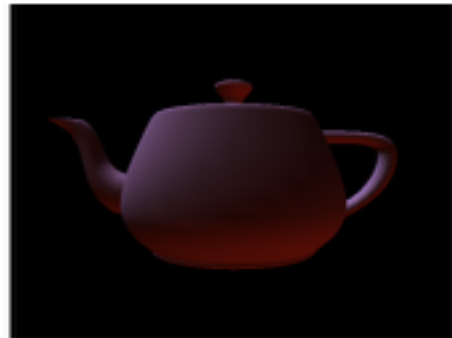
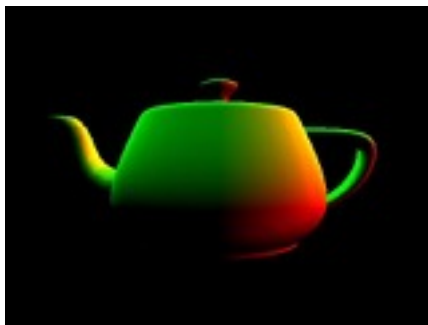


LAB 3: DUE 24 NOVEMBER 2015

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
 $(D_x, D_y, D_z) = (\cos(\phi) \cdot \sin(\theta), \sin(\phi), -\cos(\phi) \cdot \cos(\theta))$

UWAGA! This formula assumes vertical angles between -90 and 90 . You will find different formulas in the links above.

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

This coordinates will be between -1 and 1 .

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

You can find more details in both websites above.

To help you debugging your code, you can plot your sampling directions and points.

Task 3: Real Dataset (20)

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



Fighting Knight Data set with Grace lightprobe.

I inverted the directions from the light directions files, so they can be used for sampling the light probe.

Task 4: Video (20)

Create a video by relighting the dataset with a rotation of the lighting. There will be some flickering which will be bigger depending on the speed of the rotation. You don't need to make it very smooth, but if you want to, you can try making very small rotation steps, and sampling your lights using some average of the pixels around the lighting direction rather than a single point/pixel.

Deliverables

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