CS 530 Project 2

Luke Jiang (0028440468)
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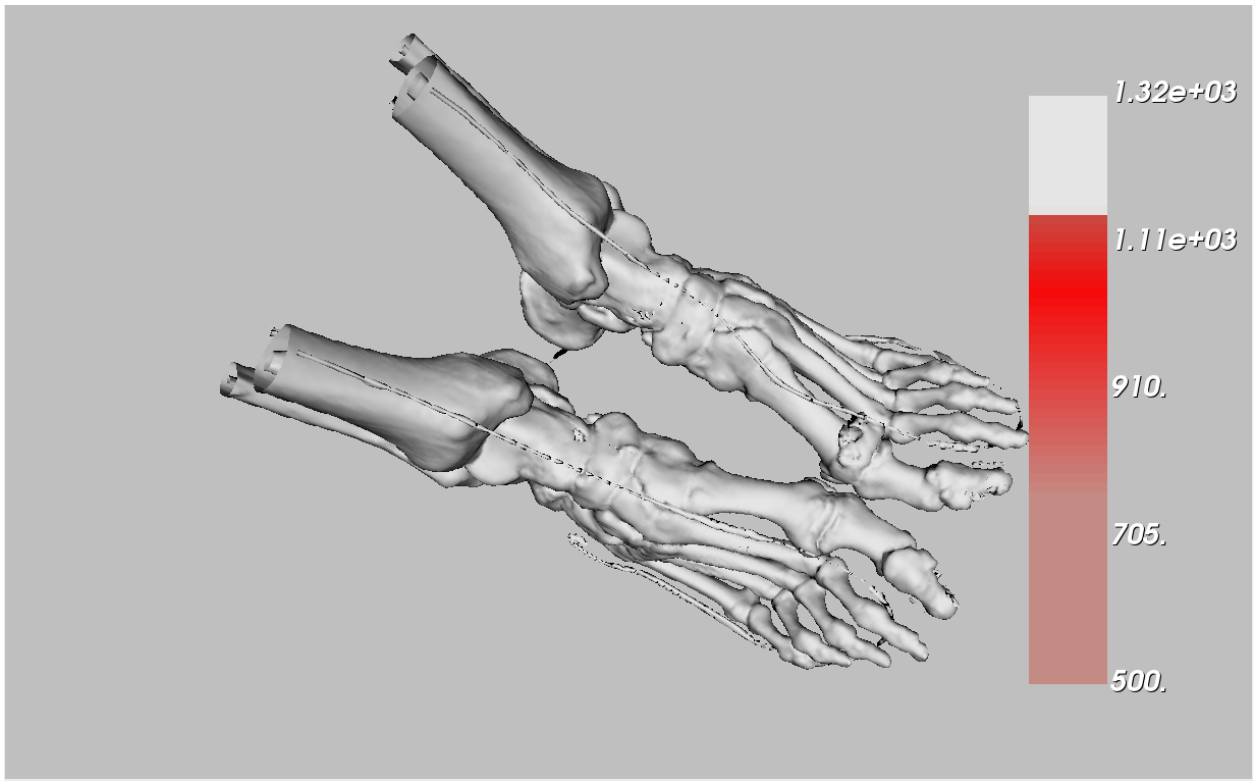
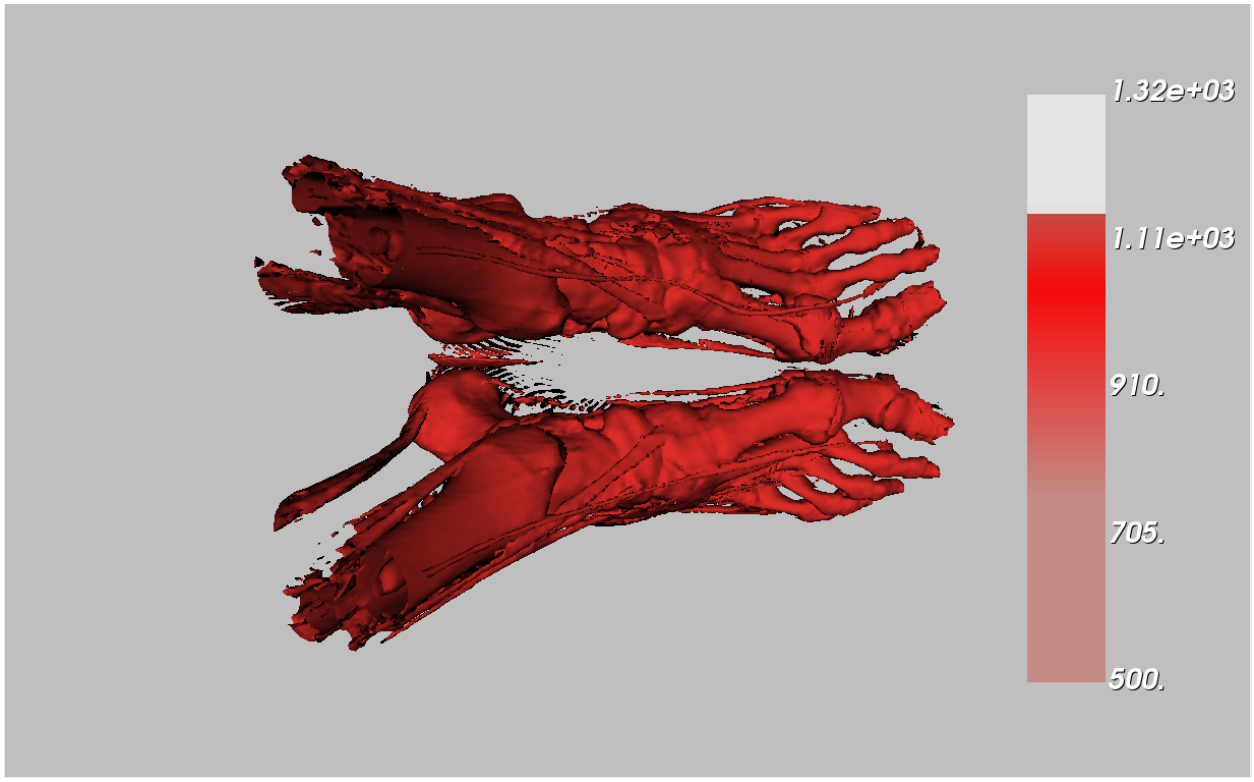
Part I: Results

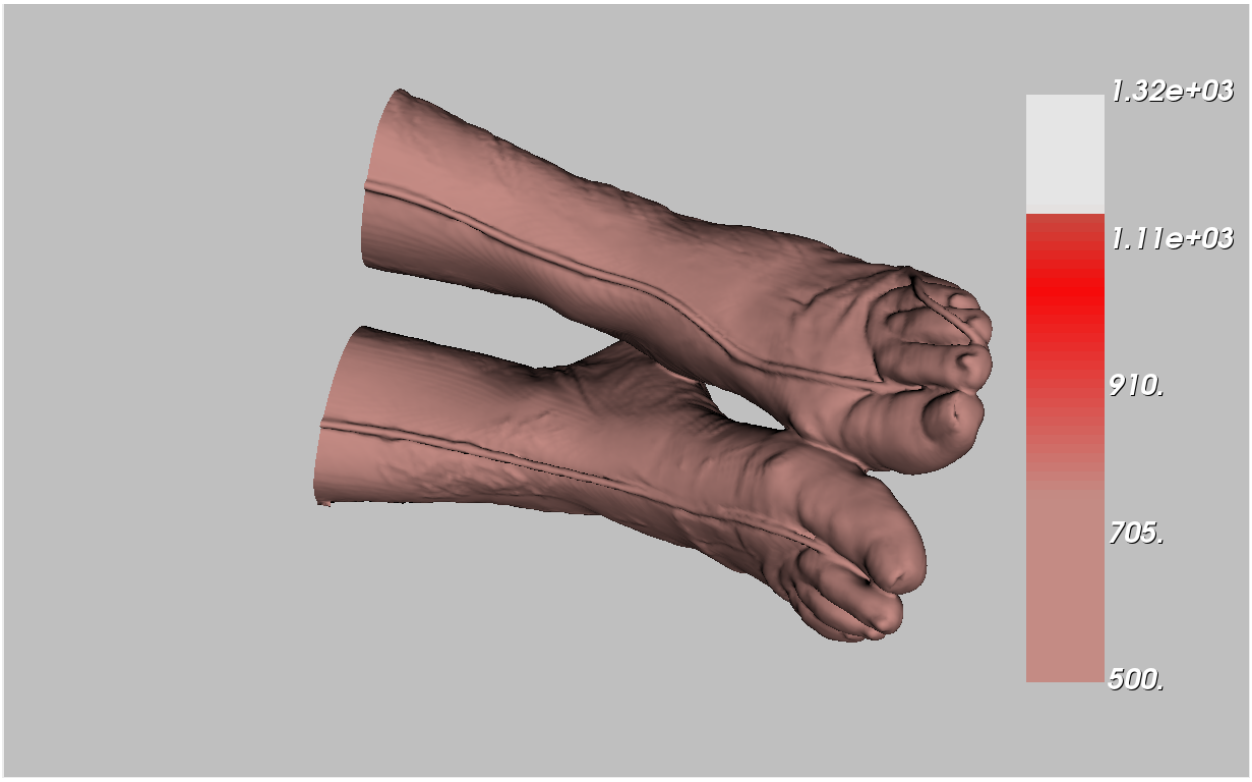
Task 1:



