CS294-164 Report - Week 6

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1 Ray tracing 3D spectral scenes through human optics models

1.1 Main Idea

This paper introduces ISET3D, an open source package for ray tracing 3D scenes through the Navarro eye model to estimate retinal excitations. This extends two existing packages, PBRT and ISETBio. PBRT is used to render 3D scenes described in the form of pbrt files. Iset3D extends pbrt to incorporate the eye model and factors such as chromatic aberration, lens transmittance. The output of this is transformed to retinal irradiances which is then fed to ISETBio to obtain the cone mosaic. The MTF on Navarro using ISET3D is comparable to the MTF using Zemax.

1.2 New Ideas based on readings

ISET3D can be applied in the Oz Vision project to understand the transformations that need to be applied to the image being projected onto the retinal surface. These transformations might help in making the image appearances more realistic. Other applications include

2 Stochastic Sampling in Computer Graphics

2.1 Main Idea

This paper describes the idea of point sampling at non uniformly spaced locations to reduce aliasing artifacts in ray tracing and ray casting. This is called distributed ray tracing and can be used to simulate motion blur, depth of field, penumbrae, gloss, and translucency. The human eye uses a Poisson disk distribution of photoreceptors. A simple and effective approximation to a Poisson disk distribution can be obtained by jittering a regular grid. When this technique is extended to distributed ray tracing, the locations in the nonspatial dimensions can be chosen by jittering randomly generated prototype patterns. Weighted functions can be evaluated using importance sampling.

2.2 New idea based on readings

The property that the human eye uses a Poisson disk distribution of photoreceptors is helpful in Oz Vision. The image displayed on the retinal surface would have to have the same distribution/jitter. Other applications/extensions of this is avoiding motion blur in a moving camera. Other antialiasing techniques that are being used involve deep neural networks and run on GPUs. This offers significant speed up and real time antialiasing and motion blur correction is possible.