DeGauss: Dynamic-Static Decomposition with Gaussian Splatting for Distractor free 3D Reconstruction

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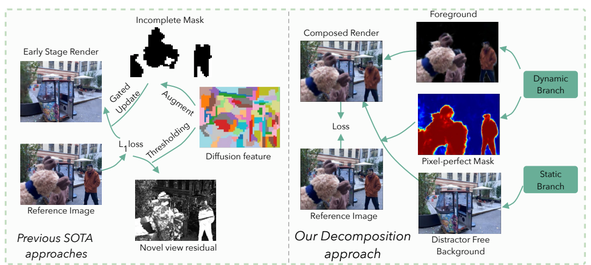
Background

Reconstructing clean, distractor-free 3D scenes from real-world, cluttered, and dynamic captures remains challenging, especially in casual captures such as egocentric videos. To address this issue, we propose DeGauss, a decoupled foreground-background design which leverages dynamic-static Gaussian splatting for robust and generalizable dynamic- static decomposition.

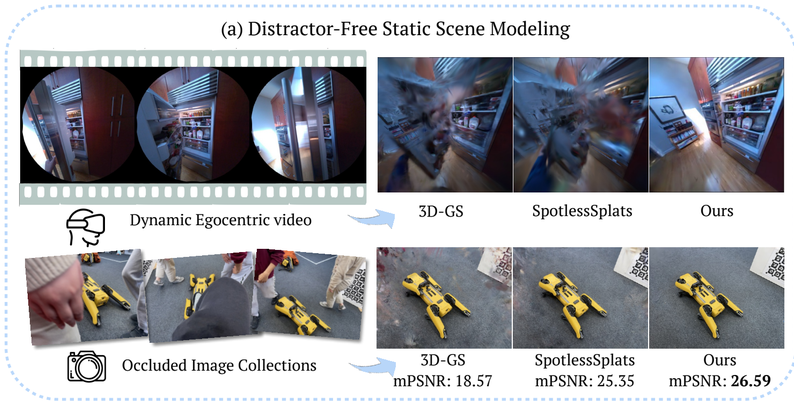
Key Insight

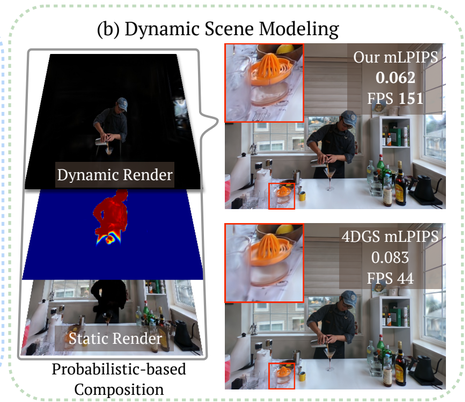
Leverage the complementary expressiveness of dynamic/static gaussians of separate branches to achieve minimum cross modeling

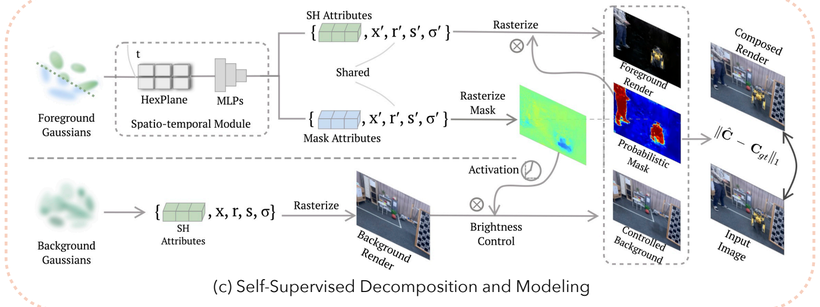


Conclusion

- Our proposed method DeGauss achieves SOTA distractor-free reconstruction results for both highly challenging egocentric videos and image collections.
- DeGauss also enables high-quality and efficient dynamic scene modeling through the decoupled dynamic-static representation.





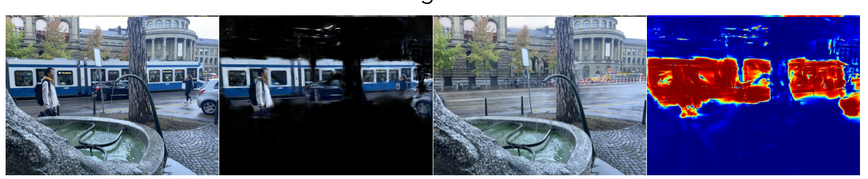


(c) Self-Supervised Decomposition and Modeling

With Self-supervised Dynamic-static decomposition based on the complementary expressiveness of foreground/background gaussian splatting (c), DeGauss models SOTA distractor-free static scene from noisy input (a) and yields high-quality & Efficient dynamic scene representation (b).

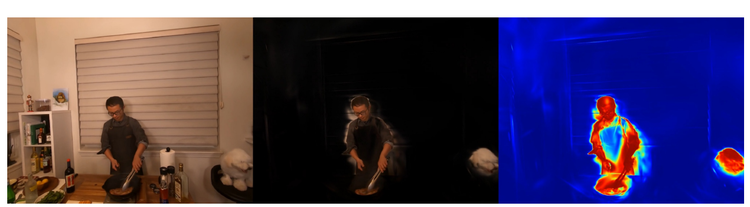
Distractor-free scene reconstruction on Nerf on-the-go dataset

	Mean		
	PSNR↑	SSIM↑	LPIPS↓
RobustNeRF [27]	19.64	0.583	0.369
NeRF On-the-go [26]	21.67	0.720	0.234
3DGS [13]	19.30	0.668	0.253
WildGaussian [15]	22.16	0.746	0.182
DeSplat‡ [41]	22.58	0.813	0.130
Spotlesssplats [28]	23.42	0.813	0.145
Ours	23.91	0.819	0.113



By leveraging Gaussian Splatting for Dynamic-static decomposition, we get:

Method	PSNR(↑)	SSIM(↑)	LPIPS(↓)	Training Time(↓)	FPS(↑)	Dyna. Gaussian nu
NeRFPlayer [26]	30.29	0.909	0.151	6 hours	0.045	-
HyperReel [1]	30.72	0.931	0.101	9 hours	2.0	-
HexPlane [3]	30.00	0.922	0.113	12 hours	0.2	-
KPlanes [6]	31.63	0.964	0.117	5.0 hours	0.3	-
SWinGS [25]	31.12	0.941	0.095	-	71	-
4DGS [31]	31.12	0.937	0.058	0.85 hours	53	124,197
4DGS† [31]	28.72	0.919	0.078	0.67 hours	68	62298
Ours	31.52	0.942	0.047	2.1 hours	71	56,533
Ours†	31.56	0.942	0.047	2 hours	157	22,479



Efficient Dynamic Scene Reconstruction on Neu3D dataset