# 6. APPENDIX

## 6.1. Evaluating GeoScaler on Meshes with Optimized UV Mappings

While demonstrating the performance of GeoScaler on the entire TMQA dataset and the 3DSet5 dataset covers meshes built and post-processed using a wide range of algorithms, the performance of GeoScaler when the UV mapping of the mesh is ”optimal” remains to be seen. An ”optimal” mapping reduces the seams in the texture map and attempts to keep the ratio of areas of triangles in 3D and areas of corresponding triangles in the UV plane as uniform as possible. Algorithms like OptCuts and AutoCuts are capable of performing the optimization. To demonstrate the performance of GeoScaler on meshes with optimized UVs we first generate fresh UV mapping of the meshes in 3DSet5 using OptCuts, bake the original texture to the new maps, and then apply our method. The results shown in Table 2 indicate that GeoScaler continues to improve downsampling performance for meshes with optimized textures.

## 6.2. Comparing with Generating Textures in Lower Resolution

We also compare the quality of textures downsampled by GeoScaler on the 3DSet5 dataset with the textures generated natively at 4x and 8x lower resolutions. Note that the meshes and textures in the 3DSet5 dataset were reconstructed using a proprietary tool MetaShape. We use the same application and pipeline for generating textures at 4x and 8x lower resolutions. The results in Table 3 suggest that downsampling textures after reconstructing 3D scenes at higher resolutions can provide higher-quality renders than generating low-resolution textures directly on 3Dset5.

| Scale | Metric | MetaShape | Bicubic | Lanczos | GeoScaler Full |
|---|---|---|---|---|---|
| **4x** | **PSNR (dB)** | 32.34 | 33.72 | 34.11 | 35.88 |
| | **SSIM** | 0.9022 | 0.9264 | 0.9294 | 0.9524 |
| **8x** | **PSNR (dB)** | 26.56 | 28.63 | 29.34 | 31.85 |
| | **SSIM** | 0.8510 | 0.8747 | 0.8779 | 0.9218 |

**Table 3**: **Quantitative results comparing GeoScaler with generating textures at lower resolutions natively**

We suspect MetaShape uses bilinear resampling internally to subsample the images fed during the reconstructing process to generate texture maps leading to poor quality. This leads to interesting future research where per-scene optimization methods such as ours can be used for generating higher-quality texture maps at lower resolutions during the 3D scene reconstruction process.

## 6.3. More Results

The results on *banjoman* and *avocado* from 3DSet5 are also shown in Figure 8. Additionally, we also show results on a few meshes sampled from Google’s Scanned Object dataset in Figure 8.

We also compared our method with Joint UV Optimization and Texture Baking (Knodt et al. *IEEE Transactions on Graphics, 2023*). Their code and hyperparameters for computing rendering-based losses are unavailable publicly. Their limited dataset only consists of very smoothly textured meshes with simple geometries and hinders comparison over diverse real-world captured mesh data. Due to these reasons, we refrained from including this method in the full paper. In Table 4, we use the result meshes generated from their own proposed dataset which they provided in our rendering loss computation setup to obtain a fair comparison.

| | **4x** PSNR/MS-SSIM | | **8x** PSNR/MS-SSIM | |
|---|---|---|---|---|
| **Mesh** | **GS** | **Joint UVOpt** | **GS** | **Joint UVOpt** |
| **Dragon Jar** | 36.83/0.996 | 40.27/0.998 | 34.79/0.989 | 33.39/0.988 |
| **Garden seat** | 34.48/0.991 | 33.12/0.989 | 30.81/0.979 | 29.27/0.971 |
| **Hemet** | 39.37/0.999 | 38.69/0.998 | 34.40/0.997 | 33.56/0.995 |
| **Cat Statue** | 38.92/0.996 | 41.25/0.998 | 35.92/0.989 | 36.27/0.991 |
| **Chn. Chess** | 37.99/0.997 | 41.42/0.998 | 35.41/0.986 | 38.77/0.993 |
| **Hand Fan** | 44.68/1.000 | 40.62/0.999 | 40.90/0.999 | 39.67/0.998 |
| **Iron Cup** | 33.66/0.994 | 32.54/0.994 | 30.06/0.986 | 29.33/0.984 |
| **Cut Fish** | 47.36/1.000 | 46.61/0.999 | 44.85/0.998 | 45.45/0.998 |
| **Easter Egg** | 41.12/0.998 | 44.21/0.999 | 38.26/0.996 | 40.31/0.997 |
| **Baguette** | 33.64/0.957 | 40.31/0.997 | 31.46/0.934 | 39.35/0.996 |
| **Greek Vase** | 40.48/0.999 | 40.53/0.999 | 38.46/0.997 | 37.85/0.997 |
| **Gundam** | 26.40/0.992 | 26.12/0.990 | 23.59/0.974 | 21.76/0.967 |
| **Italian Car** | 50.37/1.000 | 45.27/1.000 | 46.26/1.000 | 45.62/1.000 |
| **Tea Cup** | 41.77/0.997 | 43.59/0.998 | 38.67/0.990 | 40.33/0.993 |
| **Jpn. Lamp** | 37.04 /0.996 | 38.38/0.995 | 34.55/0.986 | 36.14/0.988 |
| **Lego Fig.** | 47.56 /1.000 | 41.89/0.999 | 43.00/1.000 | 38.27/0.998 |
| **Lemon** | 52.79/1.000 | 52.51/1.000 | 50.31/1.000 | 48.82/0.998 |
| **Mask** | 51.37/1.000 | 50.23/1.000 | 49.46/1.000 | 49.33/0.999 |
| **Golem** | 43.58/0.999 | 43.28/0.998 | 40.60/0.995 | 41.26/0.994 |
| **White Tree** | 34.22/0.993 | 17.86/0.815 | 32.01/0.989 | 17.88/0.818 |
| **Pengu** | 42.90/0.999 | 43.57/0.998 | 40.85/0.997 | 41.88/0.996 |
| **Pony** | 47.83/0.999 | 46.26/0.999 | 45.46/0.998 | 46.62/0.999 |
| **Sand Arena** | 45.04/0.999 | 43.93/0.999 | 43.17/0.999 | 43.67/0.999 |
| **SkateBunny** | 38.59/1.000 | 37.70/0.999 | 35.13/0.998 | 34.87/0.997 |
| **Knight** | 36.17/0.996 | 28.88/0.986 | 33.51/0.992 | 28.59/0.984 |
| **Umbrella** | 39.86/0.998 | 36.47/0.995 | 37.14/0.996 | 37.82/0.996 |
| **Average** | **40.92/0.996** | **39.83/0.990** | **38.04/0.991** | **37.54/0.986** |

