

Interactive Global Illumination for Quasi-Static Scenes

- ▶ Interactive Global Illumination for Quasi-Static Scenes
- ▶ Illumination
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Previous Work: Impact Count

- ▶ Impact Count
- ▶ Counts the impacts in the triangles.
- ▶ Vertexes radiance is calculated as an average among the triangles they belong to.
- ▶ Variance inversely proportional to triangle size: High Variance.
- ▶ Highly dependent on geometry.

Previous Work: Photon Maps

- ▶ Photon Maps
- ▶ Takes the n nearest photons, adds the energy and divides by projected area
- ▶ Surfaces should be locally planar
- ▶ Problems in Borders

Impact Count y Photon Maps

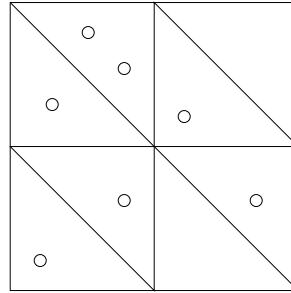


Figure 1 : Impact Count

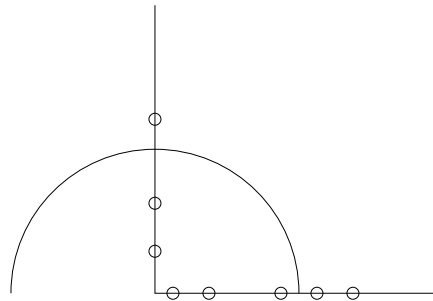


Figure 2 : Photon Maps

Density Estimation on the Tangent Plane

- ▶ Creates a fixed-size disc centered at the point, in the tangent plane.
- ▶ Rays which intersect the disc are calculated.
- ▶ Their energy is added and divided by the disc area.
- ▶ Independent of geometry.

Density Estimation on the Tangent Plane

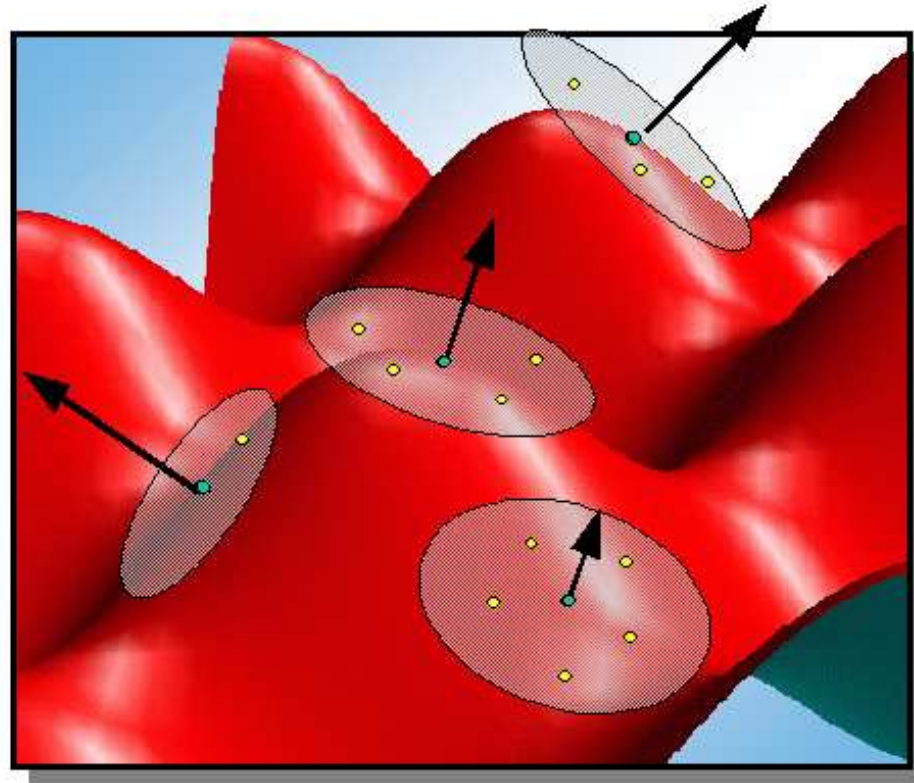


Figure 3 : DETP

Simplifications for interactivity

- ▶ The geometry is composed of triangle meshes
- ▶ Scene change:
 - Static Vertexes (most). Scene.
 - Dynamic Vertexes (comparatively few). Mobile objects, characters.
 - Static light sources.

Modifications to the algorithms

- ▶ DETP initially designed for static scenes
- ▶ Changes needed for interactive update of illumination are shown next.

Modifications in the Ray Tracing pass

- ▶ As the frames pass, dynamic vertexes move to a new position.
- ▶ Rays which intersected dynamic objects in the previous frame or do in this frame should be recalculated.
- ▶ The rest of the rays does not change their contribution to the static scene.

Ray Recalculation.

