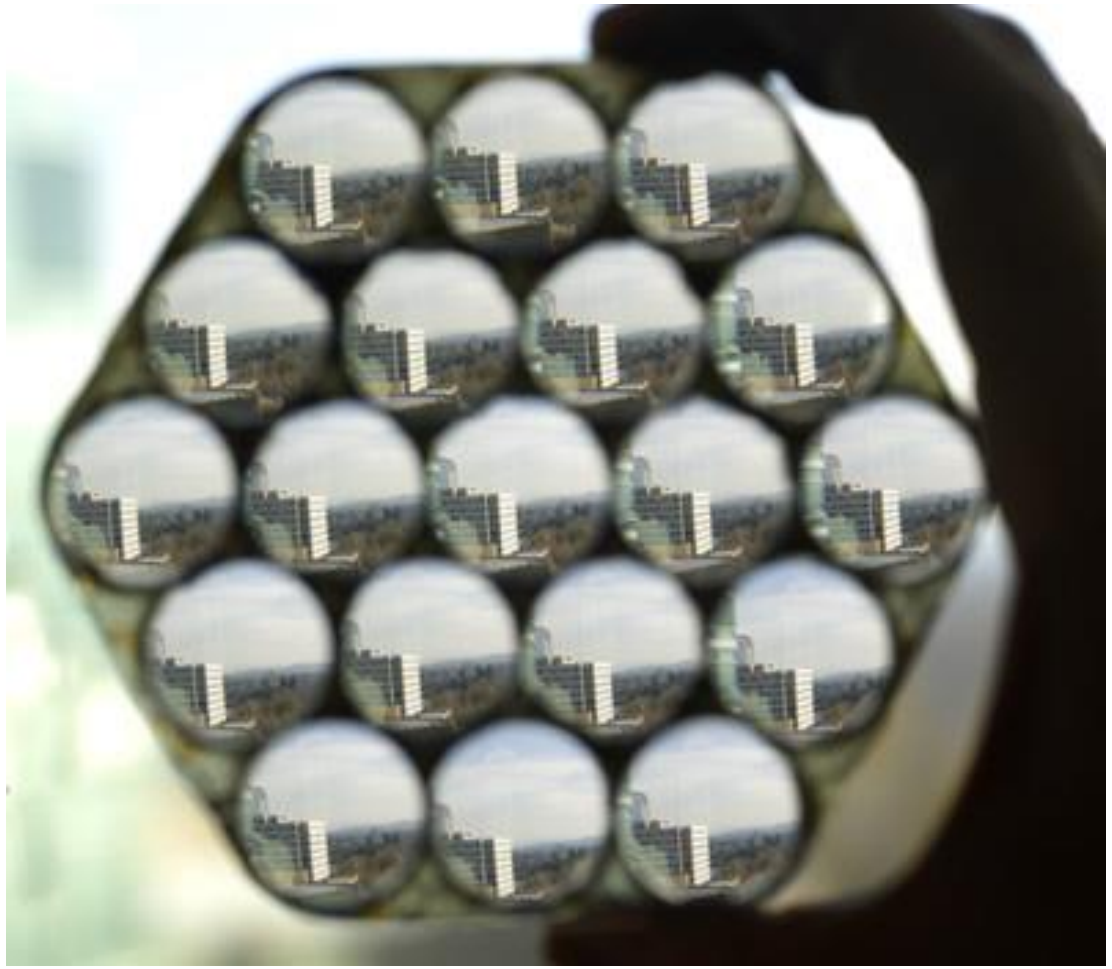
Wrap-up and discussion



15-463, 15-663, 15-862
Computational Photography
Fall 2018, Lecture 27

http://graphics.cs.cmu.edu/courses/15-463

Course announcements

- Homeworks 6 and 7 are due on Friday 7th.
  - Any questions about either homework?
  - Homework 7 is bonus and counts as 50% of a full homework.
  - You can use any remaining late days for the two homeworks.

