

Lab 5 – Image Formation and Shape from Shading

Download `/home/cs332/download/shading` from the CS file server and set the Current Directory in MATLAB to this folder

Run the following script: `showSP`

Four windows will appear – move the windows around so that you can view all of them at once. You will see the following pictures:

- (1) a colorful mesh figure depicting a sphere
- (2) a shaded image displayed from a matrix called `fmap`
- (3) a shaded image displayed from a matrix called `gmap`
- (4) a shaded image of a sphere illuminated with a point source of light

Use the Pixel Region Tool to examine the values of `f` and `g` that correspond to surface orientations that you can view on the surface of the colored sphere. You will use `fmap` and `gmap` as inputs to the `getSlantTilt` function that you write for Problem 1 of Assignment 5.

The shaded sphere demonstrates the ambiguity of recovering 3-D shape from shading – a single image intensity value can arise from a family of possible surface orientations. The Reflectance Map $\mathbf{R}(\mathbf{f}, \mathbf{g})$ specifies the image intensity that is expected for each surface orientation, given a known light source position and known surface properties.

The `showCylinder` function has a single input that specifies the direction of a point light source, expressed as the value of `f` for the surface orientation that faces directly toward this source. This function displays the image of a cylindrical Lambertian surface illuminated by this source, the corresponding Reflectance map, a cross-section of the intensity values across the image, and a cross-section of the `f` values that correspond to the surface orientations across the cylinder.

Observe the results displayed for a light source that is 20° away from the direction to the viewer:

```
showCylinder(0.353)
```

How would the appearance of the four figures change if the angle to the light source were increased to 45° ? Check this case as follows:

```
showCylinder(0.828)
```

How would the appearance of the four figures change if the angle to the light source were increased to 90° (i.e. the light source is coming in from the right)? What is the value of `f` that corresponds to this light source direction? Use `showCylinder` to examine this case.

For Problem 3 of Assignment 5, you will run parts of the code in the `shadingScript.m` code file.