

Online Resource 1

Supplementary Materials

Per-Scene Quantitative Results for “PSCD-GS: Role-Aware Perception-Structure Collaborative Densification for 3D Gaussian Splatting”

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Note: PSNR, peak signal-to-noise ratio; SSIM, structural similarity index measure; LPIPS, learned perceptual image patch similarity; #G, final number of Gaussian primitives in millions. Higher PSNR and SSIM values are better, whereas lower LPIPS values are better. #G is reported as an indicator of representation scale rather than as an independently ranked metric.

Table S1. Per-scene quantitative results on Mip-NeRF 360

Method	Scene	PSNR ↑	SSIM ↑	LPIPS ↓	#G (M)
3DGS	bicycle	27.2547	0.8257	0.2093	3.4113
3DGS	flowers	27.3418	0.8197	0.2023	3.2351
3DGS	garden	27.9271	0.8182	0.2066	3.2561
3DGS	stump	27.2525	0.8206	0.2098	3.3883
3DGS	treehill	27.4340	0.8186	0.2098	3.2544
3DGS	bonsai	27.2786	0.8190	0.2038	3.3870
3DGS	counter	27.4871	0.8274	0.1994	3.1074
3DGS	kitchen	27.7166	0.8217	0.2051	3.4153
3DGS	room	28.0487	0.8217	0.1962	3.2451
3DGS	average	27.5268	0.8214	0.2047	3.3000
AbsGS	bicycle	27.8253	0.8258	0.1769	3.5017
AbsGS	flowers	27.4889	0.8295	0.1917	3.4152
AbsGS	garden	27.7177	0.8415	0.1882	3.5399
AbsGS	stump	27.5251	0.8393	0.1876	3.2832
AbsGS	treehill	27.5122	0.8365	0.1884	3.3181
AbsGS	bonsai	27.8548	0.8306	0.1878	3.5143
AbsGS	counter	27.8917	0.8364	0.1923	3.2417
AbsGS	kitchen	27.1094	0.8382	0.1766	3.4789
AbsGS	room	27.5936	0.8335	0.1882	3.3070
AbsGS	average	27.6132	0.8346	0.1864	3.4000
Pixel-GS	bicycle	28.0130	0.8344	0.1772	5.5360
Pixel-GS	flowers	27.6930	0.8312	0.1793	5.8022
Pixel-GS	garden	27.5996	0.8328	0.1839	5.5896
Pixel-GS	stump	27.6954	0.8287	0.1809	5.4941
Pixel-GS	treehill	27.9935	0.8287	0.1814	5.6612
Pixel-GS	bonsai	28.0132	0.8356	0.1856	5.5029
Pixel-GS	counter	27.9790	0.8270	0.1883	5.6021
Pixel-GS	kitchen	27.2983	0.8312	0.1972	5.6233
Pixel-GS	room	27.4515	0.8356	0.1786	5.5885
Pixel-GS	average	27.7485	0.8317	0.1836	5.6000
Mini-Splatting	bicycle	27.1984	0.8374	0.1727	4.5623
Mini-Splatting	flowers	27.4348	0.8264	0.1714	4.7029
Mini-Splatting	garden	27.5453	0.8275	0.1739	4.8638

