Photon Mapper

Final project presentation

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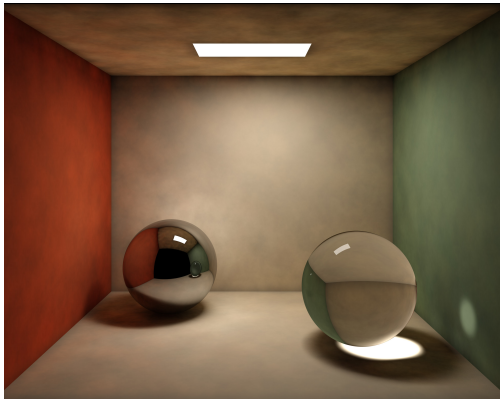


Problem description

- Path tracing does not produce significant caustics in a reasonable amount of time

- Small probability that a ray starting from camera, hits a surface that actually reflects incoming rays directly through a transparent object to the light source

Solution

- Collect additional information about light photons being emitted from the light source
- Photons carry energy which can be transmitted whenever an object is hit
- The process of storing photon→object interactions is called photon mapping

How does photon mapping work?

- Photon mapping is a two pass technique

1. Photon tracing
   - Follow photons from light into scene
   - Save photons when colliding with diffuse objects

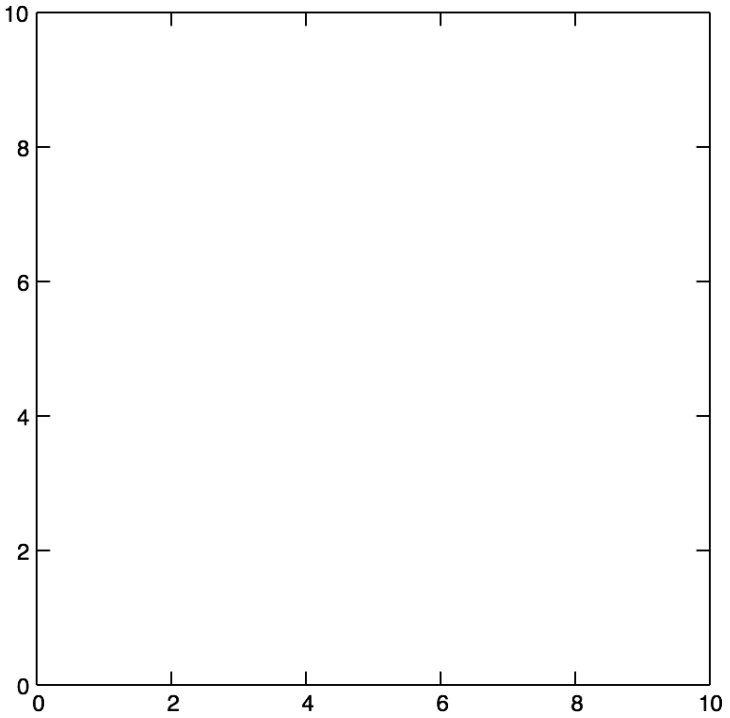
2. Photon gathering
   - Determine intersection point with e.g. raytracing
   - Collect photons nearby to estimate incident flux

Implementation details

- Enhanced path tracer
- Photon mapping for handling indirect lighting
- Shadow rays for direct lighting
- Recursive ray tracing for specularity/transmission
- Multithreaded photon map creation and ray casting
- Per object Kd-tree for storing photons

Kd-tree

Inserting 2D (x,y) coordinates:
(7,2) (5,4) (2,3) (9,6) (4,7) (8,1)



