RefSR-NeRF: Towards High Fidelity and Super Resolution View Synthesis Supplementary Materials

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Table 1. Quantitative comparison for novel view synthesis on the the real forward-facing dataset [1]. With the input resolution 504×378, we report the quantitative metrics for upsampling scale at $\times$ 2, $\times$ 4 and $\times$ 8. In addition to considerable acceleration, our method achieves more robust performance with the increasing of rendering scales.

Method	Metrics (NeRF-Blender×4)		
	PSNR↑	SSIM↑	LPIPS↓
Bicubic	26.46	0.926	0.154
NeRF-LR [2]	24.56	0.913	0.131
Ours	27.88	0.944	0.101
Method	**Metrics (NeRF-Blender×8)**		
	PSNR↑	SSIM↑	LPIPS↓
Bicubic	23.98	0.893	0.188
NeRF-LR [2]	21.62	0.873	0.179
Ours	25.31	0.909	0.171

Table 2. The ablations of the proposed RefSR model. Metrics are reported on NeRF-LLFF $\times$4 experiment setting.

Method	Metrics (NeRF-LLFF×4)		
	PSNR↑	SSIM↑	LPIPS↓
NeRF-LR	24.47	0.701	0.388
NeRF+TTSR [2]	23.43	0.72	0.39
NeRF+DATSR [3]	24.71	0.834	0.398
Ours	25.37	0.849	0.391

1. Sythetic 360° Dataset Details

We evaluate our method on the sythetic 360° dataset provided by the original NeRF paper. And we present the rendering quality on all 8 scenes. In our experiments, each scene takes 100 images for training and 25 images for testing. we report two experimental: scales $\times$ 4 with 200×200 LR resolution (Table 3, 4 and 5) and scales $\times$ 8 with 100×100 LR resolution (Table 6, 7 and 8).

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2. The Real World Forward-Facing Dataset Details

we evaluate our method on the forward-facing dataset [1] and report each scene's quantitive results, containing PSNR, SSIM, and VGG LPIPS. We test the scale for $\times$ 2. (Table 9, 10, and 11), $\times$ 4 (Table 12, 13, and 14), and $\times$ 8 (Table 15, 16, and 17). For vanilla NeRF, in addition to training and testing models at high resolution, termed NeRF-HR, we also provide the model trained at low resolution and render at high resolution using spacial super-sampling (NeRF-LR).

References

[1] B. Mildenhall, P. P. Srinivasan, R. Ortiz-Cayon, N. K. Kalantari, R. Ramamoorthi, R. Ng, and A. Kar. Local light field fusion: Practical view synthesis with prescriptive sampling guidelines. *ACM Transactions on Graphics (TOG)*, 38(4):1–14, 2019. 1

[2] B. Mildenhall, P. P. Srinivasan, M. Tancik, J. T. Barron, R. Ramamoorthi, and R. Ng. Nerf: Representing scenes as neural radiance fields for view synthesis. In *ECCV*, 2020. 1, 2, 3, 4

[3] C. Wang, X. Wu, Y.-C. Guo, S.-H. Zhang, Y.-W. Tai, and S.-M. Hu. Nerf-sr: High-quality neural radiance fields using super-sampling. *arXiv preprint arXiv:2112.01759*, 2021. 1

Table 3. PSNR↑, test on the sythetic 360° dataset for scale ×4 .

Method	PSNR (Blender×4)								
	chair	drums	ficus	hotdog	lego	materials	mic	ship	Avg
Bicubic	28.06	22.31	26.20	31.45	26.52	24.44	27.49	25.20	26.46
NeRF-LR [2]	26.44	21.33	24.67	28.56	24.35	22.92	24.65	23.56	24.56
Ours	29.17	22.86	26.88	34.04	28.04	25.75	29.98	26.30	27.88

Table 4. SSIM↑, test on the sythetic 360° dataset for scale ×4 .

Method	SSIM (Blender×4)								
	chair	drums	ficus	hotdog	lego	materials	mic	ship	Avg
Bicubic	0.934	0.896	0.940	0.968	0.922	0.916	0.955	0.879	0.926
NeRF-LR [2]	0.922	0.886	0.926	0.957	0.898	0.903	0.945	0.866	0.913
Ours	0.951	0.917	0.952	0.980	0.947	0.939	0.972	0.896	0.944

Table 5. LPIPS↓, test on the sythetic 360° dataset for scale ×4 .

Method	LPIPS (Blender×4)								
	chair	drums	ficus	hotdog	lego	materials	mic	ship	Avg
Bicubic	0.119	0.213	0.091	0.146	0.152	0.142	0.081	0.285	0.154
NeRF-LR [2]	0.108	0.168	0.096	0.077	0.141	0.141	0.069	0.244	0.131
Ours	0.083	0.127	0.066	0.056	0.102	0.105	0.049	0.223	0.101

Table 6. PSNR↑, test on the sythetic 360° dataset for scale ×8 .

Method	PSNR (Blender×8)								
	chair	drums	ficus	hotdog	lego	materials	mic	ship	Avg
Bicubic	25.81	21.05	23.26	28.29	23.34	22.58	24.49	23.03	23.98
NeRF-LR [2]	23.73	19.29	21.95	25.01	21.08	20.11	20.89	20.87	21.62
Ours	27.06	21.64	23.45	30.95	24.27	24.02	27.10	24.02	25.31

Table 7. SSIM↑, test on the sythetic 360° dataset for scale ×8 .

