Neural Radiance Fields and Surfaces
Neural Radiance Fields

Multiple views of a complex scene

Input Images → Optimize NeRF → Render new views

Mildenhall et al., ECCV’20
Neural Radiance Fields

A. Sampling 5D coordinates---location $x, y, z$ and viewing direction $\theta, \phi$---along camera rays.
B. Feeding those locations into an MLP to produce a color and volume density.
C. Using volume rendering techniques to composite these values into an image.
D. Optimizing scene representation by minimizing the residual between synthesized and ground truth images.
Physically Inspired Volume Rendering

For a ray $r(t) = o + td$, the rendered color can be computed as

$$C(r) = \int_{t_n}^{t_f} T(t)\sigma(r(t))c(r(t), d)\, dt$$

with $T(t) = \exp(-\int_{t_n}^{t_f} \sigma(r(s))\, ds)$
Neural Rendering

Given a few images of a tractor
Thresholding the Density

• Surfaces obtained by thresholding the density
• Choosing the threshold can be problematic
From NerF to NeuS

- Volume density is expressed a function of an SDF
- The reconstructed surfaces are smoother
From Interpolation to Reconstruction

Images of a shiny statue

View Interpolation

3D Reconstruction