DENOISING AND GUIDED UPSAMPLING OF MONTE CARLO PATH TRACED LOW RESOLUTION RENDERINGS

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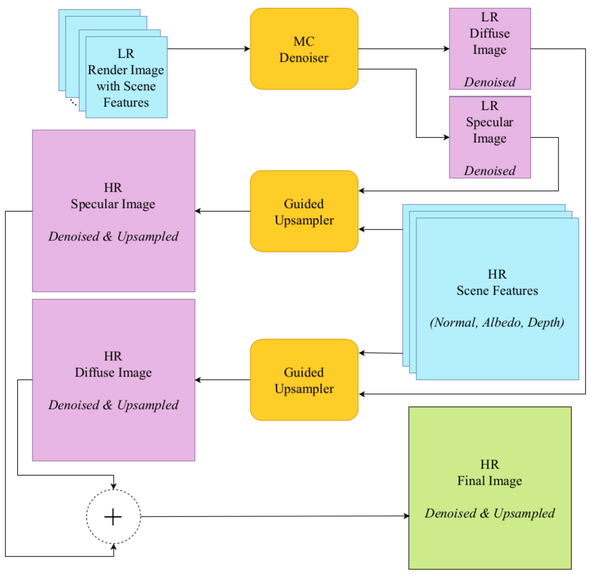
SIGGRAPH 2022 VANCOUVER+ 8-11 AUG

PROBLEM

- Monte Carlo (MC) denoisers cannot handle the high variance of the rendering accurately when the ray sample count is reduced harshly to finish the rendering in a shorter time.
- This results in a poor quality denoising output compared to a high-sample-count rendering that does not require denoising.

METHOD



- LR and HR indicates the lower image resolution and the original resolution, respectively.
- Scene features used in the method:
  - Albedo map,
  - Normal map,
  - Depth map.

RENDERING AT A LOWER RESOLUTION ALLOWS FOR A HIGHER SAMPLE PER PIXEL (SPP) IMAGE IN THE SAME TIME BUDGET, WHICH WE SMARTLY DENOISE AND UPSAMPLE AS IF IT WAS ORIGINALLY RENDERED AT A HIGHER SPP.

Baseline approach.

Our approach.

Ground-truth rendering.

Scene's renderer file courtesy of [Bitterli 2016].

OUR APPROACH

- Baseline approach renders the MC images at the original resolution with a harshly reduced sample count. High variance causes the MC denoiser fail.
- We render the MC image at a lower resolution with a higher sample count in the same time budget as baseline. It is then robustly denoised thanks to having lower variance.
- Denoised result is upsampled to the original resolution using separately-rendered-in-negligible-time original resolution scene features as guides.
- Diffuse and specular decomposition is employed [Bako et al. 2017]. Each component is processed separately and the results are merged at the end.

RELATED WORK

- Surveys detail the ideas that reduce the time cost of MC path tracing without sacrificing the quality of image [Huo and Yoon 2021; Zwicker et al. 2015].

REFERENCES

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ACKNOWLEDGEMENTS

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