

# Tianyi Zhang

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🌐 <https://tianyizhang-arc.github.io/>

## EDUCATION

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- **ETH Zürich** 01/06/2025 – Now  
PhD in Robotics Zürich, Switzerland
- **ETH Zürich** 21/09/2021 – 31/03/2025  
M.Sc. in Robotics, Systems and Control, 5.78/6.0 Zürich, Switzerland
- **Harbin Institute of Technology** 01/09/2016 – 24/07/2020  
B.Eng. in Automation, 92.56/100.0 Harbin, China

## WORK EXPERIENCE

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- **Research Assistant** 30/09/2020 – 30/06/2021  
Department of Electrical and Electronic Engineering, Southern University of Science and Technology Shenzhen
  - Assisted in scientific research work related to robotics, including machine learning, computer vision, and path planning.
  - Conducted research in image-based heuristic path planning algorithms for mobile robots.
  - Participated in the preparation of ICRA 2021 conference and served as ICRA conference volunteer.

## PUBLICATIONS

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- **Robust Incremental Structure-from-Motion with Hybrid Features** 2023  
*Shaohui Liu\**, *Yidan Gao\**, **Tianyi Zhang\***, *Rémi Pautrat*, *Johannes L. Schönberger*, *Viktor Larsson*, *Marc Pollefeys*  
European Conference on Computer Vision ECCV 2024
- **Generative Adversarial Network based Heuristics for Sampling-based Path Planning** 2021  
**Tianyi Zhang**, *Jiankun Wang*, *Max Q.-H. Meng*  
IEEE/CAA Journal of Automatica Sinica, 2021
- **A Survey of Learning-based Robot Motion Planning** 2021  
*Jiankun Wang*, **Tianyi Zhang**, *Nachuan Ma*, *Zhaoting Li*, *Han Ma*, *Fei Meng*, *Max Q.-H. Meng*  
IET Cyber-Systems and Robotics

## TECHNICAL SKILLS

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**Programming:** Python, C++

**Developer Tools:** Pytorch, ROS, etc.

## PROJECTS

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- **Gaussian Splatting with Geometric Constraints** 31/05/2024 – 13/12/2024  
Tianyi Zhang Google Zürich & CVG, ETH Zürich  
*Master Thesis, Supervised by Kunyi Li, Shaohui Liu, Tobias Fischer, Michael Niemeyer, Federico Tombari, Marc Pollefeys*
  - Develop a method to achieve pose-free, sparse-view Gaussian Splatting by utilizing geometric constraints.
  - Explore the integration of multi-view correspondences used in bundle adjustment in Structure-from-Motion within the context of Gaussian Splatting, enforcing convergence toward a globally consistent geometric solution and improving both geometry reconstruction and pose optimization accuracy.
  - Demonstrate the effectiveness of the proposed method in pose estimation, novel view synthesis, and reconstruction quality.
- **Exploiting Uncertainty for Building Enhanced 3D Maps** 11/04/2023 – 17/11/2023  
Tianyi Zhang CVG, ETH Zürich  
*Semester Thesis, Supervised by Shaohui Liu, Marc Pollefeys*
  - Exploited the uncertainty for point and line mapping and developed a covariance propagation pipeline in both triangulation and bundle adjustment for mapping points and lines, which can be used to filter the degeneracy, identify unstable tracks, and help incorporate heterogeneous assumptions on the 2D observation noise.
  - Proposed the first method to analytically model the uncertainty of 3D optimized lines based on sensitivity analysis.
  - Demonstrated the effectiveness of the measured covariance for each 3D point/line track in the context of visual localization. The improvement is stable in both the point-alone localization and the hybrid point-line case.

## •Point-Based Radiance Fields for Controllable Human Motion Synthesis

01/03/2023 – 15/06/2023

Tianyi Zhang\*, Deheng Zhang\*, Haitao Yu\*, Peiyuan Xie\* (\* means equal contribution)  
Course Project of Digital Human 2023, Supervised by Sergey Prokudin

VLG, ETH Zürich

- Proposed a controllable model-free avatar motion synthesis pipeline for fine-level deformation based on static point-based radiance fields (point-NeRF) and Dynamic Point Fields.
- Introduced ray-bending to the point-NeRF by redirecting the querying ray through local rotation estimation of each point to ensure the consistency of the learned implicit representation in the deformed space with the one in the canonical space.
- Generated dataset of avatar and human characters and demonstrated the deformation quality and generalization ability on our dataset.

## •Floorplan Localization and Navigation

20/09/2022 – 01/01/2023

Tianyi Zhang\*, Ziteng Wang\*, Yuhan Zhang\*, Lan Feng\* (\* means equal contribution)  
Course Project of Mixed Reality 2022, Supervised by Mihai Dusmanu, Paul-Edouard Sarlin

CVG, ETH Zürich

- Presented an HoloLens application to support indoor floorplan localization and navigation.
- Designed a frontend interface in the HoloLens that displays the past trajectory on the floorplan minimap and shows a route to the destination selected by the users.
- Built a backend server for localization and navigation service, which uses the visual localization method to correct the localization drift and conduct a path planning algorithm to send back the navigation path.

## •Aligning lidar scans with 2D maps

01/03/2022 – 15/06/2022

Tianyi Zhang\*, Ziteng Wang\*, Shuyang Shi, Chenguang Gao (\* means equal contribution)  
Course Project of 3D Vision 2022, Supervised by Paul-Edouard Sarlin, Mihai Dusmanu

CVG, ETH Zürich

- Developed a 3D to 2D coarse-to-fine registration pipeline for large building scale datasets.
- Proposed a facade segmentation method and an optimization method based on distance maps, which improved the result to sub-pixel accuracy.
- Tested that the method is a generalized method that can be applied to different indoor and outdoor scenes.

## •End-to-End Hover Control using Optical Flow

01/03/2022 – 15/06/2022

Tianyi Zhang\*, Jiacheng Qiu\* (\* means equal contribution)  
Course Project of Perception and Learning for Robotics 2022, Supervised by Michael Pantic, Christian Lanegger

ASL, ETH Zürich

- Proposed a fully end-to-end RL-based sensorimotor controller to predict rotor commands using an onboard optical flow sensor and IMU for the hovering task.
- Developed a learning-based method to estimate state based on optical flow sensor, which is more robust during agile flight.
- Implemented and tested the robustness of the algorithm in the Airsim simulation environment.

## •Image-based Heuristics for Sampling-based Path Planning

30/09/2020 – 30/03/2021

Tianyi Zhang

Robotics, Perception & AI Lab, SUSTech

Supervised by Jiankun Wang, Max Q.-H. Meng

- Proposed a generative adversarial network (GAN) based heuristic method for non-uniform sampling-based path planning.
- Designed a GAN model to predict the promising region for achieving non-uniform sampling.
- Applied the GAN-based heuristic method to RRT\* and compared it with the conventional RRT\* algorithm, validating the effectiveness of the proposed method.
- Tested the generative capability of the proposed model and extended the model to 3D environments.