Another Image (AI) Denoiser

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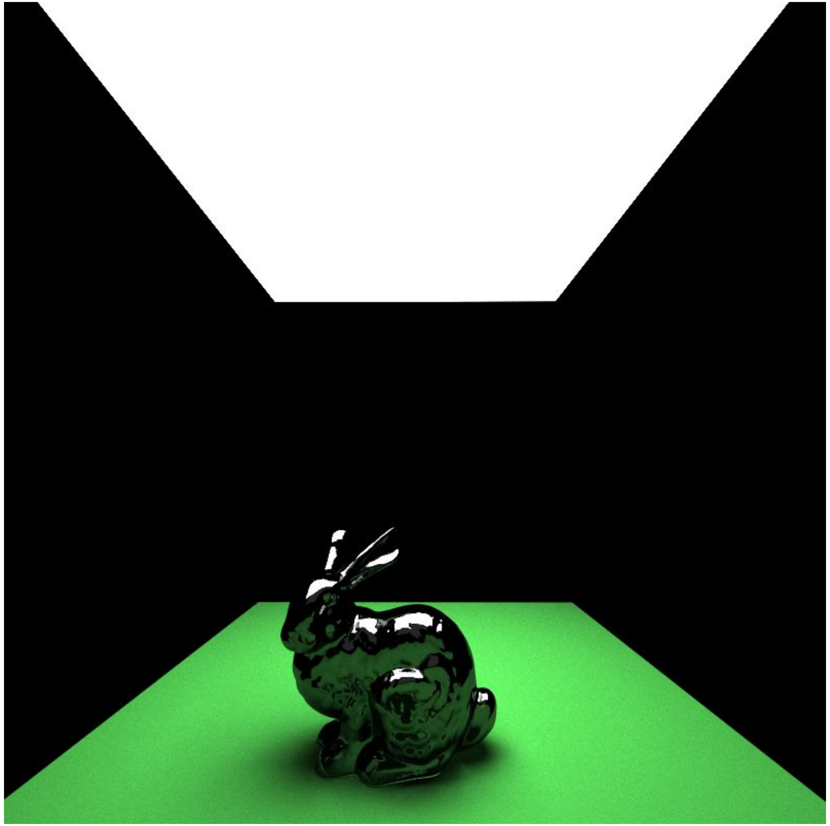
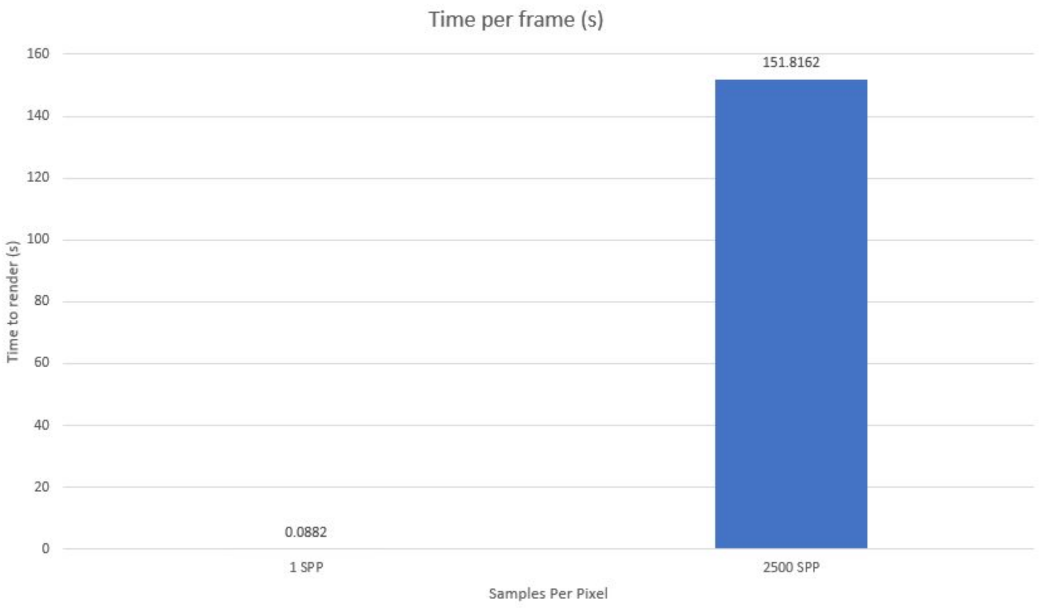
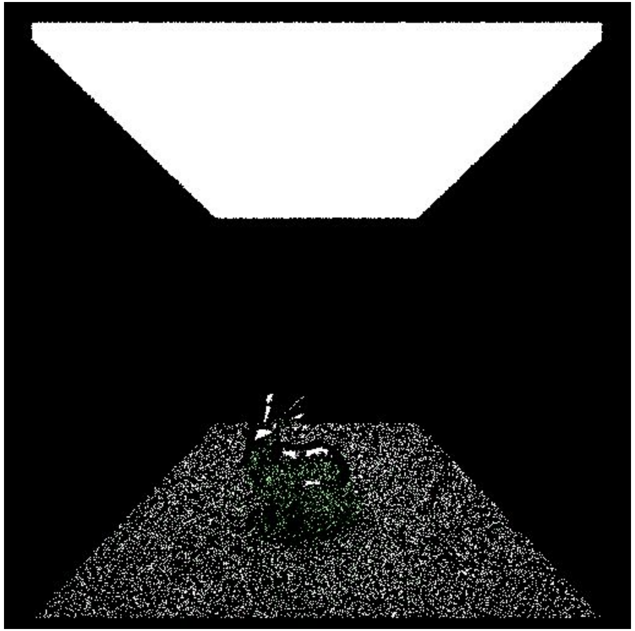
Motivation

