Chi Zhang

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Educational Experience

University of Michigan — Ann Arbor, USA
MS, Robotics — 08/2024 - present

- GPA: 4.0/4.0
- Selected Courses: Optimization in Signal Process and Machine Leaning (A), Mobile Robotics (A)

Shanghai Jiao Tong University (SJTU) — Shanghai, China
Bachelor, Mechanical Engineering - Mathematics and Applied Mathematics — 09/2020 - 06/2024

- GPA: 3.82/4.3(Major), 3.71/4.3(Overall)
- Related Courses: Stochastic Process (A+), Scientific Computation (A+), Multi-robot System and Control (A-)

Research Interest

Developing robot learning algorithms that can generalize across tasks, handle uncertainty, and remain reliable in real-world environments. Specific interests include multi-task and hierarchical robot learning, uncertainty-aware planning and control, long-horizon decision-making, and perception for dynamic and partially observable environments.

Publications

Morphology-Aware Graph Reinforcement Learning for Tensegrity Robot Locomotion
Chi Zhang, Mingrui Li, Wenzhe Tong, and Xiaonan Huang
submitted to IEEE Robotics and Automation Letters(RA-L), 2025, arXiv:2510.26067

SPOT: Sensing-augmented Trajectory Planning via Obstacle Threat Modeling
Chi Zhang*, Xian Huang*, and Wei Dong
submitted to IEEE/ASME Transactions on Mechatronics(T-MECH), 2025, arXiv:2510.16308

Tensegrity Robot Endcap-Ground Contact Estimation with Symmetry-aware Heterogeneous Neural Network
Wenzhe Tong*, Yicheng Jiang*, **Chi Zhang**, Maani Ghaffari, Xiaonan Huang
submitted to IEEE International Conference on Soft Robotics(RoboSoft), 2025
[* denotes Equal contribution]

Selected Projects

Graph-based Reinforcement Learning for Tensegrity Robot Locomotion — 09/2024 - 08/2025
Robotics, University of Michigan, Ann Arbor — Advisor: Xiaonan Huang, Assistant Professor

▶ Developed a reinforcement learning framework for tensegrity robots that leverages robot morphology to improve learning efficiency and locomotion performance.

- Proposed a morphology-aware policy architecture by designing a Graph Neural Network (GNN)-based actor that encodes the physical topology of tensegrity robots, capturing intrinsic coupling between components.
- Integrated the GNN actor into the Soft Actor-Critic (SAC) framework, achieving faster convergence, higher final rewards, and improved sample efficiency compared to MLP-based baselines.
- Trained policies for locomotion primitives including straight-line tracking and in-place turning, which transferred successfully from simulation to a physical 3-bar tensegrity robot.
- Implemented a full ROS-based control pipeline and conducted real-world experiments with Vicon motion capture, validating stable sim-to-real transfer under hardware noise and actuation variability.

Sensing-augmented Trajectory Planning via Obstacle Threat Modeling — 11/2023 - 11/2024
School of Mechanical Engineering, SJTU — Advisor: Wei Dong, Associate Professor

▶ Developed a real-time observation-aware planning framework (SPOT: Sensing-augmented Planning via Obstacle Threat modeling) that enables UAVs with a single RGB-D camera to achieve dynamic obstacle avoidance in cluttered and uncertain environments.

- Proposed a Gaussian Process-based obstacle belief map that unifies the representation of recognized dynamic obstacles and potential unseen threats.
- Formulated an collision-aware observation urgency inference method that transforms spatial uncertainty and trajectory proximity into a time-varying urgency map for sensing prioritization.
- Designed a fast gradient-based optimization scheme (< 10 ms) that optimizes UAV trajectory and camera orientation under sensing constraints.
- Demonstrated improved obstacle awareness, detecting dynamic obstacles 2.8 s earlier and achieving safer navigation in cluttered, occluded environments compared to baselines.

Dynamic Visual SLAM using Hybrid Segmentation and Optical Flow 02/2025 - 04/2025
Robotics, University of Michigan, Ann Arbor Advisor: Maani Ghaffari

► This project aims to enhanced the robustness of visual SLAM in dynamic environments by masking moving regions using real-time segmentation and optical flow.

- Utilize YOLOv11-seg and FastSAM for real-time instance segmentation, and identify dynamic regions by analyzing differences in optical flow between segmented objects and the static background.
- Developed a real-time pipeline to improve ORB-SLAM3 performance in dynamic environments by excluding unstable feature points using generated dynamic masks. The method was validated on the TUM and Bonn benchmark datasets.

Obstacle-Aware Path Planning for Robotic Arm 06/2023 - 07/2023
Institute of Marine Equipment, SJTU Advisor: Yanjun Wang

► This project focuses on implementing a collision-free path planning algorithm for a robotic arm, given predefined start and goal positions.

- Develop both forward and inverse kinematics formulations using Denavit–Hartenberg (DH) parameters, and implement collision detection for the robotic arm using a simplified cylindrical approximation model.
- Developed an obstacle-aware path planning approach by implementing the Rapidly-exploring Random Tree (RRT) algorithm in the robot arm's joint space, validated through simulations in CoppeliaSim.

Work Experience

Instructional Assistant Fall 2025
University of Michigan
Duties include: Tutored students in "Mathematics for Robotics" during scheduled help sessions.
Supervisor: Dimitra Panagou

Robotics Research Intern Summer 2023
Institute of Marine Equipment, SJTU
Duties include: Conducted a short-term research project on robotic arm path planning and motion algorithms.
Supervisor: Yanjun Wang

Technical Skills

Programming: Python, C++, MATLAB
ML Frameworks: PyTorch, MuJoCo
DevOps: Ubuntu, Git, Docker
Robotics: ROS, MoCAP
Writing: LaTeX, Illustrator