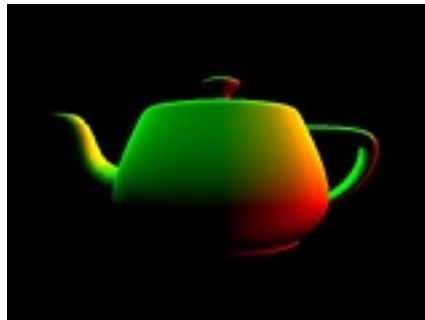


**LAB 3: DUE 25 NOVEMBER 2015**

### Task 1: Photometric Stereo (30 pts)

Implement photometric stereo. You will find three images showing the same teapot illuminated from three distinct directions:  $[0 \ -1 \ 1]$ ,  $[1 \ 1 \ 1]$ , and  $[-1 \ 1 \ 1]$ . Load the images, set up the matrix and compute the normals of the teapot. Plot the results by scaling the normal to have a unit length for the z-component and then color- code the x and y components in red and green, respectively. Should look something like this. We work with directional light sources, so the matrix  $L$  is the same for each pixel.



### Task 2: Relighting (30)

Implement image-based relighting. A set of images showing a diffuse, white teapot are provided. Each of these images shows the same teapot illuminated with a directional light source from a specific angle. The light direction is given in spherical coordinates in the file name for this example. Create three results with different light probes. You can find how to sample the probes in the following links. Note that they use different representations.

<http://www.pauldebevec.com/Probes>

<http://gl.ict.usc.edu/Data/HighResProbes>

The unit vector pointing in the corresponding direction is obtained by  
 $(D_x, D_y, D_z) = (\sin(\phi) \cdot \sin(\theta), \cos(\phi), -\sin(\phi) \cdot \cos(\theta))$

For the angular maps the corresponding  $(u, v)$  coordinate in the light probe image is  
 $(D_x \cdot r, D_y \cdot r)$  where  $r = (1/\pi) \cdot \arccos(D_z) / \sqrt{D_x^2 + D_y^2}$

For the rectangular maps the corresponding  $(u, v)$  coordinate in the light probe image is  
 $(1 + \arctan2(D_x, -D_z) / \pi, \arccos(D_y) / \pi)$ .

### Task 3: Real Dataset (20)

Take a dataset from <http://gl.ict.usc.edu/Data/LightStage/> and the light direction and light intensity files. We will ignore other calibrations. Relight the model with a light probe of your choice.

### Task 4: Video (20)

Create a video by relighting the dataset with a rotation of the lighting.

## **Deliverables**

Code and normal image, relit image with `grace_probe` for teapot and at least one of the datasets.  
And the video.

README file.

- How long did the assignment take?
- Issues and descriptions of your partial solution (for partial credit)
- Any extras?
- Collaboration acknowledgment.
- What was most unclear/difficult?
- What was most exciting?