Point Clouds can render up to 10x faster with compute shaders instead of glDraw

Rendering Point Clouds with Compute Shaders

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Abstract

Regular point rasterization with glDrawArrays(GL_POINT,...) can be slow due to the overhead of the rendering pipeline. Compute shaders with atomicMin and atomicAdd are often a faster alternative.

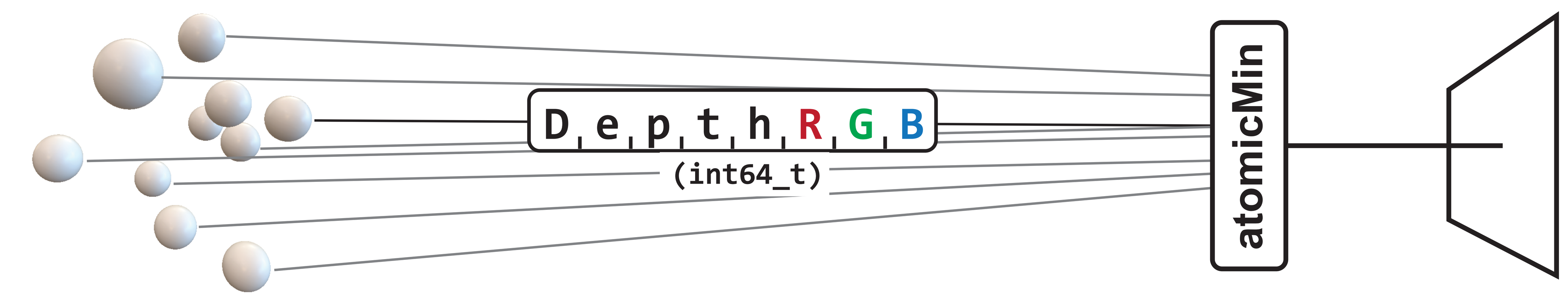
Method 1: Compute

A compute shader transforms points to pixel coordinates, and then encodes linear depth and color into a 64 bit integer. With atomicMin, we store the fragments with the lowest depth in a pixel buffer. A second compute shader transfers the pixel buffer into a texture.

Method 2: High-Quality

First, create a depth buffer with method 1. Then, use atomicAdd to sum up and count color values of points at most 1% behind depth buffer. Finally, divide sum of colors by number of fragments to get an average color value of overlapping points in a pixel. Compute shader implementation of Botsch et al. [1].

Custom Rasterization with atomicMin



Transform
to pixel coord

Encode
5 byte depth, 3 byte RGB

Write to Pixel Buffer
atomicMin keeps point with smallest depth, RGB in least significant bits → largely ignored

High-Quality Rendering with atomicAdd

Depth Buffer
using method 1

Attribute Buffer
sum of colors and fragment counts with atomicAdd

Normalize
Divide sum of colors by number of fragments

Results

GL_POINTS 60.26 ms | **Compute** 5.87 ms | **High-Quality** 15.48 ms

Regular | **High-Quality**

• Our compute and the classic GL_POINTS method produce the same result • The basic compute method is up to 2x to 10x faster than GL_POINTS • The high-quality method is up to 2x to 4x faster than GL_POINTS • Evaluated for point sizes of 1 pixel • GL_POINTS still faster for point sizes larger than 2x2 pixels

Dataset: San Simeon, 117M points, courtesy of PG&E
Code: github.com/m-schuetz/compute_rasterizer
Video: bit.ly/2nv48gl

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References / Related Work

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