Kd-tree

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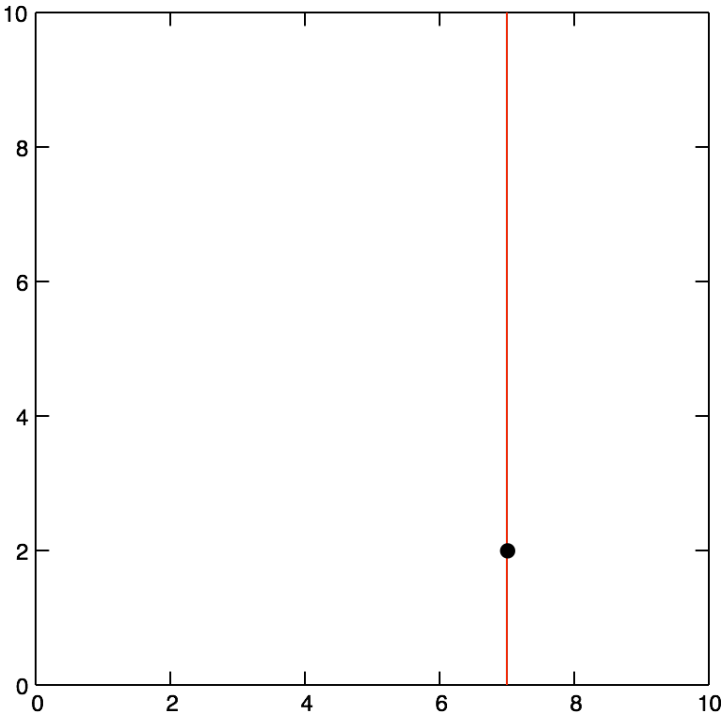

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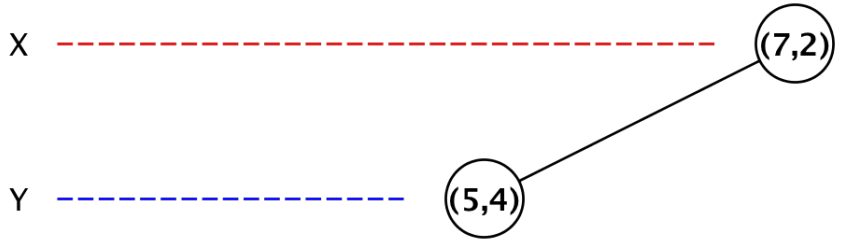

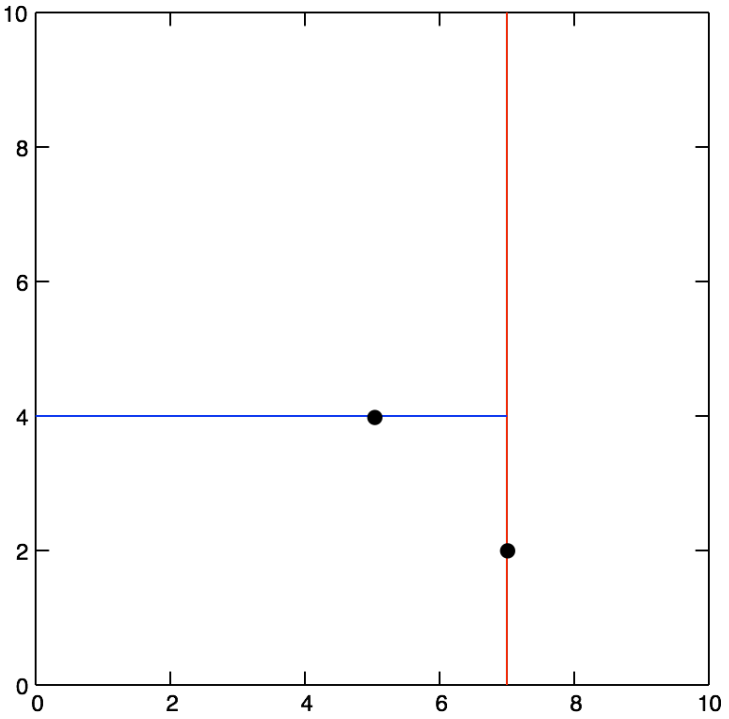

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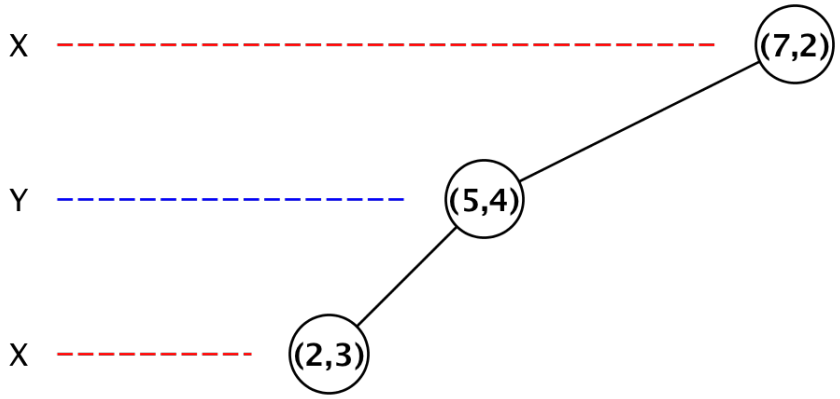

