

Improving the Progressive Denoising of MC Rendered Images in low SPPs

(From “Progressive Denoising of MC Rendered Images”, A. Firmino et al, EG 2022)

Mid-term Project Presentation

Team 3
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Background: Noises in MC-Rendering @ low SPP



16 Samples Per Pixel



1024 Samples Per Pixel

Background: Denoising in MC-Rendering



16 Samples Per Pixel



16 Samples Per Pixel *Denoised*

(By Intel OIDN)

Background: Denoisers are not flawless!



1024 Samples Per Pixel Denoised



1024 Samples Per Pixel

Problem: Existing deep-learning based denoisers for MCR

“Can produce smooth images using a low sample count”



How to overcome the problem?



“Biased and do not converge to ground truth as SPP increase”

Recap: Progressive Denoising

- Blend denoised & original images based on variance of non-denoised pixels
- Produce optimal per-pixel mix parameter (which takes the best pixels of each image)



Input 1: Rendered



Input 2: Denoised



Per-pixel mixing param

Limitations

- Progressive denoising shows limitations at very low sample counts



Figure 13: *Limitation of our method at very low sample counts, 2spp in this example, arising from insufficiently accurate sample variance estimates.*

Motivation

“Improving progressive denoising at low SPPs”

Strengths

**Apply denoising only
when it's beneficial**

Better Quality @ High SPPs

Our workarounds

**Acceptable performance
@ Low SPPs**

“Consistent, versatile denoiser in all SPP ranges”

Approaches (1) : Mounting of Adaptive sampling

- **Adaptive Sampling**: Optimizing technique in MC rendering which allocates more samples to the areas of the suspicious part of the image

How to apply?



*Un-denoised image
with low SPP*

Variance : 0!



Denoising decision

Pre-denoising step
If (variance too low):
More samples (~32)!

Variance: XX (>0)

Approaches (2) : Estimate from widen neighbourhood

- Original paper uses **11-by-11** size neighbourhood to estimate the variance of pixel
- Check if different options (larger kernels) can give better results while it does not give performance degradance

Approaches

Adaptive Sampling based approach:

- Can expect better quality in low SPPs
- Good literatures to refer (Deep Adaptive Sampling for Low Sample Count Rendering, A.Kuznetsov et al, EG 2018)
- Cannot guarantee if the implementation will be feasible

Widening kernel based approach

- Easy to implement
- Weak impact & cannot guarantee the quality

Roles

Jaehyun Ha

- Coordinates the entire project
- Check if widening kernel-based approach works
- Check whether adaptive sampling methods can be applied on top of progressive denoising
- Making slides
- Review the literatures
- ...

Thank You

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