

Path Tracer Denoising

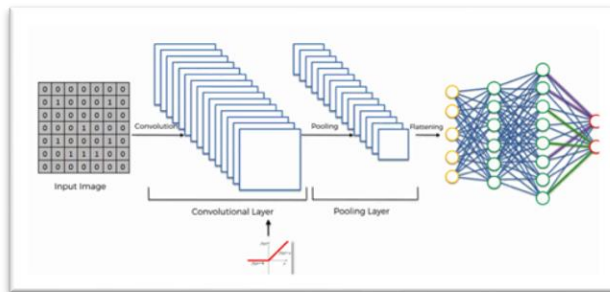
Milestone 1

Team: W. Chen, Y. Dong, Z. Xie

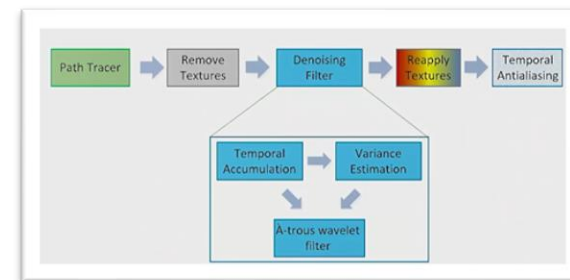
Motivation

There's an academic arms race to produce the best real-time denoised image from 1 sample per pixel (spp) path traced images. Every new paper like this brings us closer to an ideal solution that can be baked into silicon (mobile raytracing for the masses!)

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Machine Learning Techniques



Spatial-temporal Techniques

MS1 Progress

- ✓ Read papers!

Path Tracing Front

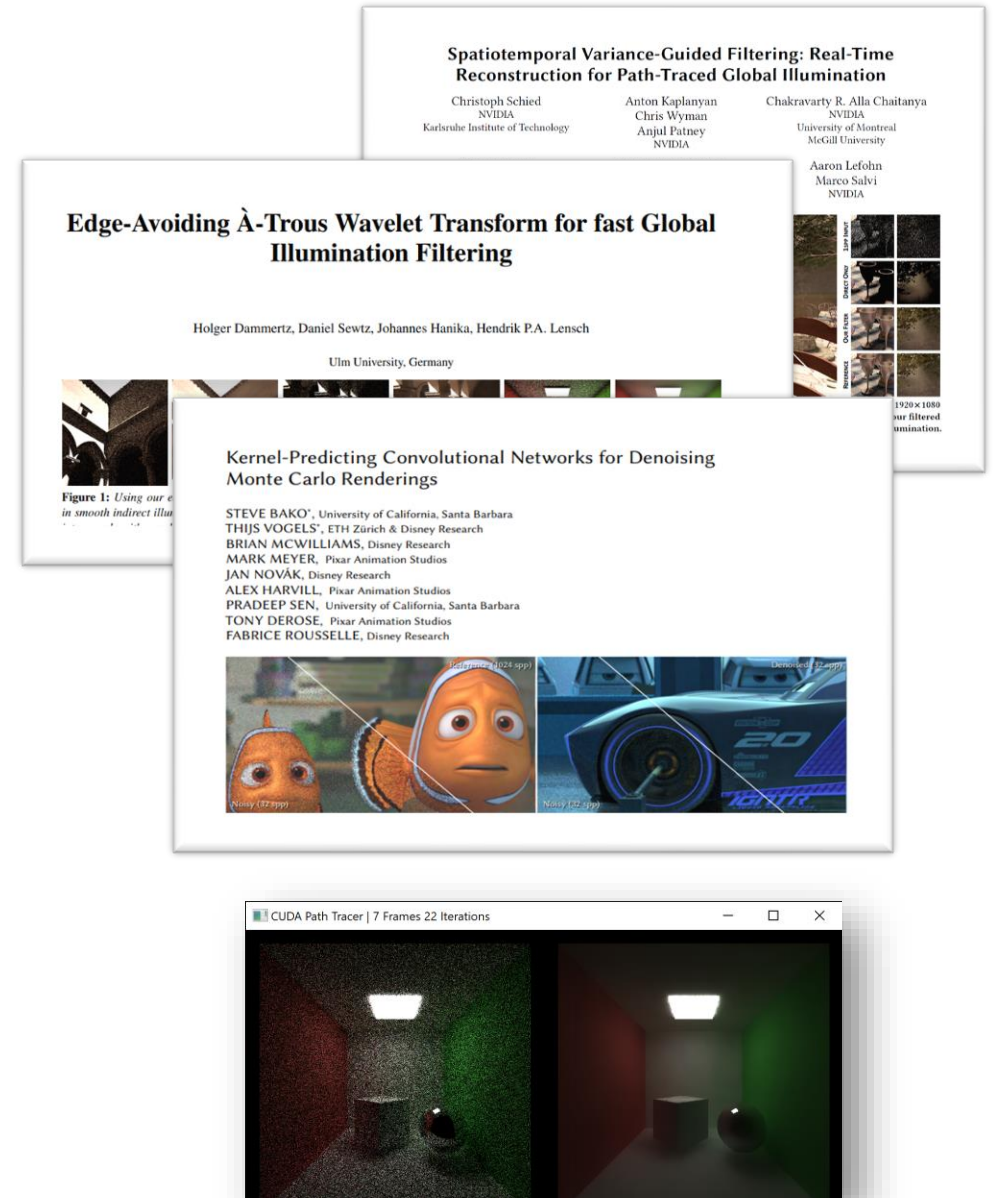
- ✓ Set-up project framework (based on HW3)
- ✓ New features: MIS, KD-Tree