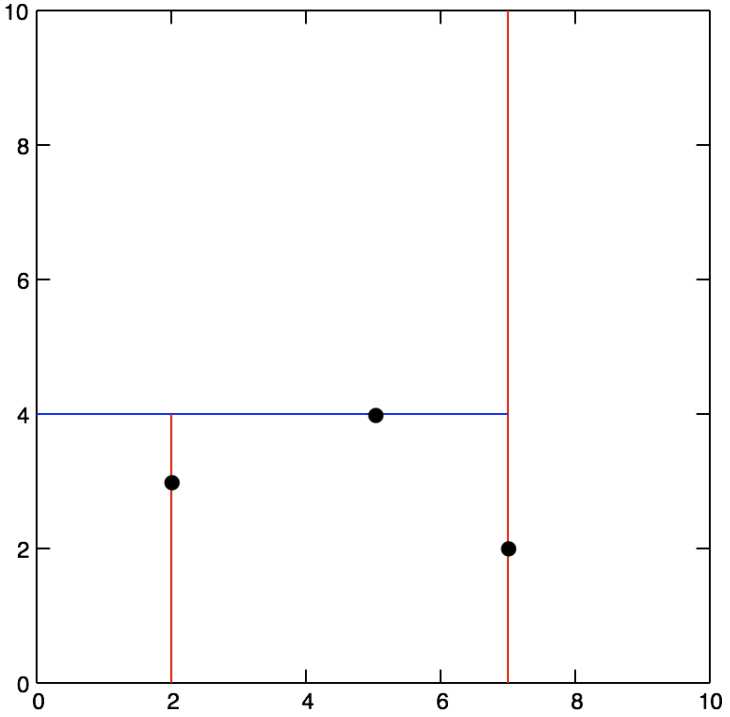

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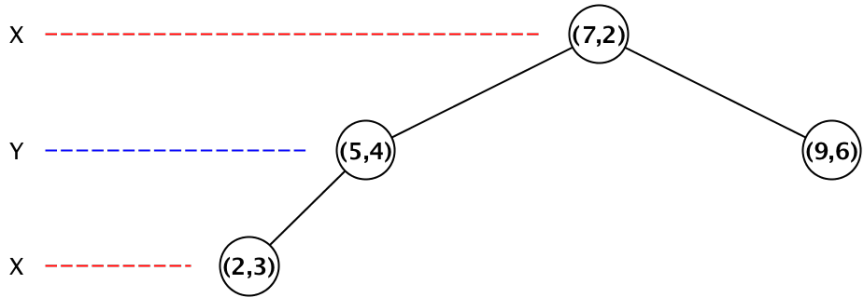

