Path tracer Denoiser

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1 Overview

Path tracers use a probabilistic model to bounce light rays off objects in a scene to render an image. They can result in realistic images, but take a long time to render the scene because each pixel needs many thousands of samples to make the image look consistent (Link to analysis from an earlier project). To help reduce the time taken, there have been attempts to use a noisy input image and output an image that looks closer to the final generated image.

We plan to train an recurrent convolutional auto-encoder with skip connections, a deep network architecture that allows for compact representation of data. The architecture resembles 2 funnels attached together. The first portion compacts the input data, essentially finding a encoding to the input. The second network decodes the encoding. The idea is that the noise will not effect the compact representation.

After training our autoencoder we plan to use TensorRt to speed up the deep learning inference pipeline which includes a deep learning inference optimizer and runtime that delivers low latency and high-throughput for deep learning inference applications. TensorRT-based applications perform up to 40x faster than CPU-only platforms during inference.

2 Goals

1. Collect training data for the denoiser by running ray tracing.
2. Prototype in Pytorch.
3. CuDNN for RCNN AE with Skip connections.
4. Speed up inference using TensorRt.
5. Evaluate Results and Performance Analysis.

3 Milestones

1. Get a working path tracer (with outputs we need) Generate training data, implement traditional approach, implement a sample architecture in Pytorch as a POC. (18 Nov)
2. Program an autoencoder using cuDNN to reproduce results paper results (25th Nov)
3. Speed up inference using TensorRt (2nd Dec)
4. Performance Analysis, prepare slides and reports.

4 References

1. https://alain.xyz/blog/raytracing-denoising
2. https://research.nvidia.com/sites/default/files/publications/dnn_denoise_author.pdf