TP 4 : Surface Reconstruction

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A. 3D Reconstruction in CloudCompare

Figure 1 Poisson surface reconstruction on bunny point cloud

1) We use the Poisson surface reconstruction of CloudCompare on the bunny point cloud with the following parameters:

- Octree depyh : 8
- Neuman boundary
- Samples per node : 1.5
- Point weight : 2

We obtain a mesh grid of 373800 triangles and 186902 vertices (fig. 1).

2) We do the same with the *Armadillo* point cloud. First, we need to compute normals using a spherical neighborhood of radius r=1.5mm, we orient them using minimum spanning tree (knn=6) and then we use these normals in the poisson reconstruction.
We obtain a mesh grid of 265504 triangles and 132754 vertices (fig. 2)

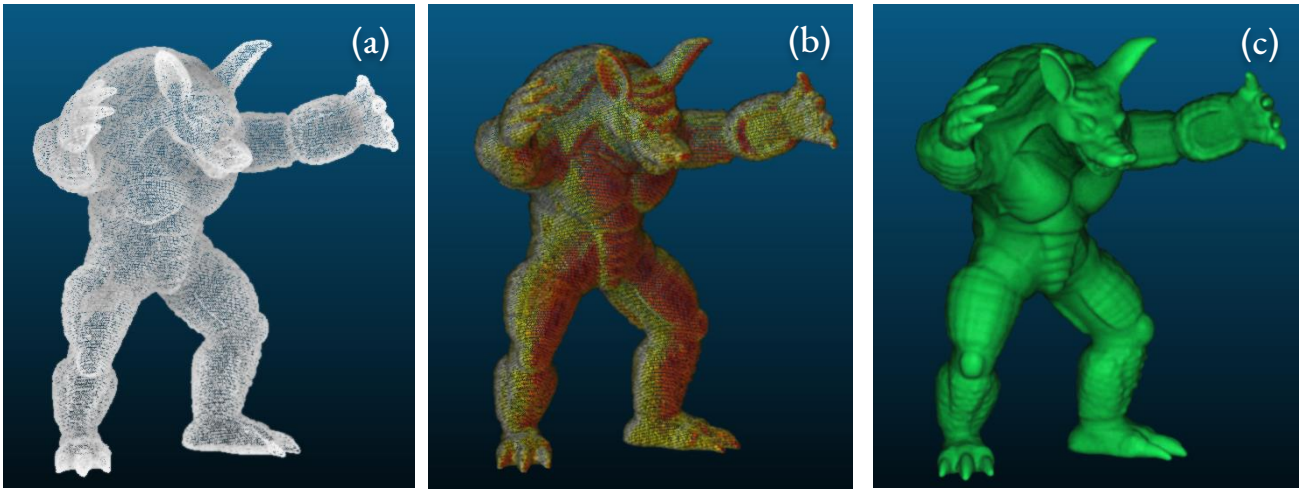

Figure 2 Armadillo point cloud (a) input point cloud (b) normals (c) Poisson surface reconstruction

