TP4: Surface Reconstruction

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Exercise A: 3D Reconstruction in CloudCompare

Question 1:

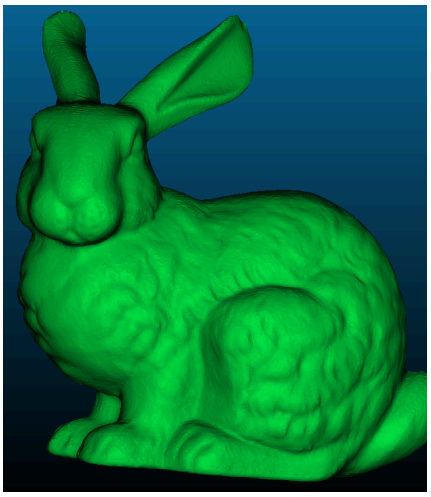


Figure 1: Bunny with Octree = 8, boundary = free, samples per node = 3.0, point weight = 3.0, number of triangles = 373812

We consider this one as our best result because it reflects a decent tradeoff between the surface quality (in terms of details) and the number of triangles. With a deeper octree, the resulting mesh doesn't look more detailed although it adds more triangles. Conversely, a shallower tree greatly degrades mesh quality.

Exercise B: Surface Reconstruction in Python

a - Implement the Hoppe implicit function

Question 2:

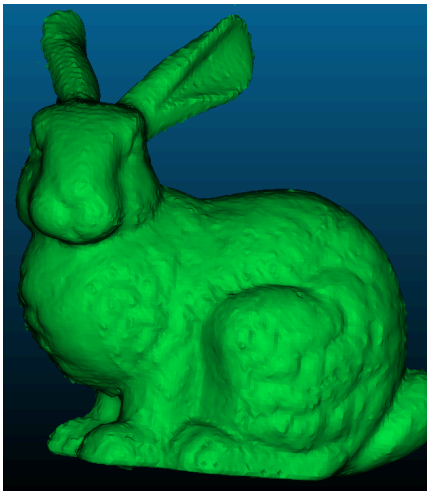
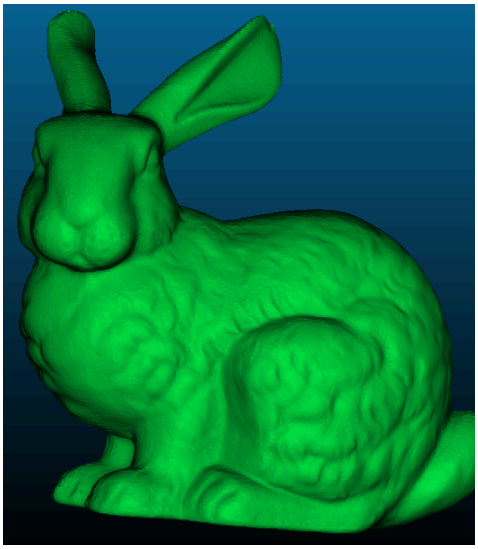
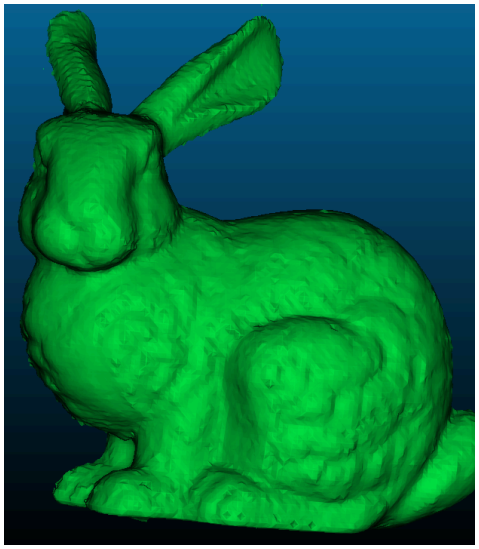


Figure 2: Surface reconstruction of the Bunny with the Hoppe function on a $128 \times 128 \times 128$ voxel grid.