- Final project presentations on Friday 14th, noon - 4pm.
  - I will post room on Piazza.
  - Presentations will be 8 minutes + 2 minutes questions.

- Final project reports due on Friday 14th, midnight.
  - I can postpone it till Sunday 16th if you prefer, but not more than that (grades are due on the 19th.

Class evaluation*s* – please take them!

- CMU's Faculty Course Evaluations (FCE): https://cmu.smartevals.com/
- TA evaluation: https://www.ugrad.cs.cmu.edu/ta/F18/feedback/
- 15-463/663/862 end-of-semester survey: https://docs.google.com/forms/d/e/1FAIpQLSedVSNENGIc3An8PjeqrIenz4O4x3yY6GCF9vAA7UySBmFSvw/viewform
- Please take all three of them, super helpful for developing future offerings of the class.
- Thanks in advance!

Overview of today's lecture

- Leftover from rendering lecture.
- Class wrap-up and discussion.

Course overview

1. Photographic optics and pipeline. ← Lectures 1 – 5
2. Image editing and compositing. ← Lectures 6 – 10
3. Focus and coded photography. ← Lectures 11, 12, 14
4. Geometry and structured light. ← Lectures 13, 15, 20-21
5. Computational light transport. ← Lectures 16-19, 22
6. Special topics. ← Lectures 23-26

Photographic optics and pipeline

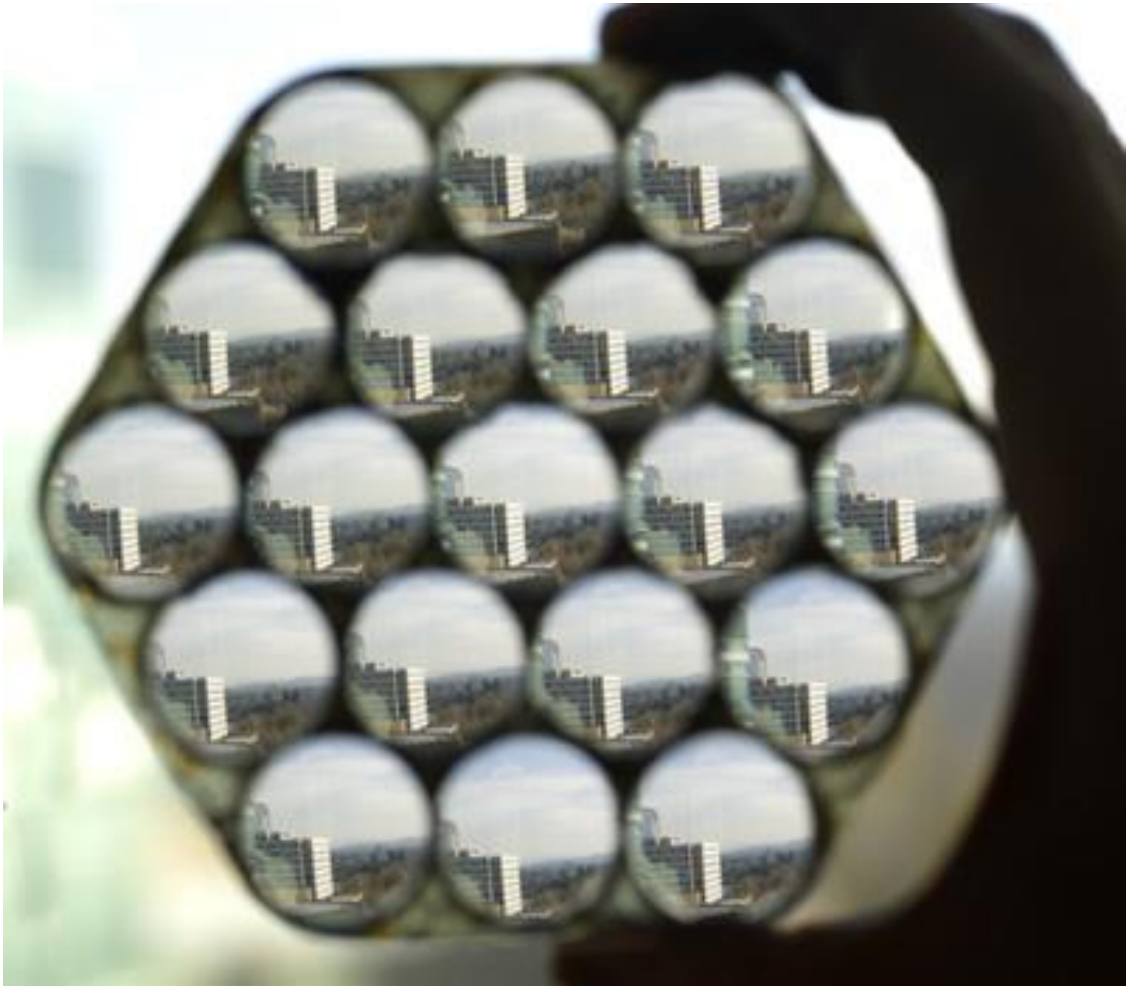
- pinhole and lens cameras
- lenses and other optical elements
- paraxial optics
- exposure
- aperture
- image processing pipeline
- high-dynamic range
- radiometric calibration