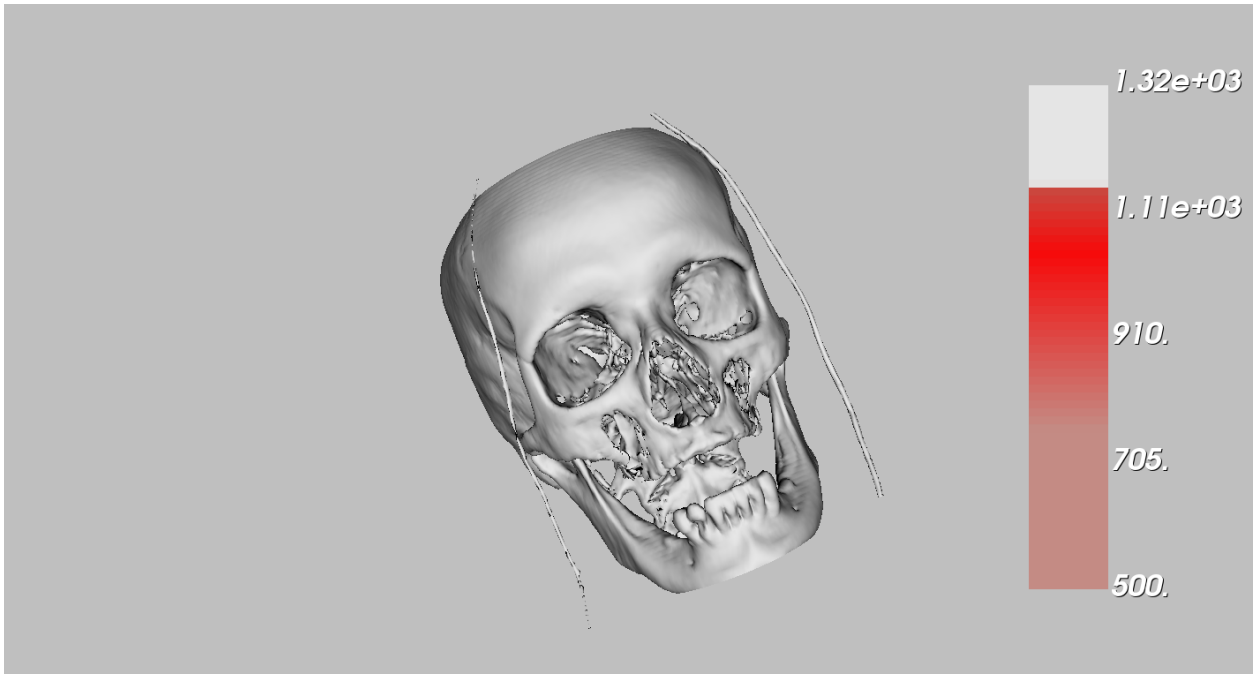
Feet Bone (isovalue = 1300)



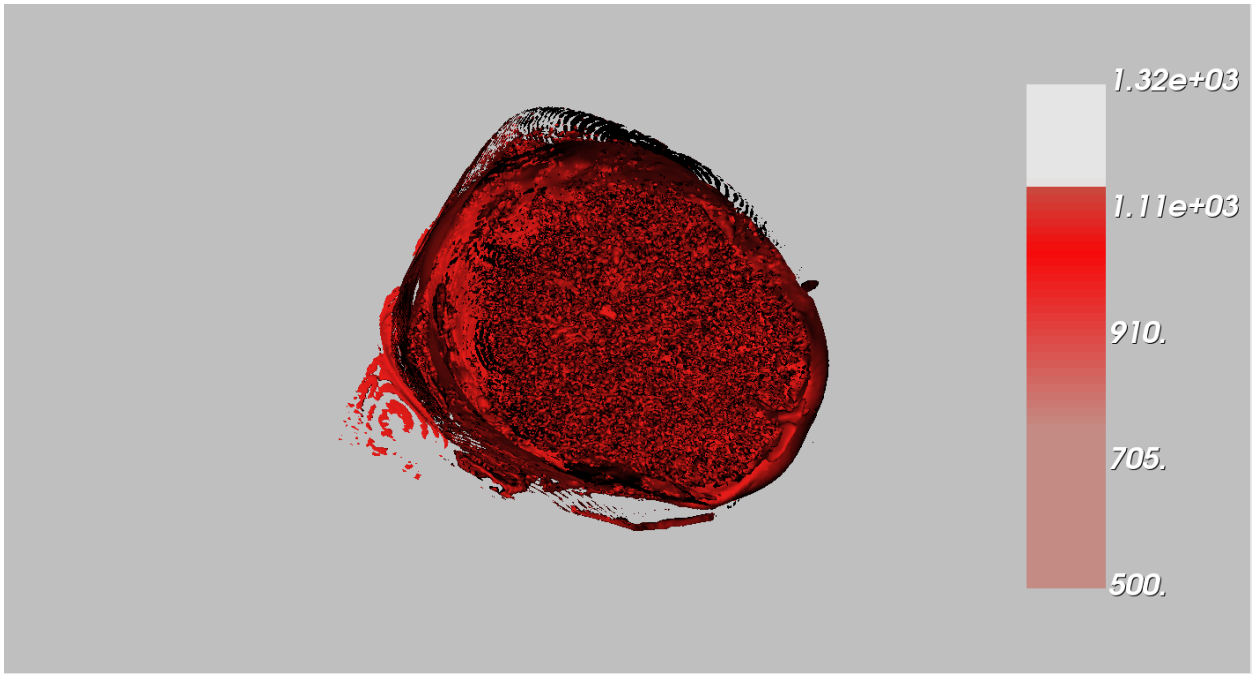
Feet Muscle (isovalue = 1100)



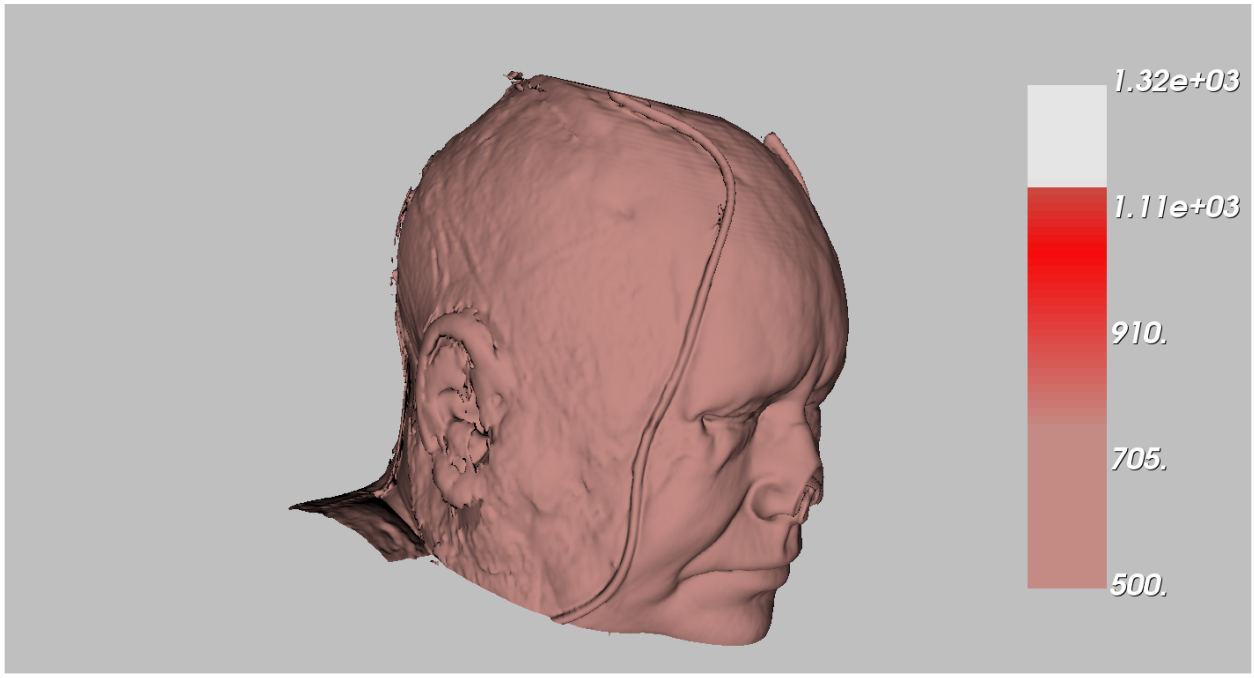
Feet Skin (isovalue = 400)



Head Bone (isovalue = 1300)



Head Muscle (isovalue = 1100)

