OmniSDF: Scene Reconstruction using Omnidirectional Signed Distance Functions and Adaptive Binoctrees

Supplementary Material

1. Additional Qualitative Comparisons

We present qualitative comparisons of our reconstruction results on synthetic scenes with two traditional surface reconstruction methods: COLMAP [5] and EgocentricRecon [3] in Figure 1. The quantitative and qualitative results of traditional methods are comparable to ours. However, Figure 1 shows that in some areas our method can recover details and smooth surfaces that traditional methods do not.

We also include omitted qualitative comparisons on the real scenes from our main paper in Figures 3. We also provide error maps for all neural methods to compare error distributions better. Figure 2 shows that our method can better estimate regions with abrupt disparity changes, for example, the concave area behind the pillars.

2. Additional Real Scene Results

We present additional results of real scenes, including 'gallery chair' from Richo360 [2], and 'Shrine 1' and 'Square 2' from the Omniphotos [1] dataset (Figure 4).

References

[1] Tobias Bertel, Mingze Yuan, Reuben Lindroos, and Christian Richardt. Omniphotos: casual 360 vr photography. *ACM Transactions on Graphics (TOG)*, 39(6):1–12, 2020. 1

[2] Changwoon Choi, Sang Min Kim, and Young Min Kim. Balanced spherical grid for egocentric view synthesis. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pages 16590–16599, 2023. 1

[3] Hyeonjoong Jang, Andreas Meuleman, Dahyun Kang, Donggun Kim, Christian Richardt, and Min H Kim. Egocentric scene reconstruction from an omnidirectional video. *ACM Transactions on Graphics (TOG)*, 41(4):1–12, 2022. 1, 2

[4] Zhaoshuo Li, Thomas Müller, Alex Evans, Russell H Taylor, Mathias Unberath, Ming-Yu Liu, and Chen-Hsuan Lin. Neuralangelo: High-fidelity neural surface reconstruction. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pages 8456–8465, 2023. 4

[5] Johannes L Schonberger and Jan-Michael Frahm. Structure-from-motion revisited. In *Proceedings of the IEEE conference on computer vision and pattern recognition*, pages 4104–4113, 2016. 1, 2

[6] Peng Wang, Lingjie Liu, Yuan Liu, Christian Theobalt, Taku Komura, and Wenping Wang. Neus: Learning neural implicit surfaces by volume rendering for multi-view reconstruction. *arXiv preprint arXiv:2106.10689*, 2021. 4

