Wanhao Liu

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Education

Guangdong University Of Tecnology *Guangzhou, China*

B.S. in Electronic science and technology *Sep. 2023 - Present*

Honors: First Prize Scholarship(Top1%), Advanced Individual, Outstanding Student Leader Scholarship

Research Interest

Embodied AI & Autonomous Robotics: My core interest is Embod-ied AI, focusing on developing autonomous robots that can intelligently perceive, reason, and act in complex, unstructured environments.

Multimodal Perception for Robotics: I am interested in how fusing sensor modalities like vision, language, and touch can enable a deep semantic understanding of the world, particularly through Vision-Language Models.

Learning-based Control: My focus includes data-efficient Rein-forcement and Imitation Learning to teach robots robust and generalizable manipulation and navigation skills.

Human-Robot Interaction: I am also keen on exploring shared au-tonomy and learning from human feedbak to create robots that can safely and effectively collaborate with people.

Publications & Patents

Journals

[J1] Prescribed-time fault-tolerant attitude control for tiltrotor UAV with input saturation and mismatched disturbances.
Liwei Luo, Wanhao Liu, Li Yuan, Qianqian Cai, Panshuo Li
Control Engineering Practice, 2025 [Paper]

CONFERENCE PROCEEDINGS

[C3] AC-MASAC: An Attentive Curriculum Learning Framework for Heterogeneous UAV Swarm Coordination.
Wanhao Liu, Junhong Dai, Yixuan Zhang, Shengyun Yin, Panshuo Li
Under Review, 2025 [Paper]

[C2] SConflict Prioritized-based Experience Replay Soft Actor-Critic Algorithm for Unsignalized Intersections Coordination.
Junhong Dai, YUe cai, Wanhao Liu, Panshuo Li
CVCI, 2025 [Paper]

[C1] Improved Heuristic JPS Algorithm for Path Planning in Intelligent Warehouse Robot.
Yixuan Zhang, Wanhao Liu, Libin Liu
ICEMCE, 2024 [Paper]

PATENT

[P1] A Multi-Algorithm Shopping Mall Recommendation Method and System Combining Multiple Metrics.
Yixuan Zhang, Libin Liu, Wanhao Liu
CN202411661572.4, 2024, Authorized [Paper]

Reseaech Experience

Attentive Curriculum Learning Framework for Heterogeneous UAV Swarm Coordination *Guangzhou, China*

Advised by Prof. LI Panshuo, Professor of School of Automation, GDUT *Mar. 2025 - Oct. 2025*

- Addressed key limitations in Multi-Agent Reinforcement Learning (MARL) for heterogeneous UAV swarm coordination, focusing on the challenges of modeling asymmetric agent dependencies and ensuring stable policy convergence.
- Designed and implemented AC-MASAC, a novel MARL framework featuring two core contributions: a role-aware heterogeneous attention mechanism to explicitly model Leader-Follower dynamics, and a structured curriculum learning strategy to overcome sparse rewards and catastrophic forgetting.
- Validated the proposed framework in a custom simulation environment, demonstrating significant performance gains over baseline algorithms in Success Rate (SR), Formation Keeping Rate (FKR), and Success-weighted Mission Time (SMT).

Prescribed-Time Fault-Tolerant Control for Tiltrotor UAVs *Guangzhou, China*

Advised by Prof. LI Panshuo, Professor of School of Automation, GDUT *Nov. 2024 - Jun. 2025*

- Investigated attitude control for tiltrotor UAVs (TRUAVs) under composite mismatched disturbances, actuator faults, and input saturation.
- Developed OPAFAC, a novel control strategy integrating a disturbance observer, an adaptive sliding mode controller, and an anti-saturation system to guarantee error convergence within a prescribed time.
- Validated the strategy via hardware-in-the-loop (HIL) experiments, achieving prescribed-time convergence and demonstrating superior fault tolerance and robustness over existing methods..

Improved Heuristic JPS Algorithm for Warehouse Robot Path Planning *Guangzhou, China*

Advised by LIU Libin, Lecturer of Guangdong University of Technology, GDUT *Oct. 2024 - Mar. 2025*

- Investigated the inefficiency of the Jump Point Search (JPS) algorithm in warehouse environments, specifically its excessive search range and interruptions.
- Developed an improved heuristic JPS by integrating angle and dynamic heuristic functions to optimize search direction and a B-spline module for path smoothing.
- Validated the algorithm via simulation, achieving a 35% reduction in planning time and a 34% reduction in searched nodes while generating safer, smoother paths.

Scientific Competition

National University Smart Car Competition *Hangzhou, Chian*

Leader, National Second Prize *Jun. 2025 - Sep. 2025*

- The system employs a data-centric approach, deeply integrating deep learning with multi-sensor information. It utilizes CNN for lane line recognition and the PP-YOLOE model to detect task targets. Based on this, the system establishes a kinematic model of the robotic arm and performs trajectory planning, translating perceptual data into precise motion commands for the arm. This enables closed-loop control from environmental perception to physical operation.
- By integrating dual infrared sensors with a high-precision robotic arm, the system achieves collaborative multi-task operations. A hierarchical control strategy is adopted: the upper-level decision-making system plans tasks based on sensor data, while the lower-level motion controller ensures accurate tracking of target trajectories by the robotic arm. This tight collaboration guarantees reliable execution of physical operations.
- The system is deployed on the Jetson Orin Nano platform, with a coprocessor and frameworks like ROS ensuring low-latency real-time control for the robotic arm. Final tests demonstrated excellent performance in task completion rates and system stability, validating the effectiveness of the full pipeline from perception to control execution.

Skills

Programming Python, C++, LaTeX MATLAB, Linux, Docker

Frameworks PyTorch, Tensorflow, NumPy, Git, Anaconda, ROS1, ROS2