

Reconstruction of Full Meshes from Segmented Depth Scans

Introduction

The want and need for generating computerized models of objects we interact with on a daily basis is increasing for both the commercial and scientific world. One way of achieving this is using depth based cameras to recreate these objects into computer models.



Problem

When using a depth based camera to generate complete 3D meshes there are many stages of processing that must be applied. These stages are:

- Deletion of unwanted data
- Registration of Meshes
- Cleaning and Appending of meshes



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Implementation

UI Development:

First an interactive mesh viewing software was developed using OpenGI. All of the other features being implemented were then integrated into this.

"Shadow" Removal:

As seen in the figure below, sometimes there is unwanted data that needs to be removed. To remove this unwanted data we use a flood fill over the depth values then reconstruct the mesh from the remaining depth values.





Pairwise Iterative Closest Point:

Since the camera is only able to capture a portion of the object we end up with multiple fragmented portions of the model. To combine all of these fragments we use an algorithm called ICP which minimizes distance between the meshes.



Since there is overlapping data from the joined meshes a Marching Cubes algorithm is run over a truncated signed distance function (TSDF) of the mesh.

Initial Registration Through Marker Detection:

Since ICP can be inaccurate due initial pose issues the objects are placed on a turntable which is tracked using AR markers. The transformation found from the markers is then applied to each mesh and then then the pairwise ICP is run.

Mesh Cleaning / Surface Reconstruction



Segmented meshes of the Stanford Bunny which was reconstructed.

From the results yielded so far the registration works but depending on the model is not waterproof. The initial registration will add much more accuracy to the reconstruction



• GUI Automatic unwanted surface deletion

KinectFusion: Real-time 3D **Reconstruction and Interaction** Using a Moving Depth Camera

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Analysis

Further Work

Marker based registration

Resources

Acknowledgments