Method	Scene	PSNR ↑	SSIM ↑	LPIPS ↓	#G (M)
Mini-Splatting	stump	27.3122	0.8345	0.1761	4.6482
Mini-Splatting	treehill	27.6703	0.8369	0.1765	4.7443
Mini-Splatting	bonsai	27.7916	0.8353	0.1869	4.7905
Mini-Splatting	counter	27.8501	0.8254	0.1731	4.7566
Mini-Splatting	kitchen	27.5441	0.8364	0.1693	4.6651
Mini-Splatting	room	27.9101	0.8362	0.1687	4.5662
Mini-Splatting	average	27.5841	0.8329	0.1743	4.7000
Taming 3DGS	bicycle	27.6464	0.8177	0.1888	3.4480
Taming 3DGS	flowers	27.8492	0.8234	0.1875	3.2453
Taming 3DGS	garden	28.2752	0.8168	0.1767	3.3472
Taming 3DGS	stump	28.1751	0.8306	0.1847	3.3781
Taming 3DGS	treehill	28.4354	0.8175	0.1750	3.2622
Taming 3DGS	bonsai	27.8629	0.8261	0.1816	3.2693
Taming 3DGS	counter	27.7770	0.8275	0.1768	3.3746
Taming 3DGS	kitchen	27.7829	0.8250	0.1806	3.2505
Taming 3DGS	room	28.4426	0.8297	0.1928	3.1248
Taming 3DGS	average	28.0274	0.8238	0.1827	3.3000
3DGS-MCMC	bicycle	28.0844	0.8318	0.1993	3.2129
3DGS-MCMC	flowers	27.9734	0.8352	0.1791	3.2193
3DGS-MCMC	garden	27.9188	0.8314	0.1968	3.2863
3DGS-MCMC	stump	27.9680	0.8347	0.1833	3.4442
3DGS-MCMC	treehill	28.3500	0.8363	0.1927	3.2407
3DGS-MCMC	bonsai	28.4630	0.8426	0.1799	3.1753
3DGS-MCMC	counter	27.9438	0.8409	0.1998	3.4220
3DGS-MCMC	kitchen	28.2133	0.8369	0.1888	3.2965
3DGS-MCMC	room	28.3111	0.8468	0.1949	3.4027
3DGS-MCMC	average	28.1362	0.8374	0.1905	3.3000
SteepGS	bicycle	28.3794	0.8268	0.1850	2.2975
SteepGS	flowers	28.2641	0.8250	0.1943	2.3416
SteepGS	garden	28.5312	0.8299	0.1955	2.4105
SteepGS	stump	28.0840	0.8338	0.1959	2.1150
SteepGS	treehill	27.9207	0.8227	0.1953	2.3554
SteepGS	bonsai	28.1367	0.8252	0.1862	2.1320
SteepGS	counter	27.8462	0.8307	0.2018	2.3897
SteepGS	kitchen	27.7757	0.8235	0.1873	2.3066
SteepGS	room	28.0953	0.8189	0.1921	2.3518
SteepGS	average	28.1148	0.8263	0.1926	2.3000
Perceptual-GS	bicycle	27.6415	0.8242	0.1959	2.7402
Perceptual-GS	flowers	27.6003	0.8351	0.2112	2.8637
Perceptual-GS	garden	28.2033	0.8255	0.2106	2.9085
Perceptual-GS	stump	27.5205	0.8236	0.2022	2.6302
Perceptual-GS	treehill	28.0615	0.8240	0.1991	2.7934
Perceptual-GS	bonsai	27.9978	0.8258	0.2019	2.8909
Perceptual-GS	counter	28.2723	0.8265	0.2097	2.8460
Perceptual-GS	kitchen	28.1586	0.8333	0.1938	2.7424
Perceptual-GS	room	28.3309	0.8330	0.1918	2.7847
Perceptual-GS	average	27.9763	0.8279	0.2018	2.8000
Deng et al.	bicycle	28.0333	0.8311	0.1753	1.7515
Deng et al.	flowers	28.4463	0.8439	0.1877	1.6959
Deng et al.	garden	28.1270	0.8415	0.1835	1.6817
Deng et al.	stump	28.0481	0.8321	0.1759	1.7654

Method	Scene	PSNR ↑	SSIM ↑	LPIPS ↓	#G (M)
Deng et al.	treehill	28.0383	0.8370	0.1960	1.8969
Deng et al.	bonsai	28.0922	0.8282	0.1902	1.9266
Deng et al.	counter	27.9941	0.8428	0.1754	1.8424
Deng et al.	kitchen	28.2303	0.8436	0.1893	1.7636
Deng et al.	room	28.3188	0.8426	0.1934	1.8760
Deng et al.	average	28.1476	0.8381	0.1852	1.8000
PSCD-GS (Ours)	bicycle	27.8334	0.8373	0.1857	2.8623
PSCD-GS (Ours)	flowers	27.9488	0.8357	0.1831	2.7154
PSCD-GS (Ours)	garden	28.8215	0.8449	0.1753	3.0089
PSCD-GS (Ours)	stump	28.1296	0.8387	0.1850	2.7964
PSCD-GS (Ours)	treehill	27.7121	0.8350	0.1865	2.5999
PSCD-GS (Ours)	bonsai	28.5973	0.8432	0.1764	2.9235
PSCD-GS (Ours)	counter	28.4053	0.8415	0.1790	2.8578
PSCD-GS (Ours)	kitchen	28.4890	0.8404	0.1804	2.7491
PSCD-GS (Ours)	room	28.2580	0.8397	0.1813	2.6867
PSCD-GS (Ours)	average	28.2439	0.8396	0.1814	2.8000

