Thesis Validation Framework

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Validation for my thesis and other projects in the area of graphics, relies heavily on the comparison of render times and memory usage. My thesis revolves around the idea of creating a ray tracing algorithm that provides indirect illumination at faster speeds than current methods. This algorithm will leverage spacial data structures and neighborhood approximations to improve efficiency of homogeneous regions in a scene. The validation of the project will be based on comparisons against naive implementations of current indirect illumination techniques.

Performance

The ultimate validation of the implemented technique is the amount of time it takes to render a scene. The runtime of the rendering as well as the memory usage of the algorithm, help define the performance. Because the implementation will not be run on a render farm or production-standard hardware, the sheer ability to render complex scenes will be the initial test.

Visual Accuracy

Different implementations and algorithms produce images that do not exactly match pixel to pixel. While there do exist methods of determining the amount of variation between images, many differences remain unseen to the human eye. The visual accuracy, comparing renderings from two different methods, therefor relies heavily on a human observer. Determining whether one image looks similar to than another can be rationalized by noting key differences between the two images. Showing a different algorithm produces a similar image with only small justifiable differences, can form a baseline to compare against.

Comparisons

In order to validate the performance of this algorithm against current techniques, naive implementations are build to compare against. Because the techniques used in production of animated films and other ray tracing applications are not openly available, it is impossible to directly compare this project's performance. Therefore using papers publish on current techniques, naive implementations can be built to estimate performance gains using a new technique. The additional gain of this setup is that all methods run off the same coding framework. Using the same framework eliminates performance losses from different implementation of key logic. In specific to indirect illumination, my thesis will compare the performance of my new technique to that of Monte-Carlo ray tracing, and Point Based Color Bleeding.

Geometry

The final aspect of validation will rely on the scene geometry that gets tested. Because the new algorithm relies on homogeneous regions for improved efficiency, scenes with different magnitudes of complexity will have to be tested. Different cases with varying concentrations and amounts of geometry will be constructed to show where the new algorithm improves performance or where the algorithm falls short.

Conclusion

Ultimately, the validation framework of my thesis will be broken up into three parts. First, create naive implementations of the current methods of indirect illumination to compare against. Second, create test scenes that vary in the density and distribution of geometry. Lastly, measure the performance of the new implementation and compare the performance and visual accuracy against the other techniques.