Question 3:

Method	**Cloud Compare**	**Hoppe Python Implementation**
Screenshots		
Computation Time	$6.3s$	$61.1s$
Number of Triangles	373812	82168
Quality of reconstruction	Smooth surface with sharp details, little artefacts	Detailed but degraded surface with many artifacts

b - Implement the IMLS implicit function

Question 4:

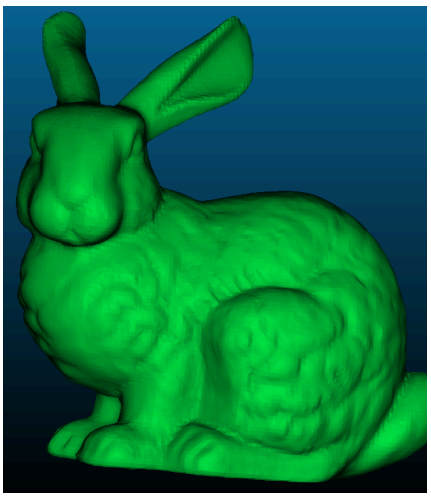
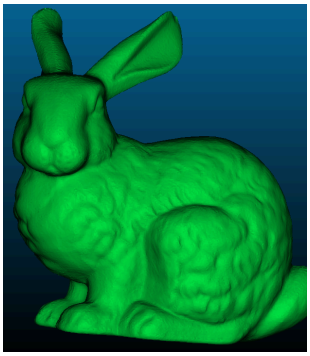
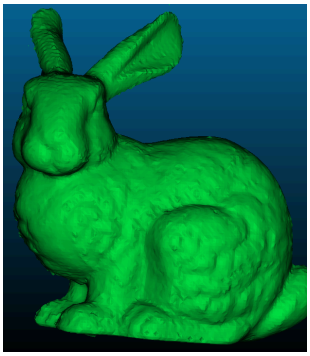
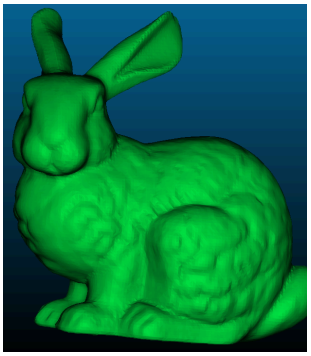
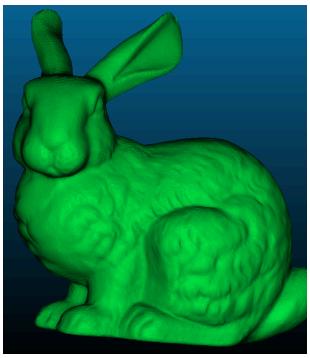
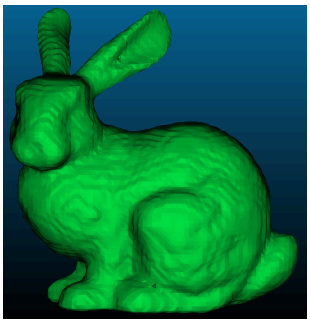
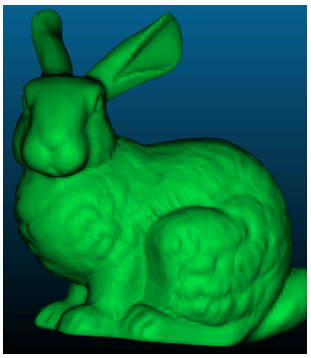


Figure 3: Surface reconstruction of the Bunny with the IMLS function on a $128 \times 128 \times 128$ voxel grid.

Method	**Cloud Compare**	**Hoppe Python Implementation**	**IMLS Python Implementation**
Screenshot			
Computation Time	6.3s	61.1s	242.4s
Number of Triangles	373812	82168	77152
Quality of reconstruction	Smooth surface with sharp details, small artefacts	Detailed but degraded surface with many artifacts	Smooth but slightly detailed than CloudCompare results

Exercise C: Going further (BONUS)

Bonus Question:
We used the vanilla weights trained on abc only. For inference we changed this script to fix a 128 grid size, after making a point cloud evaluation dataset containing the bunny only.

Method	**Cloud Compare**	**Vanilla Point2Surf Implementation**	**IMLS Python Implementation**
Screenshot			
Computation Time	6.3s	13.0s	242.4s
Number of Triangles	373812	28366	77152
Quality of reconstruction	Smooth surface with sharp details, small artefacts	Coarse details, Stratified surface	Smooth, lack details in some areas