Image editing and compositing

- tonemapping
- color processing
- color calibration
- edge-aware and bilateral filtering
- image compositing and blending
- gradient-domain processing
- high-performance image processing

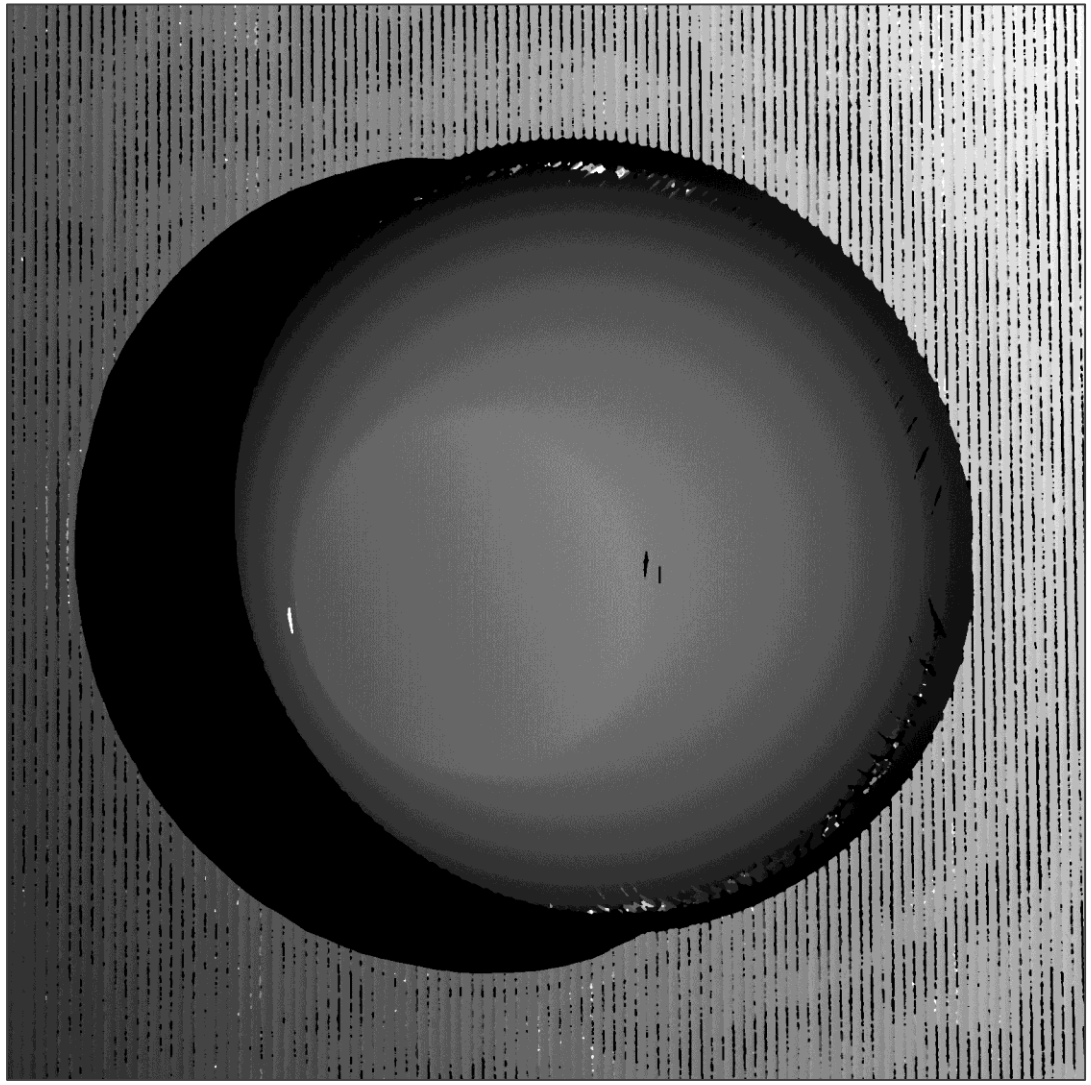
Focus and coded photography

- focal stacks
- lightfields and lightfield processing
- plenoptic camera
- deconvolution and motion deblurring
- coded aperture
- coded exposure
- depth-invariant photography
- motion-invariant photography



