RENDERING NERF MESHES WITHOUT EVALUATING A NEURAL NETWORK

With the current state-of-the-art research, exporting a NeRF to a mesh has the side effect of evaluating a Multi Layer Perceptron at render-time, causing a significant decrease in performance. But is it possible to circumvent this?

INTRODUCTION

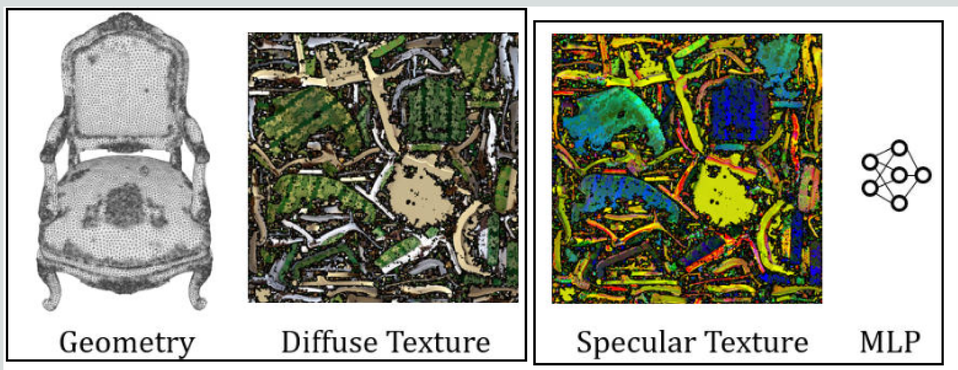
Neural Radiance Fields (NeRFs) are a great way to extract 3d data from 2d images. However, since their Neural Network representation is so different from conventional, mesh-based representations of objects, NeRFs will not work with most Computer Graphics software out of the box. There are multiple ways to convert NeRFs to a mesh, and one of the most recent ones is called Nerf2Mesh.
However, Nerf2Mesh currently requires evaluating a MLP, causing low FPS and high rendering times.

OBJECTIVE

We want to achieve the rendering of the NeRF by pre-computing values for the MLP and storing them in textures to look up during the rendering process.

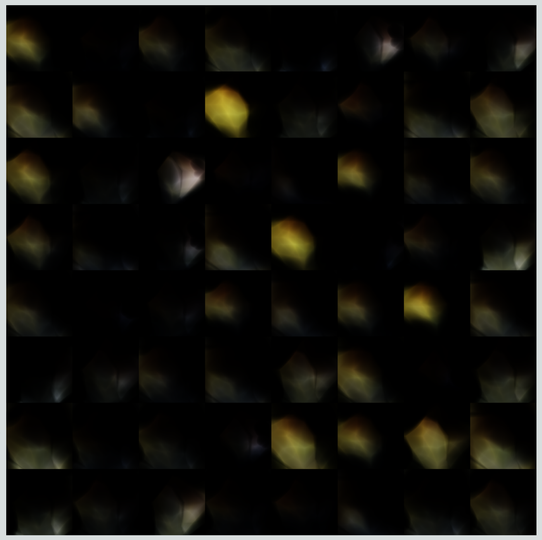
METHODOLOGY

We perform K-Means clustering to group the input texture into *n* clusters. Then, for each of the centers of the clusters we create an octahedral map, which we store in an atlas, as well as creating a texture containing information about which octahedral map to use. During render-time, we simply look up which map to use, look up the view direction, and use that as the specular value.

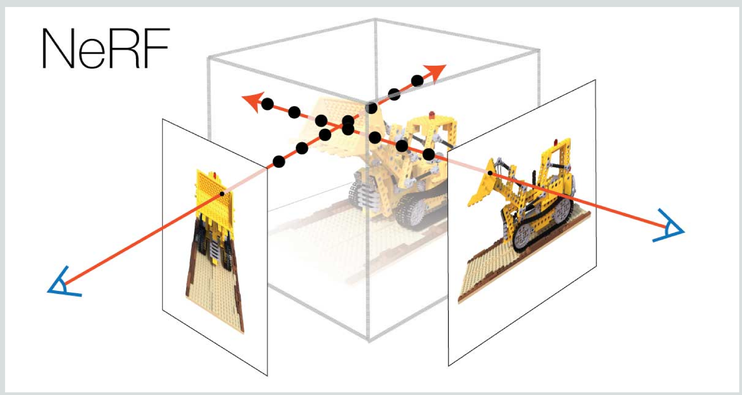


Outputs of Nerf2Mesh

Cluster Specular MLP on Similar Outputs



Octahedral Atlas



AUTHORS

Jurre Groenendijk, (he/him)

AFFILIATIONS

TU Delft

RESULTS/FINDINGS

We received an increase from ~300FPS to ~1000 FPS (which is the theoretical maximum WebGL could reach on the used hardware).
This corresponds to decreasing frametime from ~3ms to ~1ms.
Furthermore, after 64 clusters the benefit seems to fall off versus file size and clustering time

CONCLUSION

Using K-Means Clustering and Octahedral Mapping, we can eliminate the need to evaluate the MLP at render-time, while compromising reasonably on image quality.

RELATED LITERATURE

Nerf2Mesh, https://me.kiui.moe/nerf2mesh/

Clusters	MAE	MSE	Time to generate(s)
1	12.933	609.745	839
4	11.868	476.378	854
16	11.151	409.153	1176
64	10.789	379.223	1928
256	10.637	367.115	4723
1024	10.587	362.210	15289
2048	10.578	361.085	34509

Table 2: Results. Lower MAE and MSE is better