DrivingGaussian: Composite Gaussian Splatting for Surrounding Dynamic Autonomous Driving Scenes

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SCAN ME

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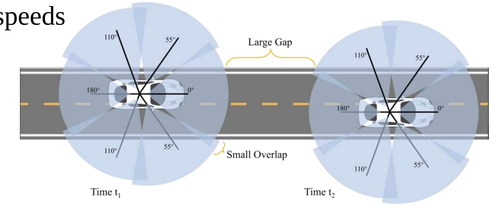
Introduction

Motivation

- **Surrounding driving scenes:** sparse vehicle-mounted sensors
- **Static backgrounds:** complex geometry, limited views
- **Multiple dynamic objects:** ego vehicles and dynamic objects moving at high speeds



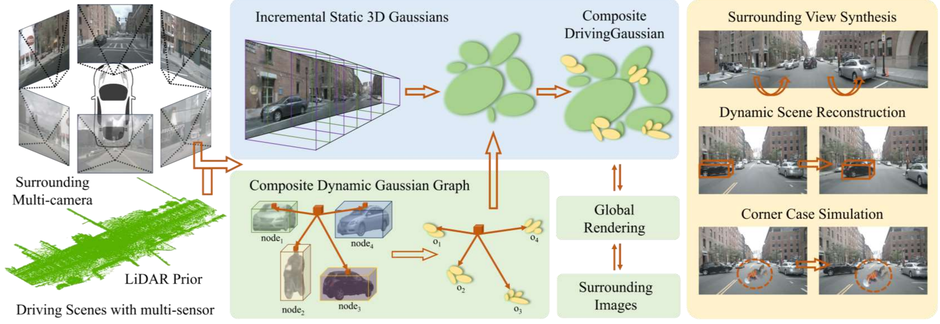
Contribution

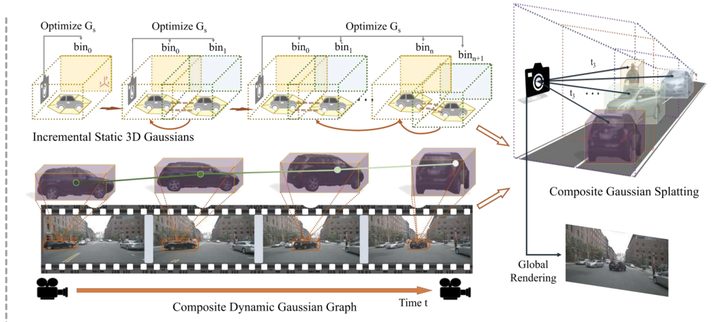
- First 3DGS framework for surrounding dynamic driving scenes
- Two effective modules: IS3G and CDGG with LiDAR prior
- Achieves photorealistic reconstruction and rendering

Method: DrivingGaussian

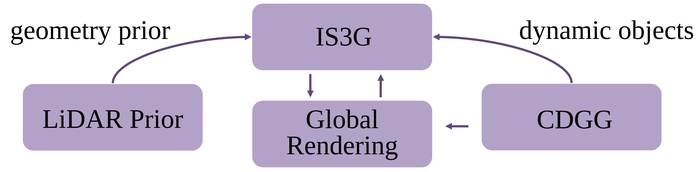
Method

- DrivingGaussian takes sequential data of multi-camera images and LiDAR
- Incrementally reconstructs background, constructs dynamic objects via Gaussian graph
- LiDAR prior for 3DGS, obtain better geometries and multi-camera consistency





Main Modules



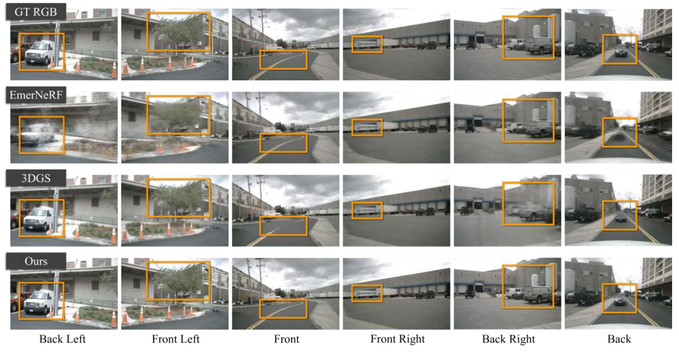
Experimental Results

Quantitative comparisons

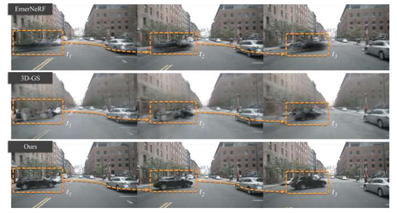
Methods	Input	PSNR ↑	SSIM ↑	LPIPS ↓
Instant-NGP [31]	Images	16.78	0.519	0.570
NeRF+Time	Images	17.54	0.565	0.532
NSG [32]	Images	21.67	0.671	0.424
Mip-NeRF [2]	Images	18.08	0.572	0.551
Mip-NeRF360 [3]	Images	22.61	0.688	0.395
Urban-NeRF [34]	Images + LiDAR	20.75	0.627	0.480
S-NeRF [50]	Images + LiDAR	25.43	0.730	0.302
SUDS [44]	Images + LiDAR	21.26	0.603	0.466
EmerNeRF [53]	Images + LiDAR	26.75	0.760	0.311
3DGS [17]	Images + SfM Points	26.08	0.717	0.298
4DGS [47]	Images + SfM Points	19.79	0.622	0.473
Ours-S	Images + SfM Points	28.36	0.851	0.256
Ours-L	Images + LiDAR	28.74	0.865	0.237

- DrivingGaussian enables photorealistic reconstruction and rendering quality.

Qualitative results on Nuscenes



Dynamic reconstruction



Corner case simulation

Qualitative results on KITTI360

- For more results and codes, please check our project page!