

RESEARCH STATEMENT

My research lies in 3D computer vision including physics-based reconstruction, diffusion models, simulation, and 3D foundation models that enable robots to better localize, navigate, and understand their environment. I also do hardware design and prototype especially for robot perception systems.

EDUCATION

Carnegie Mellon University **Pittsburgh, PA, U.S.A.**
Ph.D. Candidate in Robotics *Jan. 2022 - Present*
- Supervisor & Reference: Dr. [Matthew Johnson-Roberson](#)

University of Michigan, Ann Arbor **Ann Arbor, MI, U.S.A.**
M.S. in Robotics, Ph.D. Pre-Candidacy in Robotics *Sept. 2018 – Dec. 2021*

Tianjin University **Tianjin, P.R.China**
Bachelor of Engineering *Sept. 2014 – July 2018*
- 2018 TJU Bachelor Thesis Research Award (1%)

INDUSTRY EXPERIENCE

Embedded System Engineer, Shanghai SLAMTEC *P.R.China, 2017*
- Tested IR range sensor and realized functions that prevent a wheeled robot from falling downstairs;

Robotics Engineer, Refraction AI *USA, 2019*
- Developed a novel LiDAR-camera calibration method based on intensity-based features [\[paper\]](#);
- Developed an automatic joint calibration pipeline for 12 cameras, 2 LiDARs and multiple IMUs on a single robot;

RESEARCH EXPERIENCE

Carnegie Mellon University / University of Michigan
Research Assistant, DROP (Deep Robot Optical Perception) Lab *2019- Present*
- Building robots: electronics, firmware and software development
- Robotic Algorithms: 3D representation learning and mapping for field robots [\[paper 1\]](#)[\[paper 2\]](#)[\[paper 3\]](#)[\[paper 4\]](#)
- Deploying robots: 2019 Lake Huron, 2019 Hawaii, 2023 Florida sea [\[news on NOAA.gov\]](#)[\[The LINK\]](#)
- On going projects: a) Large-scale 3D scene generation with diffusion model for field robots;
b) 3D foundation models for real-time robot state estimation.

Massachusetts Institute of Technology
Funded Visiting Undergraduate Researcher, Dept. of Mechanical Eng. *2018*
- Developed a method to reconstruct 3D flow field from 2D images (Reference: Dr. [Dixia Fan](#))

SKILLS

What I use: C/C++, CUDA, Python, Linux, ROS, OpenCV, Pytorch, SolidWorks, KiCAD

PUBLICATIONS (Peer-Reviewed)

T. Zhang, W. Zhi, K. Huang, J. Mangelson, C. Barbalata and M. Johnson-Roberson, “RecGS: Removing Water Caustic with Recurrent Gaussian Splatting”, *RA-L to appear*.

Weiming Zhi, Haozhan Tang, **Tianyi Zhang**, Matthew Johnson-Roberson, “3d foundation models enable simultaneous geometry and pose estimation of grasped objects”, *RA-L 2024*.

Weiming Zhi, Haozhan Tang, **Tianyi Zhang**, Matthew Johnson-Roberson, “Unifying representation and calibration with 3d foundation models”, *RA-L 2024*.

Qilin Sun, Weiming Zhi, **Tianyi Zhang**, Matthew Johnson-Roberson, “Diagrammatic Instructions to Specify Spatial Objectives and Constraints with Applications to Mobile Base Placement”, *IROS 2024*.

T. Zhang, K. Huang, W. Zhi and M. Johnson-Roberson, “DarkGS: Learning Neural Illumination and 3D Gaussians Relighting for Robotic Exploration in the Dark”, *IROS 2024 Oral*.

W. Zhi, **T. Zhang** and M. Johnson-Roberson, “Learning from Demonstration via Probabilistic Diagrammatic Teaching”, *ICRA 2024*.

T. Zhang and M. Johnson-Roberson, “Beyond NeRF Underwater: Learning Neural Reflectance Fields for True Color Correction of Marine Imagery”, *RA-L 2023, ICRA 2024*.

T. Zhang and M. Johnson-Roberson, “Learning Cross-Scale Visual Representations for Real-Time Image Geo-Localization”, *RA-L 2022, ICRA 2022*.

PUBLICATIONS (Lightly Peer-Reviewed and Preprint)

Xinyi Liu, **Tianyi Zhang**, Matthew Johnson-Roberson, Weiming Zhi, “SplaTraj: Camera Trajectory Generation with Semantic Gaussian Splatting”, *arXiv:2410.06014*.

Ziwen Yuan, **Tianyi Zhang**, Matthew Johnson-Roberson, Weiming Zhi, “PhotoReg: Photometrically Registering 3D Gaussian Splatting Models”, *arXiv:2410.05044*.

Quanting Xie, So Yeon Min, **Tianyi Zhang**, Aarav Bajaj, Ruslan Salakhutdinov, Matthew Johnson-Roberson, Yonatan Bisk, “Embodied-RAG: General Non-parametric Embodied Memory for Retrieval and Generation”, *NeurIPS 2024 LanGame Workshop*.

Jiayi Zheng, Guangmin Dai, Botao He, Zhaoyang Mu, Zhaochen Meng, **Tianyi Zhang**, Weiming Zhi, Dixia Fan, “ModCube: Modular, Self-Assembling Cubic Underwater Robot”, *arXiv:2409.15627*.

Xiaohao Xu, **Tianyi Zhang**, Sibao Wang, Yongqi Chen, Ye Li, Matthew Johnson-Roberson, Xiaonan Huang, “Customizable Perturbation Synthesis for Robust SLAM Benchmarking”, *ICRA2024 Late Breaking Result*.

Weiming Zhi, Kangni Liu, **Tianyi Zhang**, Matthew Johnson-Roberson, “Learning Orbitally Stable Systems for Diagrammatic Teaching”, *CoRL 2023 LEAP Workshop*.

Tianyi Zhang, Qilin Sun, Matthew Johnson-Roberson, “Learning Neural Reflectance Fields for True Color Correction and Novel-View Synthesis of Underwater Robotic Imagery”, *IROS 2023 PIES Workshop*.

TEACHING & SERVICES

Teaching Assistant, *Self-Driving Cars: Perception & Control* (UMich) *Fall 2021*

Teaching Assistant, *Self-Driving Cars: Perception & Control* (CMU) *Spring 2023*

Teaching Assistant, *Computer Vision* (CMU) *Fall 2023*

Reviewer, *IEEE Robotics and Automation Letters (RA-L)*

Reviewer, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*

Reviewer, *IEEE International Conference on Robotics and Automation (ICRA)*

Reviewer, *IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*

Reviewer, *ACM Knowledge Discovery and Data Mining (KDD)*