Pacific Graphics 2018
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(Guest Editors)

Volume 37 (2018), Number 7

Feature Generation for Adaptive Gradient-Domain Path Tracing (Supplementary Report)

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1. Equal-Time Comparisons.

We have compared different reconstruction results within the gradient-domain path tracing (G-PT) framework [KMA*15]. Specifically, we show the $L1$ reconstruction [KMA*15] that directly outputs a final image using both the input image color and gradients from G-PT. We have also tested a regularized $L1$ reconstruction [MVZ16], which adapts the $L1$ by adding a constraint term formed by rendering-specific features (e.g., texture, normal, world coordinates and ambient occlusion buffers). In addition, a recent adaptive rendering method, i.e., adaptive polynomial rendering (APR) [MMMG16], is tested with a different set of features (i.e., G-buffers, our feature, and both features). APR with only G-buffers can be performed without image gradients, and thus this method uses a standard path tracer so that it can use more samples than the other techniques for fairness. All the other methods utilize the G-PT framework. We also show an input color image of G-PT, which does not utilize post-reconstruction. Finally, we visualize our feature that is passed into APR. As a numerical measure, the relative mean squared error (relMSE) [RKZ11] is used.

References

[KMA*15] KETTUNEN M., MANZI M., AITTALA M., LEHTINEN J., DURAND F., ZWICKER M.: Gradient-domain path tracing. *ACM Transactions on Graphics 34*, 4 (2015), 123:1–123:13. 1

[MMMG16] MOON B., MCDONAGH S., MITCHELL K., GROSS M.: Adaptive polynomial rendering. *ACM Transactions on Graphics 35*, 4 (2016), 40:1–40:10. 1

[MVZ16] MANZI M., VICINI D., ZWICKER M.: Regularizing image reconstruction for gradient-domain rendering with feature patches. *Computer Graphics Forum 35*, 2 (2016), 263–273. 1

[RKZ11] ROUSSELLE F., KNAUS C., ZWICKER M.: Adaptive sampling and reconstruction using greedy error minimization. *ACM Transactions on Graphics 30*, 6 (2011), 159:1–159:12. 1

Input color, 81 spp (105.5 s), relMSE 0.0873

L1, 81 spp (106.0 s), relMSE 0.0100

Regularized L1, 26 spp (106.8 s), relMSE 0.0052

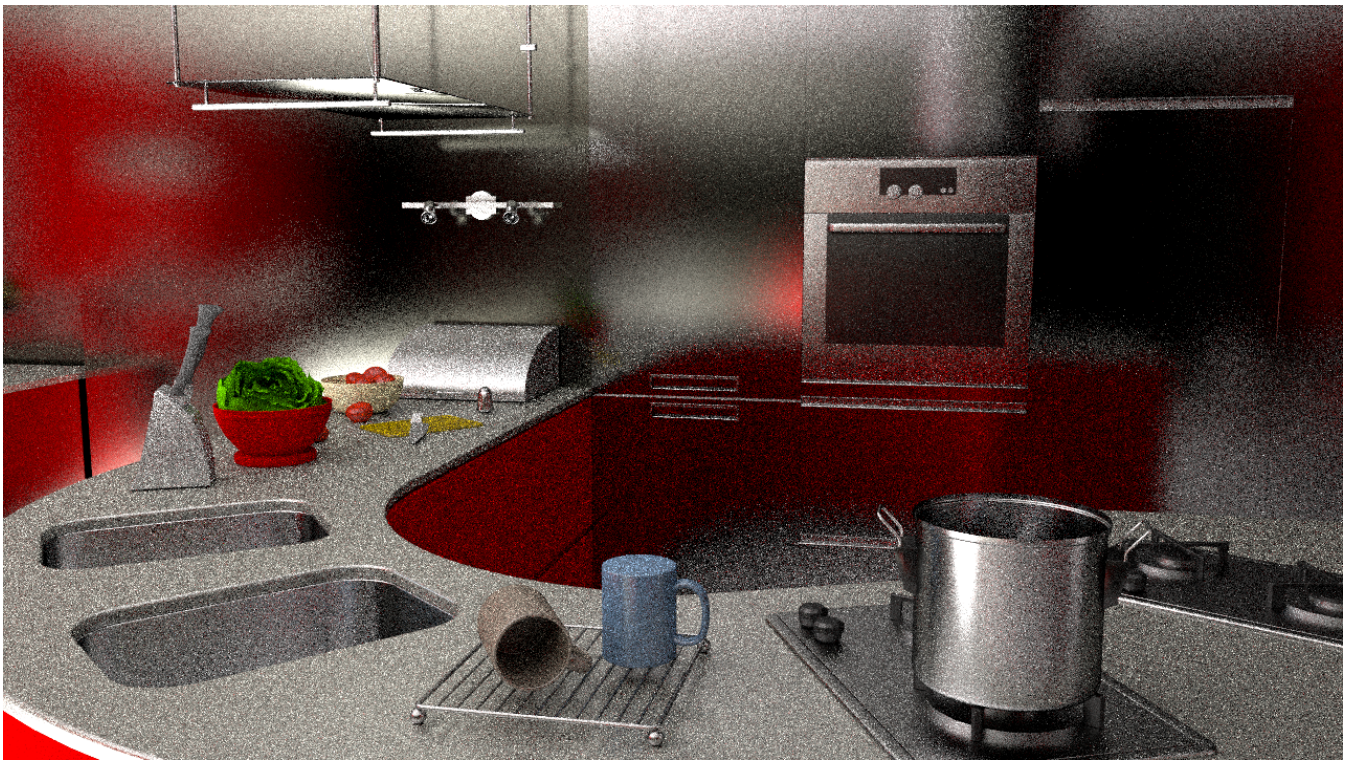
APR w/ G-buffers, 136 spp (104.6 s), relMSE 0.0030

