Progressive Photon Mapping in Real-Time Ray-Tracing using NVIDIA OptiX

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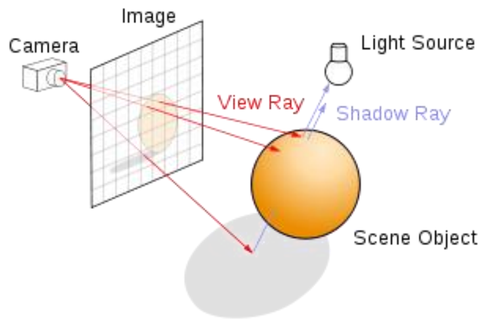
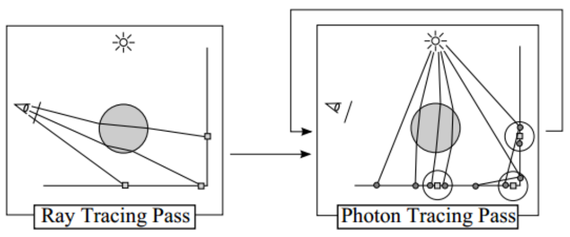
Background

- Ray-tracing is a technique long used to produce realistic images.



-Photon mapping is a similar technique except rays from the light source are mapped separately.



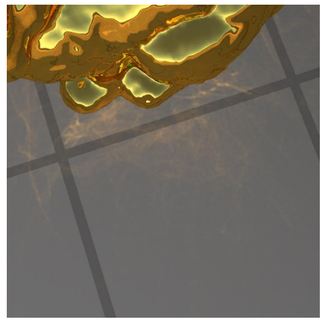
-Progressive photon mapping uses a combination of these two techniques to increase speed and still map the photons into the scene.

Goals

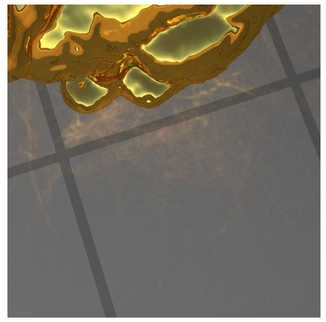
- Learn about real-time ray-tracing
- Implement progressive photon mapping
- Find an *optimal* number of photons to use
- Create multiple scenes to test PPM

Results

One of our goals was to find an *optimal* number of photons while running real-time (24 fps).



- 21-22 frames per second
- More refined, less scatter
- 250K photons per iteration
- 16.5M photons total
- 3 second photon render

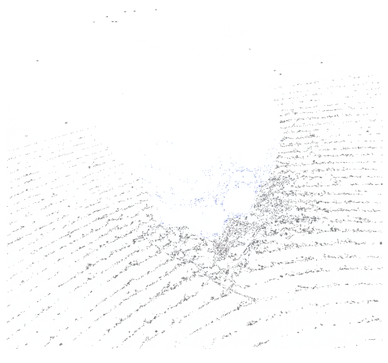


- 5-6 frames per second
- Less refined, more scatter
- 1.3M photons per iteration
- 23.4M photons total
- 3 second photon render

Rendering done on NVIDIA GeForce GTX 670, 1344 CUDA Cores

Both scenes fire an adequate number of total photons. The left picture spends more time refining and is much closer to real-time than the right image which is slower and less refined.

Here are the same two images compared.



The difference shown is at a threshold of 1% or less. The two images are so similar it is hard to notice any difference at all.

Conclusion

The photon count has little effect on enhancing this scene. Adding more photons did not enhance the image but made it less refined. The *optimal* number of photons is the lesser number. With less photons the image became more refined and ran closer to real-time speeds. Whereas the more photons gave a more scattered image and ran much slower. In the end the photon count was close to the same. The lesser photon count had more time to refine the image.

Continuation

- Create my own real-time ray-tracing engine
- Test different PPM algorithms
- Test more in-depth how viable PPM is

References

Hachisuka, T., Ogaki, S., and Jensen, H.W. 2008. *Progressive Photon Mapping.*

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