113學年度大學部專題海報展

國立清華大學 資訊工程學系
National Tsing Hua University Department of Computer Science

Accident Scene Optimization: Enhanced Scene Scanning with Gaussian Splatting for Swift Vehicle Clearance

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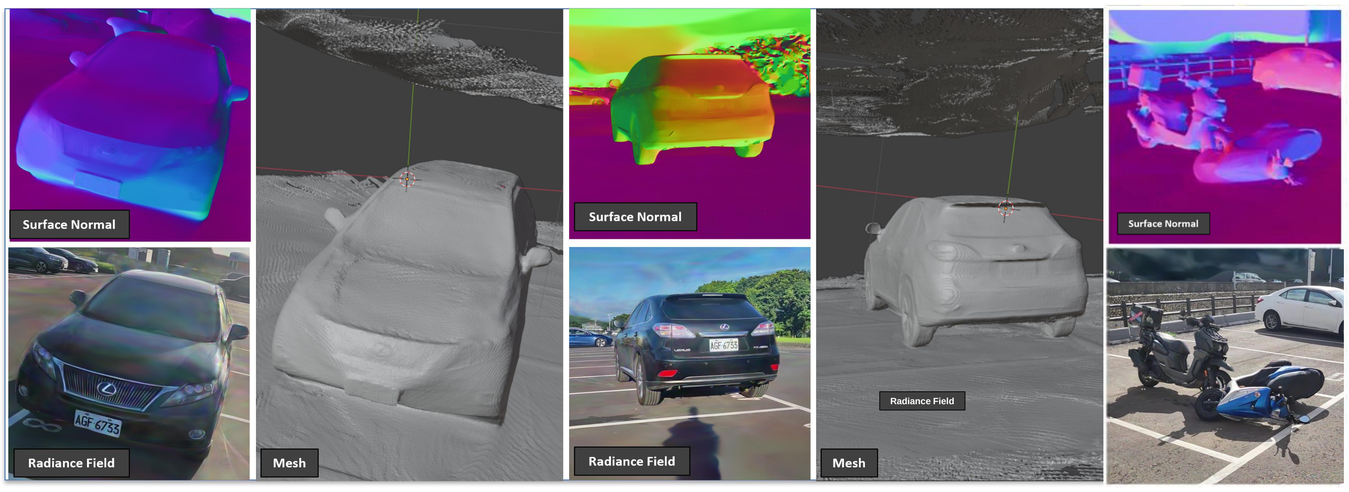

Figure 1. Surface normal, Radiance field, and Mesh for the car scene

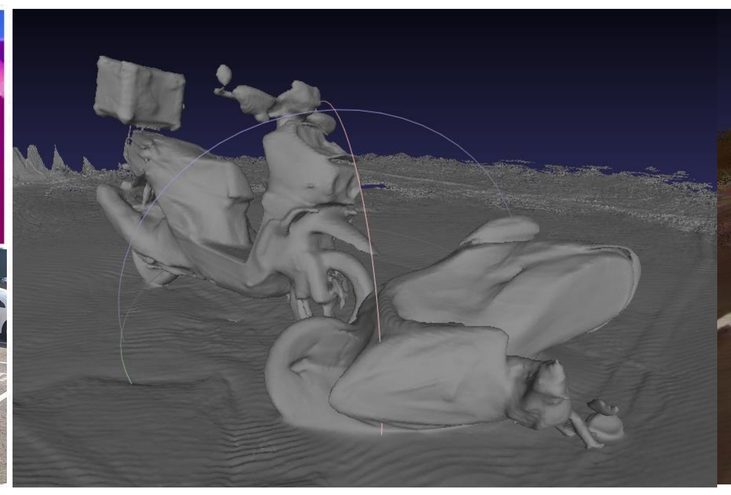

Figure 2. Surface normal, Radiance field, and Mesh for the scooter scene

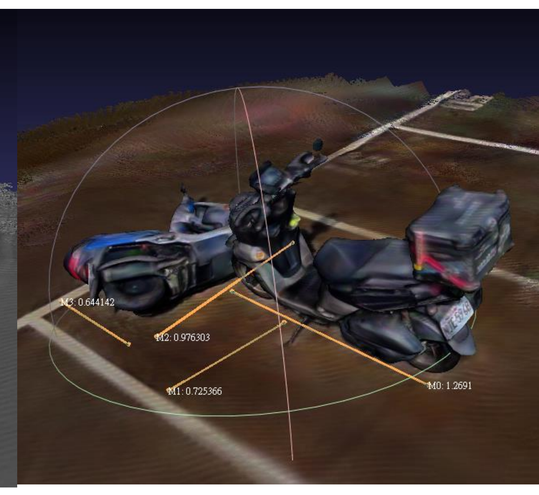

Figure 3. Example of calculating distance in mesh lab(scooter scene)

Abstract

This project aims to expedite vehicle removal following accidents through reconstructing 3D scene for evidence collection. However, extracting perfect meshes from 3D Gaussian splatting is challenging due to its volumetric nature. Therefore, we utilizes surfel gaussian splatting that support a view-consistent radiance field by using planar disks instead of 3D blobs. To address reflections, we adopted a three-stage deferred reflection training strategy, which prevents surface holes in the generated meshes.

