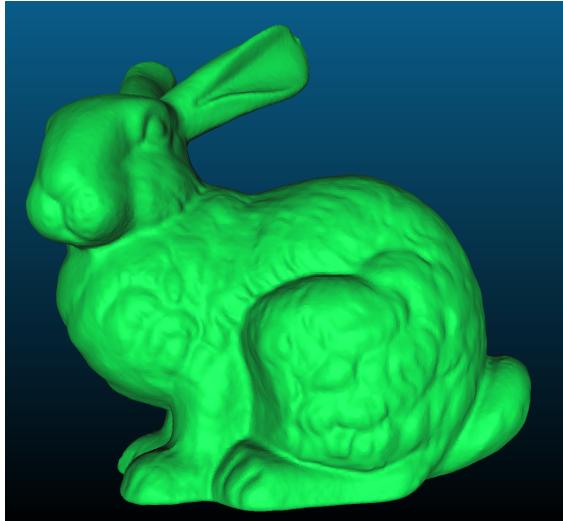


TP 4: Surface Reconstruction

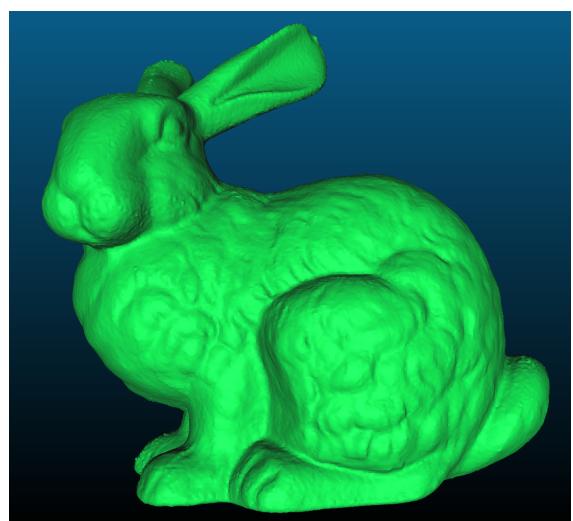
Martin Jolif

February 9, 2025

1 Question 1



default parameters



point weight = 8

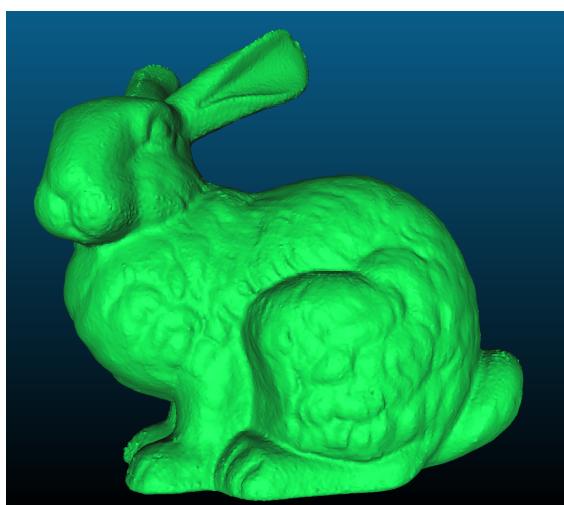
Figure 1: Visualization of the mesh reconstruction of the surface from PoissonRecon

I would say that the "best" reconstruction of the surface of the bunny from PoissonRecon is the one with the default parameters:

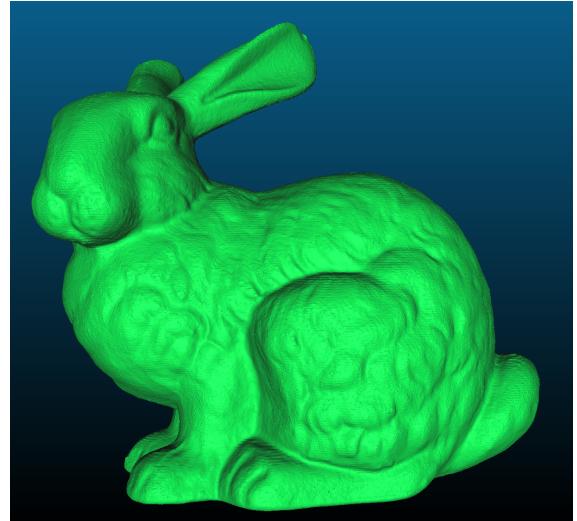
- octree depth = 8
- samples per node = 1.5
- point weight = 2

This surface reconstruction has 373,800 triangles.

