Lightfield Photography

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Background and Motivation

What Is Wrong with This Image?

What Is Wrong? It's Just a Picture!
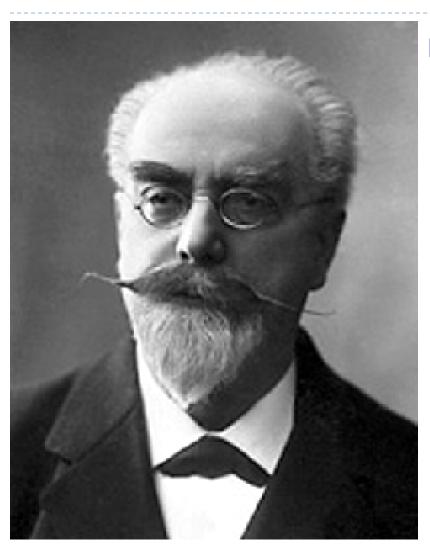
What is Wrong with Pictures?

▸ *The current most perfect photographic print only shows one aspect of reality; it reduces to a single image fixed on a plane, similar to a drawing or a hand-drawn painting. The direct view of reality offers, as we know, infinitely more variety. We see objects in space, in their true size, and with depth, not in a plane.*

Can We Create More than Pictures?

▸ *Can we request that Photography renders the full variety offered by the direct observation of objects? Is it possible to create a photographic print in such a manner that it represents the exterior world framed, in appearance, between the boundaries of the print, as if those boundaries were that of a window opened on reality.*
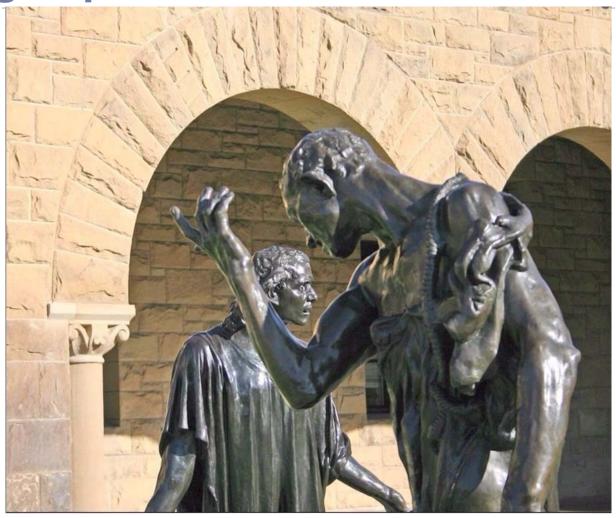
Different views

Different views

Different views

Different views

Different views

Different views
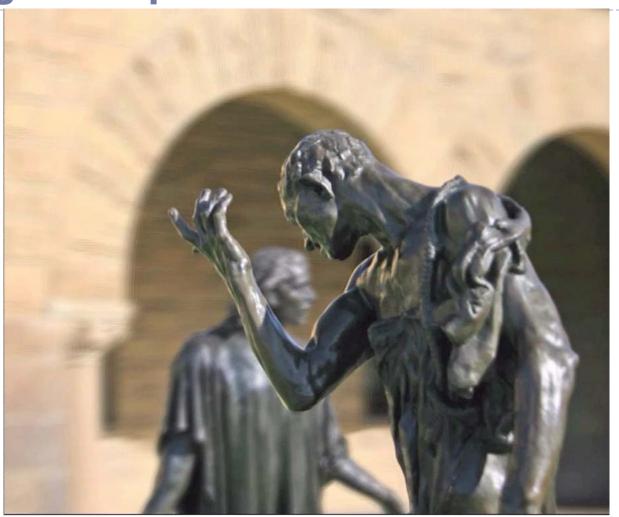
Different views

Different views

Change Aperture / All-In-Focus

Rodin Radiance Capture

Change Viewpoint

Change Focus

Change Focus

Radiance (aka Lightfield) Photography

- A picture is a rendering of the light rays in a scene
- Determined by lenses, aperture, viewpoint, etc.

- Radiance (lightfield) photography records the rays
  - Rays can be reproduced to render "the full variety offered by the direct observation of objects"
  - We can also synthesize arbitrary pictures

- Idea is over 100 years old (Integral photographs)
  - Technology now exists to make radiance photography practical

Course Outline

1. Background and Motivation
2. Ray Transforms
3. Radiance
4. Capturing Radiance with Cameras
5. Radiance in the Frequency Domain
6. The Focused Plenoptic Camera (Plenoptic 2.0)
7. Break and Hands-On with Plenoptic Cameras
8. Computational Methods for Radiance
9. Fourier Slice Refocusing
10. Efficient Implementation with GPU
11. Literature