

CSE 333/533: Computer Graphics

Lab 5: Implementing Shaders

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Introduction

Shading is a crucial aspect of computer graphics used to create the illusion of depth, realism, and three-dimensionality in rendered images. Two popular physical-based shading models, Gouraud shading and Phong shading, are used to achieve these effects by simulating how light interacts with 3D surfaces. Gouraud or smooth shading shading performs per vertex computation. Phong shading performs per fragment computation.

There are different components in lighting and shading:

1. Ambient: Let L_a be the color of the ambient light. The ambient lighting is calculated as

$$I_a = k_a L_a$$

2. Diffuse: Let L_d be the color of the diffuse light. The diffuse lighting is computed as

$$I_d = k_d \max((l \cdot n) L_d, 0)$$

where k_d is the fraction of diffused light that is reflected.

3. Specular: Specular lighting is calculated as

$$I_s = k_s L_s \max((r \cdot v)^a, 0)$$

where r is the reflected direction and v is the view vector, a is the shininess coefficient.

For the Phong lighting model we can avoid computing $r \cdot v$ by computing $n \cdot h$ where h is the halfway vector. In the implementation we will be using the halfway vector which is given by

$$h = \frac{l + v}{\|l + v\|}$$

Deliverables



In the vertex shader, you have been given $L_a, L_d, L_s, k_a, k_d, k_s$. You have to calculate I_a, I_d, I_s components and add them to generate the color vector to be used. Generate results for Gouraud model of lighting. Also *create new set of shader files* and calculate the same for the Phong model. For ambient, specular and diffuse generate screenshots $[a, d, s, (a+d), (a+d+s)]$ for both models and submit them.

Name the zip file as lab05_<name>_<roll number>.zip

Example: lab05_vishwesh_2020156.zip

References

<https://www.opengl.org/documentation/>

https://www.khronos.org/opengl/wiki/Rendering_Pipeline_Overview

<https://www.khronos.org/registry/OpenGL-Refpages>

<https://www.glfw.org/documentation.html>

<https://www.khronos.org/opengl/wiki/Framebuffer>

Note: Your code should be written by you and be easy to read. You are NOT permitted to use any code that is not written by you. (Any code provided by the instructor/TA can be used with proper credits within your program). Theory questions need to be answered by you and not copied from other sources. Please refer to IIIT-Delhi's Policy on Academic Integrity [here](#).