

Assignment 0: Describe a Parallel Application

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Bio

My name is Yan Zhao, and my major is EECS. I am a current Master of Engineering student at UC Berkeley, and I graduated from Berkeley with my bachelor degree last spring. My research interest is in image forgery detection. I am also interested in high performance computing and web development. You can find my recent work at <http://yanzhao.me> (not very updated though). By taking this course, I would like to apply parallel computing technique to **computer vision** programs as well as **image rendering** programs. Also, I would like to improve my knowledge about parallel computing and how to write efficient programs.

Real-time Photon Mapping

What is photon mapping? Photon mapping is a global illumination rendering technique. The basic concept is similar to a ray tracer. A ray tracer will simply shooting an eye ray from the eye point to each pixel. Then calculate the color of this pixel based on the intersection with objects in the scenes. Figure 1 shows an example of a ray tracer image. Beyond a ray tracer, what photon mapping does is addressing the global illumination missed by ray tracer while rendering a scene. Photon mapping starts from the light source to emit photons into the scene.

Each photon will bounce over and leave trace point in the scene. Then, we start shooting eye ray to each pixel, and calculate the color of each pixel based on interaction with the objects as well as the photon map in the scene. Photon mapping has a much more realistic effect than a simple ray tracer. Figure 2 shows an example of a photon mapping image.

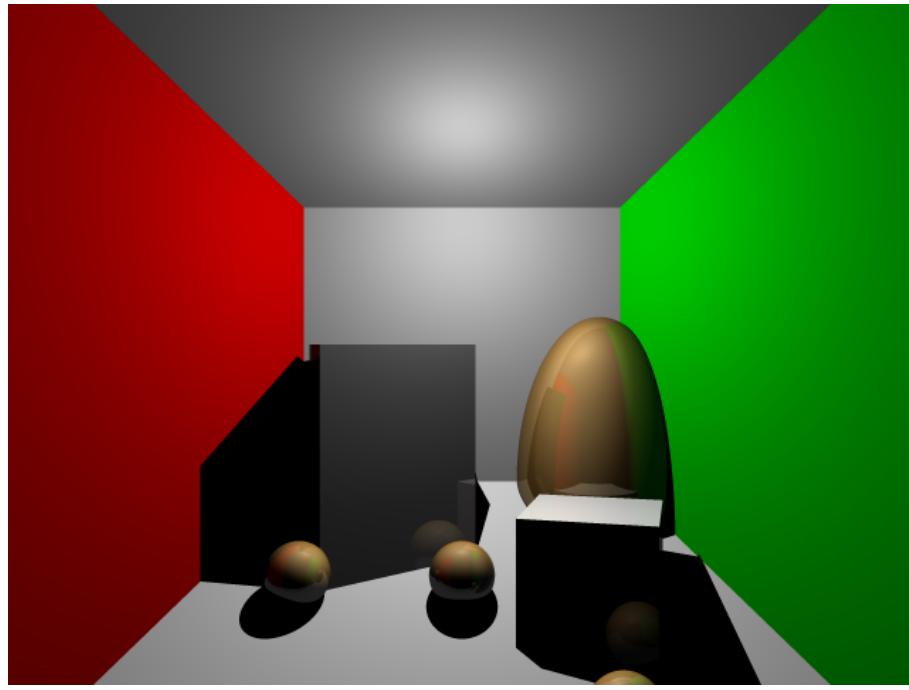


Figure 1: Ray tracer example

Parallelism in photon mapping. One of the key steps in photon mapping is photon density estimation. This step happens when a ray hits an object and gathers photon data at the intersection point. There has been a parallel algorithm developed at NVIDIA specifically for the density calculation. And they are approaching real-time rendering.

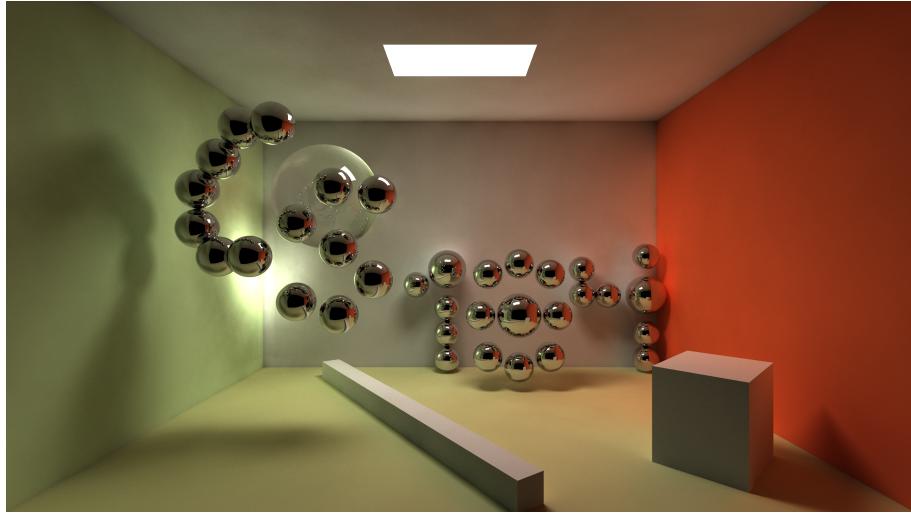


Figure 2: Photon mapping example

My goal

I would like to probe on this existing parallel photon mapping algorithm first, and if possible, push further to achieve real time photon mapping. On the other hand, I would also like to research parallelism in computer vision field.