

# IG3D: Blender with Python API – MRI 3D Scan

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## 1 Before Optimization

Before the optimization, the values that I use for all mesh parameters, including the smoothing modifier, solidify modifier parameters, are described in Table 1.

downsample	4
threshold	0.65
absolute_scale	24.0
modifier_smooth.factor	0.5
modifier_smooth.iterations	3
modifier_solidify.thickness	0.2

Table 1: Parameters before optimization

The result I get is shown in Figure 1. We can clearly see that the object is disjointed, probably because the **threshold** needs to be higher to achieve a more continuous surface.

## 2 Optimization for thresholding

I'm trying for a higher threshold for the skull head from 0.7 to 0.9. Other parameters remain the same. The results are shown in Figure 2. After testing, the threshold between 0.85 (Figure 2d) and 0.9 (Figure 2e) gives objects that are the most similar to a skull head. Here, I will choose 0.85.

## 3 Optimization for downsampling and absolute scale

To make the model fit the main viewport, I will define the **absolute scale** to 1.0 so that the skull head is scaled at (1,1,1).

I'm testing the downsampling from 2 to 8. The results are shown in Figure 3. The high downsample factor like 8 results in a shorter processing time, but we can see that the head loses a lot of detail. The downsample of value 2 gives us the most detailed skull head but will have a longer processing time. Here, I will use downsample 2 because I only have to wait a couple of seconds for the rendering.

## 4 Optimization for Smooth modifier

The smooth modifier will smooth the object; the factor values control how much smoothing is applied and the iteration values determine how many times the smoothing operation is applied. I will test the factor between 0.5 and 1.0; and the iterations between 3 and 6. The results are in Figure 4. We can see that the high factor (1.0) and iterations can blur sharp details in the skull structure. But also the difference between changing here is not very much. I will choose factor of 0.7 and iterations of 5 (Figure 4e).

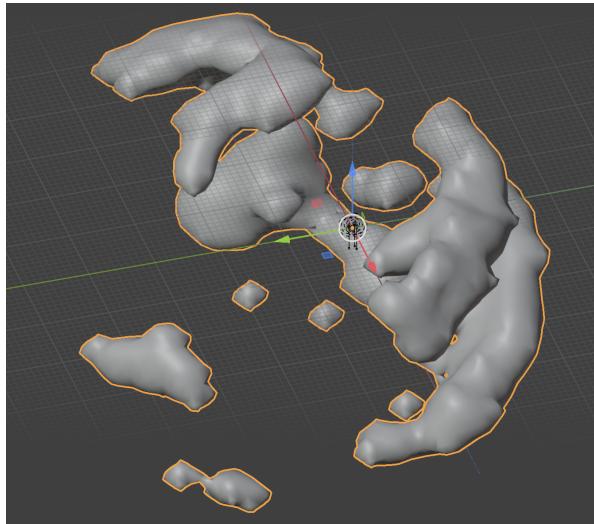


Figure 1: Object before optimization.

