ConRad: Image Constrained Radiance Fields for 3D Generation from a Single Image

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TLDR: A constrained Neural Radiance Field (NERF) for perfectly capturing an input image in one viewpoint, simplifying existing image-to-3D methods

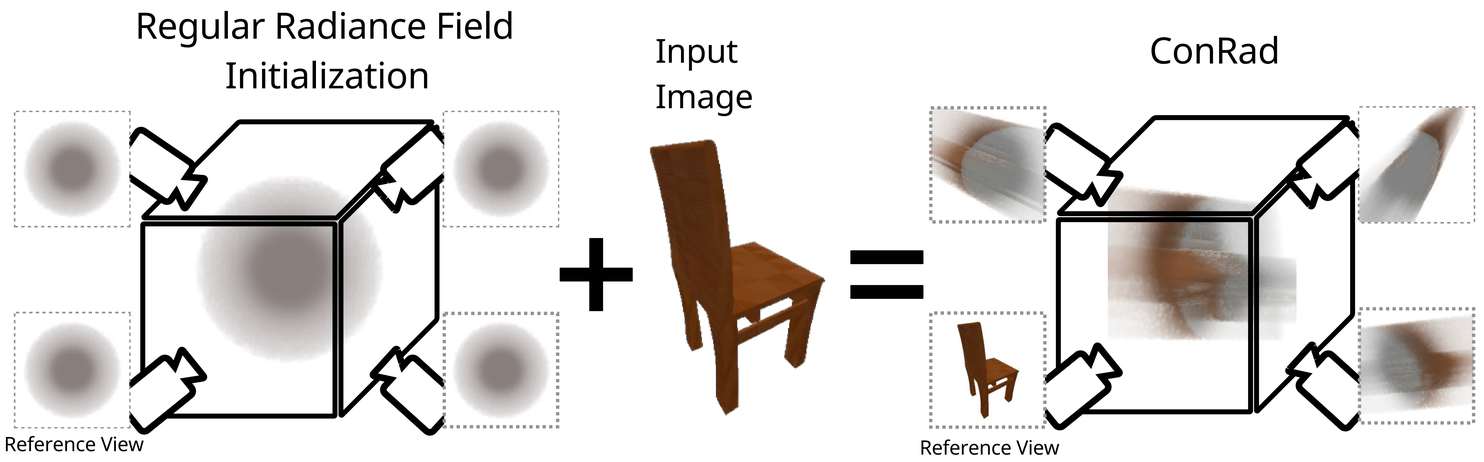


Image-to-3D using Diffusion Models

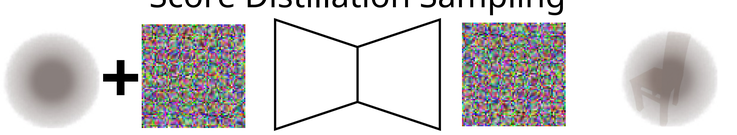
RealFusion [1], NeuralLift360 [2]

Reference Viewpoint

$$\mathcal{L}_{\mathbf{ref}} = || \quad - \quad ||_2$$

Non-Reference Viewpoint

Score Distillation Sampling



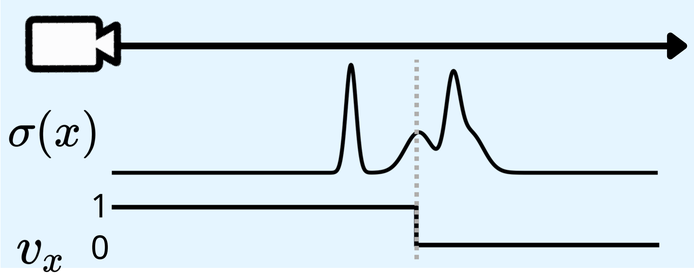
Jointly optimize Reference and Non-Reference Views

Our Approach

NERF $C(\mathbf{r}) = \int_t T(t)\sigma(r(t))c(r(t))dt$

Color Constraint

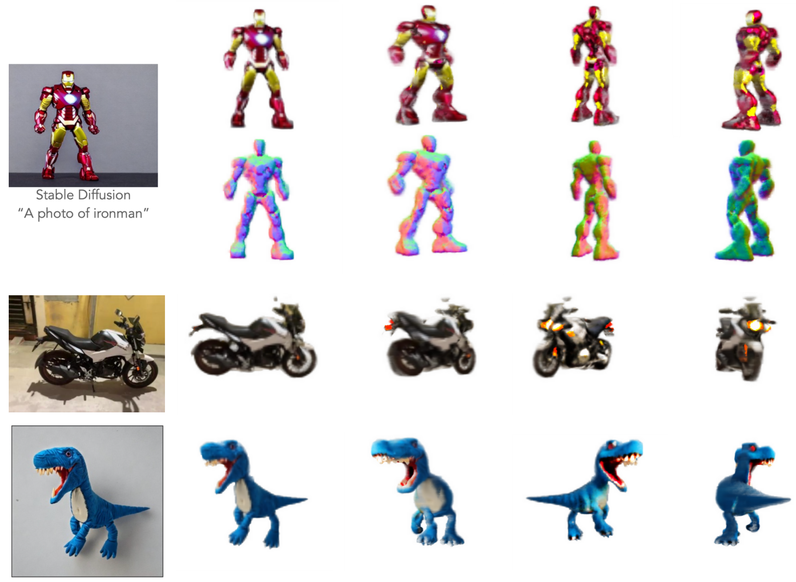
$$c'(x) = v_x \hat{I}[x] + (1 - v_x)c(x)$$



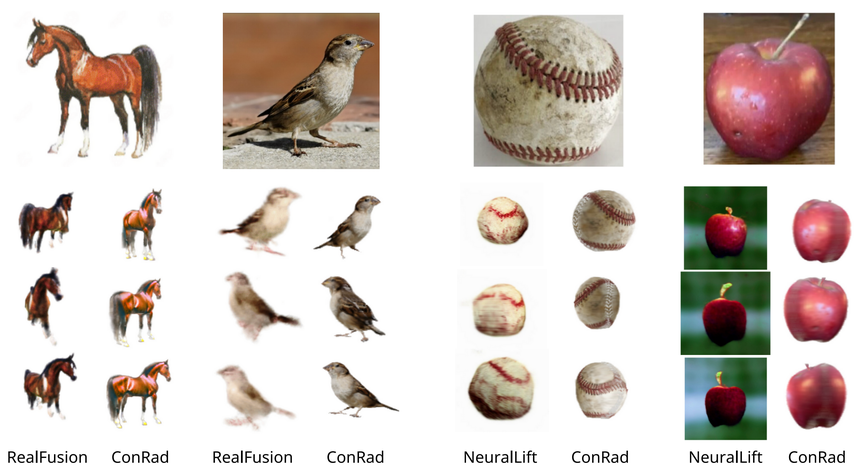
Density Constraint

$$\sigma'(x) = \hat{M}[x] * \sigma(x)$$

Results



Qualitative Comparisons



1. Melas-Kyriazi, Luke, et al. "Realfusion: 360deg reconstruction of any object from a single image." Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2023.
2. Xu, Dejia, et al. "NeuralLift-360: Lifting An In-the-Wild 2D Photo to a 3D Object With 360deg Views." Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2023.