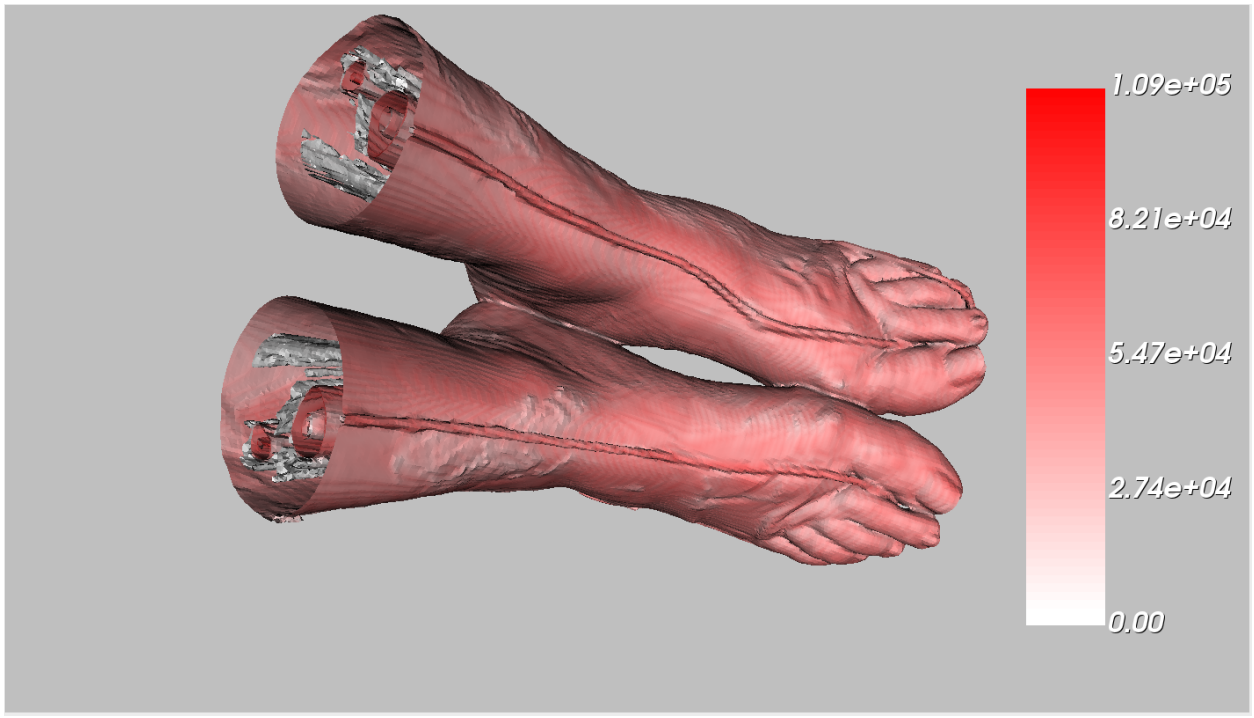


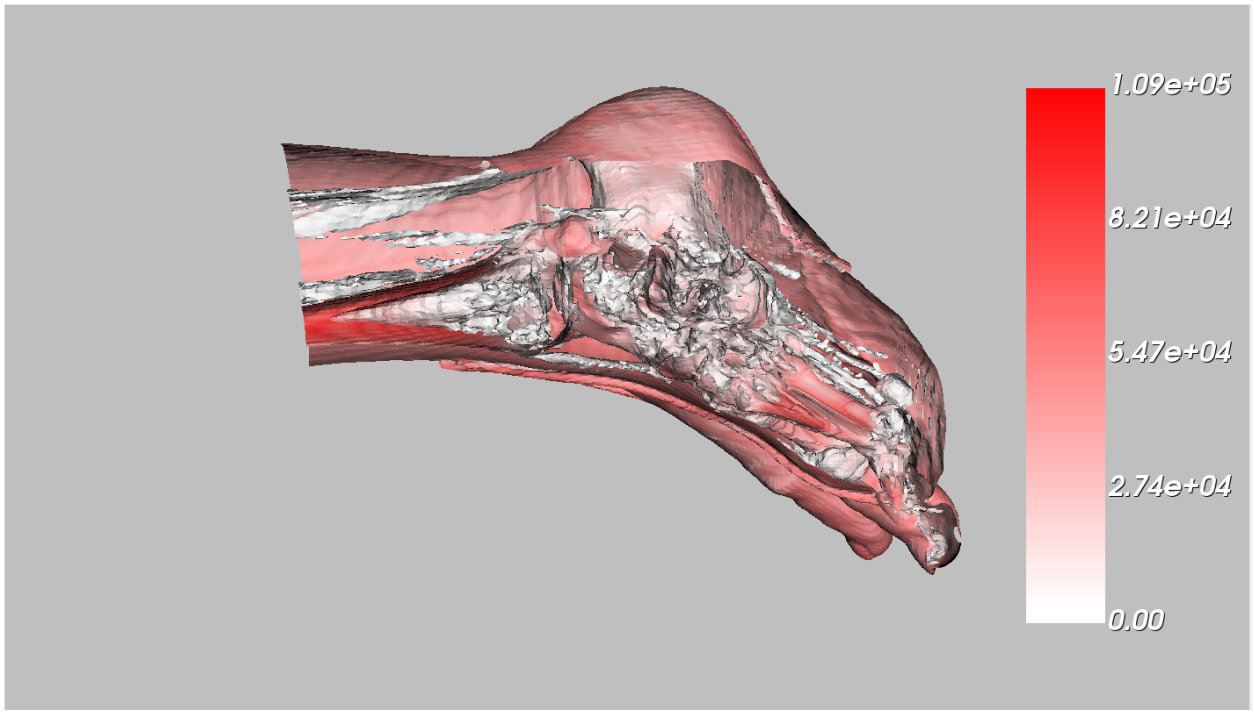
Head Skin (isovalue = 400)

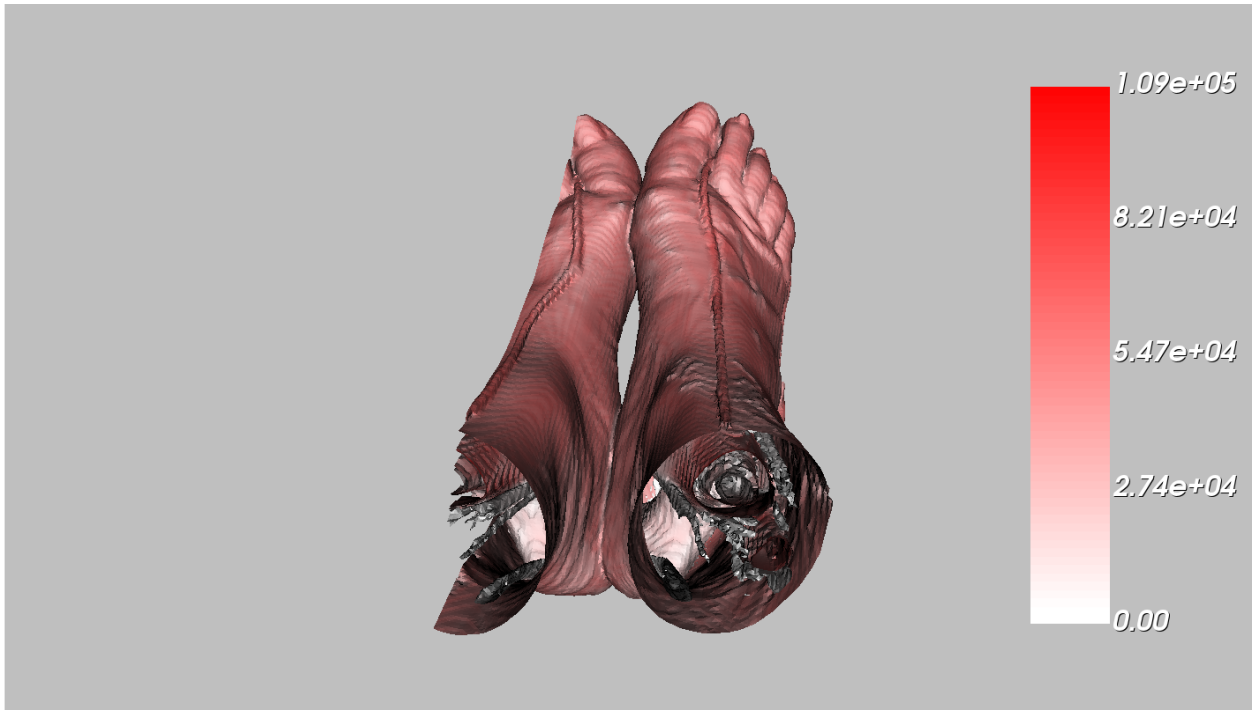
Task 2:

The three isovalues I used in this task are:

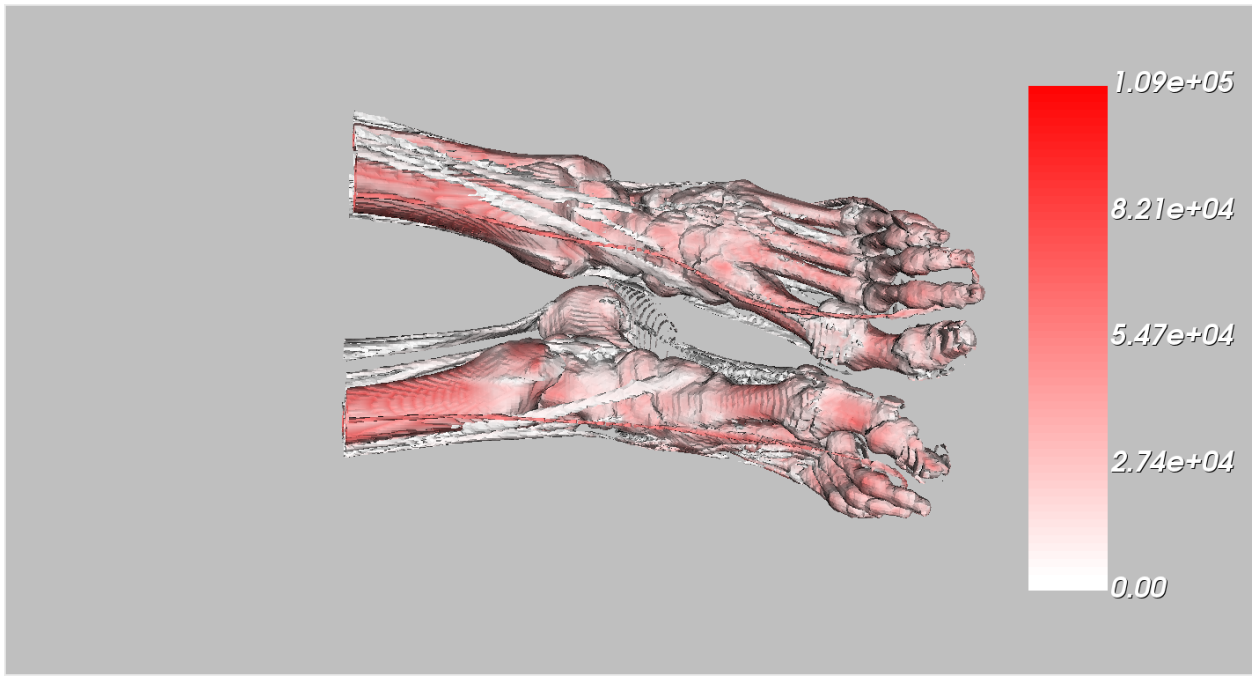
550	for skin
1100	for muscle
1349	for bone


1.09e+05
8.21e+04
5.47e+04
2.74e+04
0.00

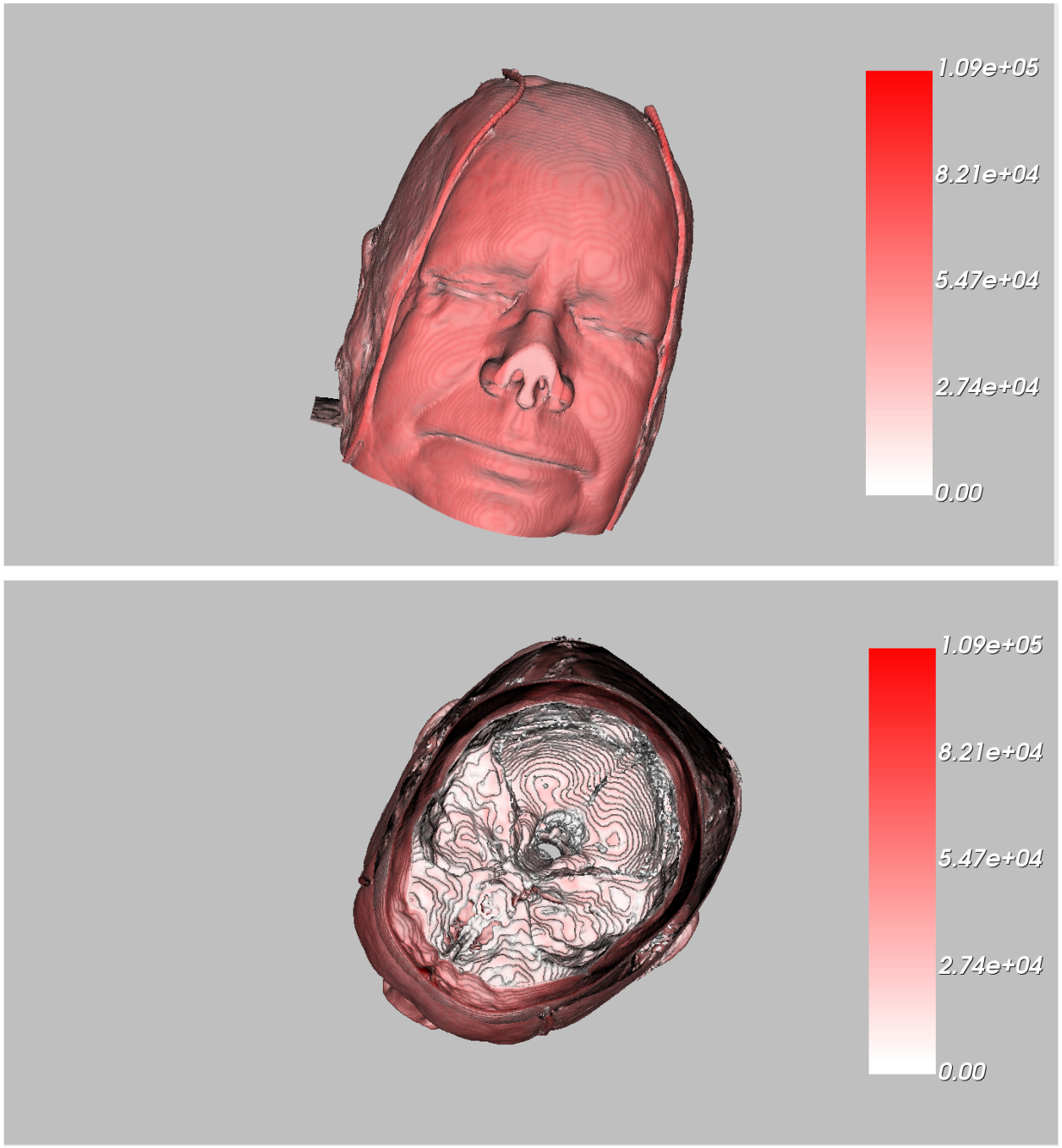

1.09e+05
8.21e+04
5.47e+04
2.74e+04
0.00



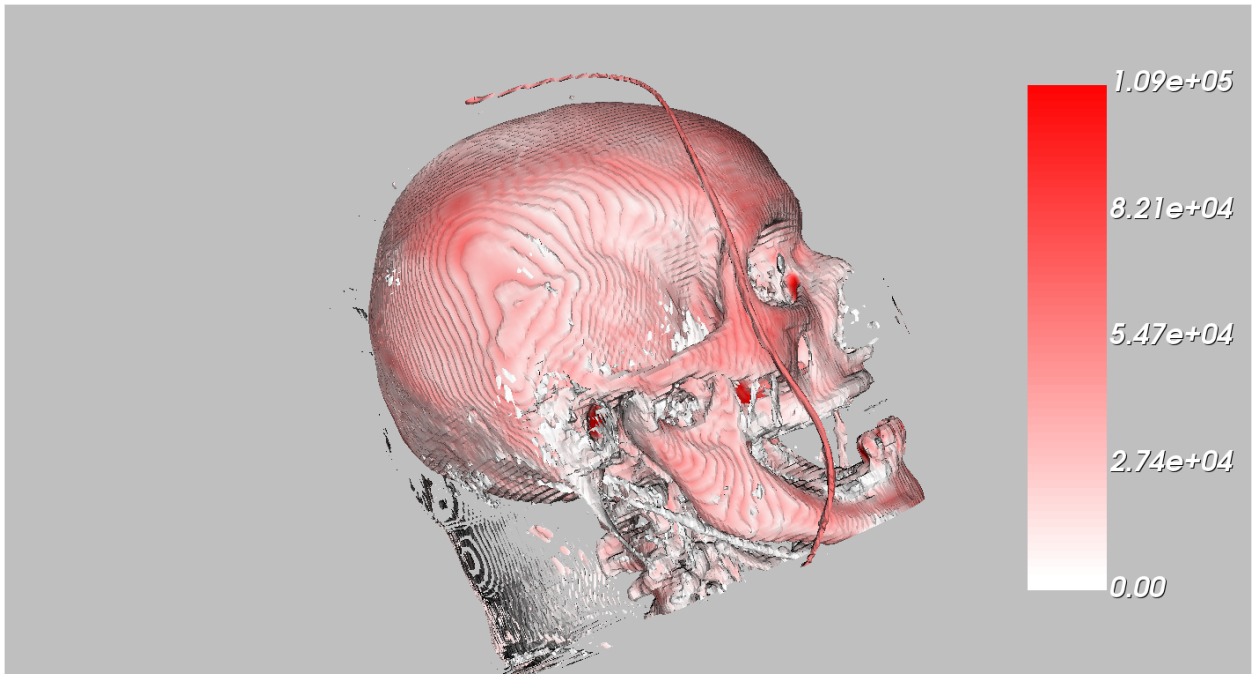
Feet Dataset (all parts)



Feet Dataset (muscle and bone)

