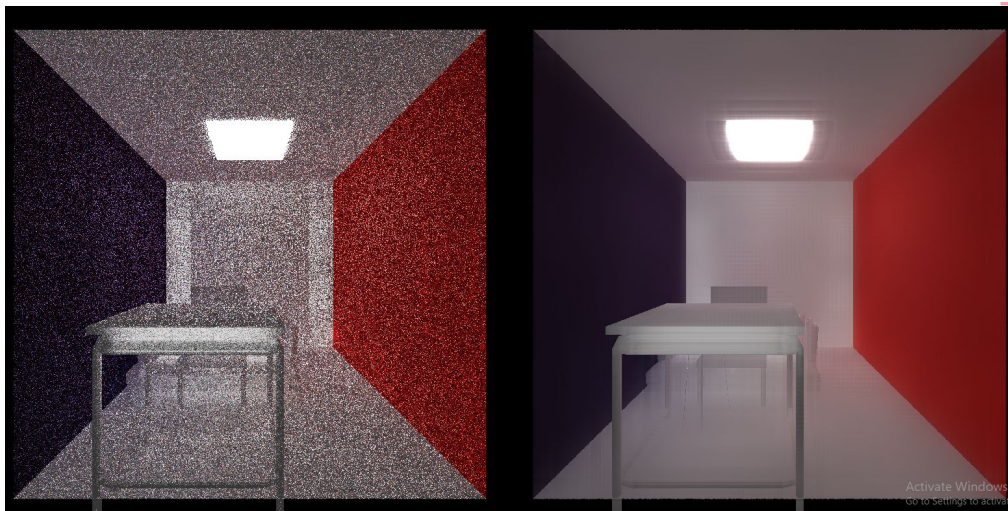# Path Tracing Denoiser

CIS 565 Final Project Milestone 2

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Overview

- Two major research areas for denoising are
  - Machine Learning
  - Hybrid Rendering
- Our project will try to implement denoising methods in both categories and compare the results.


- Light 1: 26,804
- Light 2: 32,884
- Sofa: 469,348
- Chair: 924


```
KD tree finised
Iter:1, Time:15627.9, Avg Time:15627.9
Iter:2, Time:73793.9, Avg Time:44710.9
Iter:3, Time:73879.9, Avg Time:54433.9
```