Spatiotemporal Front

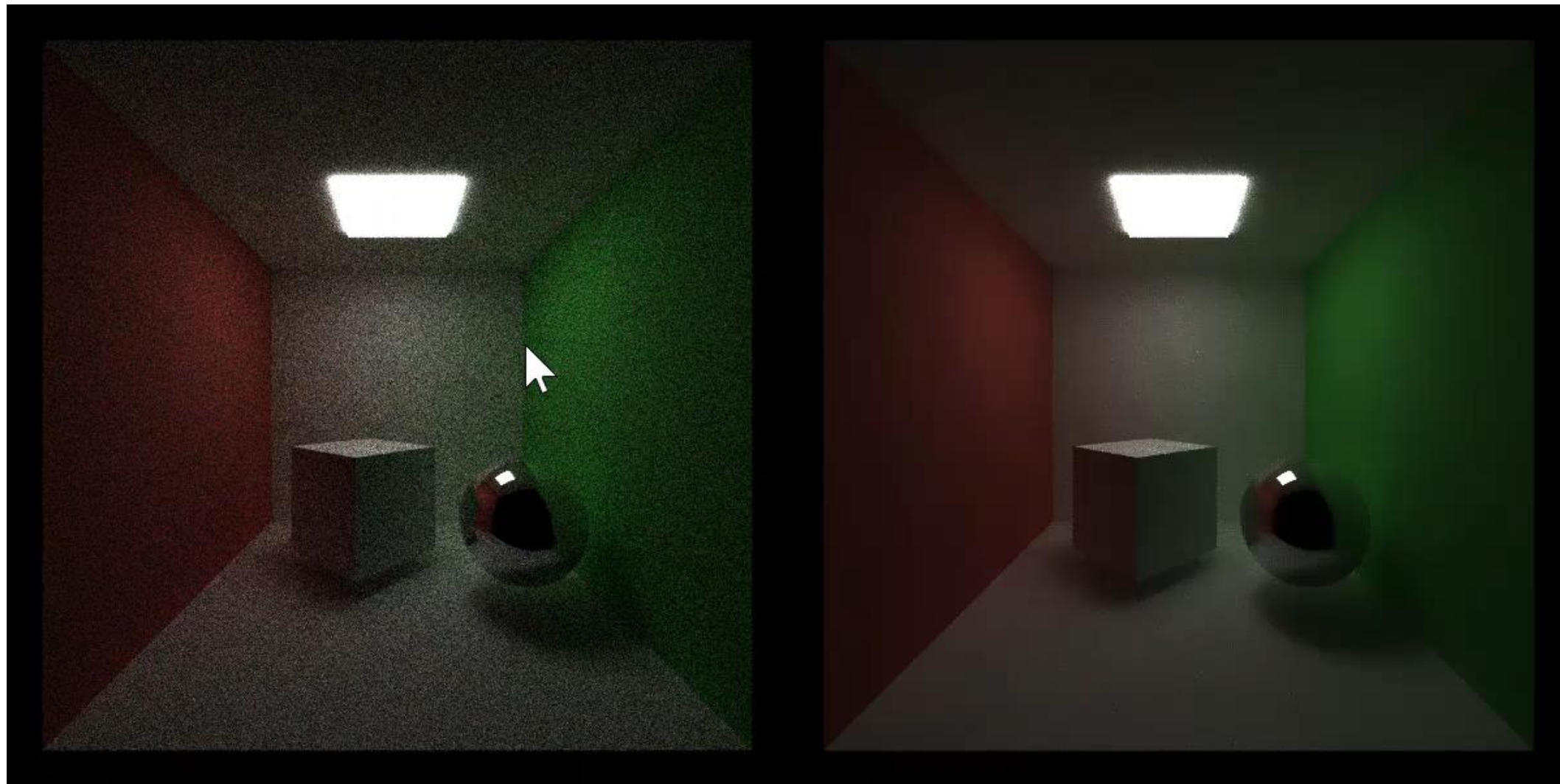
- ✓ Implemented À-Trous spatial filtering