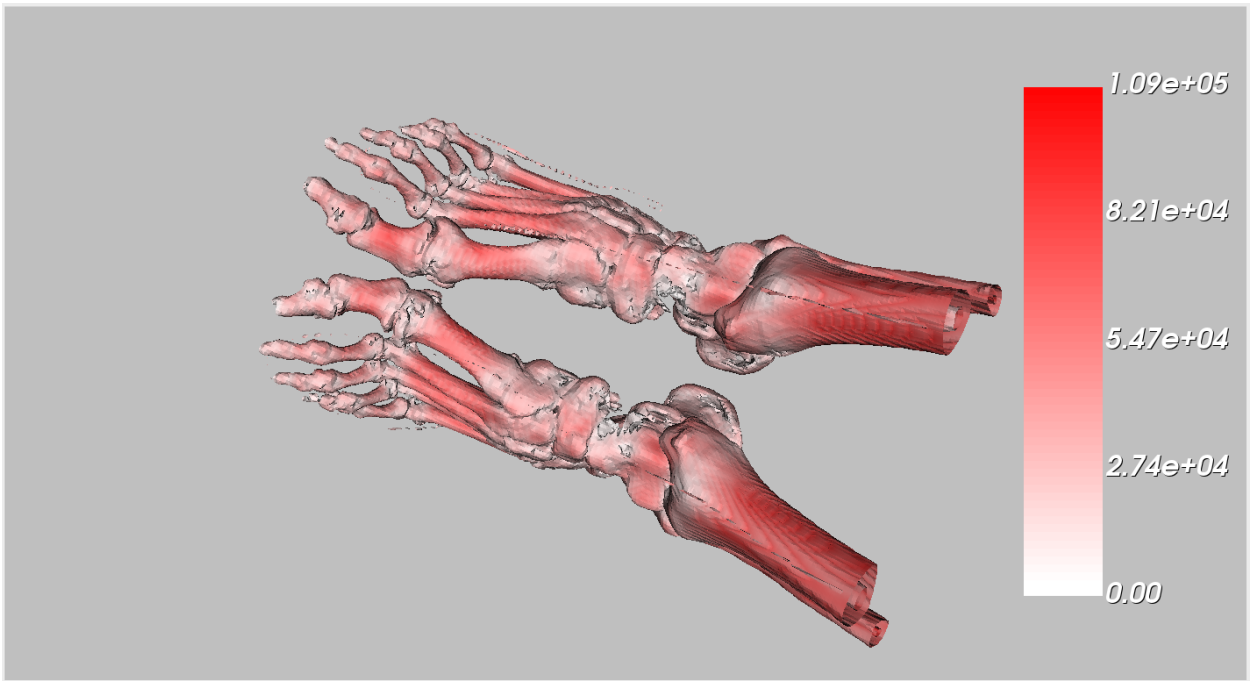


Head Dataset (all parts)

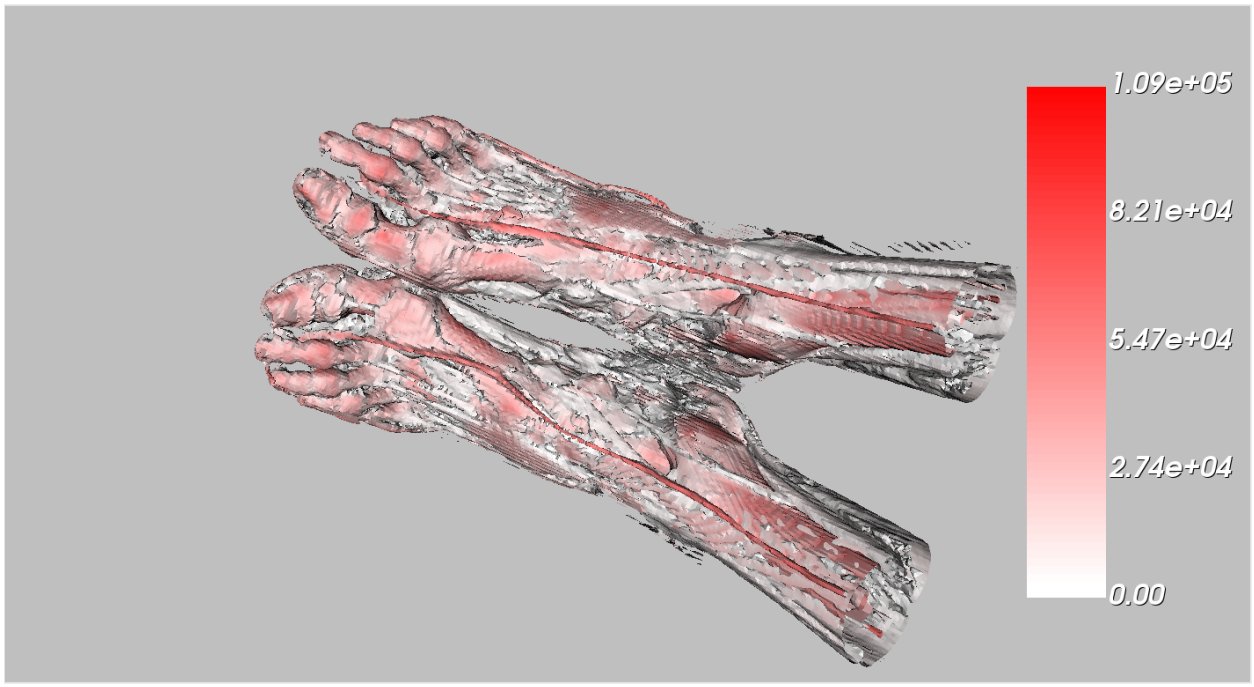


Head Dataset (muscle and bone)

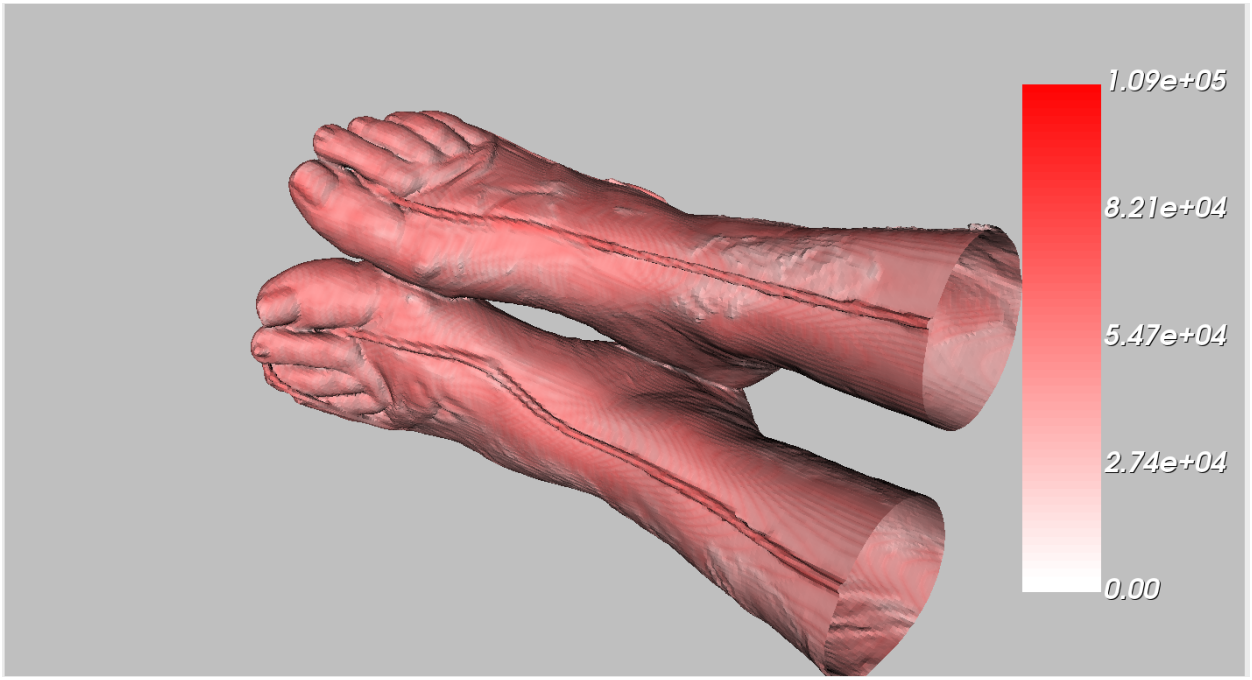
Task 3:



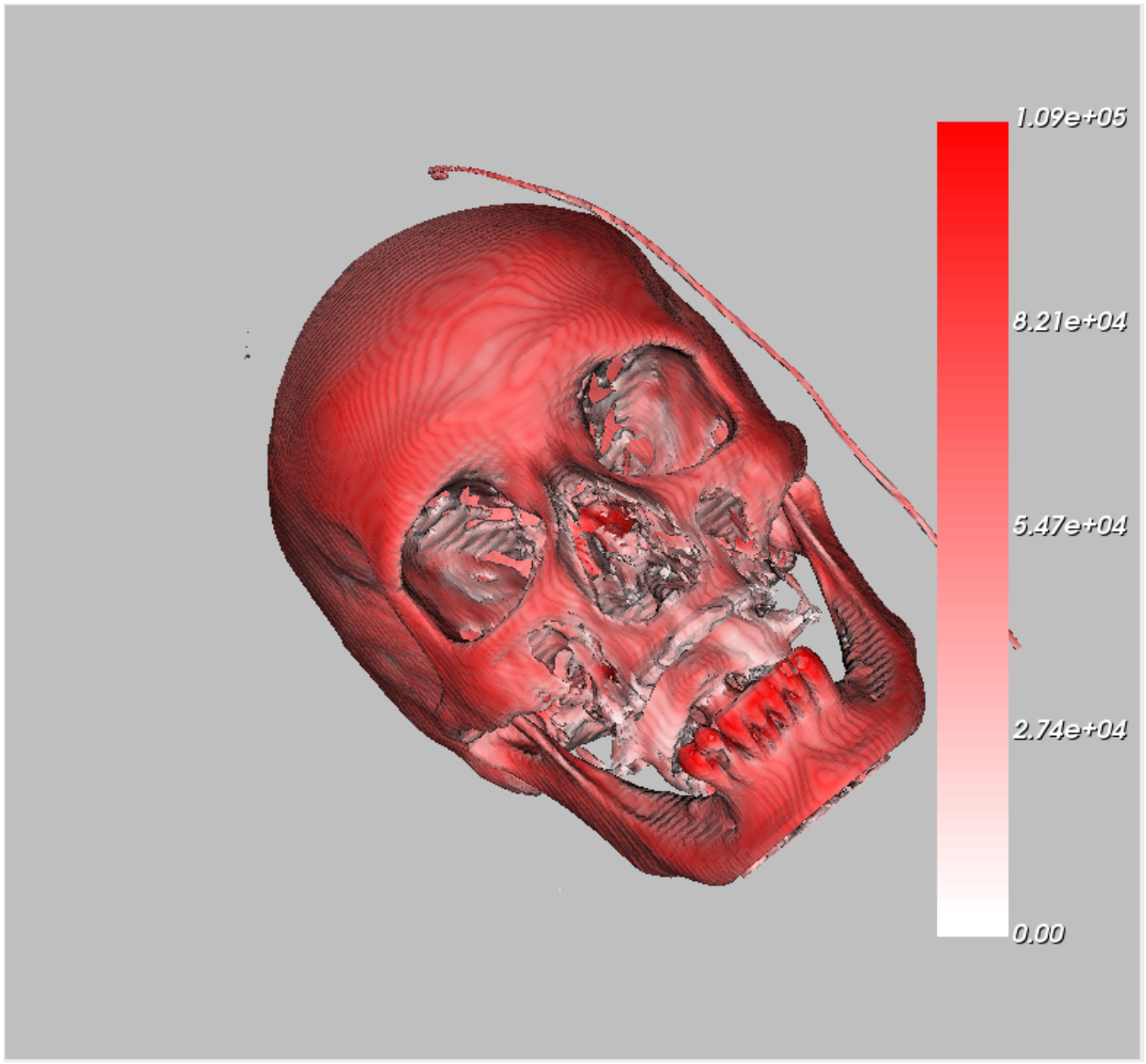
Feet Bone (isovalue = 1300)



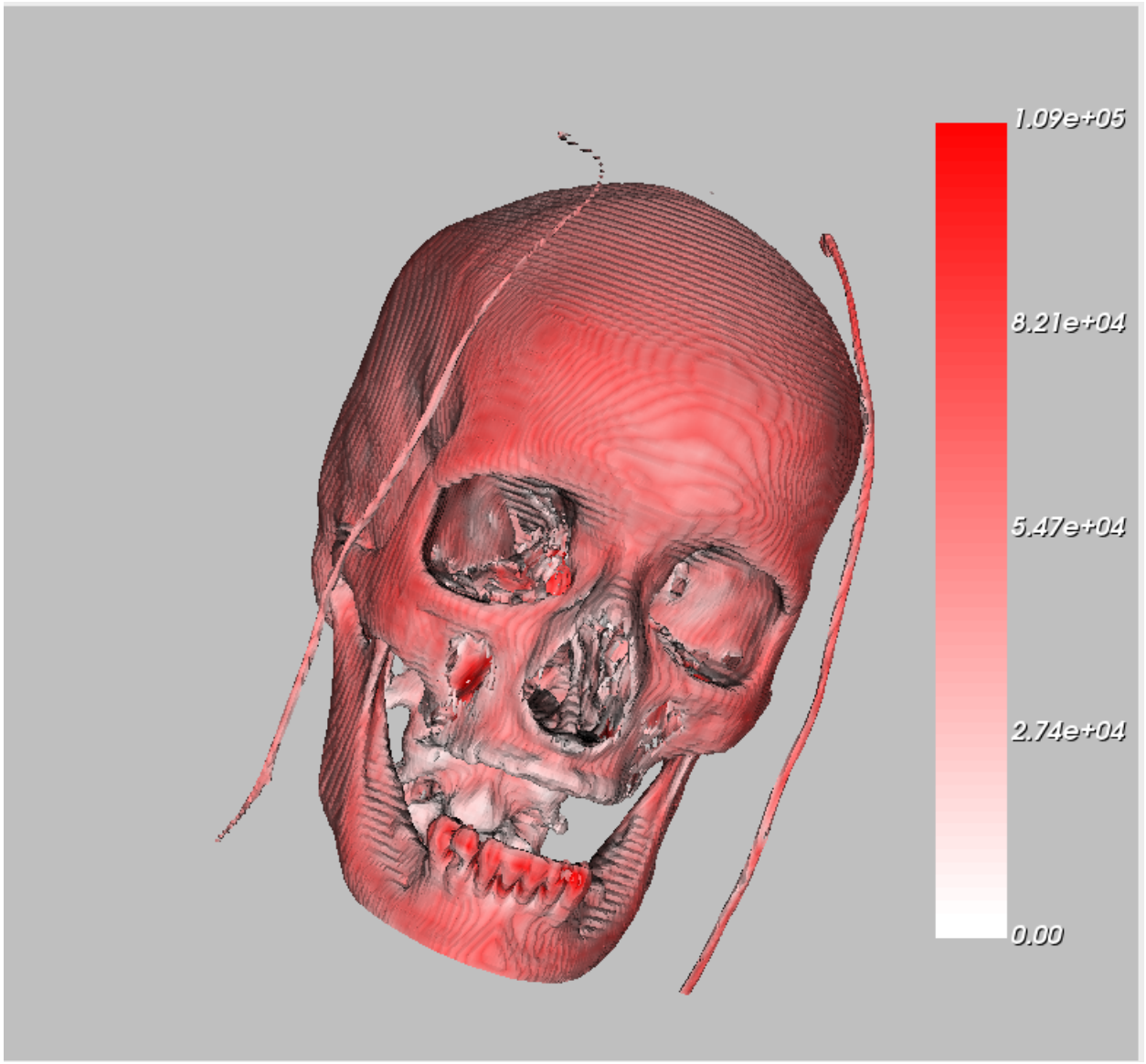
Feet Muscle (isovalue = 1100)



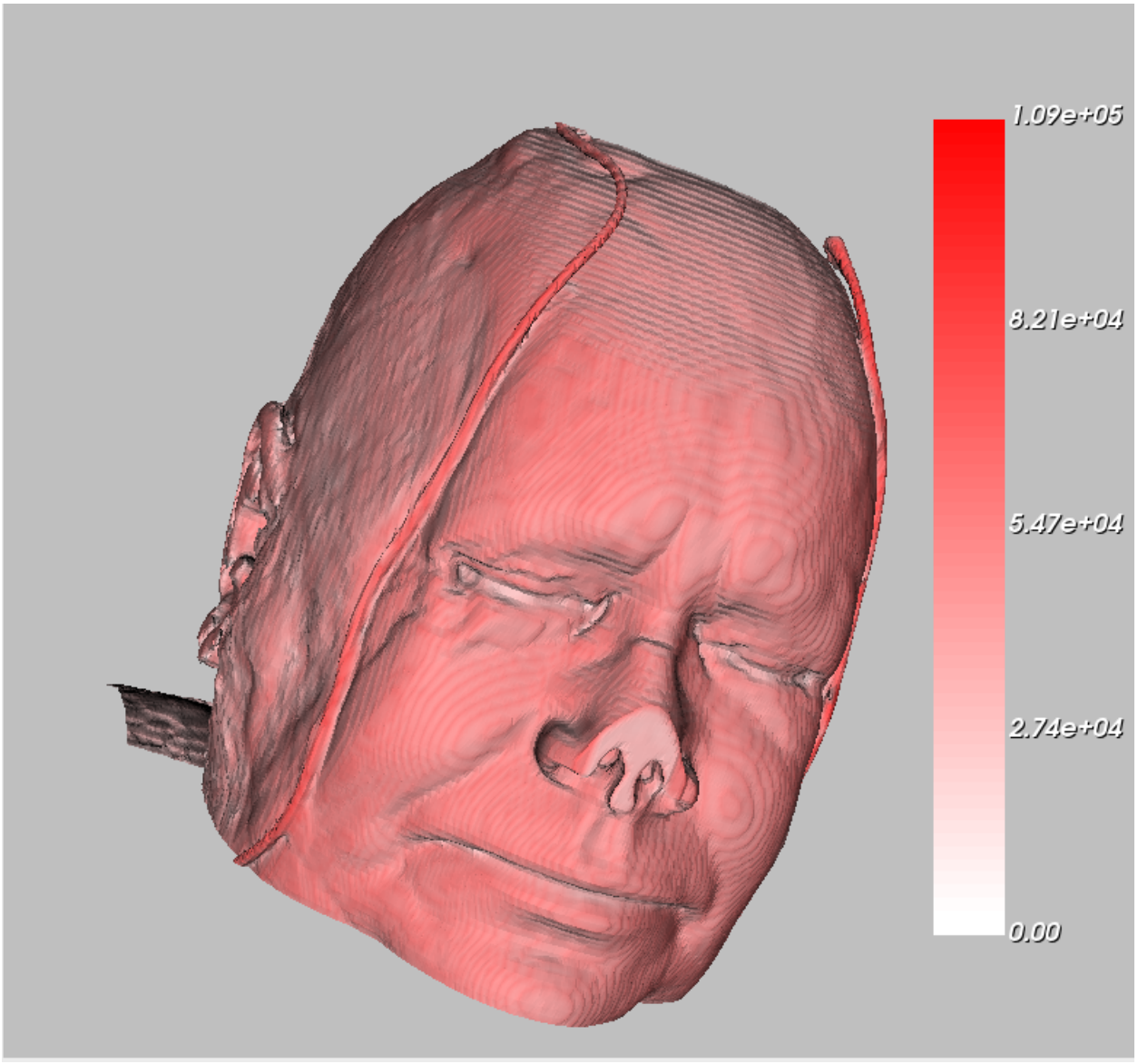
Feet Skin (isovalue = 600)