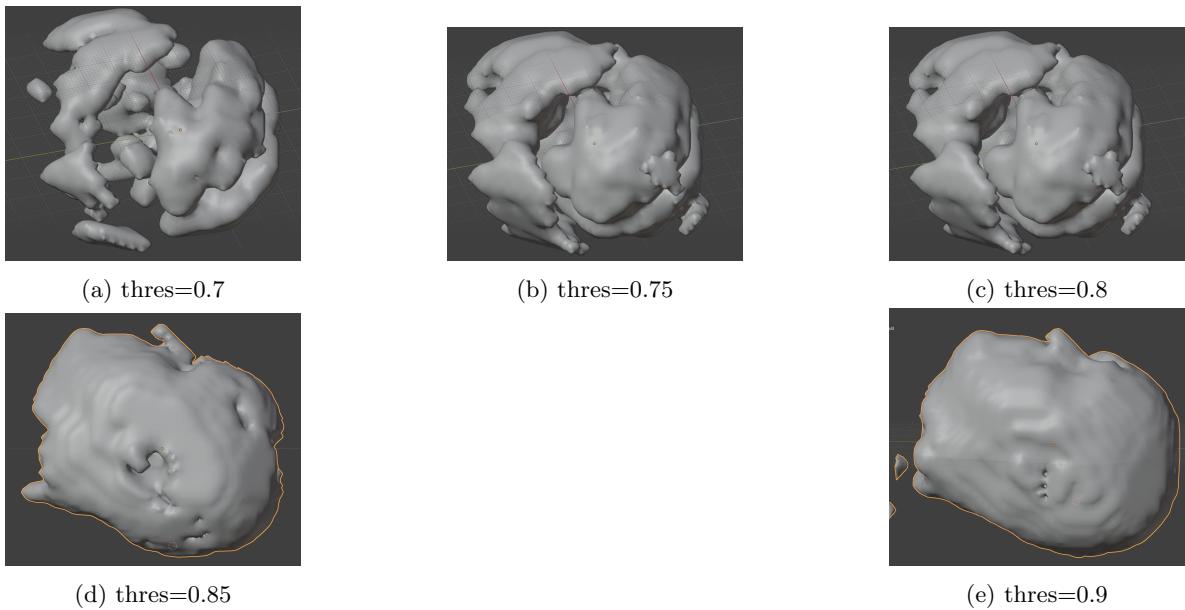


Figure 2: Object after threshold optimization

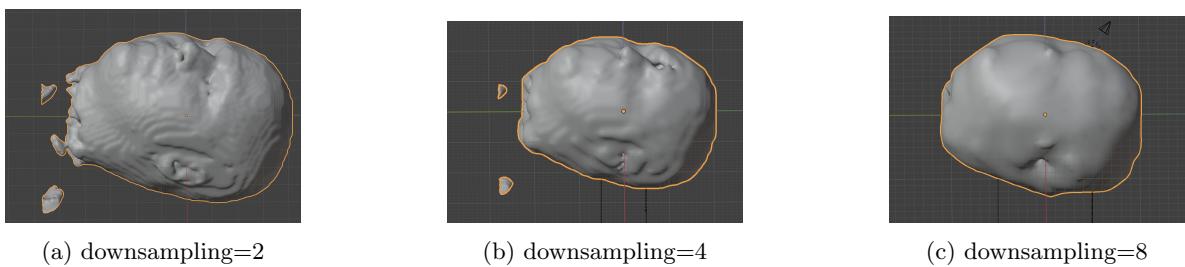


Figure 3: Objects after downsampling optimization

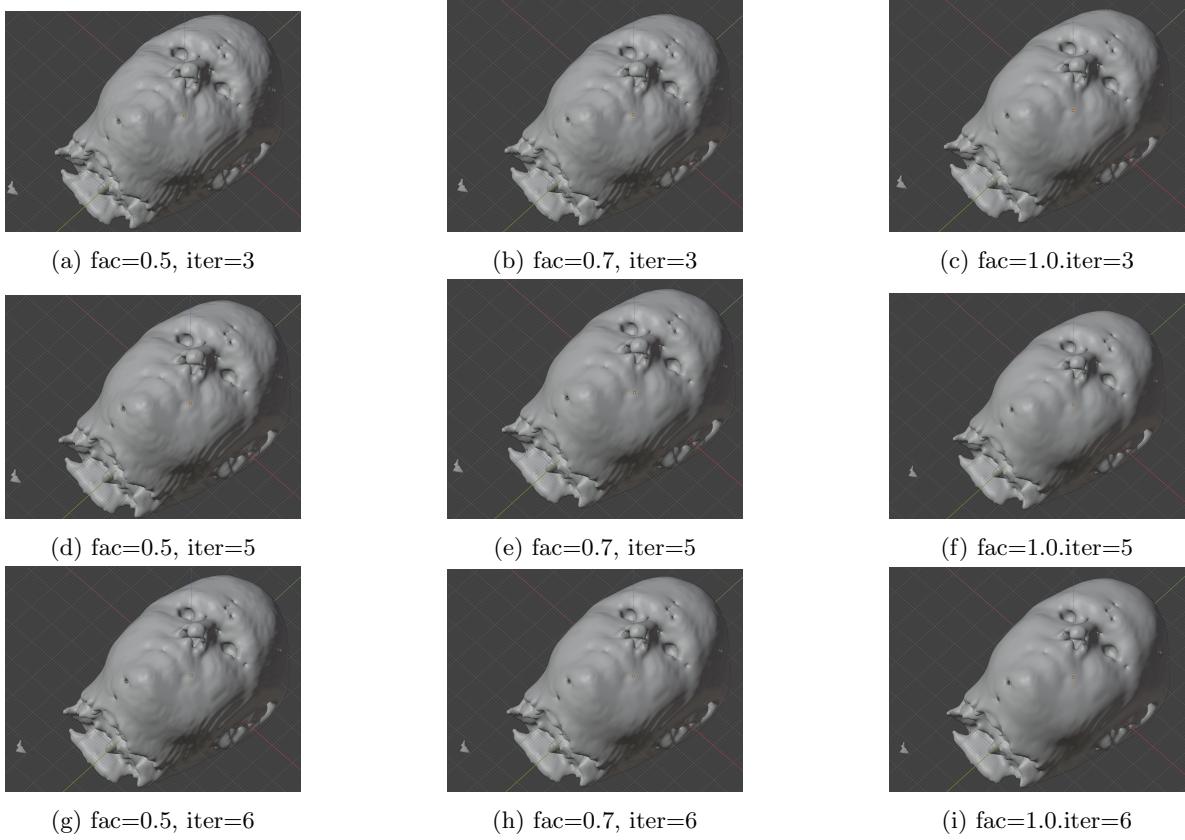


Figure 4: Objects after Smoothing optimization

## 5 Optimization for Solidify modifier and Remesh

The solidify thickness defines the thickness of the mesh, and I also add **use\_rim** option to close open edges when giving thickness to a mesh.

Additionally, I add a **remesh modifier** with mode "SHARP" for preserving hard edges and detailed features of the skull. The octree\_depth will adjust the detail level of the mesh, and the scale of the remesh is to control the mesh density. Here, I will choose the depth of 8 and scale of 0.7. The result I get is shown in Figure 5. The skull head is not showing well because of too small thickness, we should increase a higher thickness for the mesh.

I'm testing the Solidify with thickness varies from 0.2 to 1.0. The results are shown in Figure 6. The skull with higher thickness would look smoother and 3D. Here, I will choose thickness of 0.8 (Figure 6d) because thickness of 1.0 (Figure 6e) makes the mesh lose a little of detail.

