Hongrui Wu

Homepage ◇ Github ◇ LinkedIn ◇ OpenReview ◇

Phone: +86 (021) 15056988382 ◇ Email: `2152131@tongji.edu.cn`

EDUCATION

Tongji University

Bachelor of Computer Science and Technology	*Apr 2024 - Jul 2026*
AI in Construction in Civil Engineering college (switched)	*Sep 2021 - Apr 2024*

Score: 92.41/100 (CE: 92.2/CS: 94.2)   **GPA**: 4.75/5 (CE: 4.72/CS: 4.91)

Related courses: *Machine Learning, Calculus, Probability Theory, Linear Algebra, OOP, AI Principles, Pattern Recognition ...*

RESEARCH INTERESTS

- My research interests currently lie in **open-set understanding for 3D scenes** and **AIGC for 3D vision**. In the future, I aim to explore the application of generative models in **3D reconstruction tasks** and **3D scene re-editing**.

- Through developing scalable and efficient methods, I strive to bridge the gap between real-world data and AIGC, pushing the boundaries of 3D content generation and scene understanding for both academic and industrial applications.

RESEARCH EXPERIENCE

MOSS: Mask-Based Open-Vocabulary for 3D Scene Segmentation using Superpoint

Supervisors: Prof. Zhihua Wei and Prof. Wen Shen   [**PPT**]   [**Video**]   Oct 2024 - Present

- We proposed MOSS, a mask-based framework for open-set 3D scene understanding that leverages 2D pre-trained models like CLIP and SAM to enable efficient cross-dimensional feature transfer and inference.

- We identified limitations in 2D pre-trained models, lack of regional recognition and oversensitivity. We enhanced the frame by implementing global information input with mask constraints to strengthen attention and employing a density-guided dilation algorithm to optimize the matching precision between 2D and 3D masks.

- We also introduce a novel method to enhance 3D mask proposals, which leverages 2D prior knowledge to perform back-projection on a 3D pre-trained model. This approach guides the capture of superpoint clusters in the 3D scene, thereby improving the quality of the output results of fine-tuning the close-set model.

- I'm responsible for most of the idea, code, experiments and writing of this work.

- **Preparing for upcoming *ICCV 2025***

UniVerse: Unleashing the Consistent Prior of Video Diffusion Models for Robust Reconstruction

Supervisors: Prof. Sida Peng   Dec 2024 - Present

- We introduce UniVerse, the first Video Diffusion Model (VDM) based unified framework for robust reconstruction. Given any number of inconsistent multi-view images, UniVerse sorts and pads them into rough videos with masks, and then iteratively restores all of them into consistent images that match the style of the chosen reference image.

- We propose a novel training paradigm for VDMs, which includes a consistency loss function that focuses on making images consistent rather than generating novel views, and a new training data construction method that enables VDMs to learn to restore all inconsistent images into static, consistent images with the same style as the reference image.

- To the best of our knowledge, we are the first to couple the "restore" and "reconstruction" processes in robust reconstruction, demonstrating its strong potential and providing new insights to the community.

- **Preparing for upcoming *ICCV 2025***

ACHIEVEMENTS

National Scholarship	2021-2022
TianXiang Scholarship (2 slots one college)	2022-2023
Interdisciplinary Contest In Modeling hosted by COMAP Finalist Prize	2023
National Undergraduate Mathematics/Physics Competition: Third Prize/Second Prize	2022
International Concrete Dragon Boat Competition 2nd Prize	2022
ASCE Concrete Canoe Competition (2nd Place in California Section)	2024

SKILLS

Programming	Python, C++, MIPS
Technical Tools	Git, PyTorch, AutoCAD, Rhino, Linux, UNIX
Language	English: TOEFL-100, CET-596, IELTS-7

PROJECT & INTERN EXPERIENCE

Bridge Deck Inspection through Multi-Camera Vision
Team member   *supervised by Prof. Rujin Ma*   Feb 2022 - Mar 2023

- Developed a mobile robot-based vision system for real-time damage detection using Python and OpenCV.
- Implemented YOLOv5 for automated structural defect detection to enhance inspection safety.

Multi-Source Time Series Prediction for Urban Infrastructure Health
Team leader   *supervised by Prof. Jiazeng Shan in Glodon*   Mar 2023 - Apr 2024

- Developed deep learning models (clustering, LSTM, and Transformer) for urban infrastructure time series prediction using Glodon's datasets.
- Accomplished project deliverables resulting in one patent application and published a survey paper.

American Society of Civil Engineers Concrete Canoe Competition
Hull designer [Works][Video][PPT][Paper]   *hosted by ASCE in CA, US* May 2022 - Apr 2024

- Performed 3D reconstruction of the hull canoe using Colmap and CloudCompare to extract a surface envelope point set, controlling construction errors and ensuring surface form quality.
- Analyzed hull hydrodynamics via CFD simulation in Ansys Fluent based on Rhino-modeled geometry to optimize streamlined hull design.
- Validated navigation data using 3D-printed prototypes with IMU-motor setups.

3D Reconstruction for CAD Model Generation Based on Panoramic Images
Lab member   *supervised by Prof. Yujie Lu in AI Construction lab*   Nov 2023 - Apr 2024

- Developed an end-to-end pipeline for indoor 3D spatial mapping using Insta360 panoramic images, enabling rapid and lightweight 3D spatial mapping.
- Implemented algorithms for point cloud optimization and feature extraction to enable automated 3D-to-2D CAD model conversion.