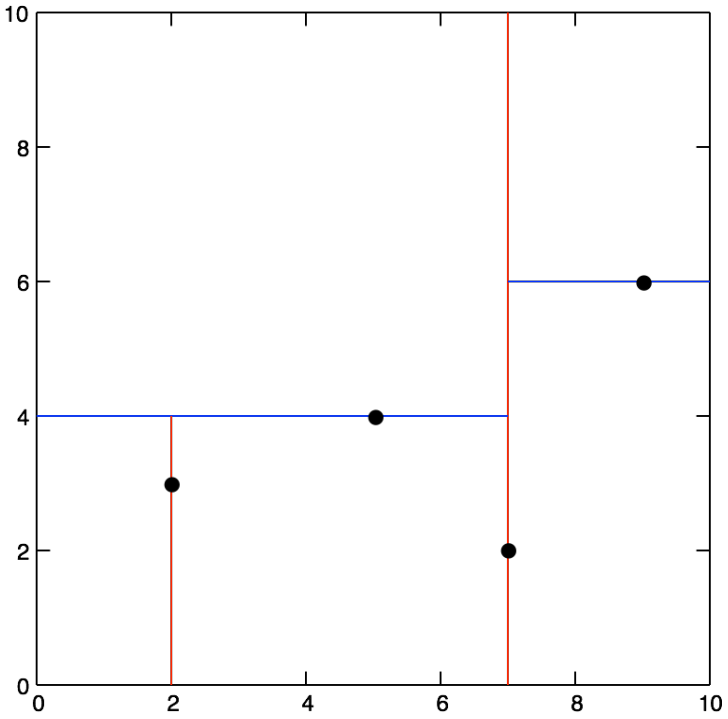

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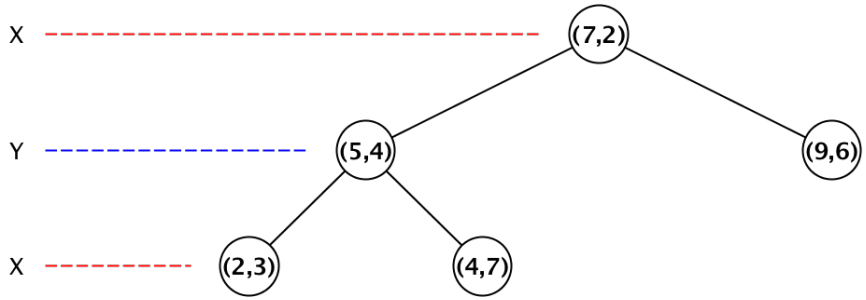

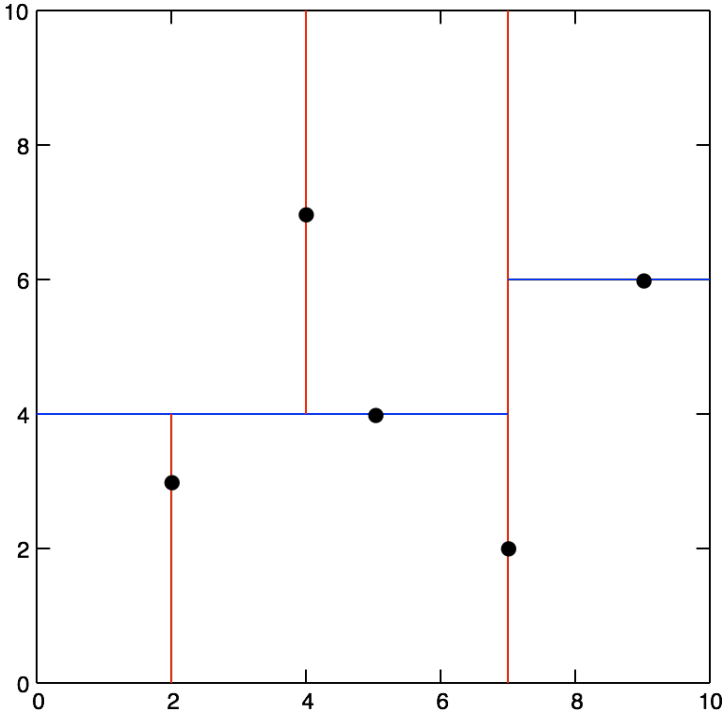

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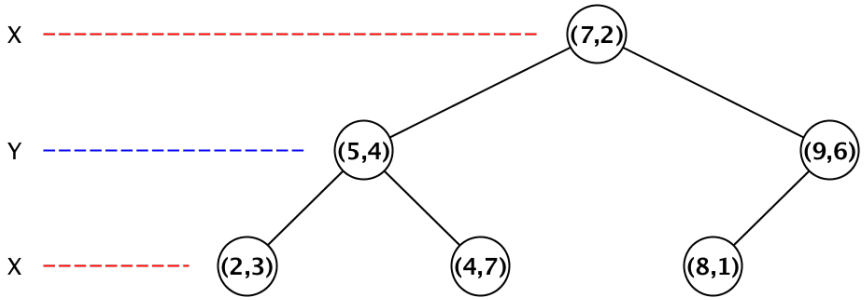