- Path Tracing uses random sampling to render a scene
- The metric is Samples Per Pixel (SPP)

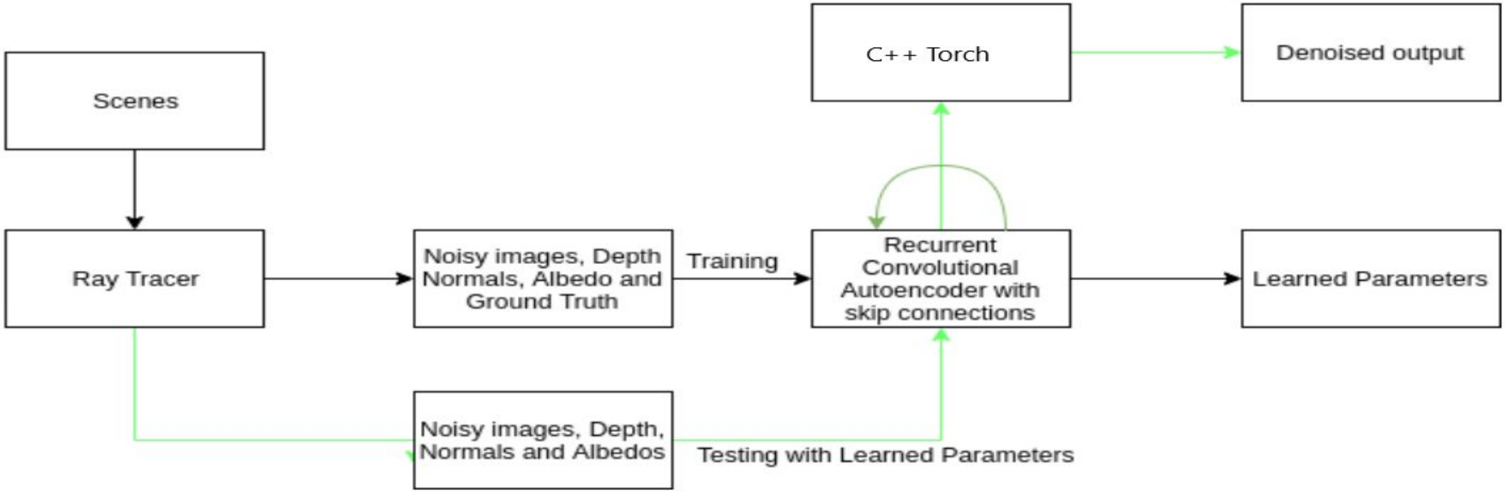


Motivation

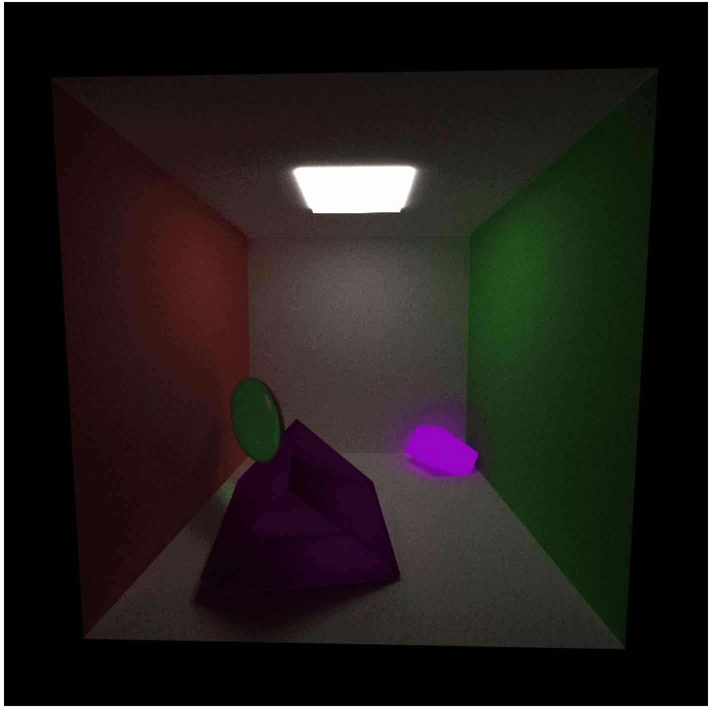

Time per frame (s)
160
140
120
100
80
60
40
20
0
Time to render (s)
151.8162
0.0882
1 SPP
2500 SPP
Samples Per Pixel



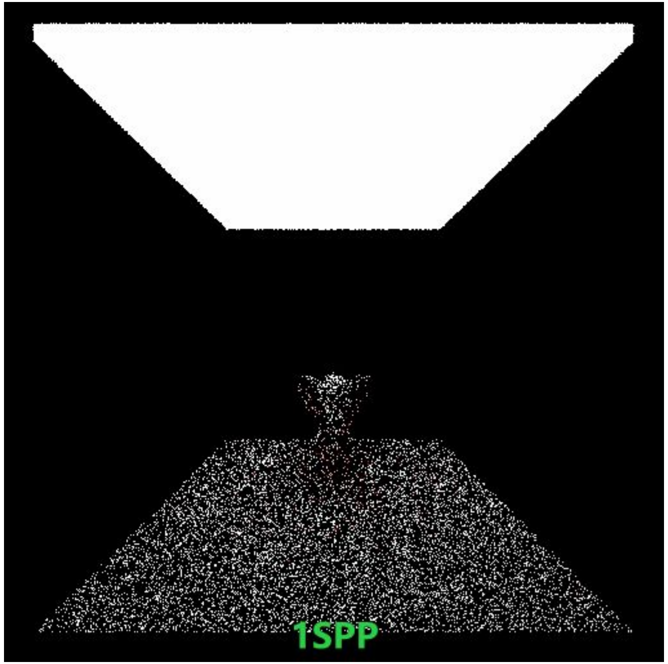
Approach


C++ Torch
Denoised output
Scenes
Ray Tracer
Noisy images, Depth
Normals, Albedo and
Ground Truth
Training
Recurrent
Convolutional
Autoencoder with
skip connections
Learned Parameters
Noisy images, Depth,
Normals and Albedos
Testing with Learned Parameters

Data



Data



https://research.nvidia.com/sites/default/files/publications/dnn_denoise_author.pdf

