# ZHIRUI GAO

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## Short Bio

I am Zhirui Gao, 26, and currently in the third year of my Ph.D. in Computer Science, on track to graduate in **June 2026**. My research interests mainly include **correspondence estimation**, neural rendering (**NeRF and 3DGS**), 3D reconstruction (**SFM, DUSt3R, VGGT**), and **AIGen 3D** (**VAE, Diffusion**). My work has been published in leading venues, including ICCV, CVPR, TIP, TCSVT, CVMJ.

## Eduction

**National University of Defense Technology** Mar.2023 – Jun. 2026
Ph.D. Candidate | Research With Prof. Kai Xu and AProf. Renjiao Yi | Computer Science and Technology

**National University of Defense Technology** Sep.2021 – Dec. 2022
Master |Research With Prof. Kai Xu | Computer Science and Technology | GPA:88.1/100 (Rank:15/153)

**China University of Geosciences** Sep.2017 – Jun.2021
Bachelor | Computer Science and Technology | GPA:4.08/5.00 **(Rank:1/151)**

## HONARS & Awards

**National Scholarship** (2025,2018)
Excellent Student Scholarship (2024, 2023)
First Prize Freshman Scholarship (2023)
**Outstanding Graduates**, Top 3% (2021)
**Outstanding Bachelor's Degree Thesis**, Top 3% (2021)
National Encouragement Scholarship, Top 3% (2019, 2020)
National Second Prize in Contemporary Undergraduate Mathematical Contest in Modeling (**CUMCM**), Top 3% (2020)
**Silver Medal** in Asian Region of International Collegiate Programming Contest (**ACM-ICPC**), (2019)

## Publications

- **Zhirui Gao**, Renjiao Yi, Yuhang Huang, Wei Chen , Chenyang Zhu, and Kai Xu. 'Self-supervised Learning of Hybrid Part-aware 3D Representations of 2D Gaussians and Superquadrics'. **ICCV 2025, CCF-A**.
- **Zhirui Gao**, Renjiao Yi, Yaqiao Dai, Xuening Zhu, Wei Chen, Chenyang Zhu and Kai Xu. 'Curve-Aware Gaussian Splatting for 3D Parametric Curve Reconstruction'. **ICCV 2025, CCF-A**.
- **Zhirui Gao**, Renjiao Yi, Chenyang Zhu, Ke Zhuang, Wei Chen and Kai Xu. 'General Objects as Pose Porbes for Few-view NeRFs'. **IEEE TCSVT 2025, Top Journal of Chinese Academy of Sciences**.
- **Zhirui Gao**, Renjiao Yi, Zheng Qin, Yunfan Ye, Chenyang Zhu and Kai Xu. 'Learning accurate template matching with differentiable coarse-to-fine correspondence refinement'. **IEEE CVMJ 2024, IF:18.3**.
- Minhao Li, Zheng Qin, **Zhirui Gao**, Chenyang Zhu, Yulan Guo, and Kai Xu. '2d3d-matr: 2d-3d matching transformer for detection-free registration between images and point clouds'. **ICCV 2023, CCF-A**.
- Yunfan Ye, Renjiao Yi, **Zhirui Gao**, Chenyang Zhu, Zhiping Cai and Kai Xu. 'Nef: Neural edge fields for 3d parametric curve reconstruction from multi-view images'. **CVPR 2023, CCF-A**.
- Yunfan Ye, Renjiao Yi, **Zhirui Gao**, Zhiping Cai and Kai Xu. 'Delving into crispness: Guided label refinement for crisp edge detection'. **TIP 2023, CCF-A**.
- Huachen Gao, Shihe Shen, Zhe Zhang, Kaiqiang Xiong, Rui Peng, **Zhirui Gao**, Qi Wang, Yugui Xie, Ronggang Wang. 'Fdc-nerf: Learning pose-free neural radiance fields with flow-depth consistency'. **ICASSP 2024, CCF-B**.
- Yuqing Lan, Chenyang Zhu, **Zhirui Gao**, Jiazhao Zhang, Kai Xu. 'BoxFusion: Reconstruction-Free Open-Vocabulary 3D Object Detection via Real-Time Multi-View Box Fusion'. **PG 2025, CCF-B**.

## Research Experience

***Parametric Curve Anything. Work in progress.*** *May,2025 – Now*

- A feedforward model for 3D parametric curve reconstruction based on the **VGGT framework.**

***3D Scene graph generation. Work in progress.*** *Mar,2025 – Now*

- A 3D scene graph generation pipeline based on **VAE and Flow-matching models.**

***Part-aware structured reconstruction. (ICCV 2025)*** *Jan,2024 – Mar, 2025*

- A novel hybrid representation for p**art-aware 3D reconstruction**, combining the strengths of **superquadrics and Gaussian splatting** to achieve reasonable decomposition and high-quality rendering.
- Several novel regularizers to enforce consistency between 3D decomposition and 2D observations, enabling self-supervised part decomposition.

***Curve-Aware Gaussian Splatting. (ICCV 2025)*** *Jan,2024 – Mar, 2025*

- A novel **bi-directional coupling framework between parametric curves and edge-oriented Gaussian components**, enabling direct optimization of parametric curves through differentiable Gaussian splatting.
- A training-time structural refinement strategy that adaptively optimizes curve topology, achieving compact parametric curve reconstructions.

***General Objects as Pose Probes for Few-view NeRFs. (IEEE TSCVT 2025)*** *Apr,2023 – Jan,2024*

- Introduced **a Pose-NeRF pipeline** for few-view inputs, without requiring any pose priors.
- A dual-branch approach targeting both the object and the scene, introducing **multi-view geometric consistency and multi-layer feature-metric consistency** as novel training constraints within a joint pose-NeRF training pipeline.

***Learning accurate template matching. (IEEE CVMJ 2024)*** *Fec,2022 – Dec,2022*

- A **structure-aware and fully differentiable** template matching pipeline, avoiding the use of RANSAC found in other feature-matching approaches.
- An accurate template matching method based on **feature matching using transformer**, robust in challenging scenarios including cross-modality images, cluttered backgrounds, and untextured objects.

***2D-3D Matching Transformer for Detection-free Registration (ICCV 2023)*** *Jan,2023 – June,2023*

- The first detection-free coarse-to-fine matching network for 2D-3D registration which first establishes coarse correspondences of patch level and then refines them into dense correspondences of pixel/point level.
- **A transformer-based coarse matching module** learning well-aligned 2D and 3D features with both global contextual constraints and cross-modality correlations.

***Neural Edge Fields for 3D Parametric Curve Reconstruction. (CVPR 2023)*** *July,2022 – Oct,2022*

- A self-supervised 3D edge detection from multi-view 2D edges based **neural implicit field** optimization.
- A benchmark for evaluating and comparing various edge/curve extraction methods.