Method	SSIM (Blender×8)								
	chair	drums	ficus	hotdog	lego	materials	mic	ship	Avg
Bicubic	0.905	0.865	0.902	0.945	0.866	0.886	0.929	0.844	0.893
NeRF-LR [2]	0.888	0.840	0.886	0.929	0.837	0.866	0.913	0.827	0.873
Ours	0.927	0.893	0.910	0.966	0.891	0.865	0.958	0.865	0.909

Table 8. LPIPS↓, test on the sythetic 360° dataset for scale ×8 .

Method	LPIPS (Blender×8)								
	chair	drums	ficus	hotdog	lego	materials	mic	ship	Avg
Bicubic	0.146	0.201	0.131	0.174	0.216	0.176	0.115	0.343	0.188
NeRF-LR [2]	0.144	0.213	0.140	0.130	0.216	0.173	0.118	0.299	0.179
Ours	0.122	0.173	0.140	0.094	0.191	0.284	0.083	0.284	0.171

Table 9. PSNR↑, test on the LLFF dataset for scale ×2 .

Method	PSNR (NeRF-LLFF×2)							
	fern	flower	fortress	horns	leaves	orchids	room	trex
Bicubic	23.45	26.59	29.87	25.73	20.01	20.03	28.80	24.73
NeRF-HR [2]	25.17	27.40	31.16	27.45	20.92	20.36	32.70	26.80
Ours	24.20	27.32	31.15	27.59	20.25	20.13	32.29	26.89

Table 10. SSIM↑, test on the LLFF dataset for scale ×2 .

Method	SSIM (NeRF-LLFF×2)							
	fern	flower	fortress	horns	leaves	orchids	room	trex
Bicubic	0.814	0.884	0.917	0.864	0.732	0.714	0.944	0.886
NeRF-HR [2]	0.792	0.827	0.881	0.828	0.690	0.641	0.948	0.880
Ours	0.847	0.902	0.941	0.912	0.753	0.734	0.974	0.932

Table 11. LPIPS↓, test on the LLFF dataset for scale ×2 .

Method	LPIPS (NeRF-LLFF×2)							
	fern	flower	fortress	horns	leaves	orchids	room	trex
Bicubic	0.342	0.253	0.217	0.336	0.364	0.352	0.235	0.306
NeRF-HR [2]	0.280	0.219	0.171	0.268	0.316	0.321	0.178	0.249
Ours	0.283	0.217	0.183	0.252	0.324	0.305	0.151	0.232

Table 12. PSNR↑, test on the LLFF dataset for scale ×4 .

Method	PSNR (NeRF-LLFF×4)							
	fern	flower	fortress	horns	leaves	orchids	room	trex
Bicubic	22.66	26.21	29.23	24.61	19.50	19.79	27.73	23.82
NeRF-HR [2]	23.57	26.88	29.98	25.81	19.93	19.84	31.12	25.52
Ours	23.30	26.85	30.13	26.12	19.76	19.90	31.18	25.63

Table 13. SSIM↑, test on the LLFF dataset for scale ×4 .

Method	SSIM (NeRF-LLFF×4)							
	fern	flower	fortress	horns	leaves	orchids	room	trex
Bicubic	0.780	0.872	0.902	0.819	0.677	0.704	0.928	0.838
NeRF-HR [2]	0.810	0.882	0.917	0.857	0.708	0.714	0.963	0.890
Ours	0.811	0.888	0.921	0.871	0.703	0.722	0.965	0.897

Table 14. LPIPS↓, test on the LLFF dataset for scale ×4 .

Method	LPIPS (NeRF-LLFF×4)							
	fern	flower	fortress	horns	leaves	orchids	room	trex
Bicubic	0.463	0.408	0.329	0.477	0.467	0.471	0.437	0.450
NeRF-HR [2]	0.41	0.376	0.295	0.428	0.430	0.444	0.388	0.401
Ours	0.433	0.389	0.332	0.411	0.430	0.447	0.362	0.382

Table 15. PSNR↑, test on the LLFF dataset for scale ×8 .

Method	PSNR (NeRF-LLFF×8)							
	fern	flower	fortress	horns	leaves	orchids	room	trex
Bicubic	22.48	26.01	28.99	22.33	19.35	19.67	27.45	20.07
NeRF-LR [2]	21.05	24.49	26.57	18.97	17.82	18.89	25.07	20.81
NeRF-HR [2]	22.85	26.16	29.15	23.82	19.47	19.64	29.39	23.26
Ours	23.04	26.61	29.68	25.36	19.55	19.79	30.01	24.99

Table 16. SSIM↑, test on the LLFF dataset for scale $\times 8$.

Method	SSIM (NeRF-LLFF×8)							
	fern	flower	fortress	horns	leaves	orchids	room	trex
Bicubic	0.802	0.884	0.916	0.860	0.698	0.748	0.923	0.827
NeRF-LR [2]	0.777	0.868	0.893	0.765	0.658	0.729	0.912	0.794
NeRF-HR [2]	0.817	0.886	0.920	0.851	0.708	0.750	0.946	0.837
Ours	0.824	0.894	0.924	0.853	0.714	0.763	0.951	0.876

Table 17. LPIPS↓, test on the LLFF dataset for scale $\times 8$.

Method	LPIPS (NeRF-LLFF×8)							
	fern	flower	fortress	horns	leaves	orchids	room	trex
Bicubic	0.521	0.491	0.447	0.335	0.550	0.560	0.483	0.497
NeRF-LR [2]	0.510	0.493	0.433	0.586	0.548	0.548	0.489	0.502
NeRF-HR [2]	0.497	0.482	0.409	0.519	0.541	0.521	0.483	0.502
Ours	0.467	0.475	0.411	0.502	0.520	0.523	0.408	0.425