IMA208 : Vision 3D et Vidéo

TP: Ranges Scans to “Beautiful” Meshes

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In this TP we did that a code that reads the file named "bunny.xyz" or “Bimba.xyz”, which contains 3D vertex coordinates representing a point cloud of a bunny. Each line in the file corresponds to a vertex, and each vertex is represented by three coordinates (x, y, z).

Then, it performs Delaunay triangulation on the 3D point cloud data for creating a mesh from the set of points in space. It connects the points to form a network of triangles such that no point is inside the circumcircle of any triangle.

It iterates over the tetrahedral elements generated by the Delaunay triangulation.

For each tetrahedron, it iterates over its vertices and constructs triangles using those vertices.

It calculates the Euclidean distances between the vertices of each triangle and then calculates the radius of the circumcircle (the circle passing through all three vertices of the triangle).

If the radius of the circumcircle is less than a certain threshold, it considers the triangle as small enough and includes it in the mesh.

Finally, it saves the resulting mesh to an STL file named "output.stl"

For the “Bimba.xyz” file, we could introduce an adaptive value for the parameter used to filter out small triangles based on the local density of points. First, we calculate the local density of points around each vertex in the point cloud. One simple method is to consider the number of neighboring points within a certain radius.

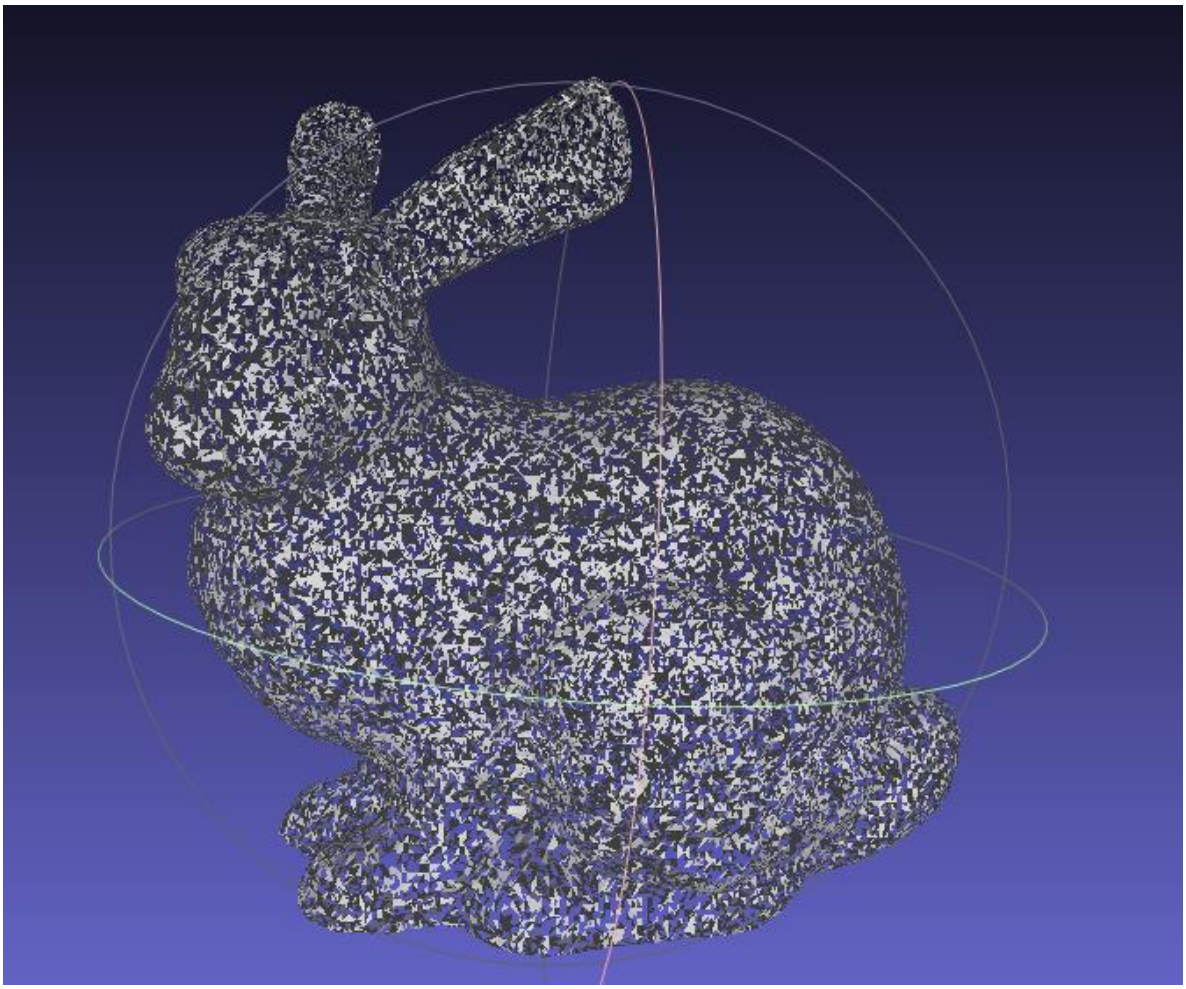
Then we could define a function to calculate an adaptive threshold based on the local density of points. For example, the threshold could be inversely proportional to the local density, ensuring that denser regions allow smaller triangles and vice versa.