Machine Learning Front

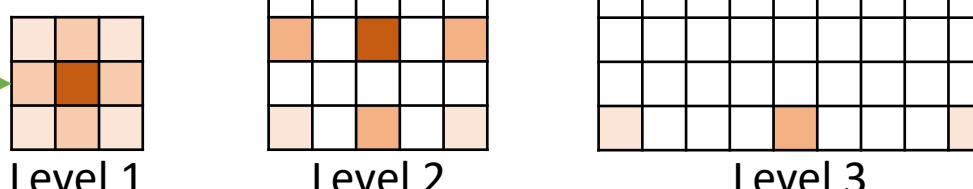
- ✓ Set up training environment



Interactive Spatial Filtering



À-Trous Wavelet Transform

$$c_{i+1}(p) = \frac{1}{k} \sum_{q \in \Omega} \overset{\text{Kernel}}{h_i(q)} \overset{\text{Edge-stopping functions}}{w(p, q)} \cdot c_i(q)$$


Level 1 Level 2 Level 3

$$w_n(p, q) = e^{\left(-\frac{\|n_p - n_q\|}{\sigma_n^2}\right)}$$

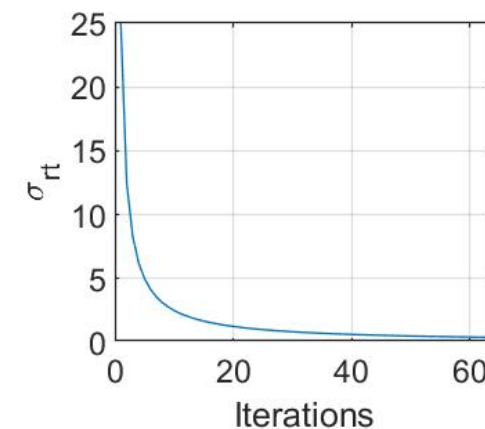
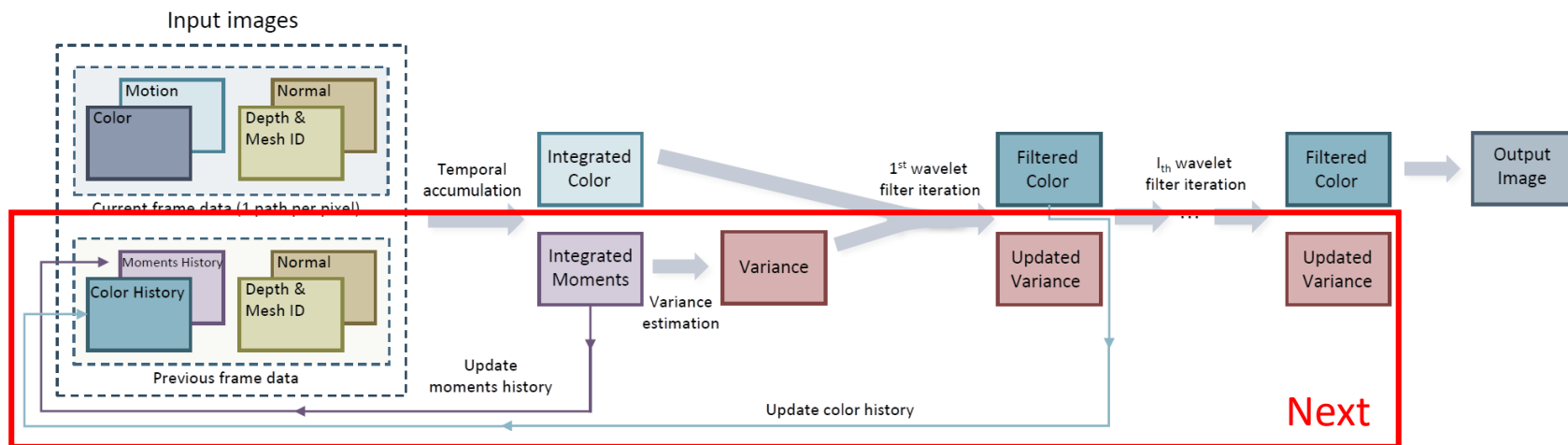
Normal