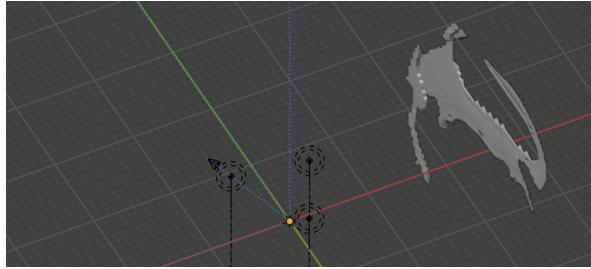


Figure 5: Adding Remesh

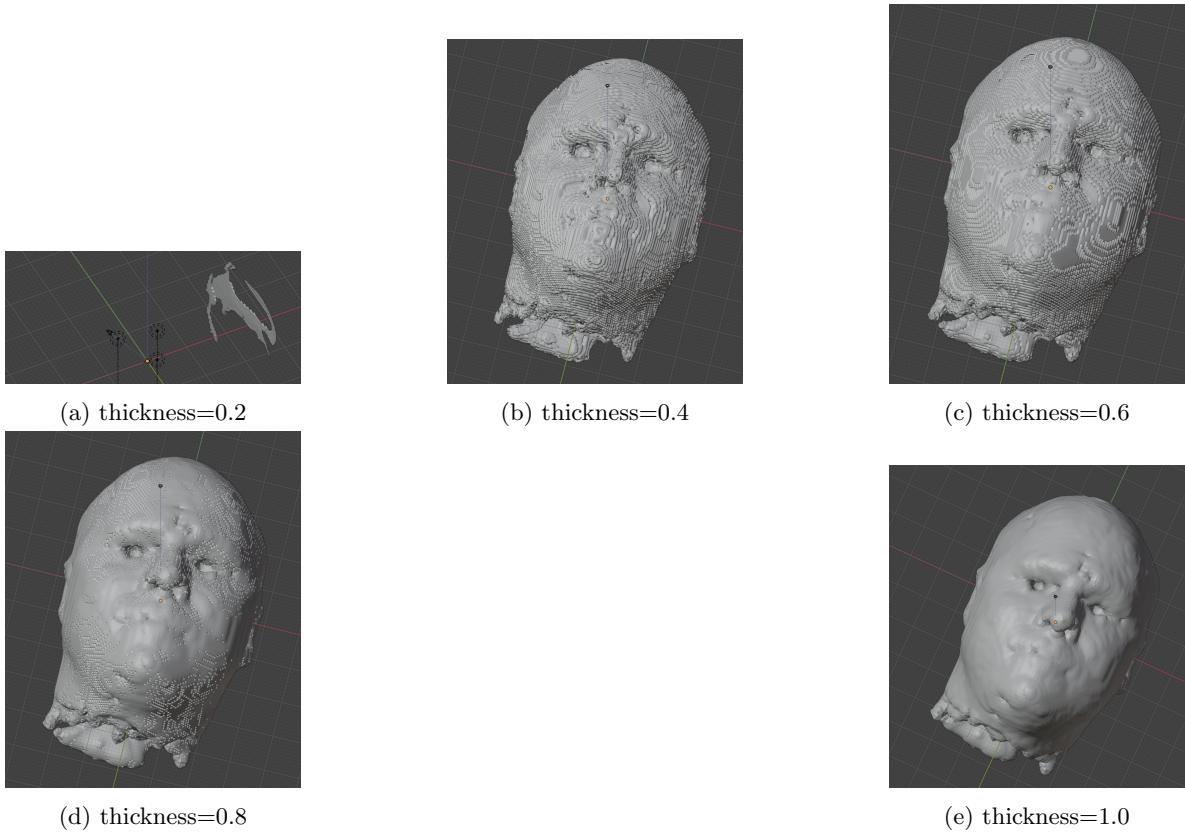


Figure 6: Objects after Solidify optimization

## 6 Result

The results object after optimization is shown in Figure 7

The final value of the parameters after optimization are shown in Table 2.

downsample	2
threshold	0.85
absolute_scale	1.0
modifier_smooth.factor	0.7
modifier_smooth.iterations	5
modifier_solidify.thickness	0.8
modifier_solidify.use_rim	True
modifier_remesh.mode	SHARP
modifier_remesh.octree_depth	8
modifier_remesh.scale	0.7

Table 2: Parameters before optimization

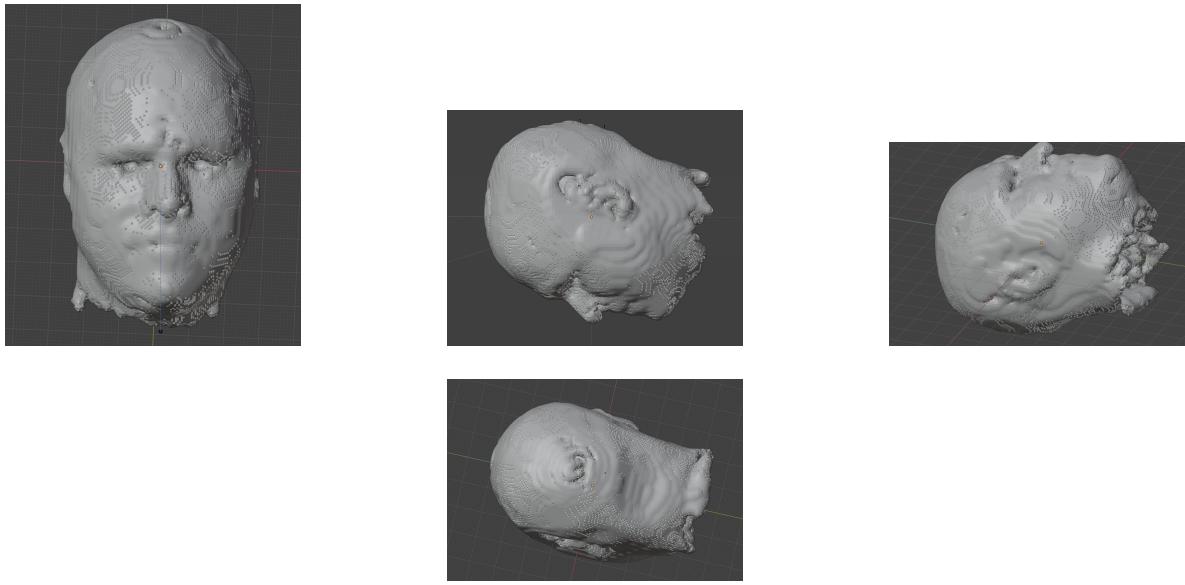


Figure 7: Object after all optimization