And lastly, use the adaptive threshold to filter out small triangles. Triangles in denser regions will have a larger threshold, allowing smaller triangles to be included, while triangles in sparser regions will have a smaller threshold, filtering out very small triangles.

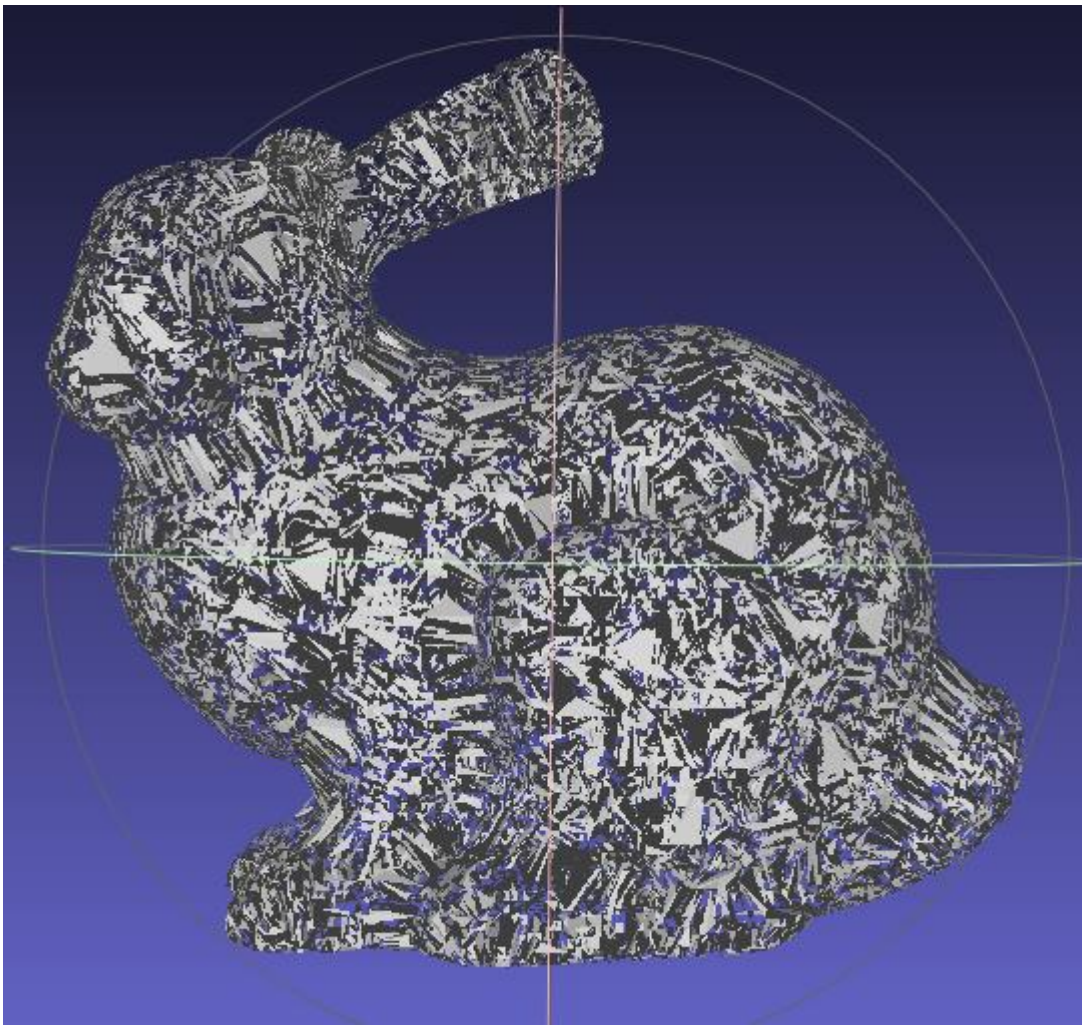
In the following images, we can appreciate the results we obtained for different thresholds for the radius