$$w_x(p, q) = e^{\left(-\frac{\|x_p - x_q\|}{\sigma_x^2}\right)}$$

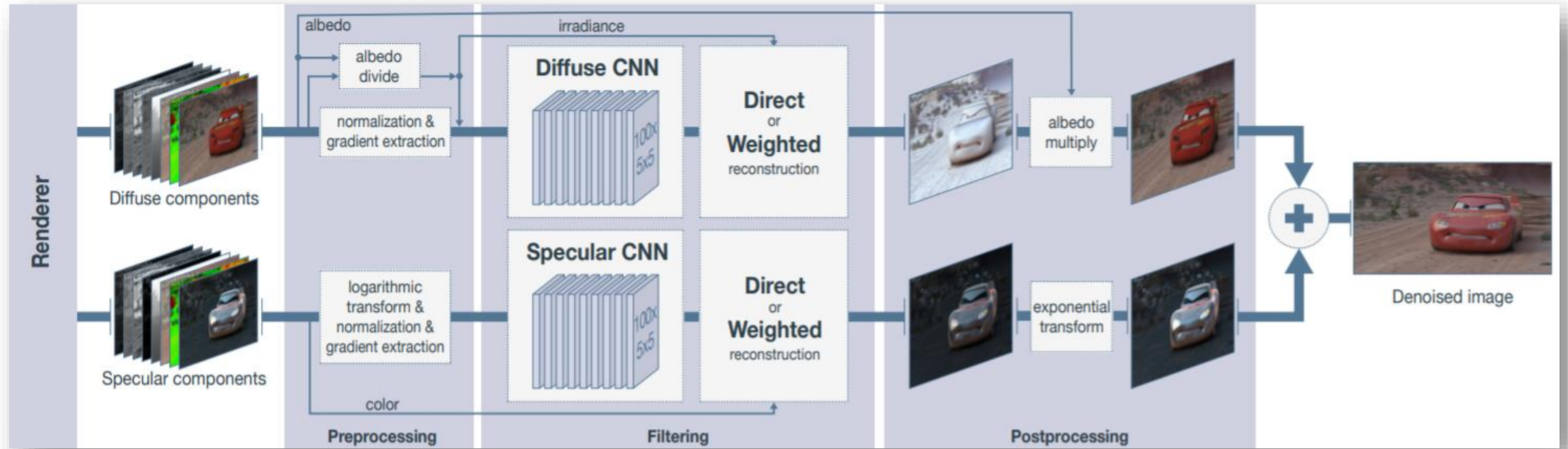
Position

$$w_{rt}(p, q) = e^{\left(-\frac{\|I_p - I_q\|}{\sigma_{rt}^2}\right)}$$

Color



Denoising Network



Work In Progress

Bako S, Vogels T, McWilliams B, et al. **Kernel-predicting convolutional networks for denoising Monte Carlo renderings**[J]. ACM Transactions on Graphics (TOG), 2017, 36(4): 97.

•**Milestone 1(done!)**

- **Revised codes from hw3 to generate data for next milestone**
- **Write machine learning 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
- Deploy network in C++ API
- Finish SVGF(maybe in general, some details still need to change)

•**Milestone 3**

- Unfinished part from milestone 2
- Achieve real-time denoising for static scenes

•**Final Presentation**

- Build more scenes
- Optimize performance