It's not easy to explain what the "better" reconstruction should be for this object. First, we need to have enough details to be able to recognize and see the details from the nose, the eyes... This is the case of the images in figures 1 and 2 in contrast to the image from figure 3. Moreover, some of the images with enough details have maybe too many details, as

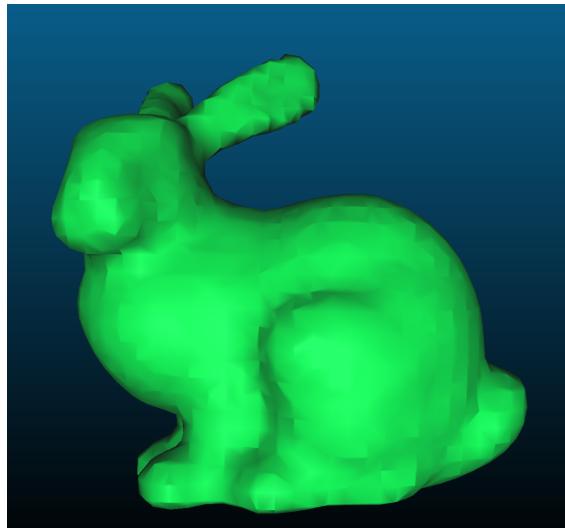


Samples per node = 10



octree = 12

Figure 2: Visualization of the mesh reconstruction of the surface from PoissonRecon



octree = 5

Figure 3: Visualization of the mesh reconstruction of the surface from PoissonRecon

images in figure 2. Indeed, we can observe sometimes a grainy texture, which maybe should not appear and is a consequence of a bad choice of the parameters (octree depth, samples per node and point weight). Moreover, the finer the reconstruction, the more triangles there are. Indeed, for example the right image from figure 2 has 2,480,388 triangles. Therefore, there is a trade-off between the number of triangles and the quality of the reconstruction.

Finally, we can say that a "better" reconstruction is the one with the most geometric details and less vertices.

2 Question 2

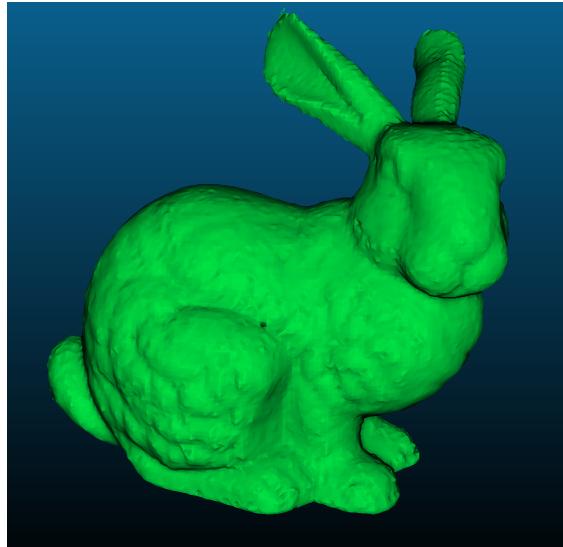
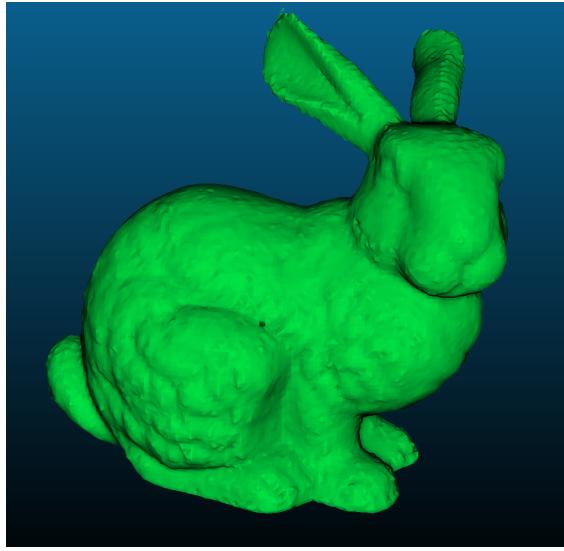