Workflow

The public could record accident scenes by capturing video. We then extracts high-quality frames for 3D reconstruction. First, we Position cameras through COLMAP. Then, our Gaussian Model reconstruct the scene.

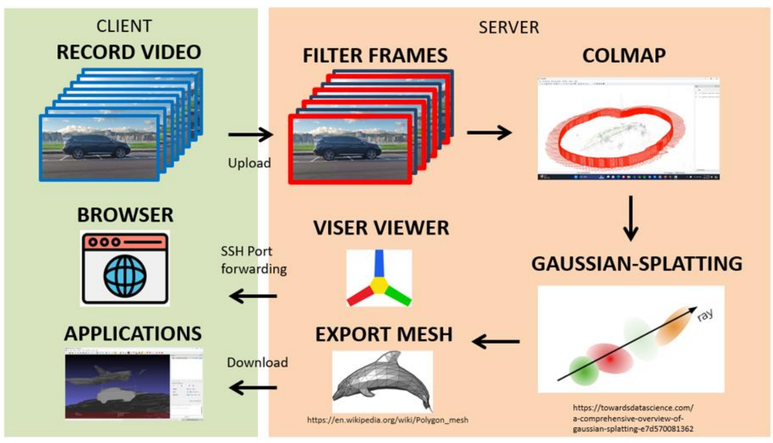

Figure 4. The overall workflow for our project

Last the public or the police could view the scene interactively in VISER viewer or measure distances via exported mesh.

Deferred reflection strategy

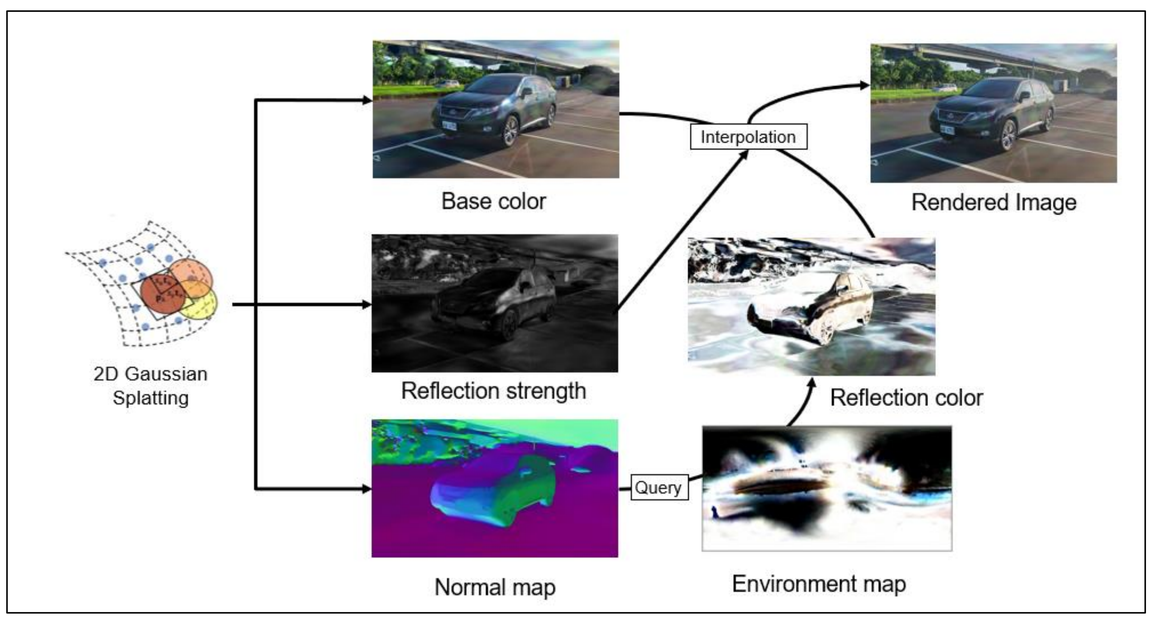

Figure 5. The rendering path for deferred reflection.

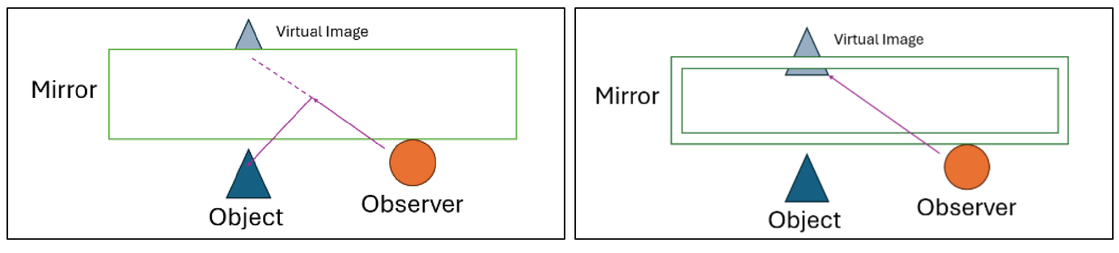

Figure 6. Illustration of how reflections can be mistaken for holes and distant objects if not accounted for in 3D reconstruction. The left image shows a real-world scenario, while the right image depicts the synthesized result where a reflection is incorrectly interpreted as a hole, revealing a distant object.

