

# Re: Deep G-Buffers for Stable Global Illumination Approximation

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## Abstract

*G-buffers can be used to efficiently render images with large amounts of light sources. This is possible thanks to a process called "deferred rendering". Using g-buffers, we are only able to compute local illumination, though. By using deep g-buffers instead we can approximate global illumination, which is way more efficient than traditional global illumination methods like pathtracing, while of course not being physically accurate anymore.*

**Keywords** *g-buffer, deep g-buffer, pathtracing, global illumination, deferred shading, deferred rendering*

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# 1 Global Illumination

Global Illumination is a lighting effect that is achieved by not only computing direct light, but also indirect light, meaning that it is necessary to take into account how light reflects and carries information (in the most basic case: color).

## 1.1 Physically correct methods

In order to generate physically correct images, which is a requirement for creating photorealistic images, we need to solve the rendering equation. The most popular method for achieving this is pathtracing [PHC14].

### 1.1.1 Pathtracing

## 1.2 Computational difficulties of physically correct methods

Since we have to take into account every ray of light and its reflections, the computational difficulty becomes apparent [FP].

# 2 Deferred Rendering

## 2.1 How deferred rendering handles lighting more efficiently

The goal of deferred rendering is to postpone the shading stage. Instead of shading right away, we compute necessary geometry buffers (g-buffers) and cache them for later use. For all practical purposes, g-buffers have to at least consist of a frame-buffer, a normal-buffer and a z-buffer. Using only these g-buffers, we can now compute the shading separately.

## 2.2 Deferred Shading

# 3 Geometry Buffer (G-Buffer)

Each geometry buffer stores information of some sort for each individual pixel, meaning that they are all two-dimensional arrays.

## 3.1 Frame-Buffer

The frame-buffer stores color values.

## 3.2 Z-Buffer

The z-buffer stores depth values.

## 3.3 Normal-Buffer

The normal-buffer stores surface-normals. Note that there are more possible buffers to choose from, but the three that were mentioned are the most essential in every g-buffer.

## 3.4 Computing local illumination using G-Buffers

After collecting all g-buffers we can now work on illumination. To do this we need to define some light sources. We distinguish between three types of lights: Point-lights, spot-lights and directional-lights [FP].

# 4 Deep G-Buffer

## 4.1 Concept

Store multiple g-buffers [MM16].

## 4.2 How Deep G-Buffers improve performance

# 5 Performance and Output Comparison

## 5.1 Deep G-Buffers vs Pathtracing

### References

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