SVGF Progress

- Last MS: Spatial Filtering
  - A-Trous Wavelet Transform
- This MS: Temporal Accumulation + Variance Estimation
  - Level 1 wavelet filter updates the color history buffer.
  - Exponential moving average: $C_i' = \alpha \cdot C_i + (1 - \alpha)C_{i-1}'$
  - Variance guiding: blur more if variance is high, blur less if variance is low.
  - Approximate variance with first and second raw moment: $\sigma_i'^2 = \mu_{2_i}' - \mu_{1_i}'^2$
  - Reject samples if mesh IDs, position or normal not consistent
- Next MS: Back Projection
  - Compare current and previous NDC coordinates for each vertex.
  - Usually done in vertex shader
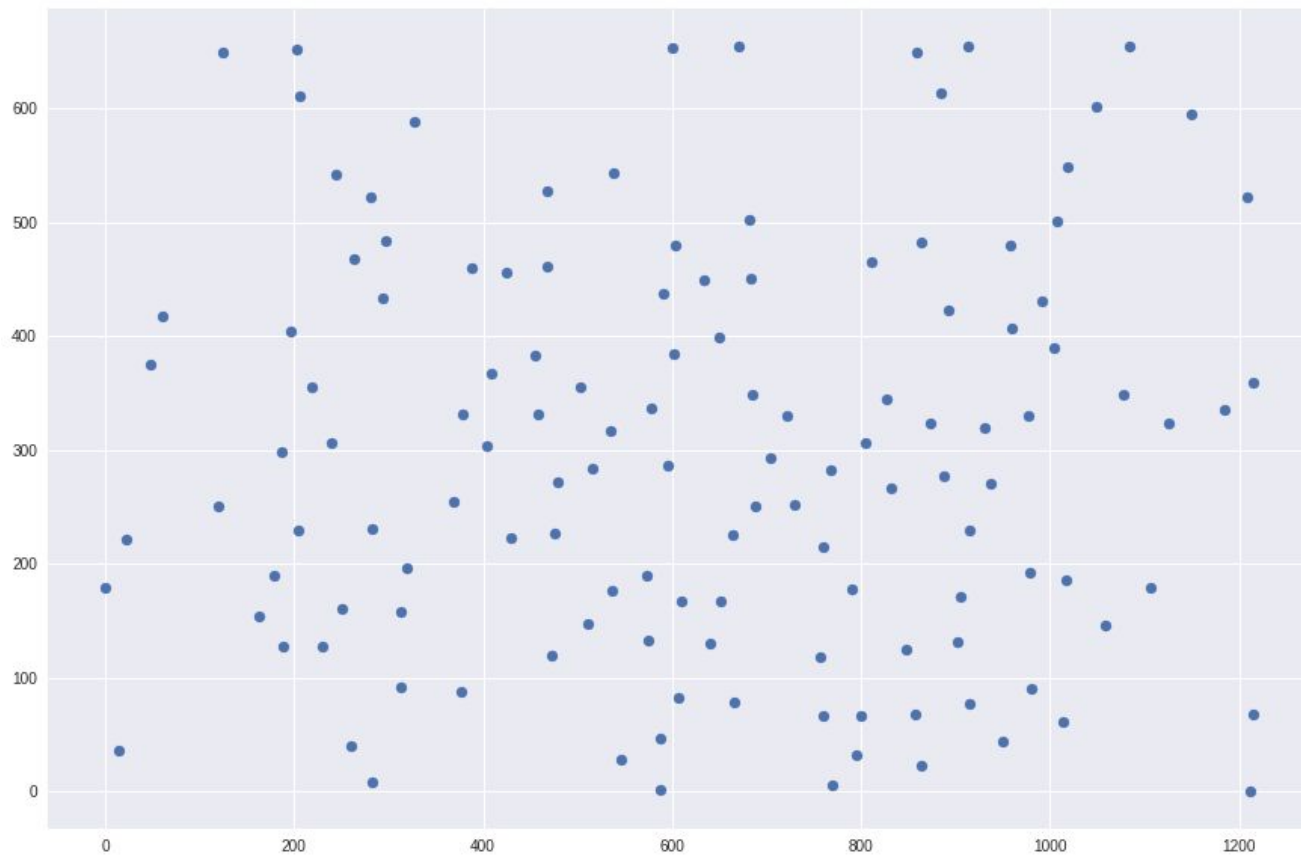 - Challenge: How to find pixel correspondence between procedural shapes?
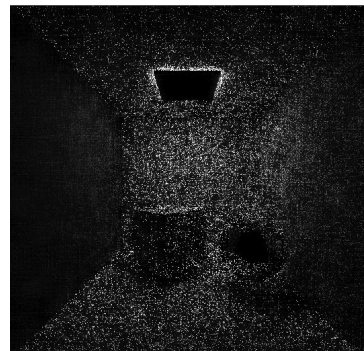
Data Preprocess

