Xintong Zhang

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EDUCATION

Duke Kunshan University (DKU) & Duke University Dual Degree Class of 2027
Major: Applied Mathematics and Computational Sciences Kunshan, China

- GPA: 3.98/4.0
- Courses: Principles of Machine Learning, Algorithm Design and Analysis, Operating System, Discrete Math for Computer Science, Computer Architecture, Computer Organization and Programming, Linear Algebra, Probability, Calculus, Physics

RESEARCH EXPERIENCE

LLMs Meet Formal Methods for Robot Swarms: Reliable, Explainable and Efficient Human-in-the-loop Planning in Unknown Environments (Science Robotics: In Preparation) April 2025-Now
Fourth Author Beijing/Kunshan, China

- Supervisor: Prof. Meng Guo, Peking Uni.
- Overview: Propose a hierarchical framework that integrates Large Language Models (LLMs) for open-world reasoning with formal methods to enable reliable, explainable, and human-in-the-loop task planning for heterogeneous multi-robot systems in dynamic and unknown environments. The system leverages temporal logic for mission specification, human verification for correctness guarantees, and a cloud–edge–end architecture to support scalable and adaptive coordination.
- Contribution: Design a mixed-integer linear programming (MILP)-based task allocation algorithm using optimization solvers to ensure efficient subtask assignment under temporal constraints. Develop structured prompt templates for LLM-based subtask generation and reasoning. Participate in physical hardware experiments, including the deployment and integration of planning algorithms on physical UAV and UGV platforms, enabling real-world validation of the proposed planning framework.
- Acquired Expertise: Human-Robot Interaction, MILP-based optimization for task allocation, structured prompt engineering for LLM reasoning, integration and deployment of algorithms onto physical UAV and UGV platforms.

CoCoPlan: Adaptive Coordination and Communication for Multi-robot Systems under Continual Temporal Tasks (RAL: Accepted) Jan 2025-August 2025
Leading Author Beijing/Kunshan, China

- Supervisor: Prof. Meng Guo, Peking Uni.
- Overview: Propose CoCoPlan, a collaborative framework addressing communication-aware task planning for multi-robot systems under intermittent connectivity constraints. The framework focuses on joint optimization of communication events and task allocation, ensuring robustness in unknown environments.
- Contribution: Propose an active-communication task planning framework, combining tree-search methods and nonlinear iterative optimization to ensure non-intermittent communication events and optimal task execution. Formulate a flexible objective function, enabling robust performance across diverse environmental distributions. Validate in large-scale 2D/3D high-fidelity simulations, demonstrating real-world applicability in dynamic scenarios.
- Acquired Expertise: LOS-aware topology optimization, intermittent protocol development, BnB based optimization, incremental search strategies, centralized and decentralized tree search algorithms, integration and deployment of algorithms onto physical UAV and UGV platforms.

DEXTER-LLM: Dynamic and Explainable Coordination of Multi-Robot Systems in Unknown Environments via Large Language Models (IROS: Accepted) Dec 2024-March 2025
Second Author Beijing/Kunshan, China

- Supervisor: Prof. Meng Guo, Peking Uni.
- Overview: Propose DEXTER-LLM, a framework integrating LLMs with MILP optimization for dynamic task planning and coordination for heterogeneous multi-robot systems in unknown environments.
- Contribution: Design a versatile task coordination framework for heterogeneous multi-robot systems in open and unknown environments, which is generalizable, verifiable, explainable and scalable. Integrate LLMs and the model-based task planner, which paves the way for new applications in open world automated task planning.
- Acquired Expertise: LTL formalization, LLM-Driven Coordination, Human-Robot Interaction, Optimization

SLEI3D: Simultaneous Large-scale 3D Exploration Inspection and Interaction via Heterogeneous Fleets under Limited Communication (TASE: Accepted) June-Dec 2024
Third Author Beijing/Kunshan, China

- Supervisor: Prof. Meng Guo, Peking Uni.
- Overview: Propose SLEI3D, a framework for large-scale 3D exploration, inspection, and interaction using heterogeneous robotic fleets (UAVs/UGVs) under limited Line-of-Sight (LOS) communication, which addressed challenges of dynamic task allocation and intermittent communication in unknown environments.
- Contribution: Formulate the novel problem formulation of simultaneous exploration and inspection under limited communication for heterogeneous robotic fleets. Propose the multi-layer and multi-rate coordination framework that

simultaneously co-optimizes the collaborative exploration task, the inspection task and the inter-robot communication; Perform the extensive large-scale simulations that validate the performance of the proposed framework for autonomous exploration and inspection in practical scenes.

- Acquired Expertise: ROS, Rviz Simulation, Blender Modeling, Coordination Strategy design, Intermittent Communication.

PUBLICATION

J. Chen, Y. Zhu, A. Zhuo, Xintong Zhang, S. Zhang, G. Wen, X. Dong, M. Guo, Z. Li, "LLMs Meet Formal Methods for Robot Swarms: Reliable, Explainable and Efficient Human-in-the-loop Planning in Unknown Environments," (Science Robotics: In Preparation)

- Homepage: https://trio-pku.github.io/DEXTER-LLM-Plus/

Xintong Zhang, J. Chen, Y. Zhu and M. Guo, "CoCoPlan: Adaptive Coordination and Communication for Multi-robot Systems under Continual Temporal Tasks," (RA-L: Accepted)

- Homepage: CoCoPlan: Adaptive Coordination and Communication for Multi-robot Systems in Dynamic and Unknown Environments

Y. Zhu*, J. Chen*, X. Zhang, M. Guo and Z. Li, "DEXTER-LLM: Dynamic and Explainable Coordination of Multi-Robot Systems in Unknown Environments via Large Language Models," (IROS: Accepted)

- Homepage: https://tcxm.github.io/DEXTER-LLM/

J. Chen, Y. Zhu, X. Zhang, and M. Guo, "SLEI3D: Simultaneous Large-scale 3D Exploration Inspection and Interaction via Heterogeneous Fleets under Limited Communication," (TASE: Accepted)

- Homepage: SLEI3D: Simultaneous Exploration and Inspection via Heterogeneous Fleets under Limited Communication

ADDITIONAL INFORMATION

Skills: ROS (Robot Operating System), Linux, Git, Python, C++, Robot Hardware (Motive, Crazyfly UAV, Tello UAV, SCOUT UGV), Basic Knowledge of Machine Learning, Video Editing