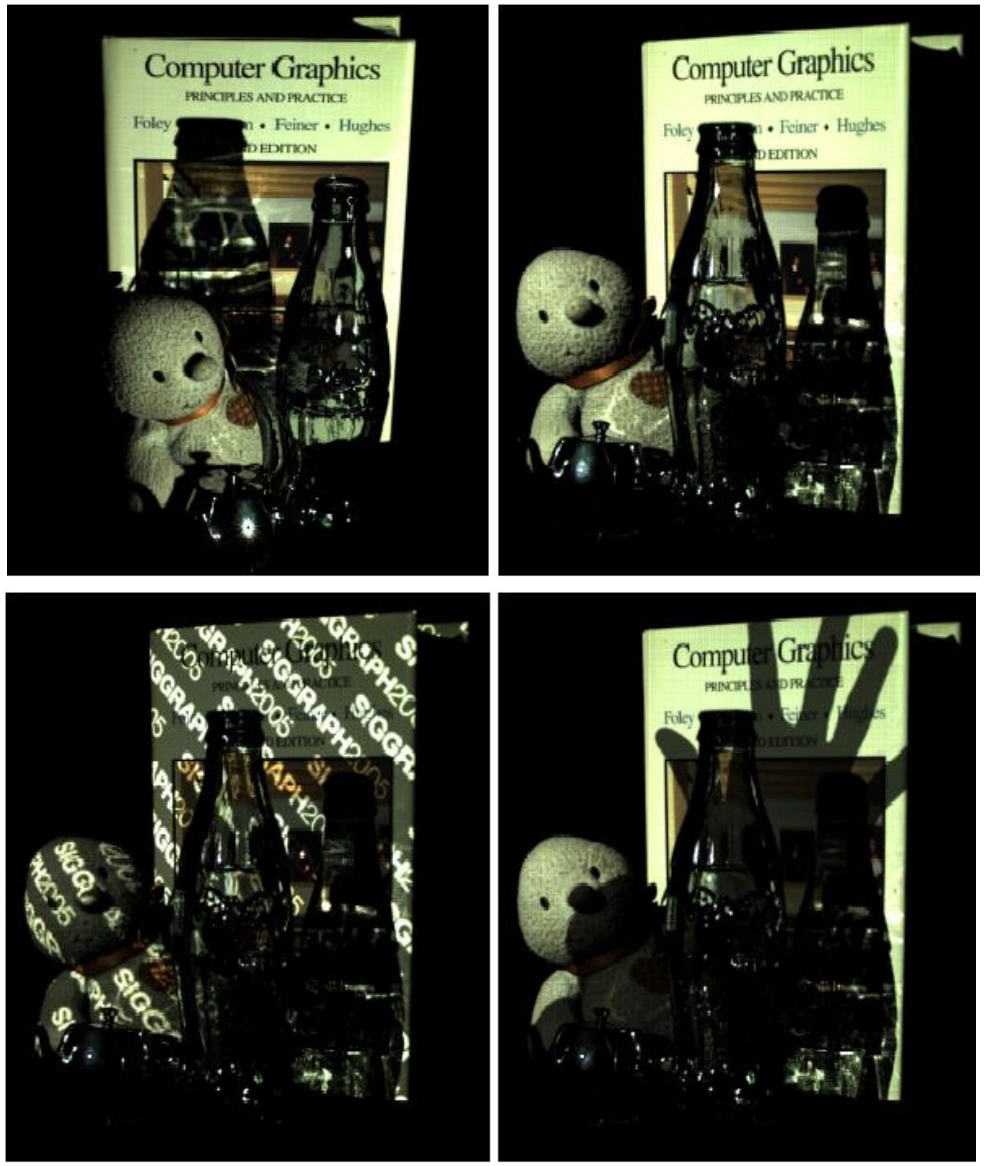
Geometry and structured light

- geometric camera models
- geometric camera calibration
- triangulation
- epipolar geometry
- stereo and disparity
- structured light systems
- dealing with interreflections



