Yi-Ruei Liu

Website: shigon255.github.io | GitHub: shigon255 | LinkedIn: yi-ruei-liu

Research Interests

3D/4D Reconstruction and Generation, Physically-Based Rendering, Robotics

Education

National Yang Ming Chiao Tung University Sep. 2026 - Sep. 2029 (Expected)
Ph.D. in Computer Science (Advisor: Prof. Yu-Lun Liu) *Hsinchu, Taiwan*

University of Illinois Urbana-Champaign Aug. 2024 - Dec. 2025
Master of Computer Science; GPA: 4.0/4.0 *Champaign, IL*

National Yang Ming Chiao Tung University Sep. 2021 - Jan. 2025
Bachelor of Computer Science; GPA: 4.27/4.3 *Hsinchu, Taiwan*

- Ranked 1st out of 167 students in the Department of Computer Science.
- Phi Tau Phi Honor Society inductee (top 1% nationwide).

Experience

AIIU Lab, Academia Sinica Jul. 2025 - Aug. 2025
Research Assistant (Advisor: Prof. Jun-Cheng Chen) *Taipei, Taiwan*

- Authored a research paper on synthesizing camera effects from real-world videos.
- Led the project development, including dataset construction, method implementation, and evaluation.

Comp Photo Lab, National Yang Ming Chiao Tung University May 2023 - Jun. 2024
Research Assistant (Advisor: Prof. Yu-Lun Liu) *Hsinchu, Taiwan*

- Researched and implemented algorithms for 3D shape reconstruction from single-view images under dynamic lighting.
- Co-authored a research paper on dynamic scene reconstruction with specular objects, contributing to method development and experiment analysis.

Publications

BRDFusion: Physics Meets Generation for Urban Scene Inverse Rendering Under Review
Yi-Ruei Liu, *Jie-Ying Lee, Zheng-Hui Huang, Yu-Lun Liu, Chih-Hao Lin*

- Combined physically based rendering with a diffusion-based generative prior (DiffusionRenderer) to achieve high-fidelity, controllable urban scene relighting.
- Achieved state-of-the-art novel-view relighting performance on a synthetic benchmark and superior visual quality on real-world urban scenes.
- Contributed to main algorithm implementation, dataset construction, experiments, and analysis.

Every Camera Effect, Every Time, All at Once: 4D Gaussian Ray Tracing for Physics-based Camera Effect Data Generation WACV 2027
NeurIPS 2025 SpaVLE Workshop, Oral

***Yi-Ruei Liu**, You-Zhe Xie, Yu-Hsiang Hsu, I-Sheng Fang, Yu-Lun Liu, Jun-Cheng Chen*

- Proposed a novel pipeline to synthesize realistic videos with physically correct camera effects from real-world videos using dynamic 3D Gaussian splatting and ray tracing.
- Achieved better reconstruction and synthesis quality than existing baselines.
- Led the overall project development and contributed to dataset construction, method implementation, and evaluation.

Skyfall-GS: Synthesizing Immersive 3D Urban Scenes from Satellite Imagery ECCV 2026

*Jie-Ying Lee, **Yi-Ruei Liu**, Shr-Ruei Tsai, Wei-Cheng Chang, Chung-Ho Wu, Jiewen Chan, Zhenjun Zhao, Chieh Hubert Lin, Yu-Lun Liu*

- The first method to synthesize immersive, real-time navigable 3D urban scenes solely from multi-view satellite imagery.
- Enables state-of-the-art 3D urban city reconstruction with superior realism and quality.
- Contributed to core algorithm development and experiment design.

SpectroMotion: Dynamic 3D Reconstruction of Specular Scenes CVPR 2025

*Cheng-De Fan, Chen-Wei Chang, **Yi-Ruei Liu**, Jie-Ying Lee, Jiun-Long Huang, Yu-Chee Tseng, Yu-Lun Liu*

- Proposed a novel method that combines dynamic 3D Gaussian splatting with physically based rendering for accurate reconstruction of dynamic, specular scenes.
- Achieved state-of-the-art dynamic 3D reconstruction of specular scenes.
- Contributed to core algorithm development, implementation, and experiment design.

Projects

Monocular Depth Estimation for 3D Diffuser Actor

Robot Learning Course Project

- Replaced costly depth sensors with monocular depth estimation (MDE) models for 3D robotic policy learning.
- Designed and tested drop-in and fine-tuning strategies using MDE models.
- Achieved strong performance with full fine-tuning, surpassing ground-truth baselines.

3D Anamorphic Object Generation with Diffusion Models

Computer Vision Course Project

- Developed an automated pipeline for generating anamorphic 3D objects that present different appearances from different viewing angles.
- Integrated text-to-image diffusion models to control the object's appearance based on user-defined prompts.

CNN Kernels in CUDA

Applied Parallel Programming Final Project

- Implemented CNN kernels in CUDA, profiled them, and proposed optimizations to improve performance.

Skills

- **Proficient:** Python, PyTorch, Git
- **Working knowledge:** CUDA, C/C++, Linux, Blender, ComfyUI
- **Languages:** Mandarin (Native), English (TOEFL 5.5/6.0), Japanese (JLPT N1)