CIS-565 Final Project - Real-Time Path Tracing Reconstruction

Overview

In the current game and file industry, path tracing is the best candidate for generating photorealistic and physically correct pictures. However, the performance bottleneck has limited the usage of path tracing in real-time rendering field. Given our interest in game industry, which concerns interactive/real-time rendering, we want to explore the possibility of real-time path tracing using the denoising method introduced recently in SIGGRAPH Asia 2019: *Blockwise Multi-Order Feature Regression for Real-Time Path Tracing Reconstruction*. We also know that the current **Direct3D 12** and **DXR** are the latest API to render picture using ray-tracing technique. Hence, we want to build up a thorough pipeline in D12 to not only generate 1spp noisy input picture, but also denoise the input picture with feature buffer through the D12 compute shader, and then generate the high quality processed-picture, recording the performance of that. This project gives us a chance to explore the latest rendering and computing API: D12 and DXR, and learn the latest technique to denoise the 1spp noisy picture.

In our real-time path tracing pipeline, we will do

1. Milestone 1: (Nov. 18)
    a. Build up the path tracing using DXR to generate 1spp input picture (since this is not the main task of our project and our TA Ziad and his team has finished one last semester, we might want to build our path tracer based on their works, if we can get permission.)
    b. Solve the compatibility problem of the code sample of paper in OpenCL
    c. Set up the preprocessing pipeline
2. Milestone 2: (Nov. 25)
    a. Using stochastic regulation and factorization QR techniques to fit the feature buffer with the input noisy picture.
3. Milestone 3: (Dec. 2)
    a. Implement temporal accumulation and temporal anti-aliasing to control the render time
    b. Accumulate the previous frame image to help correct current frame.
4. Final Submission(Dec.9)
    a. Clean up the code base
    b. Recording the performance of our version pipeline, comparing with the paper's result
    c. Build up demo scene to have better visual effect.

Goal:

Build a 1spp path tracer with DXR pipeline and apply *Blockwise Multi-Order Feature Regression* real time to achieve noise-free rendering quality.

Reference:

1. *Blockwise Multi-Order Feature Regression for Real-Time Path Tracing Reconstruction*
    a. http://www.cs.tut.fi/~foi/papers/Koskela-TOG-2019-Blockwise_Multi_Order_Feature_Regression_for_Real_Time_Path_Tracing_Reconstruction.pdf
2. *Path tracer using DXR*
    a. https://github.com/rtx-on/rtx-explore
3. *Learning DirectX 12*
    a. https://www.3dgep.com/learning-directx-12-1/