Denoising Network

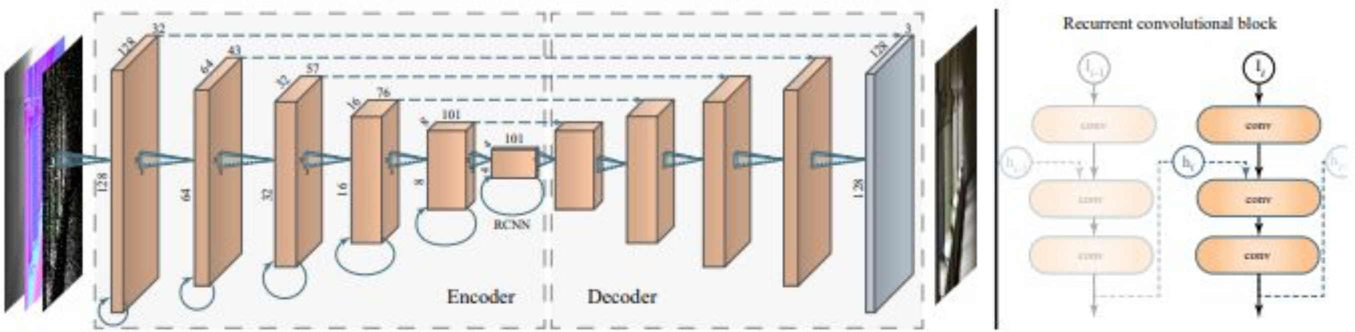
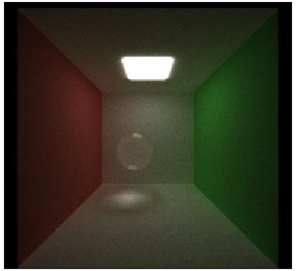


Fig. 2. Architecture of our recurrent autoencoder. The input is 7 scalar values per pixel (noisy RGB, normal vector, depth, roughness). Each encoder stage has a convolution and 2×2 max pooling. A decoder stage applies a 2×2 nearest neighbor upsampling, concatenates the per-pixel feature maps from a skip connection (the spatial resolutions agree), and applies two sets of convolution and pooling. All convolutions have a 3×3-pixel spatial support. On the right we visualize the internal structure of the recurrent RCNN connections. I is the new input and h refers to the hidden, recurrent state that persists between animation frames.

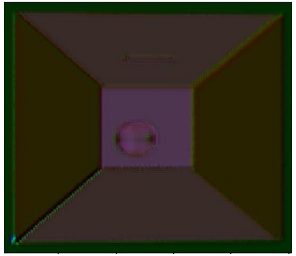
Loss Functions

Spatial L1 Loss



Ground Truth

Reduces difference b/w the entire img

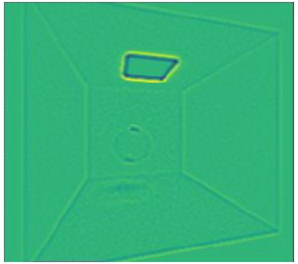


Denoiser Output

High Frequency Error Norm

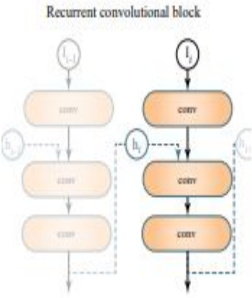
Ground Truth

Helps penalise finer details like edges using LoG



Denoiser Output

Temporal Loss



Speeding Up Inference

ONNX

TensorFlow

PyTorch

TensorRT

Caffe MODELS

http://www.tut.fi/vga/publications/Blockwise_Multi-Order_Feature_Regression_for_Real-Time_Path_Tracing_Reconstruction.html