Table S2. Per-scene quantitative results on Deep Blending

Method	Scene	PSNR↑	SSIM↑	LPIPS↓	#G (M)
3DGS	Dr Johnson	29.6021	0.9047	0.2428	2.7085
3DGS	Playroom	29.5321	0.9021	0.2514	2.8915
3DGS	average	29.5671	0.9034	0.2471	2.8000
AbsGS	Dr Johnson	29.5777	0.9107	0.2490	1.8358
AbsGS	Playroom	29.0991	0.9125	0.2424	1.9642
AbsGS	average	29.3384	0.9116	0.2457	1.9000
Pixel-GS	Dr Johnson	28.8814	0.9021	0.2577	4.4834
Pixel-GS	Playroom	28.8684	0.8975	0.2435	4.7166
Pixel-GS	average	28.8749	0.8998	0.2506	4.6000
Mini-Splatting	Dr Johnson	29.6917	0.9044	0.2358	4.7282
Mini-Splatting	Playroom	29.8007	0.9102	0.2258	4.4718
Mini-Splatting	average	29.7462	0.9073	0.2308	4.6000
Taming 3DGS	Dr Johnson	29.7909	0.9036	0.2416	1.7907
Taming 3DGS	Playroom	30.1821	0.9058	0.2372	1.8093
Taming 3DGS	average	29.9865	0.9047	0.2394	1.8000
3DGS-MCMC	Dr Johnson	30.3242	0.9160	0.2353	2.8937
3DGS-MCMC	Playroom	30.0052	0.9184	0.2377	2.7063
3DGS-MCMC	average	30.1647	0.9172	0.2365	2.8000
SteepGS	Dr Johnson	30.0741	0.9170	0.2444	1.5280
SteepGS	Playroom	29.6731	0.9146	0.2434	1.6720
SteepGS	average	29.8736	0.9158	0.2439	1.6000
Perceptual-GS	Dr Johnson	29.8806	0.9082	0.2246	2.9134
Perceptual-GS	Playroom	30.0158	0.9088	0.2168	2.8866
Perceptual-GS	average	29.9482	0.9085	0.2207	2.9000
Deng et al.	Dr Johnson	30.3557	0.9128	0.2302	1.1253
Deng et al.	Playroom	30.0589	0.9164	0.2246	1.2747
Deng et al.	average	30.2073	0.9146	0.2274	1.2000
PSCD-GS (Ours)	Dr Johnson	30.3493	0.9201	0.2210	2.7568
PSCD-GS (Ours)	Playroom	30.2429	0.9167	0.2276	3.0432
PSCD-GS (Ours)	average	30.2961	0.9184	0.2243	2.9000

Table S3. Per-scene quantitative results on Tanks & Temples

Method	Scene	PSNR↑	SSIM↑	LPIPS↓	#G (M)
3DGS	train	24.6431	0.8466	0.1702	1.1924
3DGS	truck	24.5240	0.8524	0.1732	1.2076
3DGS	average	24.5836	0.8495	0.1717	1.2000
AbsGS	train	24.0143	0.8500	0.1787	1.2948
AbsGS	truck	23.9219	0.8564	0.1803	1.3052
AbsGS	average	23.9681	0.8532	0.1795	1.3000
Pixel-GS	train	23.7578	0.8584	0.1690	4.5678
Pixel-GS	truck	23.8950	0.8492	0.1716	4.4322
Pixel-GS	average	23.8264	0.8538	0.1703	4.5000
Mini-Splatting	train	23.4283	0.8526	0.1590	4.2438
Mini-Splatting	truck	23.2267	0.8582	0.1666	4.3562
Mini-Splatting	average	23.3275	0.8554	0.1628	4.3000
Taming 3DGS	train	24.1905	0.8658	0.1641	2.8010
Taming 3DGS	truck	23.9473	0.8594	0.1667	2.7990
Taming 3DGS	average	24.0689	0.8626	0.1654	2.8000
3DGS-MCMC	train	24.0725	0.8647	0.1615	1.2613
3DGS-MCMC	truck	24.4999	0.8667	0.1577	1.1387
3DGS-MCMC	average	24.2862	0.8657	0.1596	1.2000
SteepGS	train	24.1715	0.8741	0.1667	1.3083
SteepGS	truck	24.1631	0.8743	0.1603	1.2917
SteepGS	average	24.1673	0.8742	0.1635	1.3000
Perceptual-GS	train	24.7021	0.8718	0.1525	1.6718
Perceptual-GS	truck	24.5053	0.8678	0.1463	1.7282
Perceptual-GS	average	24.6037	0.8698	0.1494	1.7000
Deng et al.	train	24.5111	0.8703	0.1475	1.1845
Deng et al.	truck	24.6671	0.8769	0.1377	1.2155
Deng et al.	average	24.5891	0.8736	0.1426	1.2000
PSCD-GS (Ours)	train	24.6573	0.8789	0.1448	1.2944
PSCD-GS (Ours)	truck	24.5363	0.8841	0.1366	1.3056
PSCD-GS (Ours)	average	24.5968	0.8815	0.1407	1.3000