion planner used to address the challenge in path planning for a large team of agents, fully accounting for their kinodynamic capabilities
- Proposed a planner framework that merges search-based and optimization-based methods to generate trajectories with smooth speed profiles executable by controllers
- Enhanced planning runtime efficiency by designing a dominance check mechanism to eliminate redundant symmetry nodes and implementing a cache mechanism for reusing results from the optimization-based method

- Achieved up to 49.79% improvements in terms of solution cost compared to existing methods within the domains of traffic intersection coordination and grid map navigation

### Multi-agent Exploration with Unknown Initial Pose

Jun 2022 – Aug 2022

Student Researcher | Supervisors: Dr. Sebastian Scherer, Dr. Ji Zhang

CMU, Pittsburgh, PA

- Built a multi-agent autonomous system designed for exploring unknown environments where global pose estimation of agents is challenging
- Devised a framework to enable multi-agent exploration in environments with unknown initial relative poses. Integrated a map merge module to merge sensor inputs and determine relative poses between agents using sensor data association. Employed a hierarchical multi-agent planner to plan paths for unknown environmental perception
- Proposed an adaptive merge module that plans paths for agents to actively increase the robustness of the map merge module. This approach balanced the exploration efficiency with map merge robustness
- Designed a sub-map-based global planner that plans the global paths for those agents whose relative pose is confirmed by map merge module
- Realized up to 50% improvement in exploration efficiency compared to other state-of-the-art methods within complex, highly realistic simulation environments

### Isaac Sim Simulation Environment Development

Jun 2022 – Aug 2022

Student Researcher | Supervisor: Dr. Ji Zhang

CMU, Pittsburgh, PA

- Built a 3D simulation environment for autonomous navigation and exploration tasks using NVIDIA Isaac Sim
- Provided autonomous navigation modules such as collision avoidance, terrain traversability analysis, waypoint following, and more, along with a suite of visualization tools
- Implemented and tested TARE planner and FAR planner at this simulation environment

### 3D CT Images Segmentation

Jul 2020 – Jun 2021

Research Assistant | Supervisor: Dr. Chunhui Zhao

ZJU, Hangzhou, China

- Conducted research on a 3D CT image segmentation algorithm aimed at improving early detection of ovarian cancer
- Developed a multi-scale graph learning U-Net (MGLU-Net) for ovarian tumor segmentation
- Designed the graph convolutional module that learns both the local characteristics and the global structure of the tumors, aiming to handle the polycentric distribution of the ovarian tumors and the size variation problem
- Achieved better performance than the state-of-the-art methods on the real ovarian CT image dataset and Sliver07 challenge dataset

### Monocular Visual-Inertial Odometry

Jul 2019 – Jun 2020

Student Researcher | Supervisor: Dr. Jianke Zhu

ZJU, Hangzhou, China

- Conducted research on the monocular visual-inertial state estimator algorithm
- Implemented a Fully Convolutional Neural (FCN) Network for road semantic segmentation, addressing the challenge of transformation estimation in environments with moving cars and similar lanes
- Evaluated using KITTI Visual Odometry dataset, showing superior performance over VINS-Mono in certain sequences

## Service

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### Reviewer:

- IEEE International Conference on Robotics and Automation (ICRA), 2023

### Patents & Software Copyrights

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- “The invention relates to a tracked security patrol robot”, CN 209492625 U, Oct.2019
- “Robot mobile terminal software for indoor air quality monitoring”, 2019SR0118235, Jan.2019
- “Intelligent mobile robot software for indoor air quality monitoring”, 2019SR0117978, Jan.2019
- “UAV mobile terminal software for river garbage monitoring”, 2019SR0117981, Jan.2019

### Awards

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- Outstanding student of Zhejiang University (Top 3%) Jul 2018
- Zhejiang provincial government scholarship (Top 1%) Jul 2017
- The second prize of the 13th “Zktecho Cup Supermarket Robot Competition” (Top 2%) May 2017
- “Zktecho” scholarship (Top 1%) Nov 2018

## Technical Skills

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### Programming Languages:

C++ | C | Python | MATLAB | LaTeX

### Software & Tools:

ROS & ROS2 | Linux | Git | CPLEX | TensorFlow | PyTorch | OpenCV