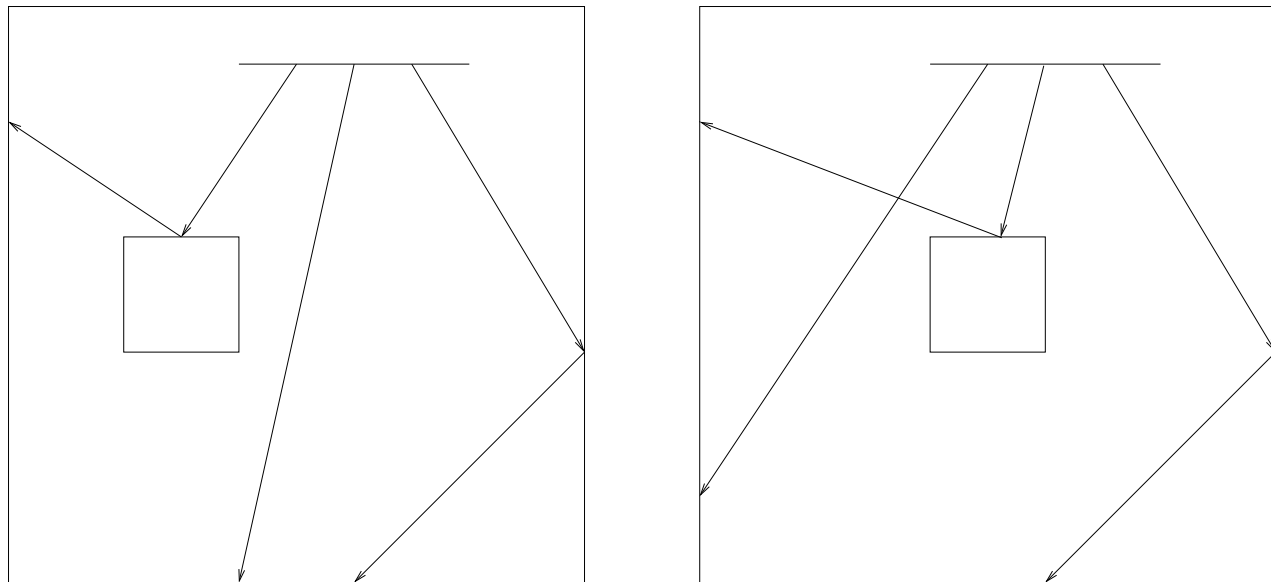


Figure 4 : Ray Recalculation

Modifications. Density Estimation

- ▶ The recalculation algorithm depends on the vertex type:
- ▶ Static vertexes: Use the rays which changed.
- ▶ Dynamic vertexes: The algorithm depends on the estimation method.

- ▶ Take the estimated radiosity from the previous frame.
- ▶ Add the contribution of the new rays.
- ▶ Subtract the contribution of the old rays.
- ▶ The result is radiosity on this frame.

- ▶ Algorithm dependent on density estimation method.
- ▶ Impact Count: The same as static vertices.
- ▶ DETP or Photon Maps: Discard radiosity on the previous frame and recalculate it using all rays.