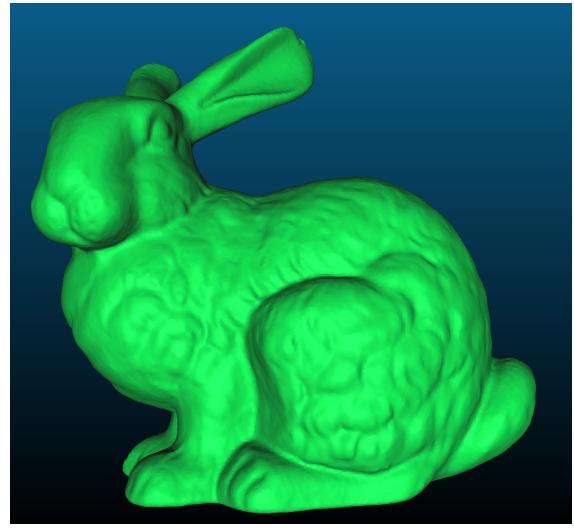
Figure 4: Surface reconstruction of the Bunny with the Hoppe function on a 128x128x128 voxel grid

3 Question 3

We can observe that the reconstruction of the bunny by the PoissonRecon method in CloudCompare seems to be much satisfying than the one from the Hoppe function in the reconstruction.py file. Indeed, we can observe that the reconstruction from the Hoppe function is less precise (the geometry is less smooth), maybe it comes from the fact that there are only 79 610 triangles in the mesh. Moreover the computing time to do the reconstruction is much longer for the Hoppe function too. Indeed, it takes approximately 14 seconds against only 2/3 seconds for the PoissonRecon method on CloudCompare. (See figure 5).



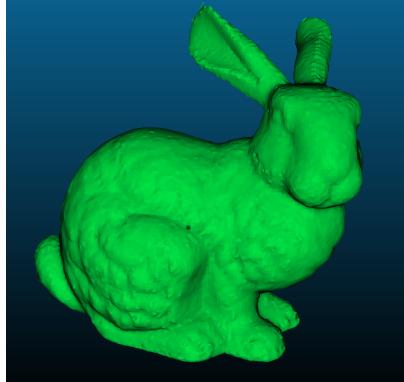
Hoppe function with reconstruction.py



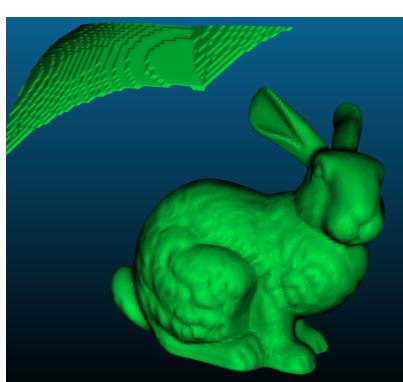
PoissonRecon on CloudCompare

Figure 5: Surface reconstruction of the Bunny

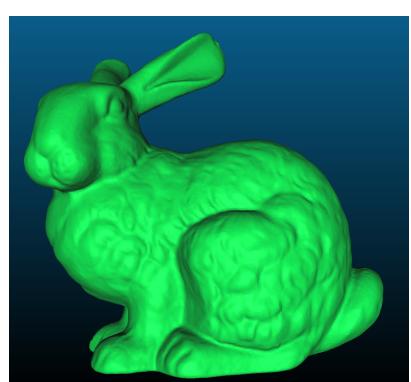
4 Question 4



Hoppe reconstruction



IMLS reconstruction



PoissonRecon

Figure 6: Surface reconstruction of the Bunny

The surface reconstruction with the IMLS implicit function takes 28 seconds, which is the slowest. Indeed, the computation of this function requires an additional weighted average compared to the Hoppe function. The reconstruction with IMLS contains 84 221 triangles, which is a little bit above the Hoppe reconstruction but much less than the Poisson reconstruction (373 800 triangles). The quality of the reconstruction seems to be quite good, the geometry is smooth as it is the case for the Poisson reconstruction in contrary of the Hoppe reconstruction which is not so smooth. However, there is an outlier part of the mesh "in the sky". This is not very good, but it can be removed with a postprocessing method as it is not in close around the original bunny.