- Diffuse - Divided by albedo
- Specular - Logarithmic Transform
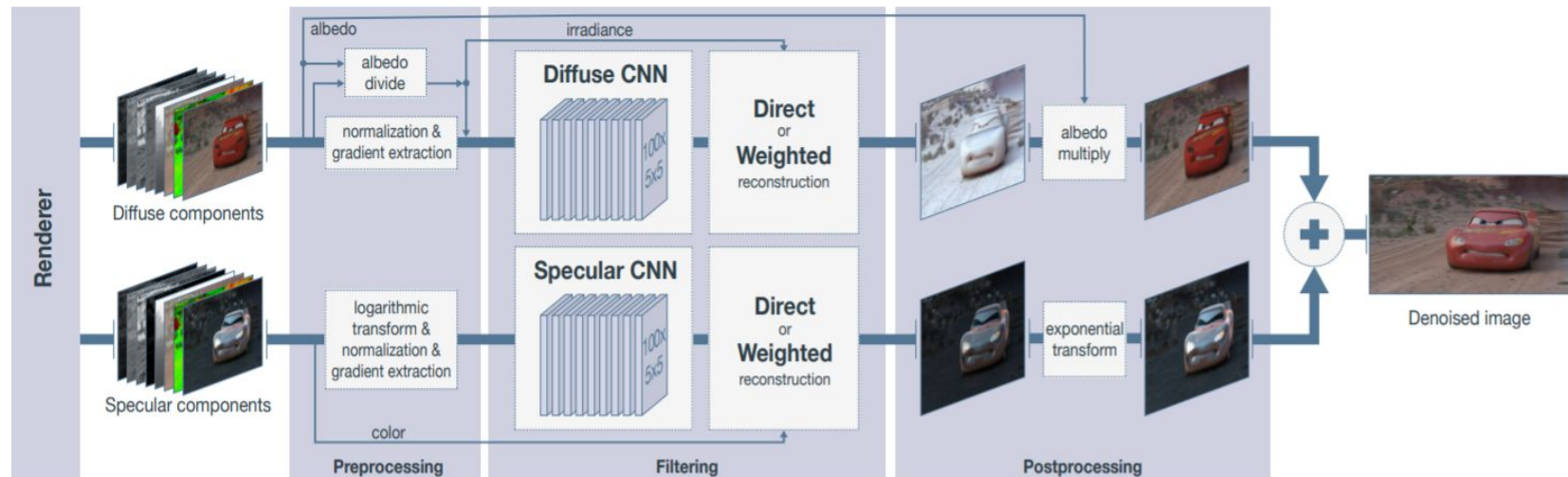- Depth - Linear scaled
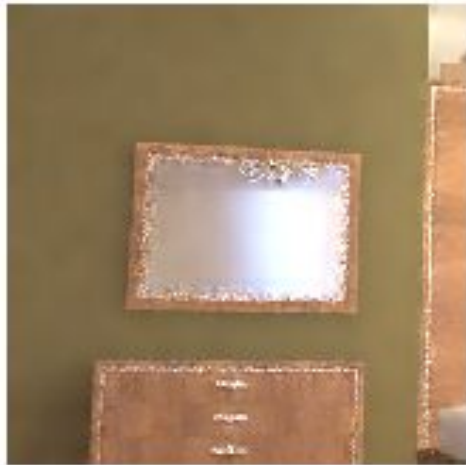- Gradient in both directions