1.09e+05
8.21e+04
5.47e+04
2.74e+04
0.00

Head Bone (isovalue = 1300)

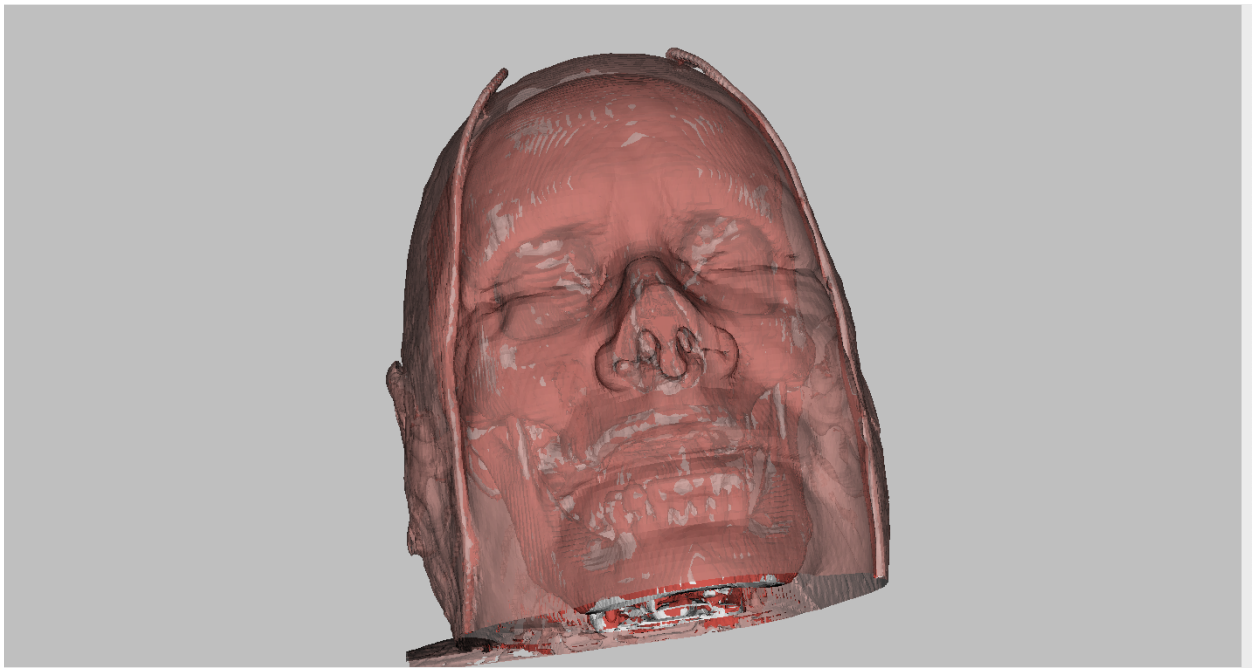


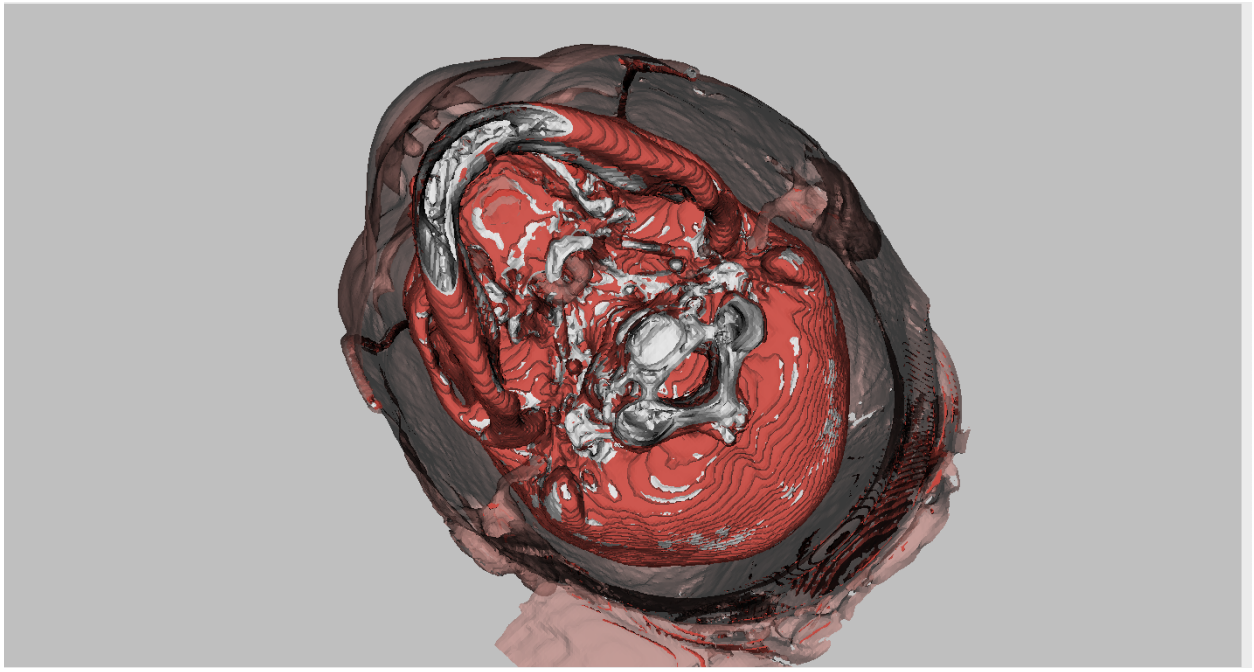
Head Muscle (isovalue = 1100)



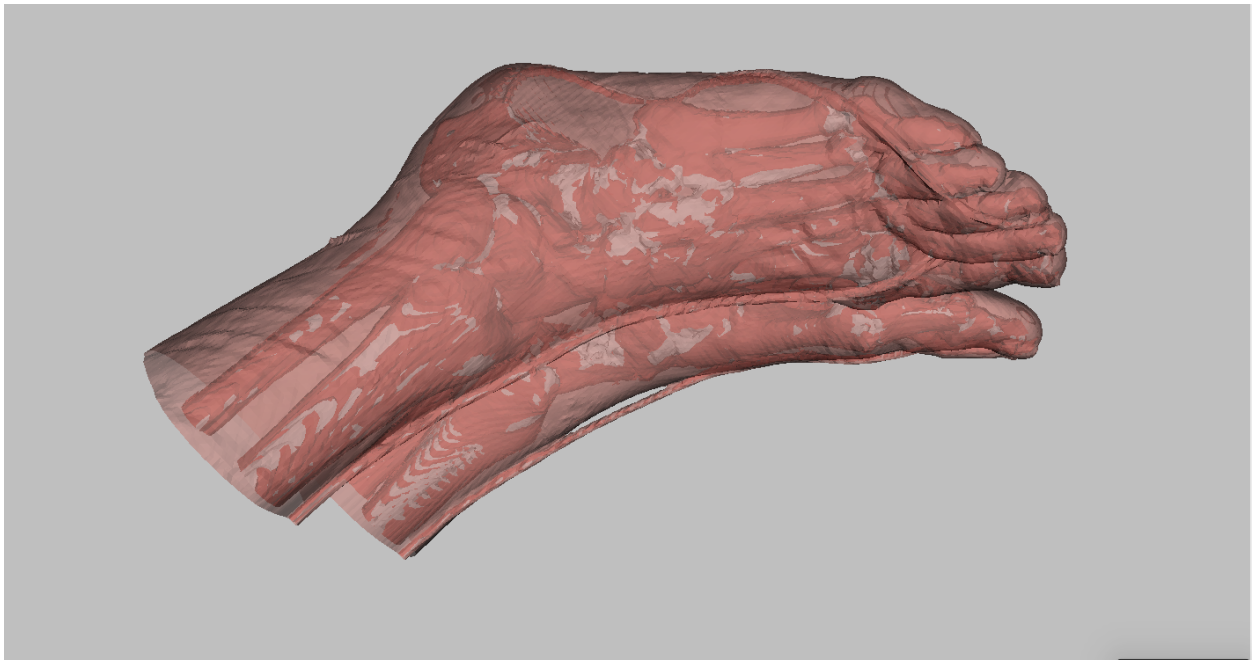
Head Skin (isovalue = 600)

