

Project Proposal: Creating 3D Reconstructions of Semi-Transparent Objects

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Although object detection and recognition has been applied with good results to rigid opaque objects, semi-transparent objects typically pose problems for these algorithms. However, many semi-transparent objects are common household objects, and often used in everyday manipulation tasks, requiring that they be perceived effectively. We propose a method for creating 3D reconstructions of semi-transparent objects. Our project will conducted in three stages: First we will implement an algorithm for creating 3D reconstructions of opaque objects. This will involve finding correspondences between two images, using the correspondences and the know camera parameters to generate a point cloud, and then creating a 3D mesh from the point cloud. Second, we will attempt to implement/derive an algorithm for finding correspondences between images of a specific semi-transparent object, as was done in [2]. Third, we will attempt to generate a 3D reconstruction of the semi-transparent object, and test our algorithm on other semi-transparent objects. Because this is still an open area of research, we do not expect to create perfect reconstructions of the semi-transparent objects, but rather 3D shapes that roughly occupy the same space as the semi-transparent objects, similar to [7].

As a backup plan, if we are unable to reconstruct the semi-transparent objects, we will default to a slightly different project. Instead of reconstructing semi-transparent objects from images, we will program a quadcopter to film video of an object, and then use the video to create a 3D reconstruction of the object.

To collect data, we will use images from a Primesense camera (RGB and depth), as well as stereo RGB camera to capture images of both opaque and semi-transparent objects. Example images are shown in Figures 1 and 2, with possible output in Figure 3. It is possible that we could also use the stereo dataset from <http://eco3d.compute.dtu.dk/pages/transparency>. If we default to our second plan, we will use a Parrot Bebop flown using existing code to fly around the object.

Prior work on transparent object segmentation and 3D reconstruction includes [1, 3, 8, 2, 5, 6, 4]

References

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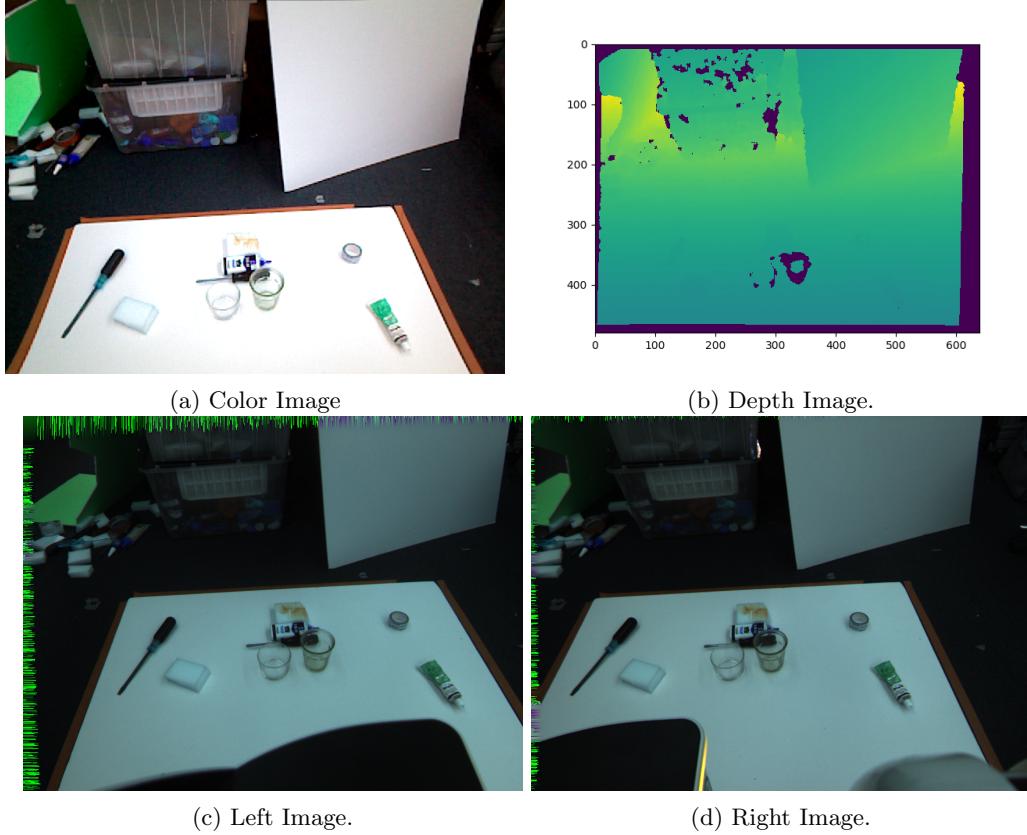
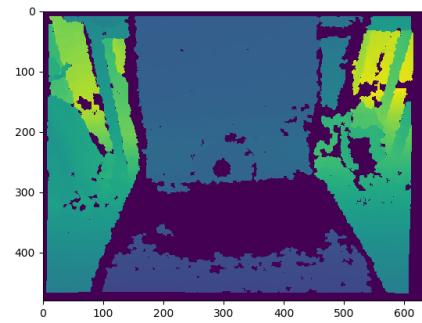


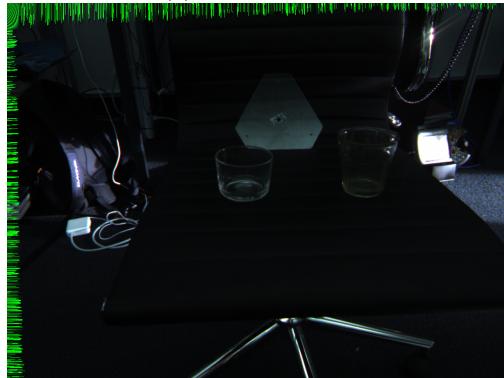
Figure 1: Color and Depth images from Primesense, and stereo RGB images for a scene with two transparent objects.



(a) Color Image



(b) Depth Image.



(c) Left Image.



(d) Right Image.

Figure 2: Color and Depth images from Primesense, and stereo RGB images for a scene with three transparent objects.



Figure 3: Possible 3D Mesh Reconstruction, our desired output