A Directional Occlusion Shading Model for Interactive Direct Volume Rendering

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Light transport

Directional Occlusion Shading

Ambient Occlusion

Difference from spherical occlusion

Isotropic phase function
Cone phase function
Implementation

- slice 0
- slice 1
- eye buffer
- occlusion buffer

Occlusion buffer update

- determine $\sigma_t$ 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 $\sigma_t$ at current position for each sample position
- read previous occlusion buffer
- attenuate average with slice-distance
- write to next occlusion buffer

Implementation

- slice 1
- slice 2
- eye buffer
- occlusion buffer

Difference from reference

Monte Carlo, cone phase function ≈ 24 hours 10.6 FPS
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  Directional Occlusion Shading (2x2)
59.0 FPS  48.3 FPS

Results – CT scan of a hand
244x124x257, 619 slices
Diffuse  Directional Occlusion Shading (4x4)
29.1 FPS  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