Karlsruhe Institute of Technology

Importance Sampling in Many Lights Trees

Bachelor's Thesis of

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I declare that I have developed and written the enclosed thesis completely by myself, and have not used sources or means without declaration in the text.

Karlsruhe, 23. August 2018

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(Beini Ma)

Abstract

English abstract.

Zusammenfassung

Deutsche Zusammenfassung

Contents

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1. Introduction

1.1. Problem/Motivation

Ray tracing is one of the most important rendering techniques when the aim is to create highly realistic pictures. It allows us to render the scene much closer to reality compared to typical scanline rendering methods at the cost of more computations. In situations where the images can be rendered ahead of time, such as for visual effects or films, we can take advantage of the better results of ray tracing. Then again, ray tracing is not useful for real-time applications like video games where the rendering speed is critical. But even when it comes to ray tracing, we cannot completely ignore the rendering time. Too long rendering times are becoming a problem in scenes with many lights. For instance a scene of big city with skyscrapers at night could have hundreds or thousands of lights that could potentially all affect a single point in the scene. Typical light sampling methods would be too slow to deal with these situations, since we cannot calculate the effect of every single light on the sampled point.

There are sampling approaches that try to limit the time required to render these scenes with a big amount of lights. For instance, we could say that the probability of a point of the scene being sampled by a certain light is only dependent on the emission power of said light. We would make a distribution that only takes into account the emission power of the lights. To light a point we would then pick out a single light with a random number generator and sample the point with that light. Obviously there are a lot of problems with this approach. An area light source or a spotlight could be facing towards a completely different direction and not have any effect on the point. Or the light could be potentially too far away to have a noticeable effect on the point. This sampling technique asserts a fast sampling speed but can lead to very noisy images that we try to avoid.

For this bachelor thesis I have implemented a light sampling technique that optimizes the rendering speed without making the rendered image too noisy.

1.2. Content

1.3. Example: Tables

A citation: [**becker2008a**] For referencing, see **??**

A reference: The SDQ logo is displayed in Figure 1.1. (Use `\autoref{}` for easy referencing.)

Figure 1.1.: SDQ logo

abc	def
ghi	jkl
123	456
789	0AB

Table 1.1.: A table

1.4. Example: Todo-Note

Meaningless text.

1.5. Example: Formula

One of the nice things about the Linux Libertine font is that it comes with a math mode package.

$$f(x) = \Omega(g(x))\ (x \to \infty) \ \Leftrightarrow\ \limsup_{x\to\infty} \left|\frac{f(x)}{g(x)}\right| > 0$$

2. Preliminaries

2.1. Bounding Volume Hierarchies

2.2. Surface Area Heuristics

3. First Content Chapter

The content chapters of your thesis should of course be renamed. How many chapters you need to write depends on your thesis and cannot be said in general.

Check out the examples theses in the SDQWiki:
`https://sdqweb.ipd.kit.edu/wiki/Abschlussarbeit/Studienarbeit`
Of course, you can split this .tex file into several files if you prefer.

3.1. First Section

...

3.1.1. A Subsection

...

3.1.1.1. A Subsubsection

3.2. Second Section

...

4. Second Content Chapter

…

4.1. First Section

…

4.2. Second Section

…

Add additional content chapters if required by adding new .tex files in the `sections/` directory and adding an appropriate `\input` statement in `thesis.tex`.

5. Evaluation

…

5.1. First Section

…

5.2. Second Section

…

5.3. Third Section

…

6. Conclusion

…

A. Appendix

A.1. First Appendix Section

Figure A.1.: A figure

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