bunny.xyz

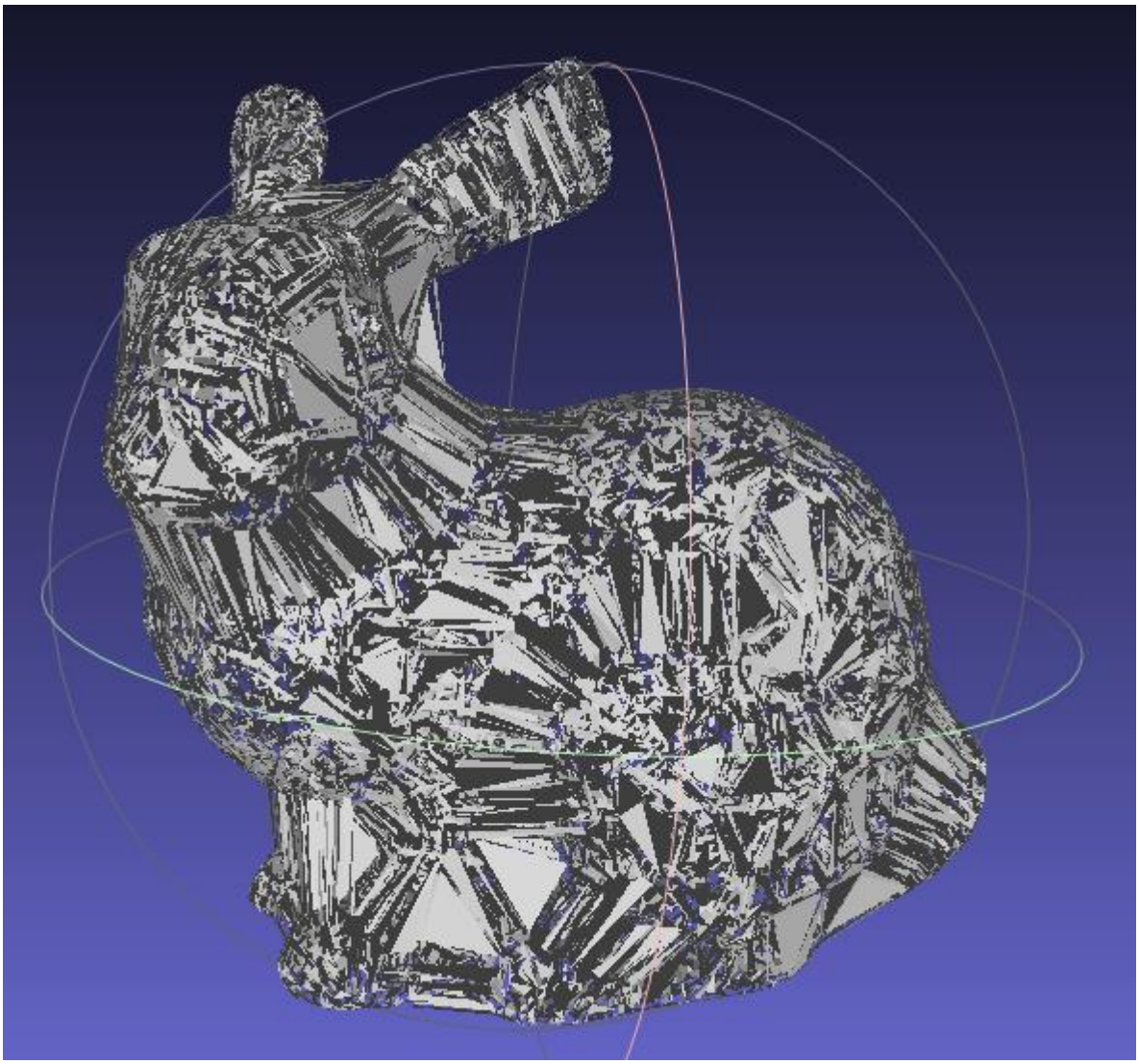
Threshold: 0.002