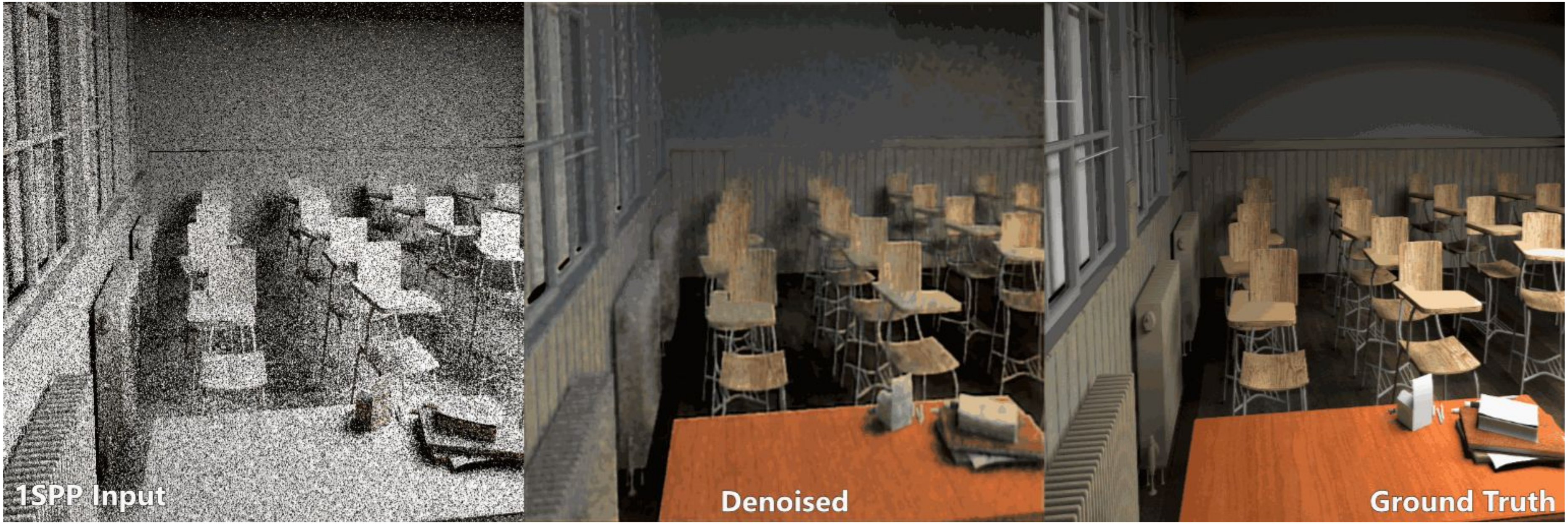
Results

Trained On

http://www.tut.fi/vga/publications/Blockwise_Multi-Order_Feature_Regression_for_Real-Time_Path_Tracing_Reconstruction.html