Example scene

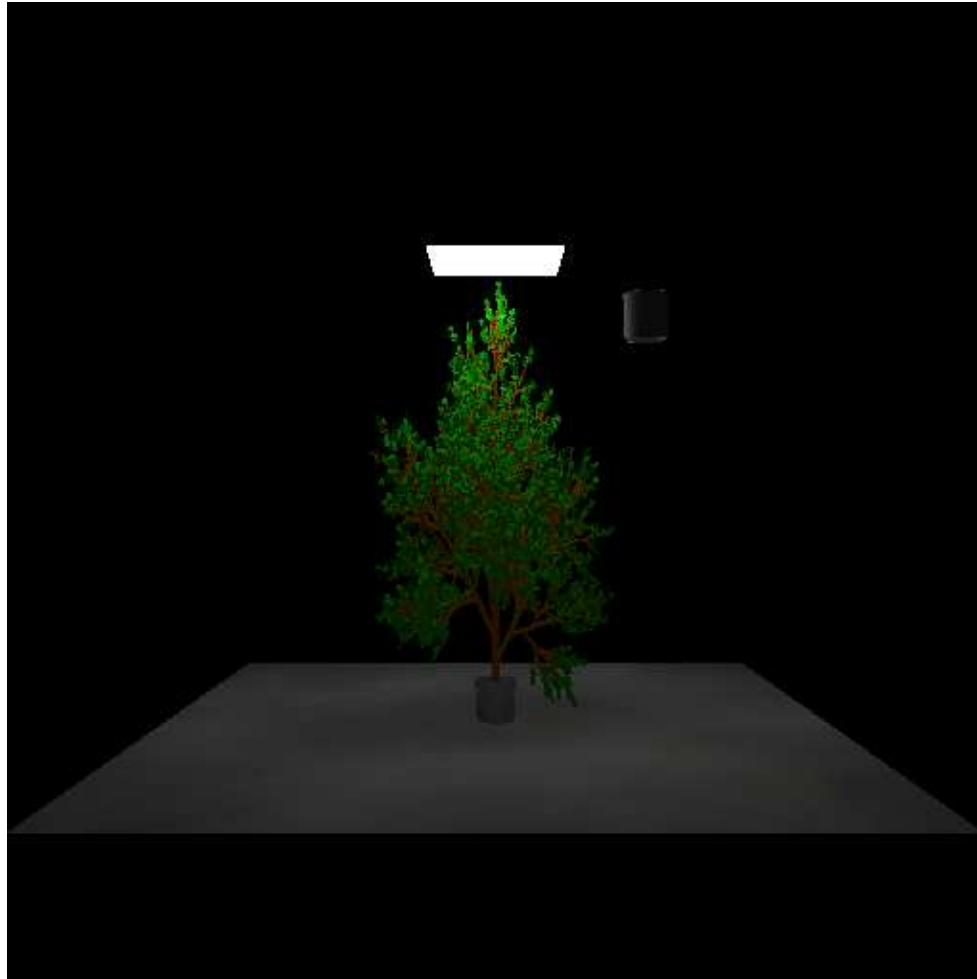


Figure 6 : Tree Scene

Computation time for 10 000 photons and 0.1 radius

PhotoSimulation time (initial frame) 0.09

Photosimulation update 0.00

No Ray Caché		Ray Caché			
		No Sort Queries		Sort Queries	
Inic	26.14	Inic	2.56	Inic	2.56
Frame	0.29	Frame	0.26	Frame	0.11

Activating the Ray Caché and Sort Queries optimization leads us to $1/0.11=9$ frames per second, which is clearly interactive.

- 1 J. R. Arvo Backward Ray Tracing. ACM SIGGRAPH '86
- 2 Henrik Wann Jensen Realistic Image Synthesis using Photon Mapping AK Peters 2001
- 3 M. Lastra et al. A Density Estimation Technique for Radiosity. 1st Ibero-American Symposium in Computer Graphics (SIACG'2002) 2002

Recalculation algorithms

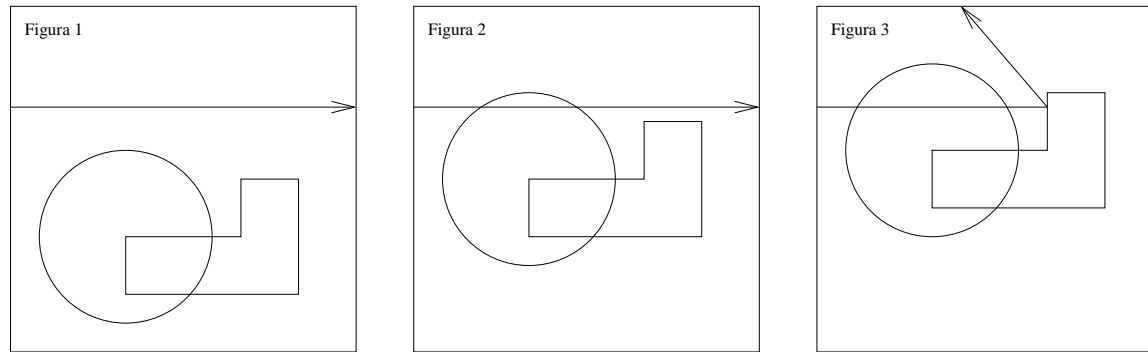


Figure 6 : DETP

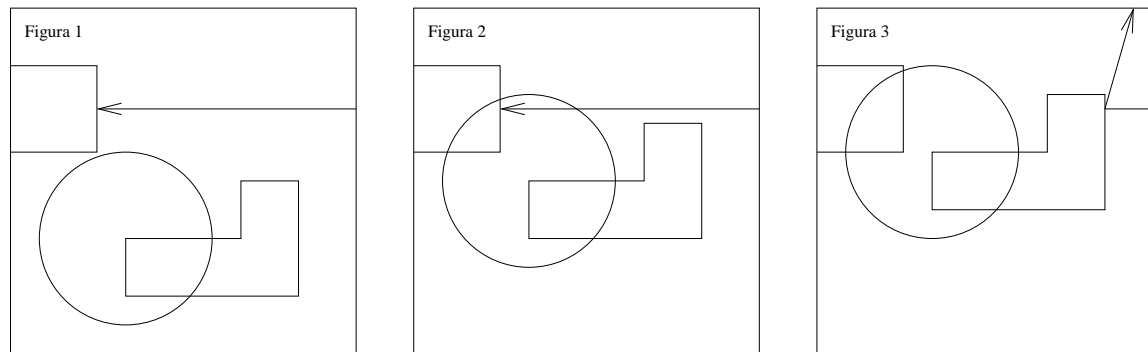


Figure 7 : Photon Maps