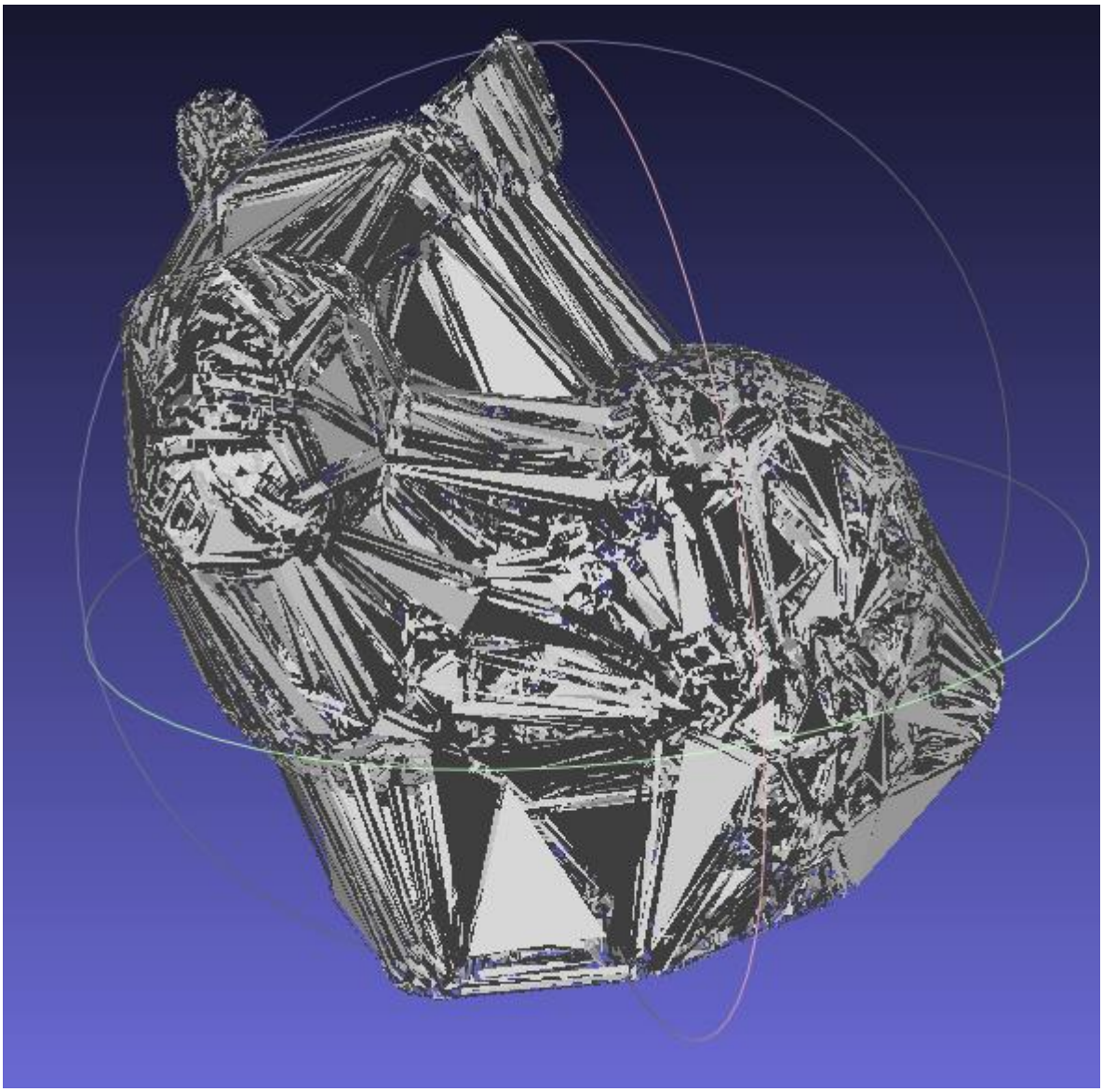
Threshold: 0.005



Threshold: 0.01

