gsplatam: Real-time Splat, Track, and Map with gsplat

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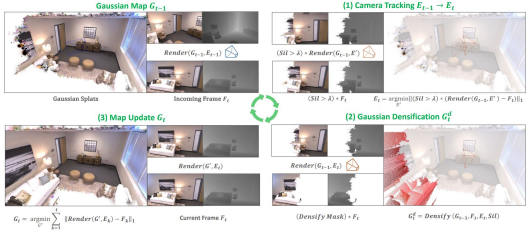
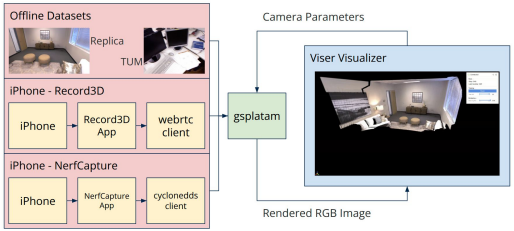
Motivation: SplaTAM [1]

+ High Quality Reconstruction
+ Simple
- Lack of Online Gaussian Visualization
- Slow
- 3D Gaussians Geometrically Inaccurate





Interactive Visualization

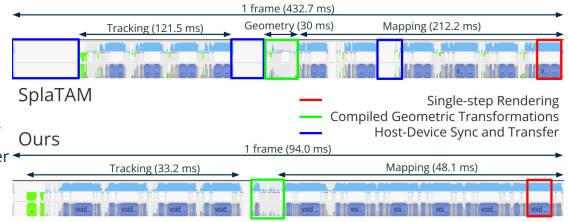
SplaTAM provides point cloud visualization

We use viser to visualize rendered gaussians

We add a webrtc client for 15 fps mapping

Runtime Optimization

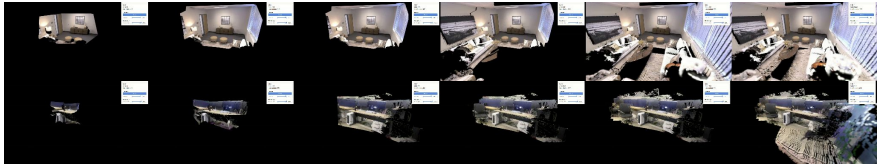
1. Single-step Rendering with Gsplat
2. Compiled Geometric Transformations
3. Remove Host-device Sync and Transfer
4. Decrease Number of Iterations



Results: Replica Dataset

Setting	Methods	Track Time (s/frame) ↓	Map Time (s/frame) ↓	Total Time (s/frame) ↓	Num Gaussians ↓	ATE RMSE (cm) ↓	PSNR (db) ↑	Depth L1 (cm) ↓
base	reported	1.00	1.44	-	-	0.27	32.81	0.49
	reproduced	2.74	4.94	7.85	5,085,417	0.32	32.48	0.51
	ours	0.32	0.59	0.93	973,059	0.05	35.78	0.25
small	reported	0.19	0.33	-	-	0.39	-	-
	reproduced	0.27	0.45	0.84	931,214	0.52	29.29	0.83
	ours	0.08	0.14	0.24	1,101,708	0.28	30.44	0.55
tiny	reported	-	-	-	-	-	-	-
	reproduced	0.10	0.17	0.39	880,241	6.40	22.97	4.31
	ours	0.03	0.05	0.10	954,972	0.26	22.92	3.28

Results: Rendered Gaussians



Results: Comparison of Gaussians

Type	Covariance	Track Time (s/frame) ↓	Map Time (s/frame) ↓	Total Time (s/frame) ↓	Num Gaussians ↓	ATE RMSE (cm) ↓	PSNR (db) ↑	Depth L1 (cm) ↓
3D	Isotropic	0.03	0.05	0.10	984,531	0.26	23.17	2.58
3D	Anisotropic	0.03	0.05	0.10	954,972	0.26	22.92	3.28
2D	Isotropic	0.12	0.16	0.30	1,193,273	0.60	23.66	2.33
2D	Anisotropic	0.11	0.16	0.29	1,171,766	0.60	23.11	2.74

[1] Keetha et al. SplaTAM: Splat, Track & Map 3D Gaussians for Dense RGB-D SLAM. (CVPR 2024)