Nuages de Points et Modélisation 3D (NPM3D) TP4

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1 Question1

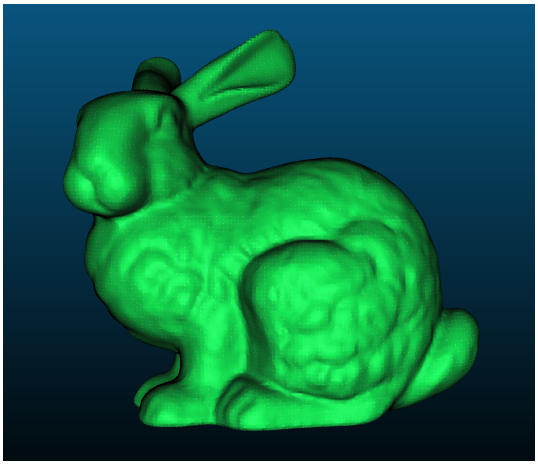

Figure 1: The "best" reconstruction of the surface from PoissonRecon

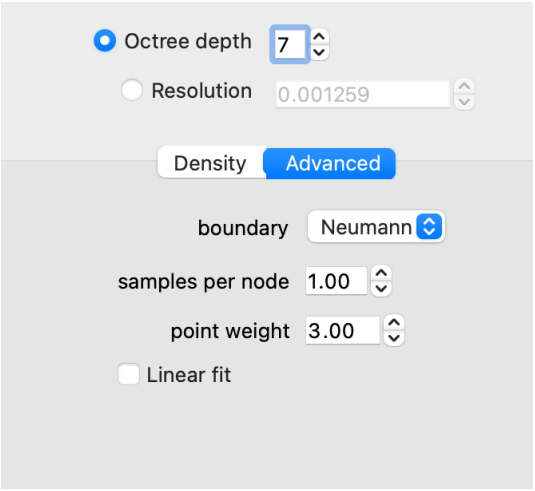

Figure 2: The parameters that lead to this result

Figures 1 and 2 illustrate the outcome of the surface reconstruction using the PoissonRecon method and the parameters that were fine-tuned to achieve this result, respectively. The final mesh comprises $93,376$ triangles, reflecting a detailed reconstruction that accurately captures the intricate surface details of the original model.

A "better" reconstruction, in this case, denotes a higher fidelity to the model's true form, characterized by smooth surfaces, minimal artifacts, and an evenly distributed triangle mesh. These qualities collectively enhance the accuracy of the reconstructed point cloud.

2 Question2

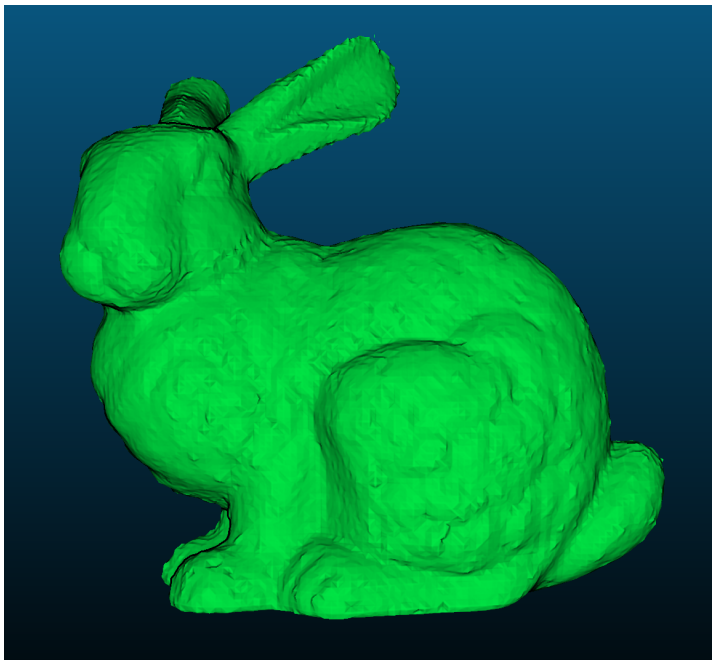

Figure 3: The surface reconstruction of the Bunny with the Hoppe function on a 128x128x128 voxel grid

3 Question3

	PoissonRecon	**Hoppe**
computation time	0.03	129.02
number of triangles	93,376	98,284

Table 1: Comparison of computation time and number of triangles for surface reconstructions using PoissonRecon and Hoppe

