Yao He

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Education

The Chinese University of Hong Kong, Shenzhen (CUHK-Shenzhen) *Guangdong, China*
B.E. in Electronic Information *2018-2022*
- First Class Hornor
- MGPA: 3.864/4.0 (2/44), CGPA: 3.783/4.0 (6/144)
- Scholarship & Award: 2020-2021 CUHK-Shenzhen Excellent Student Award (Top 1%), Academic Performance Scholarship (2019-2021 for Top 5%), Dean's Lists of School of Science and Engineering (2019-2022), Shaw College Master's List (2019-2021 for Top 5%), Bowen Scholarship (2018-2022)

Publications

[1] **FoundLoc: Vision-based Onboard Aerial Localization in the Wild**
 Y. He*, I. Cisneros*, N. Keetha, J. Patrikar, Z. Ye, I. Higgins, Y. Hu, P. Kapoor, and S. Scherer, IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2024 (Under Review) [**Paper**][**Project Website**]

[2] **Towards Robust Visual-Inertial Odometry with Multiple Non-Overlapping Monocular Cameras**
 Y. He, H. Yu, W. Yang, and S. Scherer, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022 [**Paper**] [**Repo**] [**Video**]

[3] **GPU-Enhanced Front-end for Visual-Inertial Odometry**
 Y. He, H. Yu, W. Yang, and S. Scherer, 2021 CMU RISS Working Papers Journal, pp.112-117. [**Paper**] [**Poster**]

[4] **Computational Efficient Simulation of Kelvin Wake for Unmanned Surface Vehicles**
 Y. He, Q. Sun, W. Qi, X. Ji, and H. Qian, IEEE International Conference on Real-time Computing and Robotics (RCAR), 2021 [**Paper**] [**Repo**]

[5] **Vision-Enabled Safety for High-Speed Detection and Avoid**
 P. Kapoor*, N. Keetha*, J. Patrikar*, I. Higgins*, Z. Ye, I. Cisneros, *Y. He*, Y. Hu, J. Oh, and S. Scherer, Nature, 2024 (Under Review) [**Project Website**]

*=Equal Authorship

Experience

AirLab, Carnegie Mellon University *Pittsburgh, PA*
Research Assistant Nov. 2022 - Present
- Advised by **Prof. Sebastian Scherer**
- Work on various projects at the intersection of artificial intelligence and robotics to improve the robustness and reliability of real-world robot autonomy
- Selected Projects: Wildfire UAS, Shared Airspace, CHAMP. (Details are presented in the **Selected Projects** section)

Robotics Institute Summer Scholar (RISS) May. 2021 - Aug. 2021
- Mentored by **Dr. Huai Yu** and **Prof. Sebastian Scherer**
- Develop Multi-camera Visual-Inertial Odometry with GPU-accelerated computer vision algorithms
- Paper [2] as first author accepted to IEEE IROS 2022

Robotics & Artificial Intelligence Laboratory, CUHK-Shenzhen *Guangdong, China*
Undergraduate Research Intern Sept. 2019 - May. 2022
- Mentored by **Prof. Huihuan Qian**
- Develop Ship wake simulation that benefits dynamic analysis for unmanned surface vehicles (USVs) using ROS
- Design a vision-based obstacle detection and collision risk evaluation for unmanned surface vehicles
- Paper [4] as first author accepted to IEEE RCAR2021

Network Communications and Economics Lab, CUHK-Shenzhen *Guangdong, China*
Independent Study Student (Final Report) Jan. 2021 - May. 2021
- Mentored by **Dr. Lihua Ruan** and **Prof. Jianwei Huang**
- Develop an unmanned aerial vehicle (UAV) platform based on AirSim and Unreal Engine (UE4)
- Evaluate a UAV-vehicle interaction algorithm and verify the optimal solution for minimizing cost on time and UAV energy

Selected Projects

Wildfire UAS (Ongoing) *Website* — *Pittsburgh, PA*
PI: Prof. Sebastian Scherer, Prof. Katia Sycara — Sept. 2023 - Present

- **Technical leader of sub-canopy drone perception and navigation**
- Develop SLAM, depth mapping, and autonomous UAV systems using RGB cameras, thermal cameras, and IMU
- Design drone platform with NVIDIA Jetson AGX Orin for deployment and operation

Safe and Seamless Operation of Crewed and Uncrewed Aircraft in Shared Airspace *Website* — *Pittsburgh, PA*
PI: Prof. Sebastian Scherer, Prof. Jean Oh — Jan. 2023 - Jun. 2023

- Develop an autonomy system that keeps UAVs and manned traffic safely separated and behave as expected in GPS-denied situations by anticipating, reacting, and coordinating with other aircraft in uncontrolled airspace with only passive (vision-based) sensing
- Develop Vision-based GPS-Denied localization system using visual-inertial odometry, foundation model based visual place recognition, and satellite map
- Deploy the system onto NVIDIA Jetson Xavier NX for real-world experiments and demonstration
- Relevant papers: [1], [5]

Collaborative Heterogeneous Autonomy for Multi-Domain Platforms (CHAMP) — *Pittsburgh, PA*
PI: Prof. Sebastian Scherer — Nov. 2023 - Mar. 2023

- Prototype technology development seedling for Collaborative UAVs and Multi-Domain Operations
- Develop shoreline localization system for UAVs using visual-inertial odometry and visual place recognition
- Conduct experiments and demonstrations in NVIDIA IsaacSim

Service Robot Challenge (ECE4310 Programming for Robotics) *Github Page* — *Guangdong, China*
Director: Prof. Tin Lun Lam — Jan. 2022 - May. 2022

- Develop a service robot for delivery in an indoor environment in Gazebo
- Use RTAB for indoor environment mapping, AMCL for robot localization, move-base ros package for navigation and Ar-tag tracker for target marker detection
- The only student completing the project among all the enrolled graduate and undergraduate students

Leadership & Service

Reviewer — 2021 - Present

- IJRR, RA-L, IROS, ICRA, CVPR

CMU MRSD Team Mentor *MRSD Program* — Sept. 2023 - Present
Mentoring CMU MRSD students to work on hands-on robotics topics proposed by an industry partner or CMU lab

- Team 1: Resilient Subcanopy UAS Navigation Through Smoke for Wildfire Applications
- Team 2: Reforestation Drone

Tartan Planning Series *Website* — Mar. 2023 - May. 2023
Organizer

- Organized an interactive series of talks, tutorials, and learning on planning for robotics with world-renowned pioneers

ICCV SLAM Challenge *Website* — Mar. 2023 - May. 2023
Organizer

- Provide datasets TartanAir and SubT-MRS, aiming to push the robustness of SLAM algorithms in challenging environments and advance sim-to-real transfer.
- My work on Multispectral Inertial Odometry (MSO) is present at *SLAM Challenge Summary*

Teaching — Sept. 2020 - May. 2022
Undergraduate Student Teaching Fellow — CUHK-Shenzhen

- PHY1001 Mechanics (19 Fall), MAT1002 Calculus II (20 spring), CSC3002 Introduction to Computer Science: Programming Paradigms (21 spring), MAT2002 Ordinary Differential Equations (22 Spring)

Skills

Programming Languages: Python, C/C++, CUDA, Matlab, Latex, Bash, Julia
Libraries: OpenCV, Eigen, Ceres, NVIDIA VPI, Pytorch, PCL, Numpy
Environments & Tools: Linux, ROS, Docker, CMake, Conda, UE4/AirSim, IsaacSim, Git, Jupyter