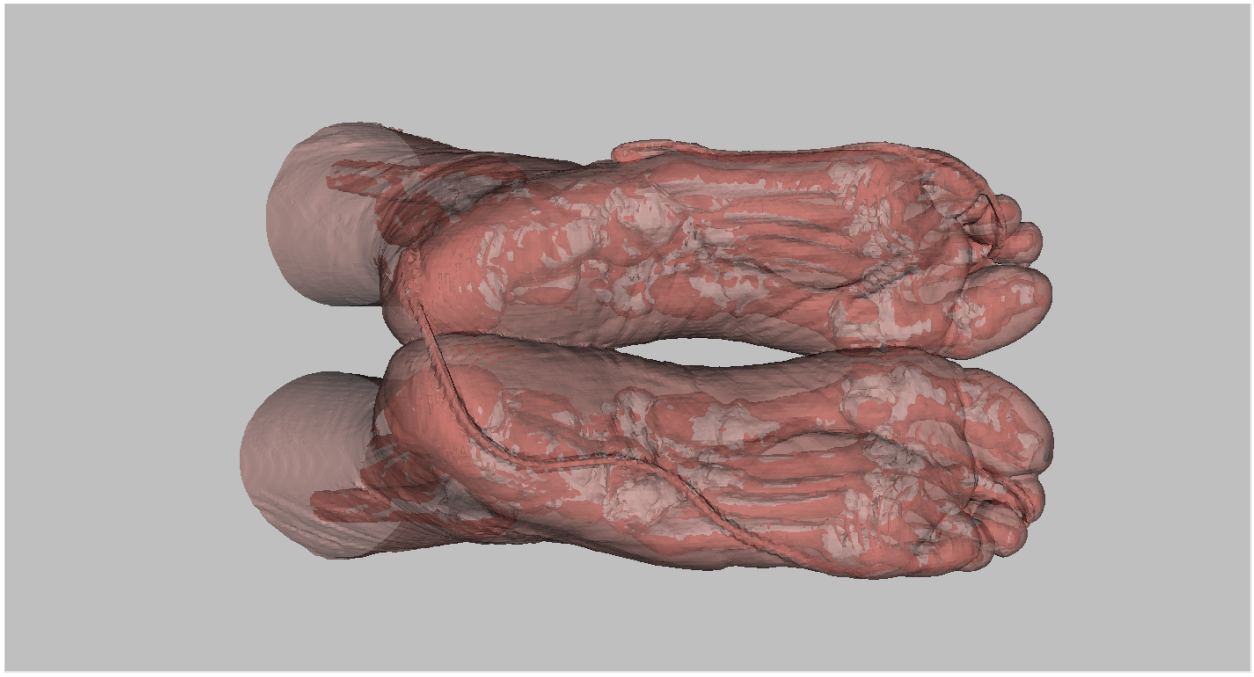
Task 4:

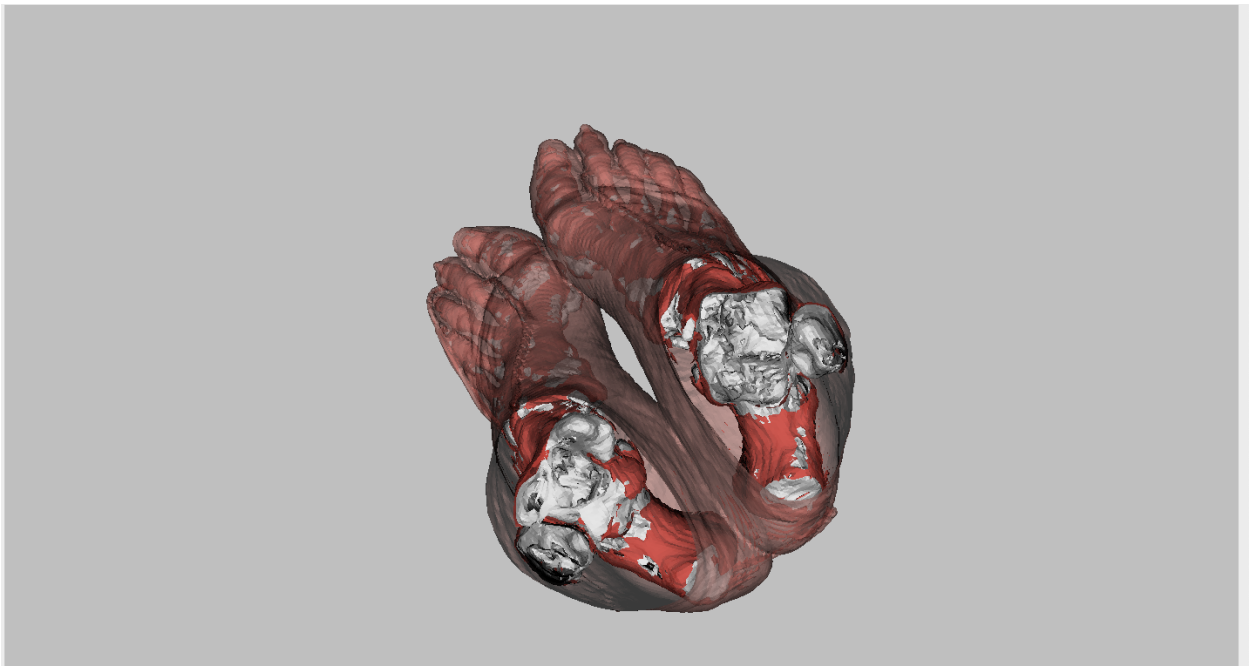




Head







Feet

Part II: Discussion

Task 1:

1. **Which isosurfaces look the most interesting? Justify your answer.**
   The muscle isosurfaces for head and feet are the most interesting because they are more trickier to extract.
2. **How did you select the position of clipping planes?**
   I set the initial positions to zero to show the whole picture at the beginning. I mostly use the Z-plane to investigate cross sections.

Task 2:

1. **What differences can you identify between the various isosurfaces in terms of their associated gradient magnitude distribution?**
   The bones have the lowest gradient magnitude; the skin has the highest; and the muscle is in between.
2. **How do you interpret these results? Justify your answer.**
   It seems that the gradient magnitude has a correlation with how deep the body part is. The deeper the tissue is, the lower the gradient magnitude would be.
3. **What does that tell you about the value of the resulting visualization? Explain.**
   We should perform separate visualizations for each isovalue to exploit such correlation.

Task 3:

1. **To what extent did the gradient magnitude filtering help in refining the isosurface selection? Be specific.**
   Gradient magnitude filtering is good for separating skins and bones, but it is hard to separate skins and muscles, since the range of skin overlaps the range of muscle.
2. **Which isosurfaces benefited the most from this filtering? Why?**
   The muscle isosurface now becomes very obvious to identify, so it benefits the most from this technique.

Task 4:

1. **Comment on your selection of the transparency for each isosurface.**
   I selected the bones to be completely opaque (1.0), since we do not need to peek in what's inside of the bone isosurface. I chose the opacity for the muscle to be 0.9 and the skin to be 0.7 so that we can still peek into the skin while the skin is still obvious to identify.
2. **How does transparency benefit your visualization? Explain.**
   It makes the overall structure easier to see. We do not need to apply any clipping to inspect the muscle and bone structures that are inside the skin.

Overall:

1. **What explanation can you propose for this success?**
   Isosurfaces with gradient magnitude reveals the important body parts in an intuitive and detailed way. The clipping planes can also help the doctors to focus on one region of the CT image.
2. **Comment on the quality of the images you were able to obtain in each case.**
   I can obtain pretty high quality images, but for the datasets I can still see small triangles that are used to approximate curved surfaces.
3. **Discuss any shortcomings of the isosurfacing technique you may have come across in this project.**
   One obvious shortcoming is that it's quite hard to identify the correct range for muscles, which can be crucial for diagnostics. Also, it seems that the range of isovalues change a little when I tried to switch to the larger dataset, so it would be inconvenient to use if the user has to manually adjust isosurface values.
4. **Comment on the role and meaning of gradient magnitude to filter isosurfaces.**
   Gradient magnitude gives a more meticulous way to fine-tune the resulting isosurfaces so that we can exclude noises that cannot be removed by adjusting isovalues.
5. **Comment on the benefits and limitations of transparency and clipping planes to enhance the visualization.**
   The benefit of transparency and clipping planes is that they are relatively easy to implement compared to more advanced enhance methods. However, using clipping planes can be tricky if the user is interested in an irregular region, and transparency may make the contrasting features in a isosurface less obvious.