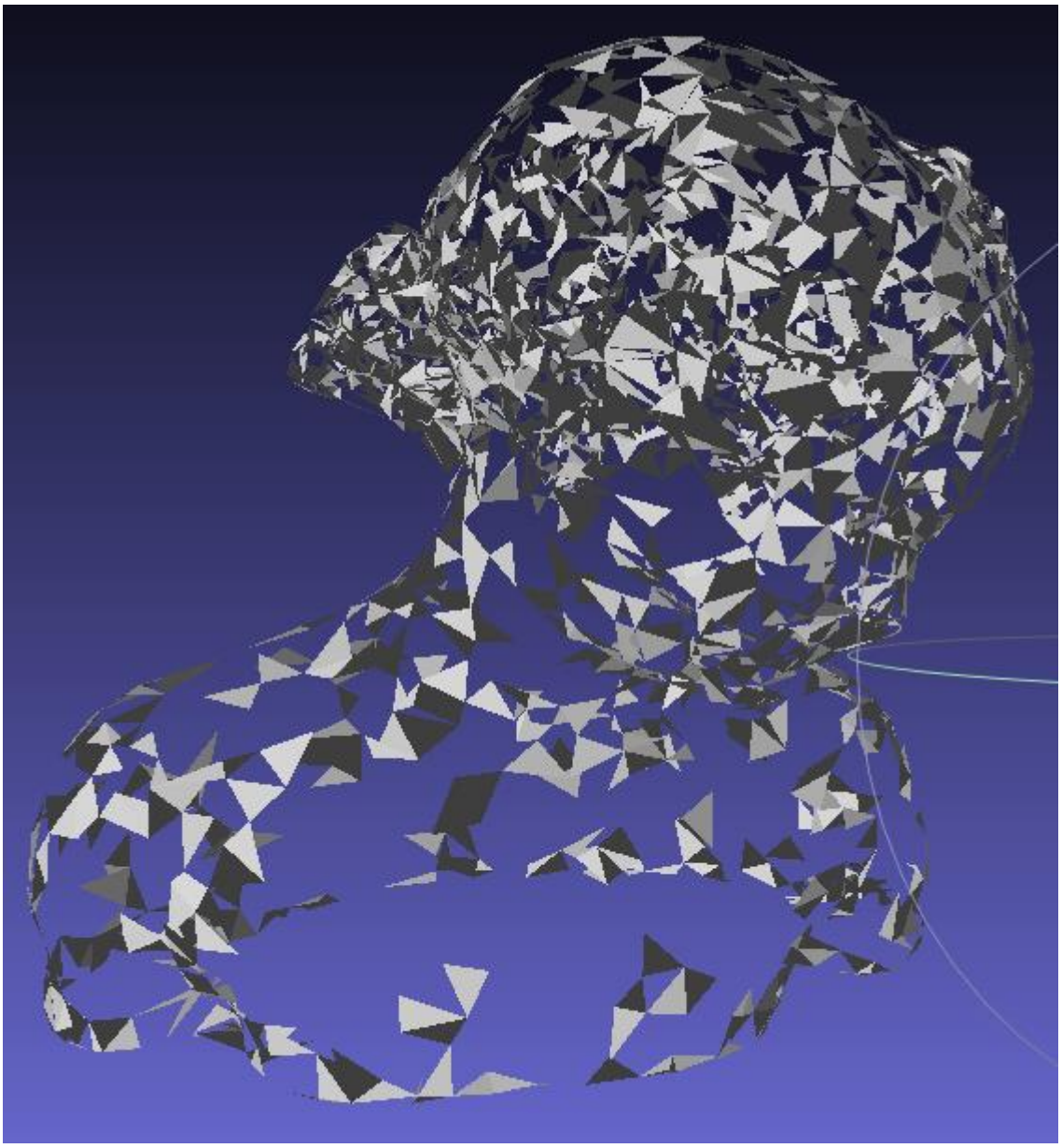


Threshold: 0.02