**Table 4**: Comparison of GS with Joint UV optimization

**All the meshes for which results are shown are included in the zipped file along with the supplementary materials.**

| Scale | Bicubic | Lanczos | GS Base | GS Base+GCM | GS Base+UVW | GeoScaler (Full) |
|---|---|---|---|---|---|---|
| **4x** | 33.80 / 0.9490 | 33.91 / 0.9500 | 34.33 / 0.9531 | 34.39 / 0.9537 | 34.55 / 0.9554 | 35.28 / 0.9610 |
| **8x** | 29.17 / 0.9056 | 29.23 / 0.9068 | 29.51 / 0.9142 | 29.66 / 0.9149 | 30.25 / 0.9168 | 31.04 / 0.9222 |

**Table 2**: **Performance of GeoScaler on meshes with optimized UV mappings.** The two numbers in each cell indicate the PSNR(dB) and SSIM.

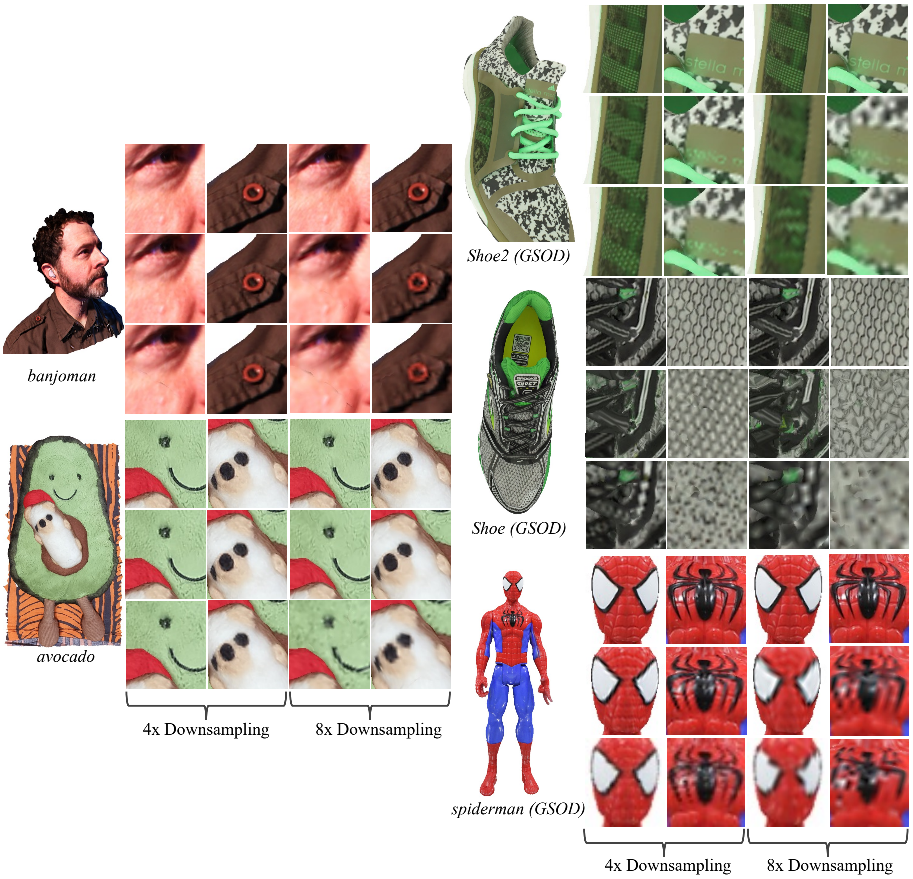

**Fig. 8**: **More Results on remaining 3DSet5 meshes and a few meshes from Google's Scanned Objects Dataset**For each mesh result, the top row is the Ground Truth texture, the middle row shows results from GeoScaler, and the bottom row shows results using Bicubic