Results

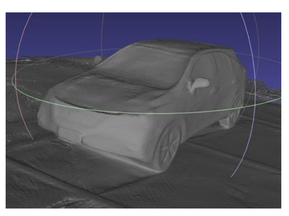

Figure 7. Mesh (OURS)

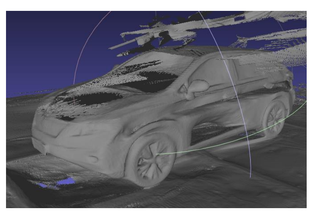

Figure 8. Mesh (2DGS)

Figure 9. Rendered images

Figure 10. Ground truth

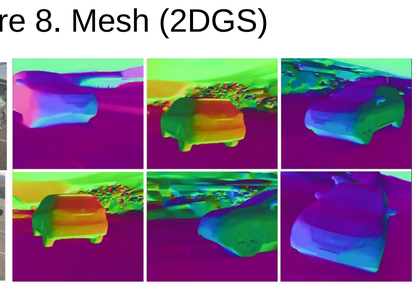

Figure 11. Normal maps

Table 1. Calculated distances (car)

GT(mm)		Mesh	Ratio	Calculated Distance	Error
Car length	4890	2.614198	1870.554564	4890	0.00%
Car Width	1895	1.04539		1955.459036	3.19%
Car Height	1705	0.971017		1816.340281	6.53%
Wheel base	2790	1.6264		3042.269943	9.04%
License Plate Length	380	0.216335		404.6664216	6.49%
License Plate Width	160	0.079961		149.5714135	-6.52%

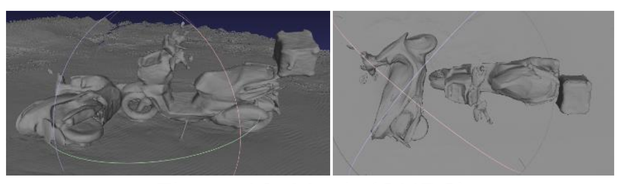

Figure 12. Mesh (OURS)

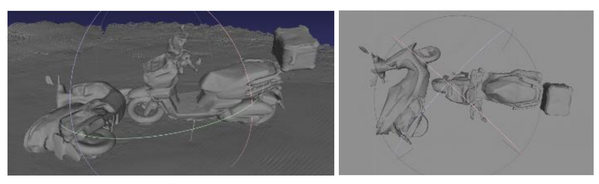

Figure 13. Mesh (2DGS)

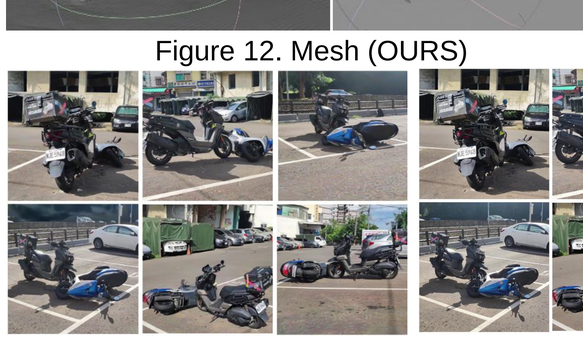

Figure 14. Rendered images

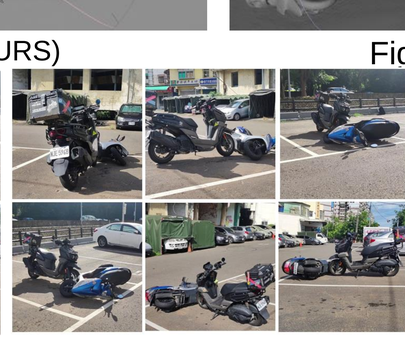

Figure 15. Ground truth

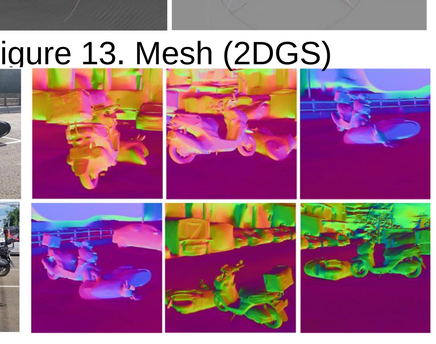

Figure 16. Normal maps

Table 2. Calculated distances (scooter)

GT(mm)			Mesh	Ratio	Calculated Distance	Error
Famous 125	Scooter Length	1810	1.545071	1171.467201	1810	0.00%
	Scooter Height	1090	0.870793		1020.105439	-6.41%
	Wheel base	1250	1.08271		1268.359253	1.47%
YAMAHA BWS	Scooter length	1920	1.499206		1756.270657	-8.53%
	Scooter Width	760	0.716573		839.4417668	10.45%
	Wheel base	1340	1.017562		1192.040508	-11.04%