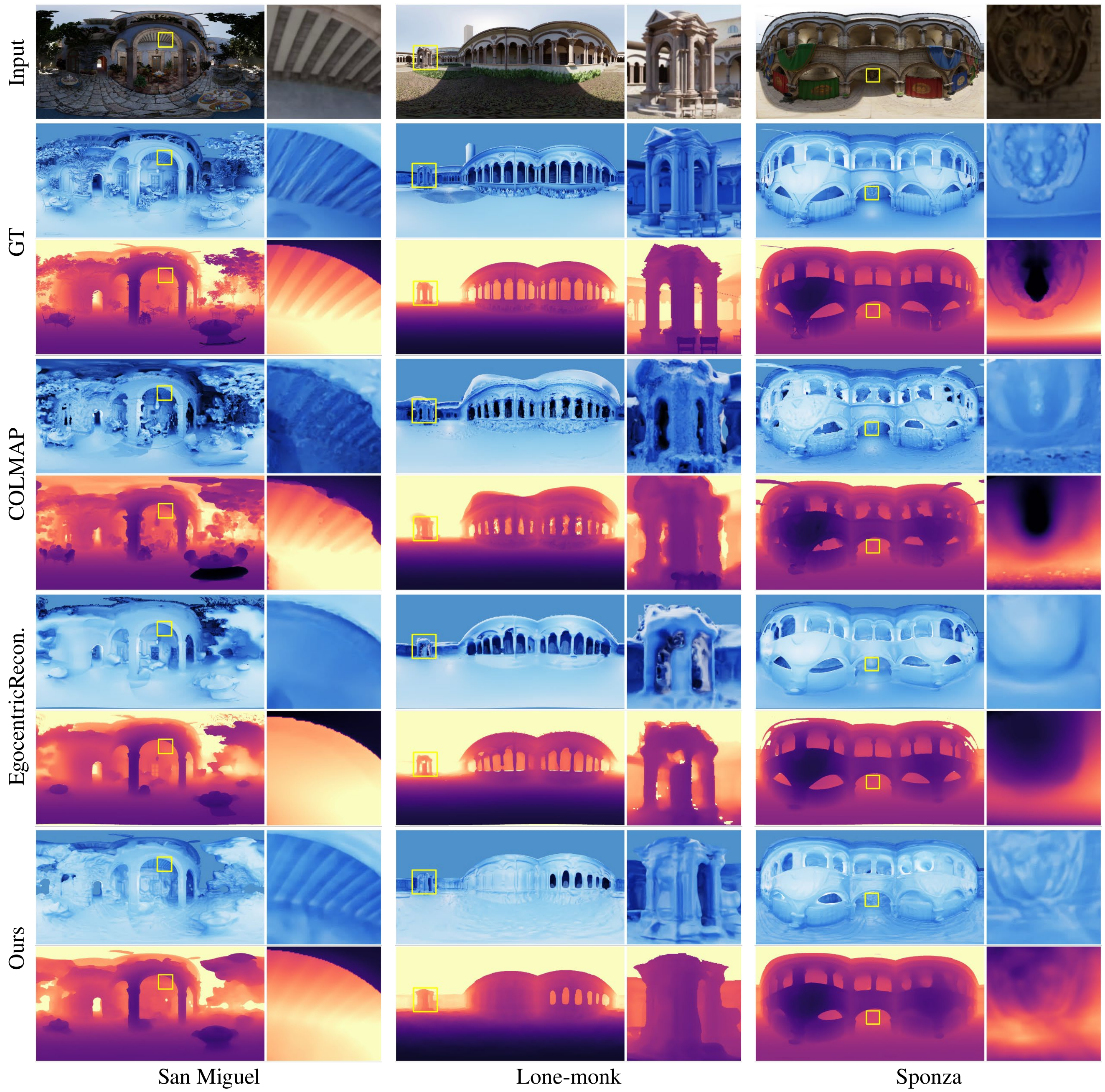

Figure 1. We compare our method with traditional and neural methods using ground-truth geometry, including COLMAP [5], and EgocentricRecon [3]. We also compare 3D reconstructed geometry rendering and depth maps and observe that our method produced higher-quality 3D geometry than EgocentricRecon and smoother reconstruction than COLMAP.

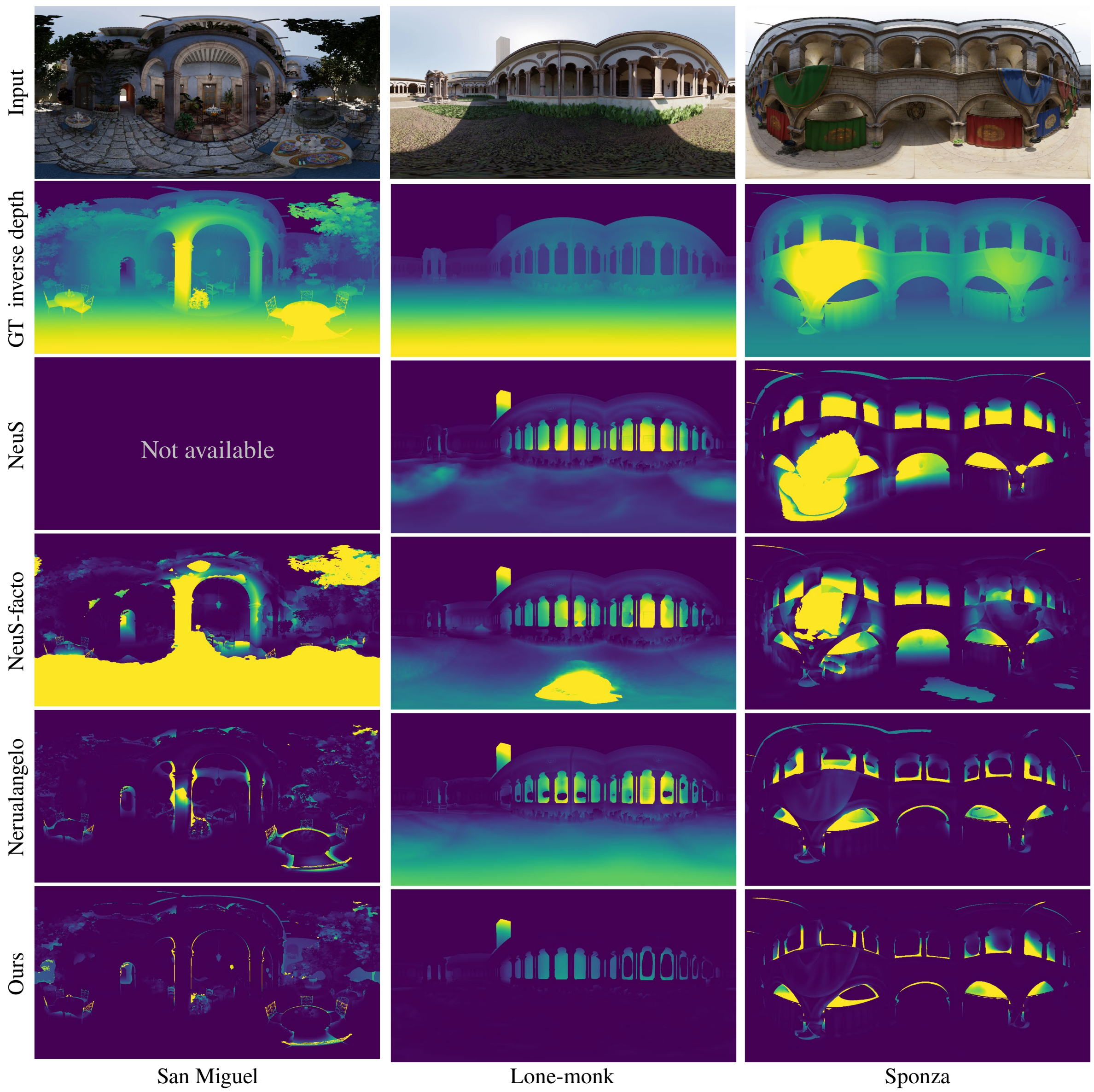

Figure 2. Comparison of error maps between our methods and other neural methods. While all approaches have some errors, our approach generally has lower errors. NeuS fails to execute on the San Miguel scene.

