BOTAO HE

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EDUCATION

University of Maryland, College Park, U.S. **08/2022 – Now**

Ph.D. student in Computer Science.

Nanjing Institute of Technology, Nanjing, China **09/2018 – 07/2022**

B.Eng. in Robot Engineering, School of Automation.

COLLABORATION & CO-ADVISE

Carnegie Mellon University, Pittsburgh, U.S. **05/2023 – Now**

Advised by Dr. Ji Zhang.

Zhejiang University, Hangzhou, China **01/2020 – 08/2022**

Advised by Prof. Fei Gao

RESEARCH INTERESTS

Field Robotics, Active Perception, Interactive Navigation.

PUBLICATIONS

- **Botao He***, Guofei Chen*, Wenshan Wang, Ji Zhang, Cornelia Fermuller, Yiannis Aloimonos. *"Interactive-FAR: Interactive, Fast and Adaptable Routing for Navigation Among Movable Obstacles in Complex Unknown Environments"*. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS), 2024. [Website] [Pre-print] [Video] [Code]
- **Botao He**, Ze Wang, Yuan Zhou, Jingxi Chen, Chahat Deep Singh, Haojia Li, Yuman Gao, Kaiwei Wang, Yanjun Cao, Chao Xu, Yiannis Aloimonos, Fei Gao, and Cornelia Fermuller. *"Microsaccade-inspired Event Camera for Robotics"*, **Science Robotics**. [Website] [Paper] [Pre-print] [Video] [Code]
- Jingxi Chen, **Botao He**, Chahat Deep Singh, Cornelia Fermuller, and Yiannis Aloimonos. *"Active Human Pose Estimation via an Autonomous UAV Agent."* IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS), 2024. [Website] [Pre-print]
- Tianyi Xiong*, Jiayi Wu*, **Botao He**, Cornelia Fermuller, Yiannis Aloimonos, Heng Huang, Christopher A. Metzler. *"Event3DGS: Event-Based 3D Gaussian Splatting for High-Speed Robot Egomotion"*. Submitted to CoRL 2024. [Pre-print], code coming soon.
- Chahat Deep Singh, **Botao He**, Cornelia Fermuller, Christopher Metzler, Yiannis Aloimonos *"Minimal Perception: Enabling Autonomy in Resource-Constrained Robots"* Submitted to Frountier Robotics.
- **Botao He**, Ze Wang, Yuan Zhou, Jingxi Chen, Chahat Deep Singh, Cornelia Fermuller, Yiannis Aloimonos, Chao Xu and Fei Gao. *"Leveraging an Active Prism to Enhance Feature Detection in Event Cameras"* Technical Report
- Qianhao Wang*, **Botao He***, Zhiren Xun and Fei Gao. *"GPA-Teleoperation: Gaze Enhanced Perception-aware Safe Assistive Aerial Teleoperation"* IEEE Robotics and Automation Letters (RA-L) and IEEE International Conference on Robotics and Automation (ICRA 2022). [Paper] [Video] [Code]
- **Botao He***, Haojia Li*, Siyuan Wu, Dong Wang, Zhiwei Zhang, Qianli Dong, Chao Xu, and Fei Gao. *"FAST-Dynamic-Vision: Detection and Tracking Dynamic Objects with Event and Depth Sensing"* IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2021). [Paper] [Video] [Code]
- Shaohui Yang, **Botao He**, Zhepei Wang, Chao Xu and Fei Gao. *"Whole-Body Real-Time Motion Planning for Multicopters,"* IEEE International Conference on Robotics and Automation (ICRA 2021), [Paper] [Video]

Research Experience

Zhang Lab, Carnegie Mellon University **05/2023 – Now**

Advised by Dr. Ji Zhang

Interactive Navigation. [IROS]

- Proposed a solution for interactive navigation in cluttered unknown environments, focusing on fast and adaptable navigation with environmental interactions.
- Designed a directed visibility graph that encodes the interaction strategies and accelerates path finding.
- Designed an interaction strategy that adapts to movable obstacles' online physics property estimation.

Ground/Aerial Autonomy Development Environment. [Website]

- Proposed a fully autonomy stack for developing ground/aerial autonomous navigation systems and later on deploying to real robots with minor sim-to-real gap. Can be quickly deployed and tested in 10 minutes.
- Designed 29 multi-scale scenes with different complexity, supports Gazebo/Unity with multiple sensor setups.

Perception and Robotics Group, University of Maryland **09/2022 – Now**

Advised by Prof. Yiannis Aloimonos and Dr. Cornelia Fermuller

Microsaccade-inspired Event Camera for Robotics (Co-advised by Prof. Fei Gao) [Science Robotics]

- Proposed a new hardware design to make the event camera see static background even when it is static.
- Designed a new algorithm to transform the new data format to the same domain of standard event camera, making the proposed system a plug-in-and-use solution with existing event-based perception algorithms.

Active Perception for Navigation [IROS]

- Designed a distance-field and corresponding planner that combine the view-point guidance with other navigation constraints into an optimization-based planning framework for improving human pose estimation.

FAST (Field Autonomous System & compuTing) Lab, Zhejiang University **01/2020 – 08/2022**

Advised by Prof. Fei Gao

Advanced Pilot Assistance System (APAS). [RA-L & ICRA]

- Designed a gaze-enhanced APAS considering topological intent consistency and perception awareness. Make drone operation easy for everyone.

Event-based perception. [IROS]

- Proposed a perception system for dodging fast-moving objects with low latency and high precision.

Whole-body Motion Planning for UAVs. [ICRA]

- Proposed a full-body, optimization-based, yaw-considered real-time motion planning framework for aerial robots.

All-terrain Vehicle Lab, Nanjing Institute of Technology **10/2018 – 12/2019**

Challenge Arena Fighting Robot. Advised by Prof. Guifang Qiao *Team leader*
Electromagnetic Throw System. *Team leader*
Lightweight quadruped robot. *Team leader*

- Acquired the ability to independently build a robot system.

Service

Reviewer:

IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS), 2024

Robotics and Automation Letters (RA-L), 2022-2024

Frontiers in Robotics and AI, 2023-2024

The Visual Computer, 2023

CVPR Workshop, 2023

Editor:

NeuroPAC

Honors & Awards

NeuroPAC Fellowship, NeuroPAC, 2023, 2024

Dean's Fellowship, UMD, 2022-2023

Skills

Programming: C/C++, Python, Keil-C, Matlab, Git, OpenCV.
Robotics: ROS, Unity, Airsim, Gazebo, Adams, IoT chips(STM32, Arduino).
Hardware: SolidWorks, machining, circuit design.

Additional activities

Volunteer teaching assistant at community autism school. 300+ volunteer hours.