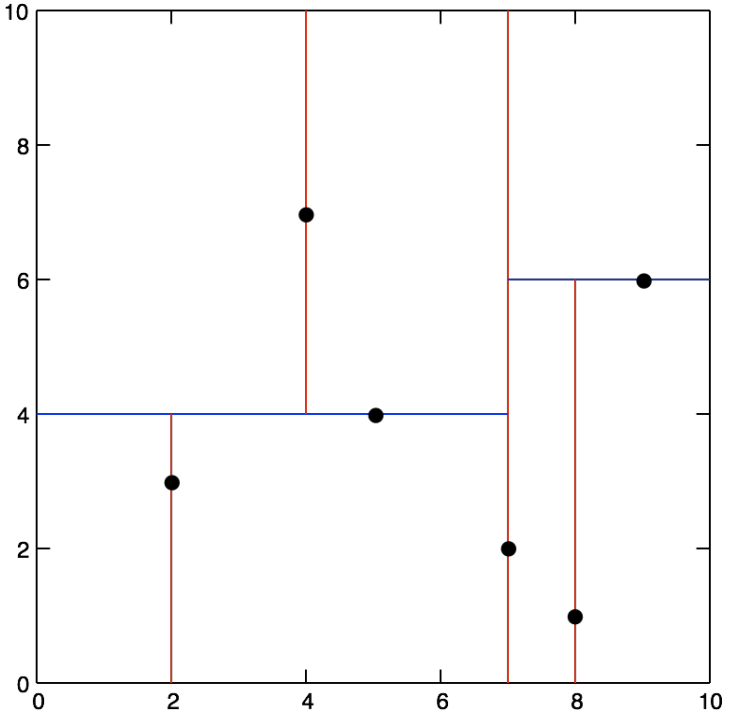

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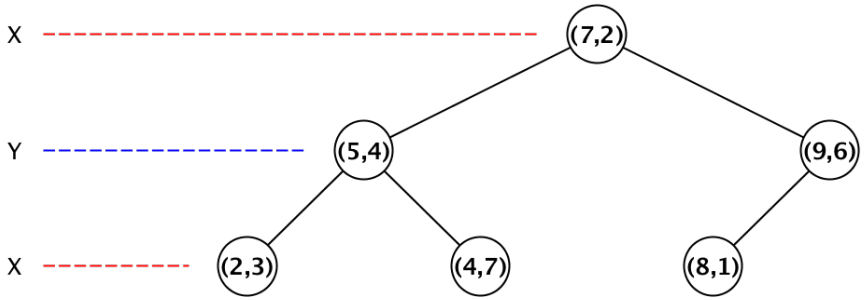

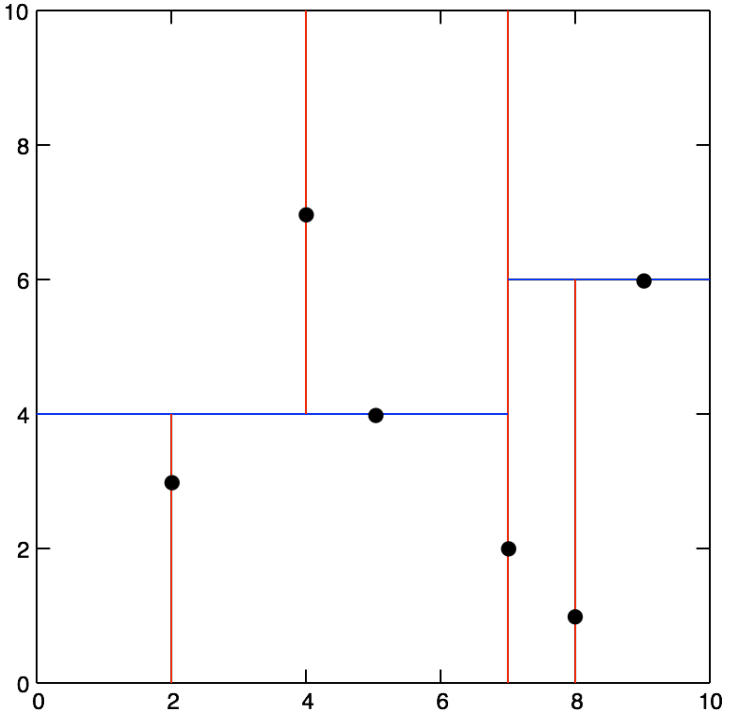

Libraries and resources to be mentioned

- GLM
- OpenGL
- Glut
- NanoFlann (Kd-tree)