

SimpleNeRF: Regularizing Sparse Input Neural Radiance Fields with Simpler Solutions Adithyan Karanayil Nagabhushan Somraj Rajiv Soundararajan Visual Information Processing (VIP) Lab, Indian Institute of Science, Bengaluru https://nagabhushansn95.github.io/publications/2023/SimpleNeRF.html

NeRF with Sparse Inputs

 NeRF produces severe distortions when trained with few images due to under-constrained volume rendering equations.



NeRF with dense input views



NeRF with sparse input views



Prior Work on Sparse-Input NeRF

- Hand-crafted priors generalize well across different different scenes but are not as strong as learned priors.
- Learned priors require pre-training on large datasets and suffer from generalization issues.

Our solution: learn prior w/o generalization issues by learning the prior on the given scene only \rightarrow train augmented/helper models in tandem with NeRF.



Analyzing NeRF Limitations

Floater artifacts



Undesired depth discontinuities due to high positional encoding degree



High capability of NeRF leads to distortions with sparse input views.

4 Mitigating Floaters and Shape-Radiance Ambiguity using Simpler Solutions

NeRF



Depth edges are sharp, but contains floaters

NeRF





Observe the change in position of the object on the table



Augmented NeRF



Floaters reduced while

retaining sharp depth edges

SimpleNeRF

Object does not change position

while supporting specularity

Floaters reduced, but depth edges are not sharp Augmented NeRF

Does not support specularity

We employ DS-NeRF [2] as our baseline





Input views



Estimated Depth Visualization



Acknowledgements:

This work was supported in part by a grant from Qualcomm. The first author was supported by the Prime Minister's Research Fellowship (PMRF) awarded by the Ministry of Education (MoE), Government of India.



Reliable Supervision from Simpler Solutions



•Depth with higher similarity between reprojected patches \rightarrow more reliable. •Use the more reliable depth to supervise the other.

Results

NeRF - 3 input views SimpleNeRF - 3 input views NeRF - 54 input views



Dense-NeRF

Framework can be used to address limitations of any volumetric model