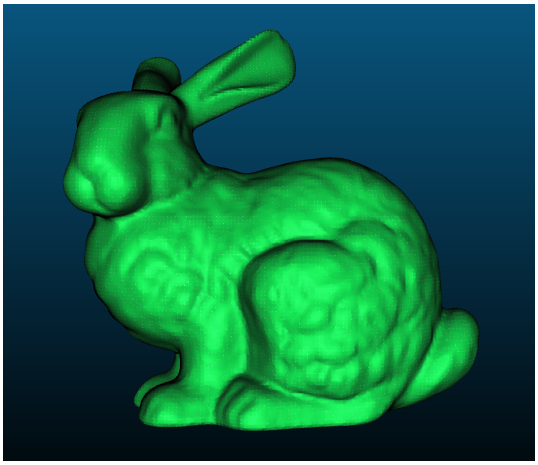

Figure 4: The reconstruction using Poisson-Recon

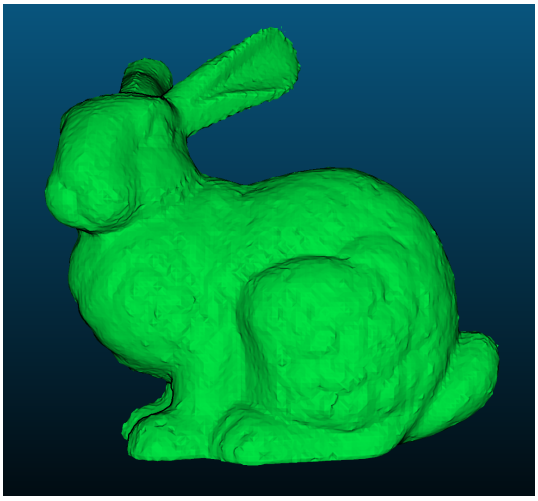

Figure 5: The reconstruction using Hoppe

The comparison between surface reconstruction methods PoissonRecon and Hoppe reveals significant differences. PoissonRecon's process is exceptionally faster, requiring only 0.03 seconds, while Hoppe's method takes considerably longer at 129.02 seconds, as shown in Table 1. The number of triangles generated by Hoppe is slightly higher, suggesting a more detailed mesh output.

Visually, PoissonRecon (Figure 4) produces a smoother surface which may result in the loss of finer details but offers a cleaner appearance overall. Conversely, the Hoppe method (Figure 5) retains a greater level of detail, as evidenced by the more pronounced features and textures on the surface, albeit with some increased roughness and the presence of minor artifacts.

4 Question4

	PoissonRecon	**Hoppe**	**IMLS**
computation time	0.03	129.02	388.79
number of triangles	93,376	98,284	232,256

Table 2: Comparison of computation time and number of triangles for surface reconstructions using PoissonRecon, Hoppe and IMLS

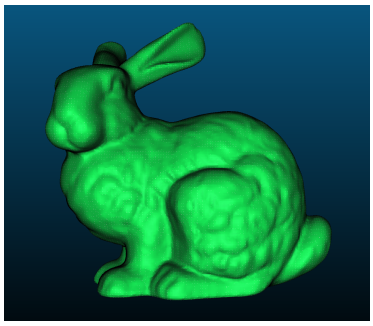

Figure 6: The reconstruction using PoissonRecon

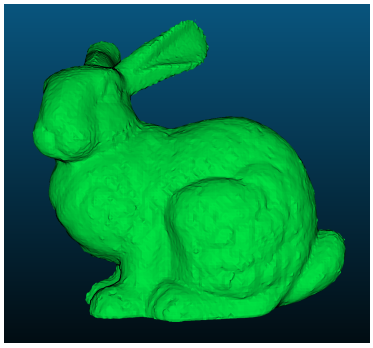

Figure 7: The reconstruction using Hoppe

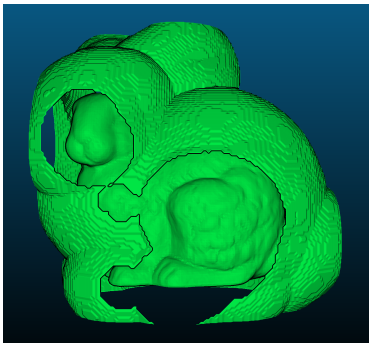

Figure 8: The reconstruction using IMLS

As summarized in Table 2, PoissonRecon is the fastest method with a computation time of 0.03 seconds, followed by Hoppe with 129.02 seconds, and IMLS being the most computationally intensive at 388.79 seconds. The number of triangles in the resulting meshes also varies, with PoissonRecon producing $93,376$ triangles, Hoppe with slightly more at $98,284$, and IMLS yielding a significantly denser mesh at $232,256$ triangles. This increase in triangle count with IMLS is indicative of a more detailed and complex reconstruction but comes at the cost of a longer computation time.

Visually, the PoissonRecon reconstruction (Figure 6) appears to have a smoother surface. Hoppe's reconstruction (Figure 7) shows slightly more surface detail. The IMLS method (Figure 8), while producing the densest mesh, also introduces a noticeable "halo" effect around the Bunny, which could be attributed to the method's sensitivity to the chosen parameters and the influence of outlier points. This effect may require further parameter tuning and possibly preprocessing of the point cloud to mitigate.