Computational Visual Perception

Project Part – II: Calculate Distances & Render Images

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1 – Choosing Dataset: For the first part of the project, we worked on *OmniObject3D* because of it having a diverse category of models of real-life objects. Unfortunately, some of the cloth meshes we generated had scaling issues, so we decided not to move forward with them.

We selected *Annika Heil's* solution as it was sourced from the same dataset and was appealing for us.

2 – Distance Rendering: To find the closest points on the objects for all cloth vertices, we used the *K-D Tree* algorithm. It is a special case of binary space partitioning trees and a highly efficient nearest neighbor searcher.

The distances were mapped as required using standard operands and then explicitly written to the .obj files as vertex colors. To do this, vertex information in the .obj file was updated by adding color information to each vertex using the following syntax:

```
v 0.102981 0.105697 -0.279121 0.6733791753318403 0.6733791753318403 0.6733791753318403
```

Vertex	Coordinate – X	Coordinate – Y	Coordinate – Z	Color – R	Color – G	Color – B

50 images were rendered for each of the 100 meshes. The camera was positioned at a vertical angle of 45° and then rotated around the mesh in steps of 50/360 ° giving a complete horizontal view of each mesh. Adequate viewing distance from the object was also set to get a decent sized snapshot of the meshes.

To ensure that there is no shading in the rendering, no external illumination source was used. Rather, vertex shaders were incorporated to imitate an ambient lighting effect using the vertices themselves.

3 – Illuminated Cloth Rendering: For rendering the cloth, we used the same camera settings as in – 2.

A point light source was added to illuminate the cloth. The light source was randomly rotated around the cloth but restricted to be always within ± 45° (horizontally) of the camera position. This ensured that we not only have renderings from distinct views but also under different illuminations while making certain that the mesh is never fully (or mostly) dark.

50 images were again rendered for each of the 100 meshes but this time with a black background.

4 – Test Objects Rendering: As instructed, the same settings as from – 3 were used in this task. The camera was confined to be within ± 45° of the frontal view of the test object.

Texture was removed by removing all kinds of materials associated to the meshes. Objects were scaled independently to fit the rendered images nicely.

All the images were saved as B&W to reduce storage size.