B. Surface Reconstruction in Python: implement the Hoppe implicit function

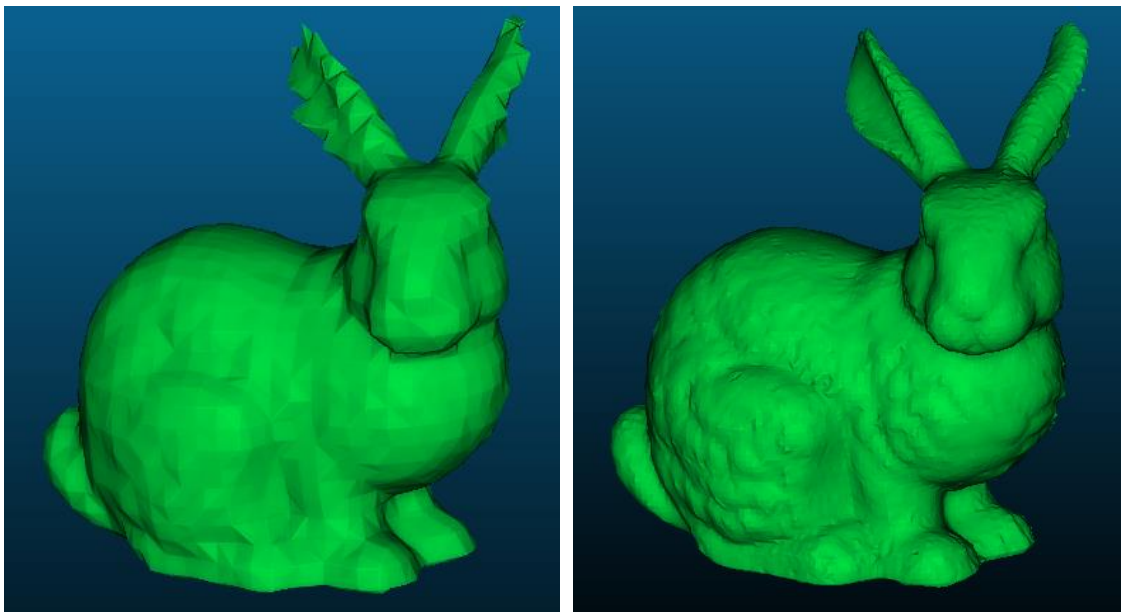

Figure 3 Iso-zero surface of bunny point cloud using the Hoppe function with a grid resolution of 30 (left) and 100 (right) along each axis

Fig. 3 shows bunny point cloud meshs with the hoppe implicit function with grid_resolution = 30 and 100. First, With a smaller number of voxels along each axis (bigger voxels), surface reconstruction is faster (~ x23 times than grid_resolution=100).

However, with higher grid resolution, we get a more accurate surface.

C. Going further (BONUS)

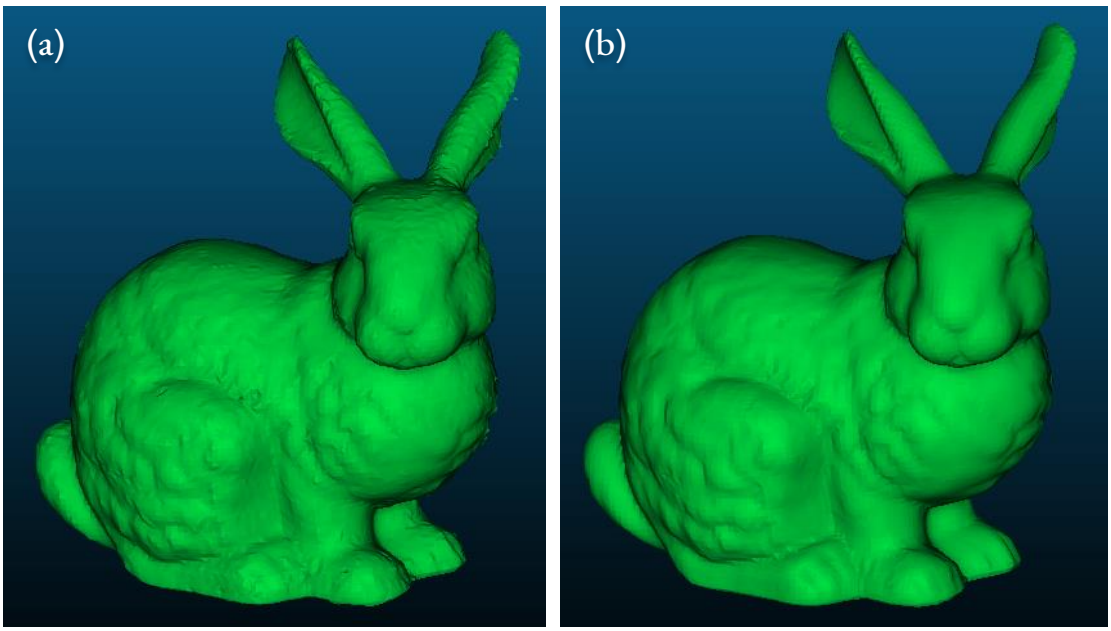

Figure 2 Iso-zero surface of bunny point cloud with a grid resolution of and 100 using (a) the IMLS function, (b) Hoppe function

- The IMLS function is a smooth version of the Hoppe function.
- We replace the scalar product $ni \cdot (x - pi)$ with an averaged scaler product. This gaussian smoothing produces a more continuous surface representation.
- This will reduce the noise on the surface as shown in fig. 4.