

USTC-CG/2024 课程作业 实验报告

实验 7

Path Tracing

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功能实现 Features Implemented

作业要求部分 Required Features

实现 **Rectangle** 光源

```
Color Hd_USTC_CG_Rect_Light::Sample(  
    const GfVec3f& pos,  
    GfVec3f& dir,  
    GfVec3f& sampled_light_pos,  
    float& sample_light_pdf,  
    const std::function<float()>& uniform_float)  
{  
    auto sampledPos = GfVec3f(  
        corner0[0] + (corner1[0] - corner0[0]) * uniform_float(),  
        corner0[1] + (corner2[1] - corner0[1]) * uniform_float(),  
        corner0[2]);  
  
    sampled_light_pos = sampledPos;  
  
    dir = (sampledPos - pos).GetNormalized();  
    auto distance = (sampledPos - pos).GetLength();  
  
    sample_light_pdf = 1.0f / area;  
  
    return irradiance;  
}  
  
Color Hd_USTC_CG_Rect_Light::Intersect(const GfRay& ray, float& depth)  
{  
    double distance;  
    if (ray.Intersect(corner0, corner1, corner2, &distance) ||  
        ray.Intersect(corner1, corner2, corner3, &distance)) {  
        depth = distance;  
        return irradiance;  
    }  
    depth = std::numeric_limits<float>::infinity();  
    return { 0, 0, 0 };  
}
```

Path Tracing Integrator

```
// Russian roulette :
float p = 0.8f;
float q = 1 - p;
float r = uniform_float();
if (r < p) {
    return directLight / p;
}
else {
    const unsigned spp = (2 << 9);

    for (int i = 0; i < spp; i++) {
        float pdf;
        GfVec3f shadowDir = si.TangentToWorld(
            CosineWeightedDirection(GfVec2f{ uniform_float(), uniform_float() },
pdf));
        GfRay shadow_ray;
        shadow_ray.SetPointAndDirection(si.position + 0.00001f *
si.geometricNormal, shadowDir);

        if (VisibilityTest(shadow_ray)) {
            GfVec3f newColor =
                EstimateOutGoingRadiance(shadow_ray, uniform_float,
recursion_depth + 1);
            color += GfDot(shadowDir, si.shadingNormal) / pdf * newColor;
        }
    }

    color /= spp;
    return color / q + directLight;
}
```

Composition Graph

```
graph TD
R[Read USD] --> M[Merge to Global]
A[Add Point Light]
A2[Add Dome Light]
```

运行截图 Screenshots