Our feature

APR w/ ours, 69 spp (104.2 s), relMSE 0.0027

APR w/ ours and G-buffers, 56 spp (103.6 s), relMSE 0.0021

Reference, 256K spp

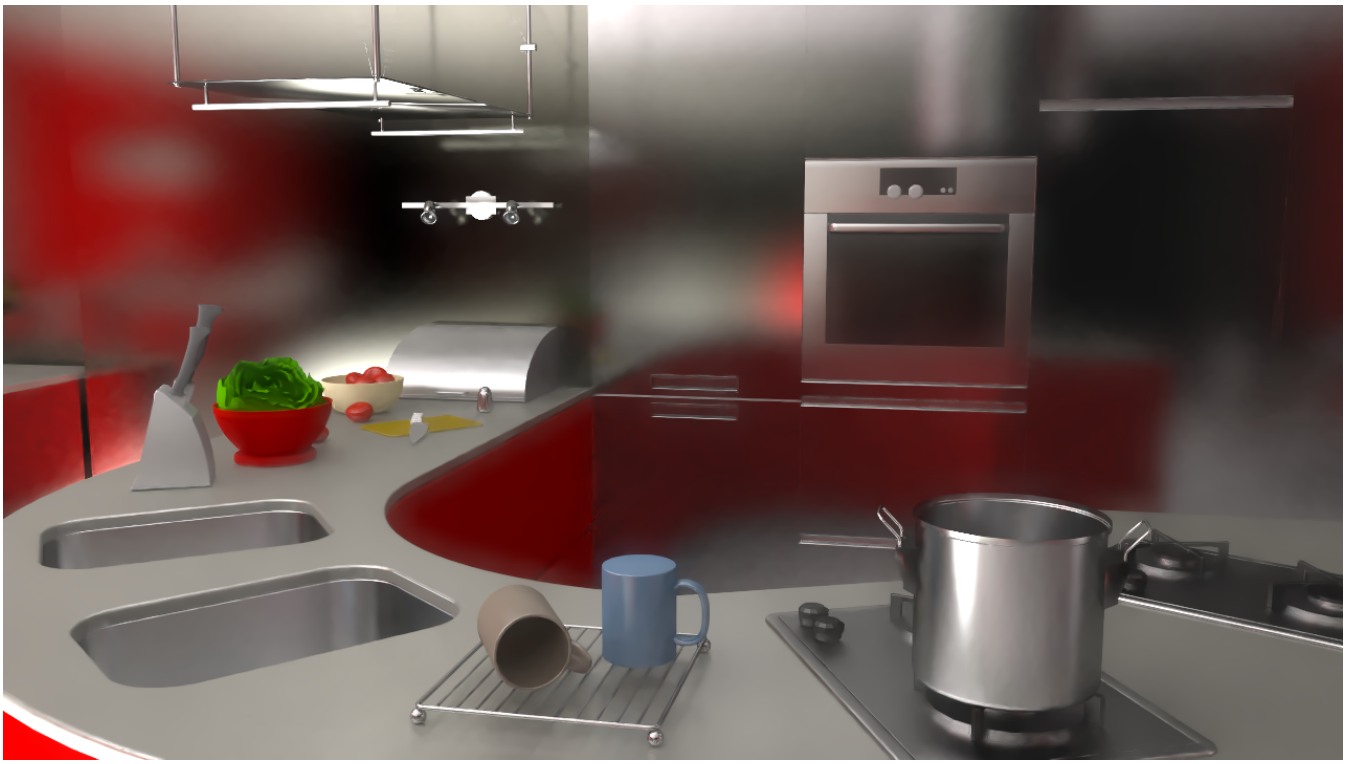


Input color, 150 spp (189.2 s), relMSE 0.1715

L1, 150 spp (190.5 s), relMSE 0.0181

Regularized L1, 88 spp (189.3 s), relMSE 0.0041

APR w/ G-buffers, 253 spp (188.4 s), relMSE 0.0036



Our feature

APR w/ ours, 129 spp (187.4 s), relMSE 0.0026

APR w/ ours and G-buffers, 111 spp (187.5 s), relMSE 0.0018

Reference, 512K spp

Input color, 372 spp (483.0 s), relMSE 0.1260

L1, 372 spp (484.7 s), relMSE 0.0069

