Volumetric Plane-based Rendering: A Novel Approach for Internal View Synthesis in 3D Gaussian Splatting

Supplementary Material

A. Point Cloud Initialization

We observe that initializing 10 million Gaussians within the normalized coordinate range $[-1, 1]$ makes training unstable because it causes overly aggressive densification. With the same number of Gaussians distributed within a compact spatial range, the initial representation becomes excessively dense, and even modest updates to Gaussian positions produce large image-space errors. As a result, the position gradients frequently exceed the fixed densification threshold used in 3DGS, repeatedly triggering densification and exhausts GPU memory. Expanding the initialization range to $[-3, 3]$ spreads the Gaussians over a larger volume, reduces the effective initial density and stabilizes the gradient scale seen by the adaptive density control. Consequently, 10 million Gaussians are initialized randomly within this range.

B. Plane Rotation Evaluation

Table A summarizes novel-view synthesis under plane rotation, where the baseline denotes Mip-Splatting trained without GS-IR. To evaluate interpolation between adjacent training orientations, we generate novel test planes by rotating a training slicing plane to unseen intermediate orientations, with offsets ranging from θ to 5θ. On KiTS23 (CT), GS-IR consistently outperforms the baseline over rotation offsets from 10% to 40%, achieving higher PSNR and SSIM together with lower LPIPS and MSE. At a 10% rotation offset, GS-IR improves PSNR from 24.97 dB to 27.74 dB (+2.77 dB) and reduces LPIPS from 0.2045 to 0.1167. On IXI (MRI), GS-IR achieves higher PSNR than the baseline from 20% to 50%, with the largest gain at 50% (+0.99 dB), indicating stronger interpolation between adjacent training orientations. These results show that GS-IR yields more robust novel-view synthesis via plane rotation across both CT and MRI.

Table A. Novel-view synthesis via plane rotation. Each column corresponds to a rotation offset from θ to 5θ, i.e., 10% to 50% of the angular spacing between adjacent training planes defined in Fig. 6. The baseline denotes Mip-Splatting.

Model	Dataset	Metric	10%	20%	30%	40%	50%
MS-IR (Ours)	CT	PSNR↑	**27.74**	**25.30**	**24.03**	**23.29**	21.59
		SSIM↑	**0.8776**	**0.8348**	**0.8094**	**0.7931**	0.7737
		LPIPS↓	**0.1167**	**0.1490**	**0.1705**	**0.1841**	0.2535
		MSE($\times 10^{-3}$)↓	**1.865**	**3.275**	**4.391**	**5.193**	8.502
	MRI	PSNR↑	23.15	**21.80**	**20.77**	**20.07**	**20.47**
		SSIM↑	**0.8286**	**0.7910**	0.7647	0.7460	**0.7549**
		LPIPS↓	0.1005	0.1134	0.1238	0.1320	**0.1279**
		MSE($\times 10^{-3}$)↓	6.018	**6.938**	**7.835**	**8.554**	**7.286**
Baseline	CT	PSNR↑	24.97	23.77	22.88	22.18	**21.64**
		SSIM↑	0.8408	0.8173	0.7993	0.7853	**0.7744**
		LPIPS↓	0.2045	0.2180	0.2310	0.2423	**0.2514**
		MSE($\times 10^{-3}$)↓	3.351	4.627	5.927	7.201	**8.432**
	MRI	PSNR↑	**23.25**	21.08	20.55	19.91	19.48
		SSIM↑	0.8174	0.7846	**0.7680**	**0.7532**	0.7149
		LPIPS↓	**0.0993**	**0.1109**	**0.1165**	**0.1232**	**0.1279**
		MSE($\times 10^{-3}$)↓	**5.881**	7.196	8.241	8.876	9.150