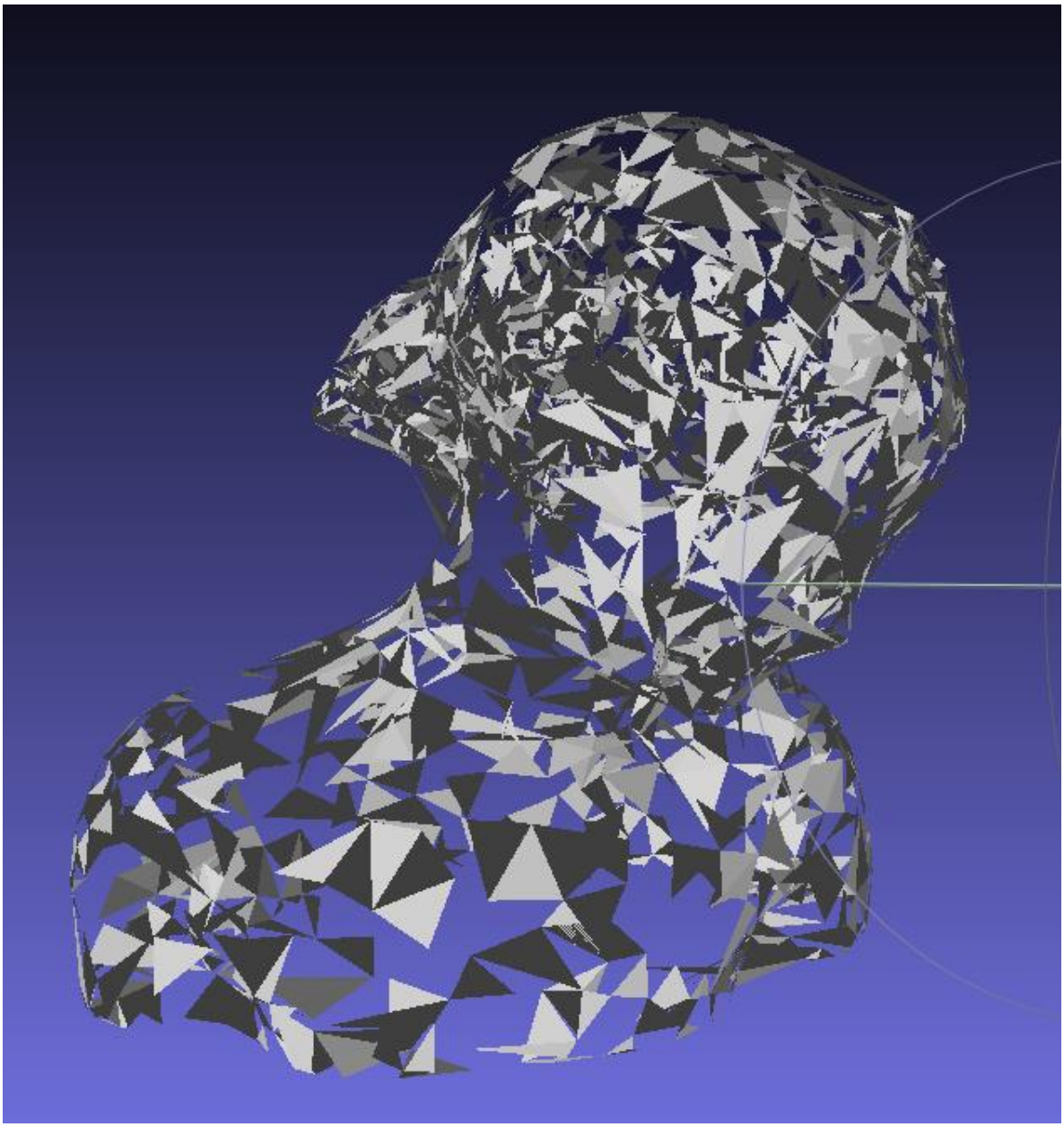
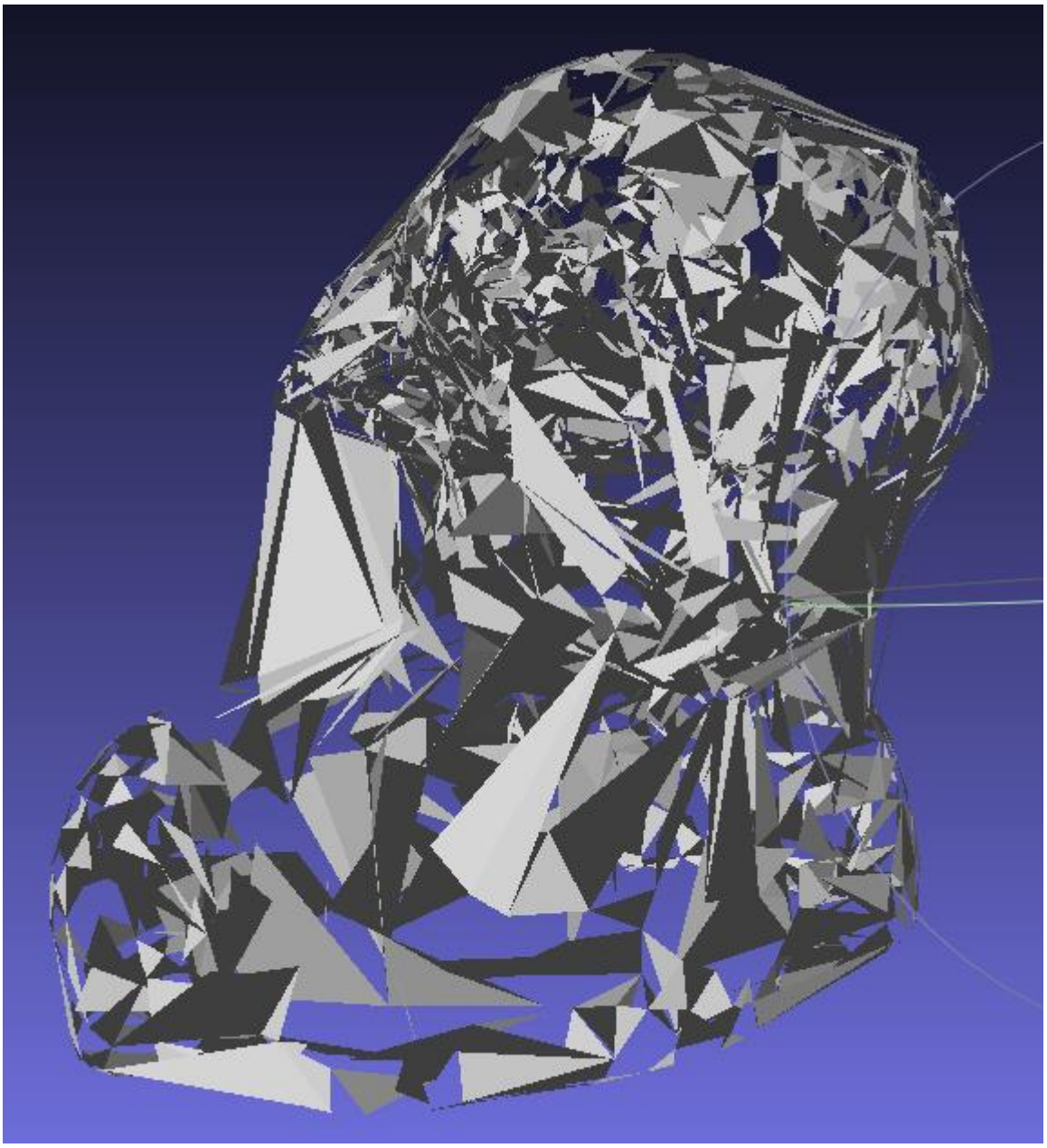


Bimba.xyz

Threshold: 0.01



Threshold: 0.02



Threshold: 0.05