Results

Never seen before

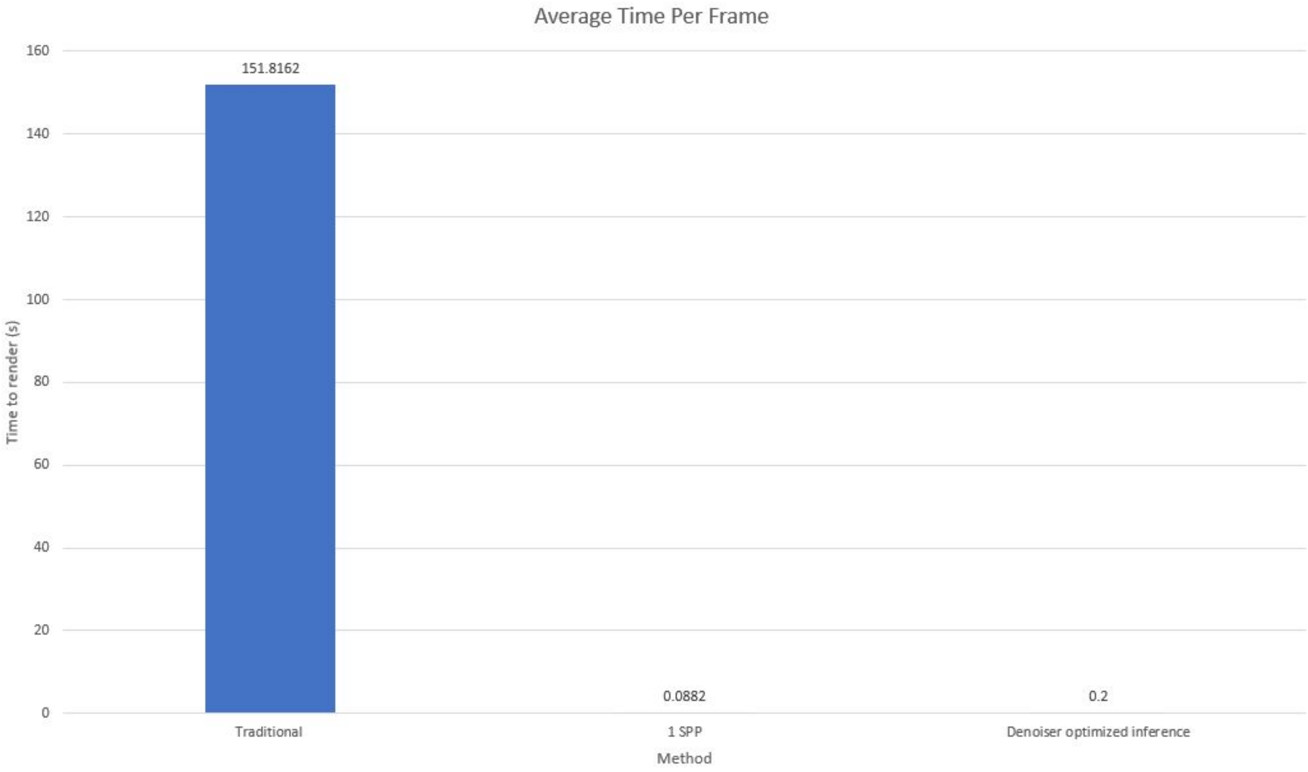


http://www.tut.fi/vga/publications/Blockwise_Multi-Order_Feature_Regression_for_Real-Time_Path_Tracing_Reconstruction.html

Results

Never seen movement

Results



Average Time Per Frame
160
140
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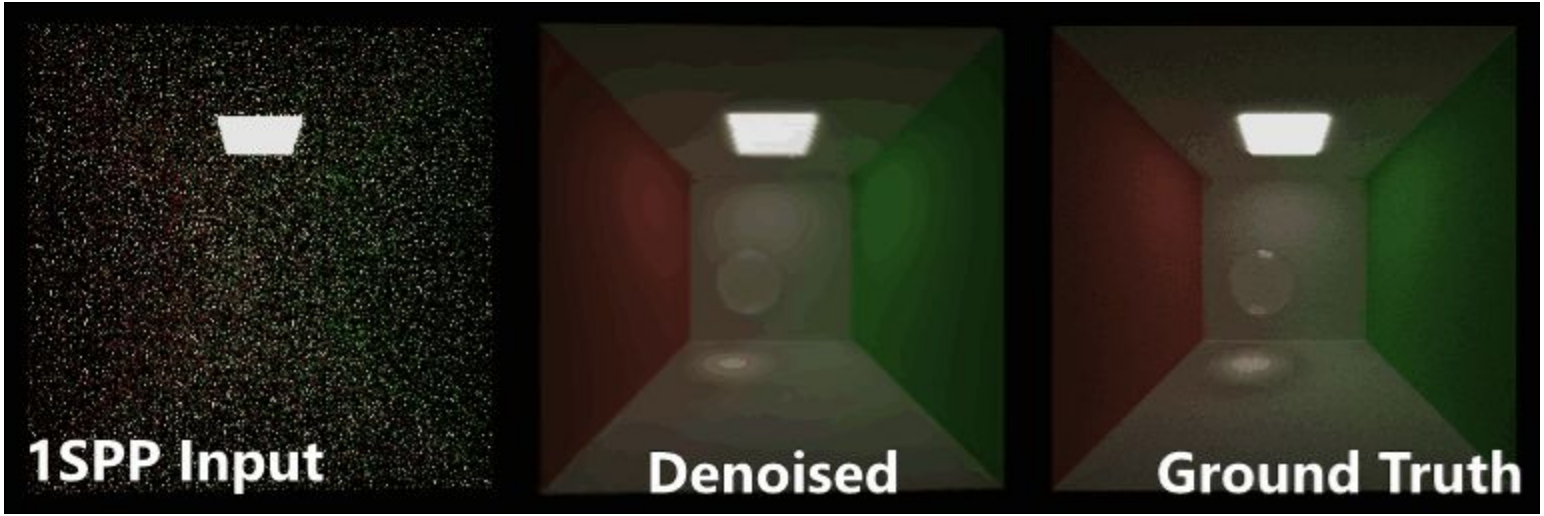
0
Time to render (s)
151.8162
0.0882
0.2
Traditional
1 SPP
Denoiser optimized inference
Method

Demo

Acknowledgements

- We would like to extend our gratitude to the authors of the paper “Interactive Reconstruction of Monte Carlo Image Sequences using a Recurrent Denoising Autoencoder”.
- We would also like to extend our thanks to the authors of the paper titled “A Machine Learning Approach for Filtering Monte Carlo Noise”
- Special Thanks to Alan Galvin for giving us inputs on ways to improve results.
- We would also like to thank our shadow team (DroneMoM) for all their inputs

Thank You



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