A Directional Occlusion Shading Model for Interactive Direct Volume Rendering

Mathias Schott, Vincent Pegoraro
Charles Hansen

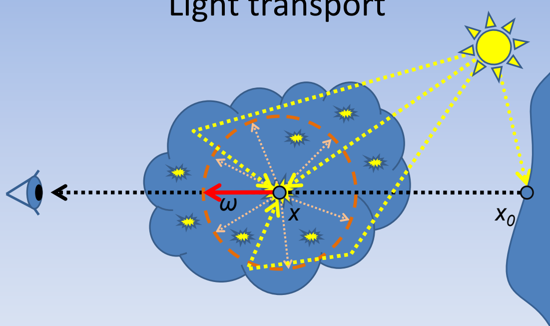
SCI Institute, University of Utah, USA

Kévin Boulanger, Kadi Bouatouch

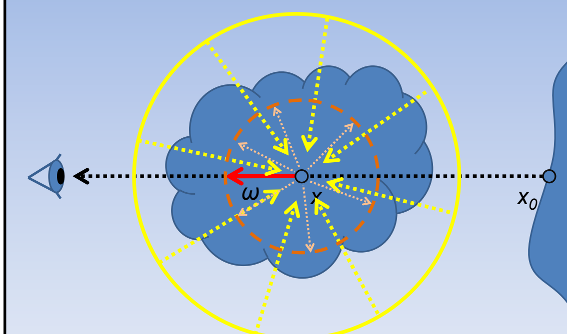
INRIA Rennes, Bretagne-Atlantique, France

Directional Occlusion Shading

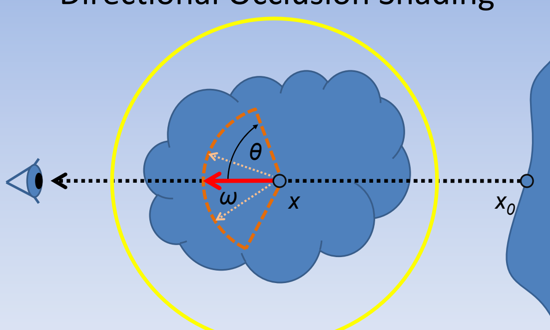
Light transport



Ambient Occlusion



Directional Occlusion Shading

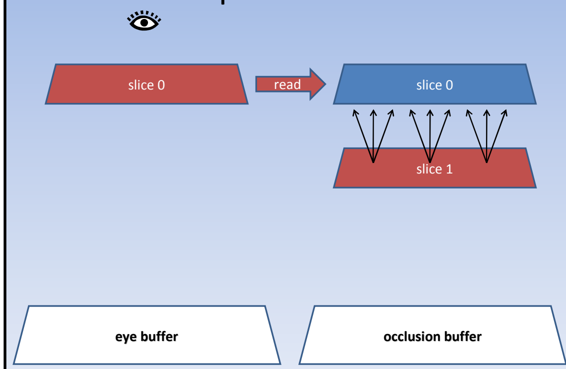


Difference from spherical occlusion

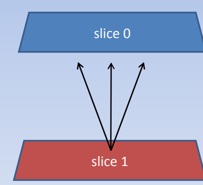
Isotropic phase function

Cone phase function

Implementation



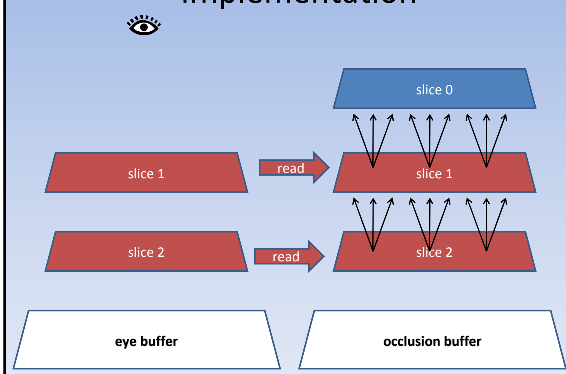
Occlusion buffer update



determine σ_t at current position
for each sample position
  read previous occlusion buffer
  attenuate with distance to sample
  accumulate
write average to next occlusion buffer

approximation
determine σ_t at current position
for each sample position
  read previous occlusion buffer
  accumulate
attenuate average with slice-distance
write to next occlusion buffer

Implementation



Difference from reference

Monte Carlo, cone phase function

≈ 24 hours

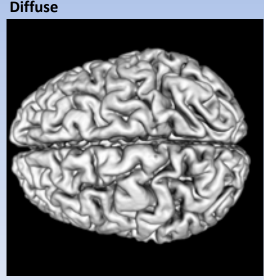
Interactive Directional Occlusion

10.6 FPS

Results – MRI scan of a brain

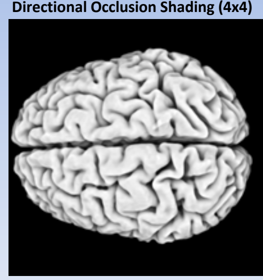
256x256x160, 1000 slices

Diffuse



13.3 FPS

Directional Occlusion Shading (4x4)

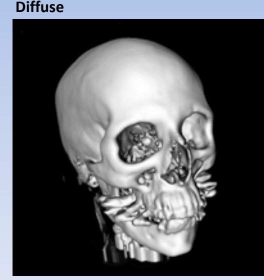


3.7 FPS

Results – CT scan of a head

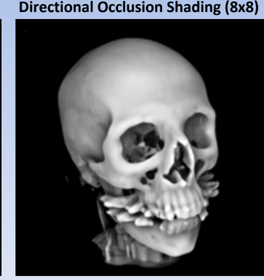
128x256x256, 1485 slices

Diffuse



16.0 FPS

Directional Occlusion Shading (8x8)

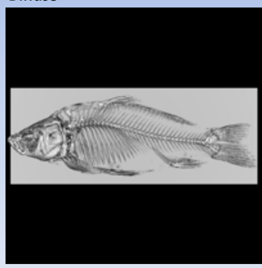


1.6 FPS

Results – CT scan of a carp

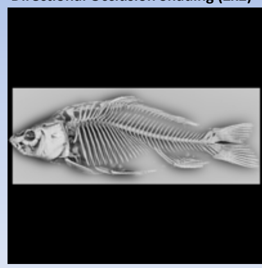
128x256x256, 220 slices

Diffuse



59.0 FPS

Directional Occlusion Shading (2x2)



48.3 FPS

Results – CT scan of a hand

244x124x257, 619 slices

Diffuse

29.1 FPS

Directional Occlusion Shading (4x4)

8.8 FPS

Conclusion

- restriction of occlusion to view-oriented cone allows interactive computation
- plausible occlusion effects
  - qualitatively similar to full ambient occlusion
  - interact with solid and semi-transparent features
- no precomputation, interactive change of
  - transfer function
  - clipping planes
  - camera position