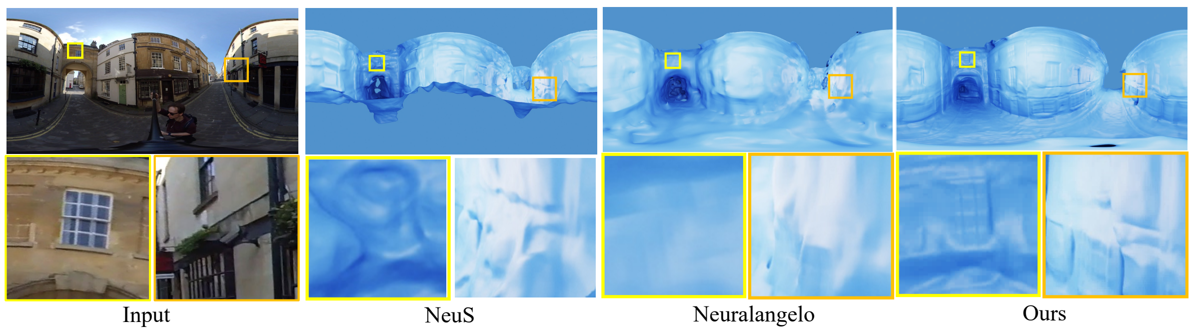

Figure 3. Additional real-scene qualitative comparisons of our method with NeuS [6] and Neuralangelo [4].

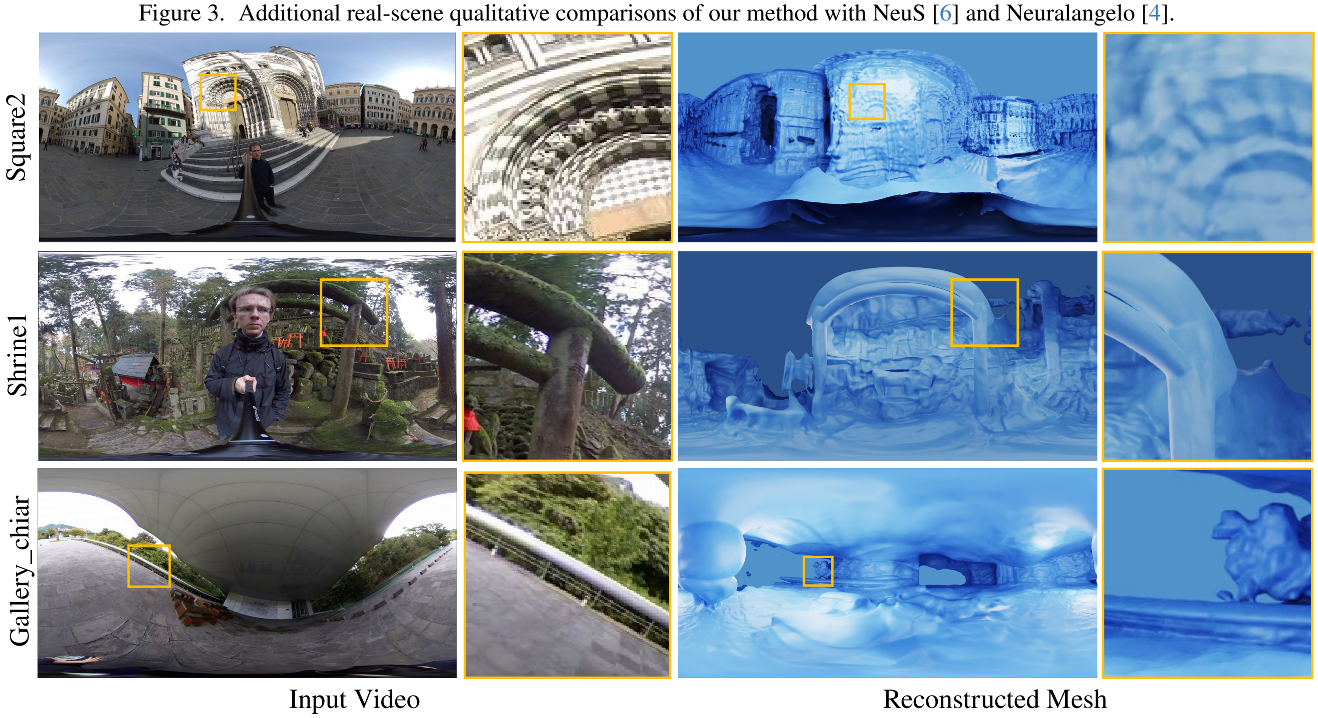

Figure 4. Additional reconstruction results from real-scene circular sweep baseline videos for our method.