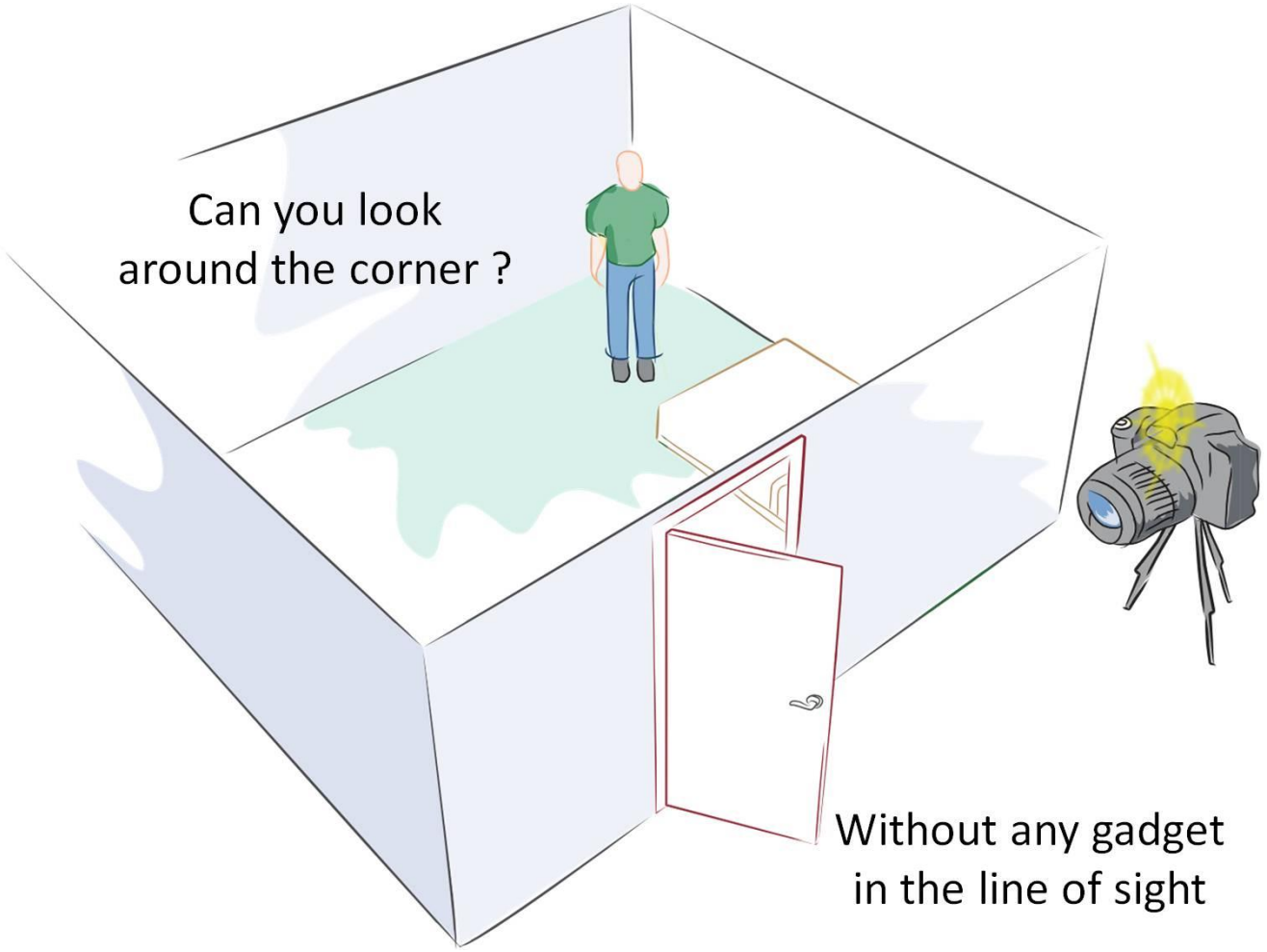
Computational light transport

- radiometry
- reflectance and illumination
- photometric stereo
- light transport matrices
- dual photography
- optical computing
- direct and global illumination
- probing and epipolar imaging



Special topics

- time-of-flight sensors
- non-line-of-sight imaging
- compressed sensing
- Fourier optics
- Monte Carlo rendering



Things you should know how to do

1. Build simple pinhole cameras, use DSLR cameras and modern lenses.
2. Write your own LDR and HDR image processing pipelines.
3. Calibrate the radiometric, color, and geometric properties of a camera.
4. Fuse images and perform flash/no-flash photography.
5. Use bilateral and gradient-domain filtering for image editing tasks.
6. Capture and refocus your own lightfields.
7. Build three different types of depth sensing systems: depth-from-defocus, photometric stereo, structured light.
8. Build simple non-line-of-sight imaging systems.

Interested in doing research in computational imaging?

Many, many possible projects, including:

- Projects on rendering and inverse rendering.
- Projects on theory of light transport.
- Projects on coherent imaging and optical coherence tomography.
- Projects on material inference (reflectance, scattering, refractive fields, particle sizing).
- Projects on tissue imaging.
- Projects on non-line-of-sight imaging.
- Projects on combining physics (rendering) and deep learning.
- Projects on data-driven optimization of imaging systems.
- Projects derived from your final project for a paper publication.

Five of last year's 15-463/663/862 alumni are working on various research projects in my group.

Ideal background:

- Knowledge of (at least one of) graphics, physics, numerical computing.

This class is still evolving, so your feedback is invaluable.

Questions?

Do you plan on taking any other vision/graphics courses?

Which part of the class did you like the most?

Which part of the class did you like the least?

Any topics you wanted to learn more about?

Any topics you wanted to learn less about?

Any topics you would cover in a different order?

Which was your favorite homework?

Which was your least favorite homework?

Any kind of homework you would have wanted to see?

How does homework difficulty compare to other classes?

Would it be better if homeworks were in Python?