HW1 – Report

1 METHOD

1.1 intersect_ray_triangle

Ray : $\dot{p} = \dot{o} + t\vec{d}$

Triangle : $\dot{p} = (1-u-v)\dot{V_0} + u\dot{V_1} + v\dot{V_2}\ (u, v \geq 0, u+v \leq 1)$

Calculate intersection point:

$Let\ E_1 = \boldsymbol{V_1} - \boldsymbol{V_0}, E_2 = \boldsymbol{V_2} - \boldsymbol{V_0}, T = \boldsymbol{V_1} - \boldsymbol{V_0}, \boldsymbol{P} = \vec{\boldsymbol{d}} \times E_2, Q = T \times E_1, then$

$$\begin{bmatrix} t \\ u \\ v \end{bmatrix} = \frac{1}{|P \cdot E_1|} \begin{vmatrix} Q \cdot E_2 \\ P \cdot T \\ Q \cdot \vec{d} \end{vmatrix}, \qquad \mathbf{t} = \frac{|Q \cdot E_2|}{|P \cdot E_1|}$$

Finally, calculate intersect point by $\dot{\boldsymbol{p}} = \dot{\boldsymbol{o}} + \boldsymbol{t}\vec{\boldsymbol{d}}$.

1.2 intersect_ray_sphere

Ray : $\dot{p} = \dot{o} + t\vec{d}$

Sphere : $|\dot{p} - \dot{p_c}|^2 - r^2 = 0, where\ \dot{p_c}\ is\ the\ center\ of\ the\ circle, r\ is\ the\ radius$

Calculate intersection point:

$$Let\ \ \Delta\mathbf{p} = \dot{\boldsymbol{p}}_{\boldsymbol{c}} - \dot{\boldsymbol{o}}, \qquad then\ \ \mathbf{t} = \vec{\boldsymbol{d}} \cdot \Delta\boldsymbol{p} \pm \sqrt{\boldsymbol{r^2} - \left|\Delta\boldsymbol{p} - (\vec{\boldsymbol{d}} \cdot \Delta\boldsymbol{p})\vec{\boldsymbol{d}}\right|^2}$$

Similarly, we can calculate intersect point by $\dot{\boldsymbol{p}} = \dot{\boldsymbol{o}} + \boldsymbol{t}\vec{\boldsymbol{d}}$.

1.3 CALCULATE PIXEL VALUE

Record t value for each pixel and normalize to [0,1].

Minimum t value will be normalized to 0 and background to 1.

2 RESULT

2.1 TEST SCENE: `test.scene`

Figure 1: Depth Image (depth range from 0 to 1)

Figure 2: Colorful Image

2.2 TEST SCENE: `sphere.scene`

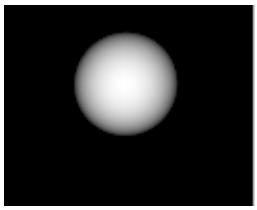

Figure 1: Depth Image (depth range from 0 to 1)

Figure 2: Colorful Image

3 SUMMARY

For code changes please refer to https://github.com/ReeLiu/ray/pull/2 .