Photometric Stereo Viewer Instructions

1 Introduction

The Photometric Stereo Viewer app utilizes stereoscopic vision to project, in real time, a 3D representation of an object on the scene observed by the phone's camera. It requires a stereoscopic viewer (such as Google Cardboard) and an iOS device.

2 Stereoscopy

Stereoscopy is a technique used to give the illusion of depth from 2D images. Given two images of the same object taken from slightly different angles, with the help of a stereoscopic viewer—which isolates the images so they are each only visible to a single eye—the images together will appear to exhibit depth.

To aid in the intuition behind this, consider Figure 1. The figure illustrates how, when we view a 3D object, each eye sees a slightly different portion of the object.

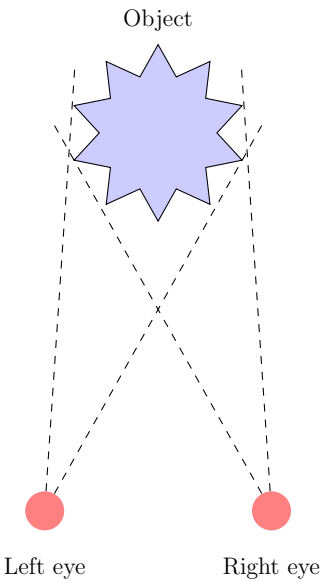

Figure 1: Perspective Difference when Viewing 3D Object

If we have two pictures of an object—each taken from a slightly different viewpoint corresponding to the different viewpoints of each eye—and we let each eye see only the picture corresponding to that eye's viewpoint, the resulting object our brain pieces together will appear three dimensional. The different viewpoints will cause us to interpret the result as a 3D object rather than a 2D image.

3 Generating Figures

In order to project a 3D object on our scene, we must obtain two images of our object from slightly different viewpoints. We assume that the user has access to a `.mat` file containing a 3D model of the object. Viewing this object from two angles that differ by roughly 10° produces a representation that works well for stereoscopic viewing.

The code for the Photometric Stereo Viewer app is designed to load two `png` images of our object. In order to generate these images, please see the `MATLAB` script `generate_images.m`. This file automatically generates images of your object taken from viewpoints differing by the correct amount. Follow the instructions found in the comments in this file to generate the two images of your surface.

Note that `generate_images.m` assumes the `MATLAB` package `export_fig` is installed. This package can be downloaded here.

The script generates images that, depending on your surface orientation, may not be correctly rotated. Rotate the `png` files created so that the object is upside down in each image.

Once you have generated the images, place them in the folder \Photometric Stereo Viewer. In the Xcode project, under "File", click "Add Files to "Photometric Stereo Viewer"" and select your two images. Now open the file `ViewController.m`. In the function `viedDidLoad`, on lines 104 and 108, change 'cat_r' and 'cat_l' to the names of your images.

Note that, depending on the size of your dataset, you may need to decrease the image size in order to keep the object from taking up the majority of the screen. The code for Photometric Stereo Viewer assumes the image is roughly 300×400 pixels.

4 Running the App

To run the app on your iOS device, follow the instructions found here. In summary:

- Open the Xcode project and connect your iOS device to you computer.
- In the upper left corner of the Xcode display, to the right of the "Run" and "Stop" buttons, click the drop down menu and select your device.
- *Code sign* the app (see below).
- Unlock your iOS device and click the "Run" button.
- If a dialog box pops up on your iOS device asking to access the camera, select "Allow".

4.1 Code Signing

Code signing your app certifies that it was created by you and is required to run the app on a device. Several relevant links on code signing can be found here and here. In essence, to code sign the app:

- Go to Preferences in Xcode and under the Accounts tab enter your Apple ID.

- In the Project navigator sidebar, click on the top item, “Photometric Stereo Viewer”. Under the “General” tab, the first item should be “Identity”. If it does not display the words “No matching provisioning profiles found” attempt to run the app. If it does display that message click “Fix Issue”.

- Note: You may need to change the “Bundle Identifier” under the “Identity” tab so the first portion of it corresponds to your Apple ID.

For a more thorough discussion, please see the links provided above.