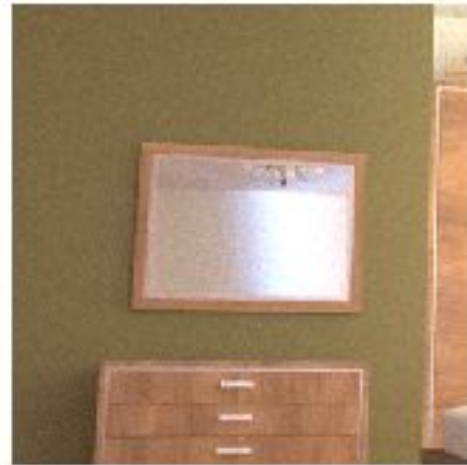# Uniform Sampling
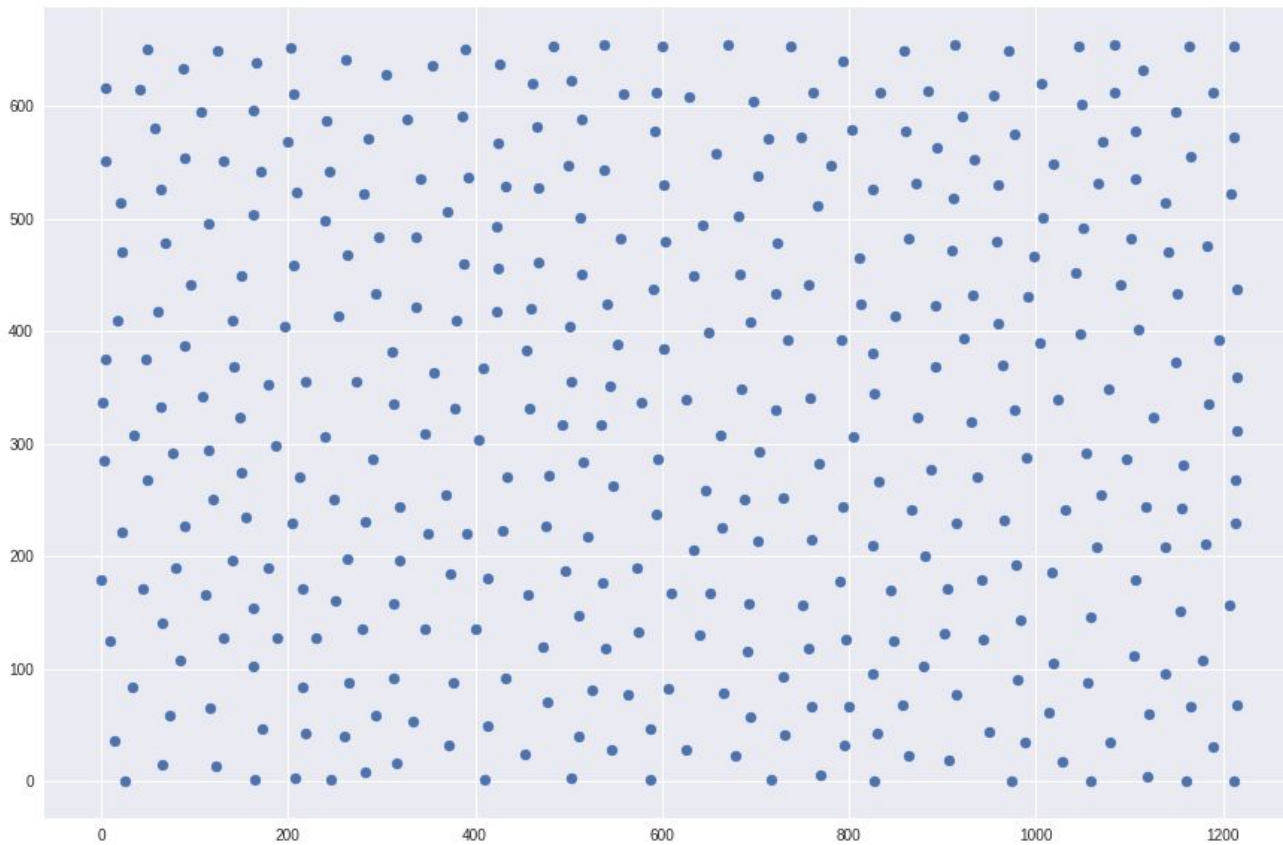
Pruned patches

Denoising Network

Noisy Input   Network Output   Reference

Proposed Timeline

- **Milestone 1**
    - **Revised codes from hw3 to generate data for next milestone**
    - **Write nn framework code**
    - **Write basic spatial filter**
- **Milestone 2**
    - **Add texture to the path tracer** **and generate image data from path tracer**
    - **Build and train denoising neural network on PyTorch first for proof of concept**
    - **Pytorch C++ API**
    - **Continue SVGF(face some problems)**
- Milestone 3
    - Unfinished part from milestone 2(red), blue noise
    - SVGF Finish(?)
    - Achieve real-time denoising for static scenes
- Final Presentation
    - Different environment
    - Optimization