Regularized L1, 291 spp (483.8 s), relMSE 0.0020

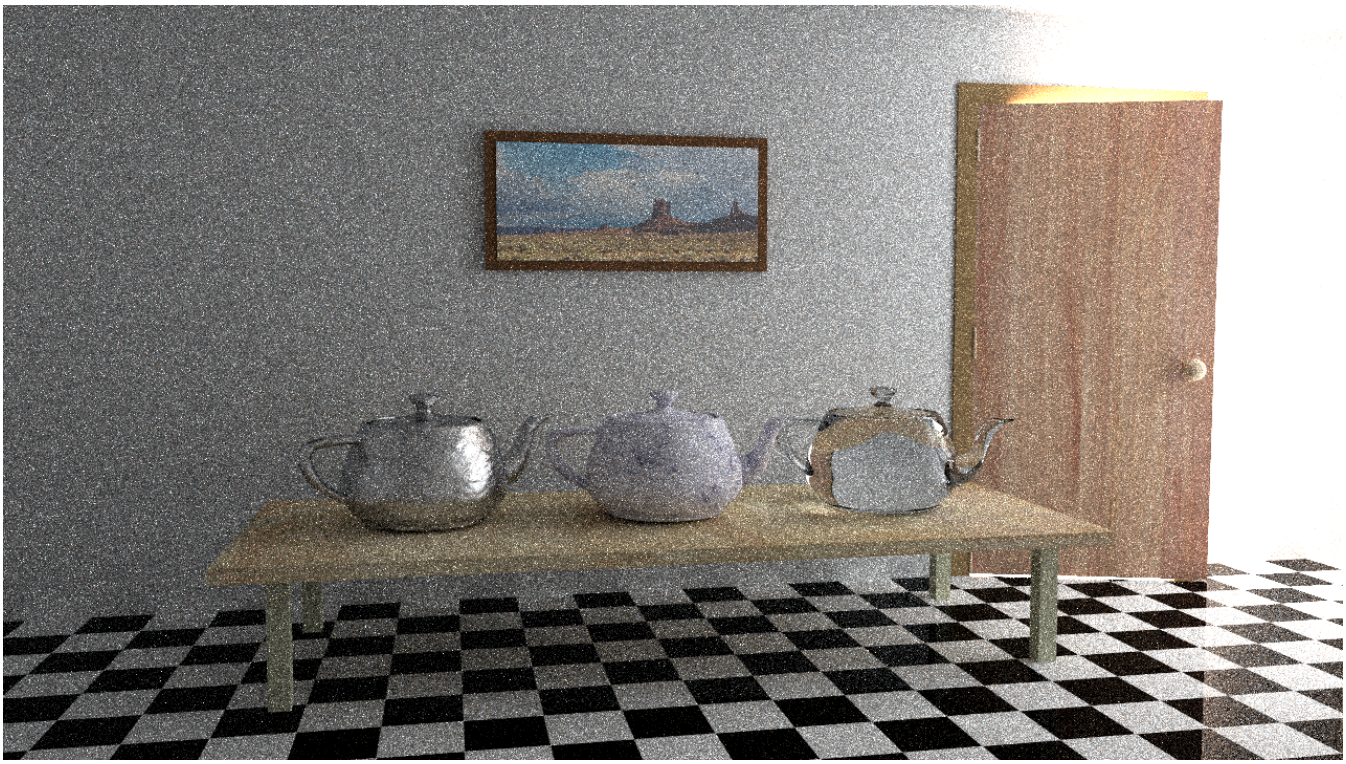
APR w/ G-buffers, 696 spp (483.1 s), relMSE 0.0017

Our feature

APR w/ ours, 344 spp (482.9 s), relMSE 0.0033

APR w/ ours and G-buffers, 308 spp (482.7 s), relMSE 0.0016

Reference, 512K spp



Input color, 512 spp (468.6 s), relMSE 0.4087

L1, 512 spp (469.8 s), relMSE 0.0284

Regularized L1, 397 spp (468.8 s), relMSE 0.0040

APR w/ G-buffers, 1130 spp (468.8 s), relMSE 0.0020

Our feature

APR w/ ours, 464 spp (467.4 s), relMSE 0.0023

APR w/ ours and G-buffers, 408 spp (466.0 s), relMSE 0.0018

Reference, 1024K spp