Visual Computing &
Artificial Intelligence
Prof. Matthias Nießner

Fast 3D Style Transfer using Neural Radiance Fields

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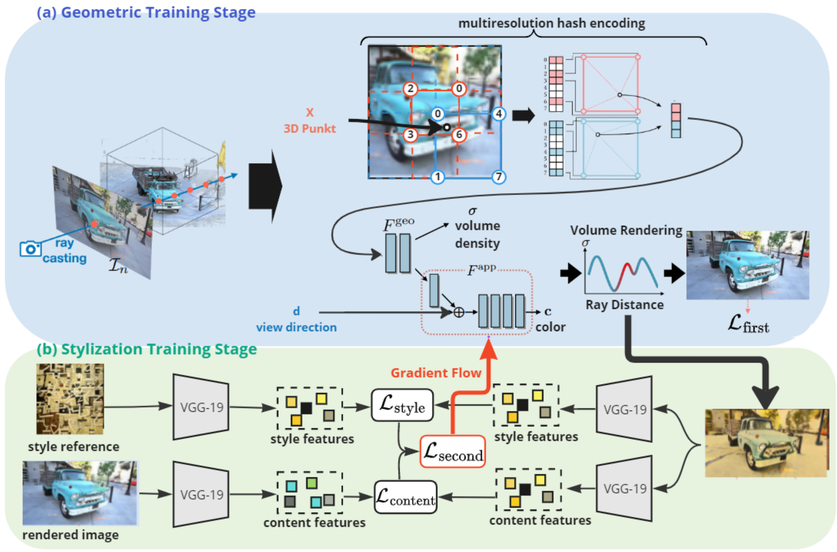
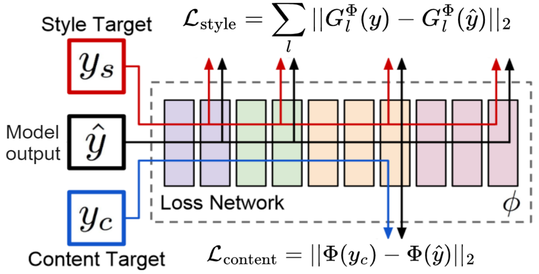
1. Introduction:

- Input: Multi-view images of a 3D scene & a style image (i.e. a painting)
- Output: Stylized novel views of the scene, where the style is 3D-consistent, i.e., no flickering in videos.
- Related Work: Neural Radiance Fields (Nerf) for novel view synthesis. Speedup through Instant Neural Graphic Primitives (Instant-NGP) [1]. Stylization with two stage training process similar to Chiang *et al* [2].
- Contribution: Speedup of training process with finer style details in the output image.

2. Method:

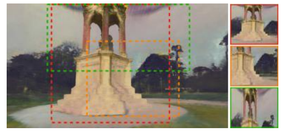


3. Loss Function and Subsampling:



Downsampling

Patch-wise subsampling



4. Visual Comparison and Muliview Consistency:

5. Speedup:

Training Time	First Stage	Second Stage	Total
Chiang *et al.* [1]	17 h	22 h	39 h
Ours	5 min	15 min	20 min

Render Time	
Chiang	210 seconds
Ours	0.7 seconds

6. Conclusion:

- Achieved multi-view consistent stylization with NeRF
- Speedup of the training process by multiple orders of magnitude compared to the baseline
- Inference now real-time capable to facilitate manipulation of viewing angle and point of view in a GUI
- Better style transfer with finer stylistic details present in the output images

Scan me for reference video

References:

[1] Chiang et al. “Stylizing 3D Scene via Implicit Representation and HyperNetwork” WACV 2022.
[2] Müller et al. “Instant Neural Graphics Primitives with a Multiresolution Hash Encoding,” *ACM Trans. Graph.*, vol. 41, no. 4