



Computational Photography and Capture

Gabriel Brostow & Tim Weyrich

TA: Frederic Besse

Today's schedule

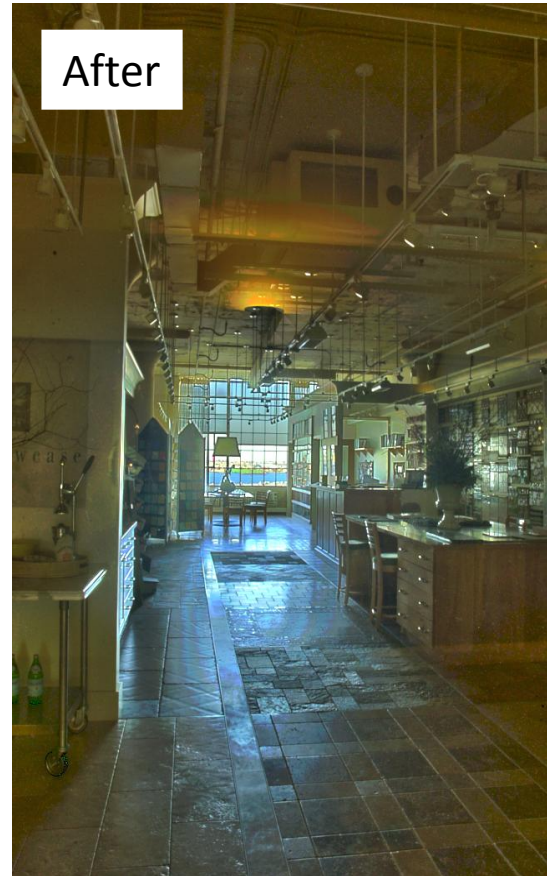
- Introduction to *Computational Photography*
- Course facts
- Syllabus
- Capture + More Examples

What is *computational photography*

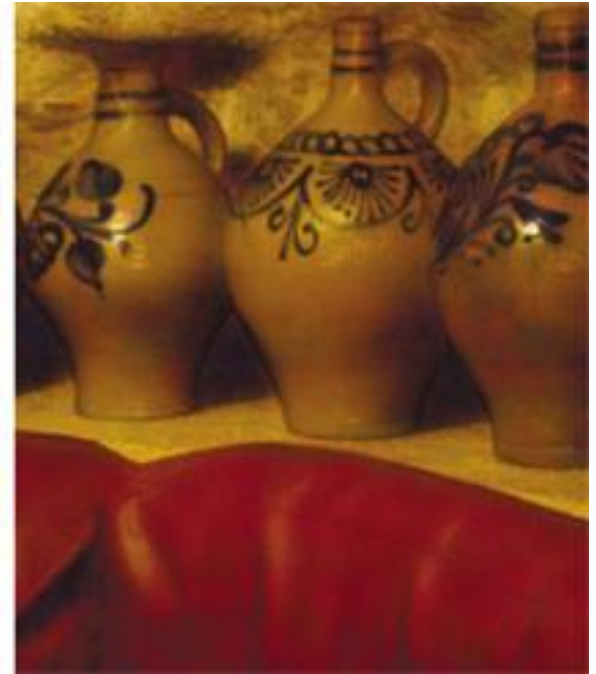
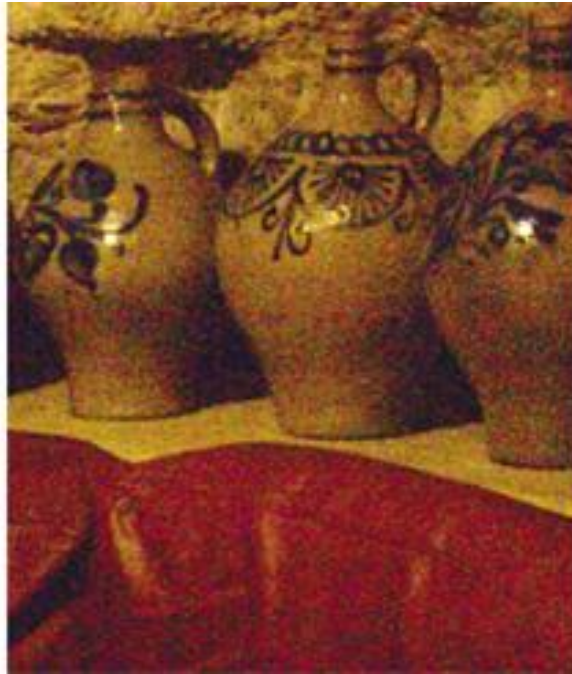
- Convergence of image processing, vision, graphics, learning, and photography
- Digital photography:
 - Simply replaces traditional sensors and recording by digital technology
 - Involves only simple image processing
- Computational photography
 - More elaborate image manipulation, more computation, interaction
 - New types of media (panorama, 3D, etc.)
 - Camera designs that take computation into account

(many slides inspired/borrowed from similar classes elsewhere)

Tone mapping



Flash/No-Flash



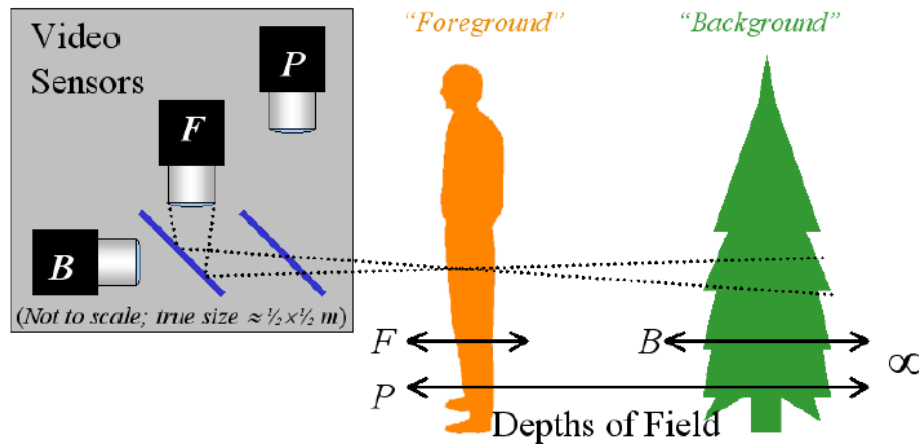
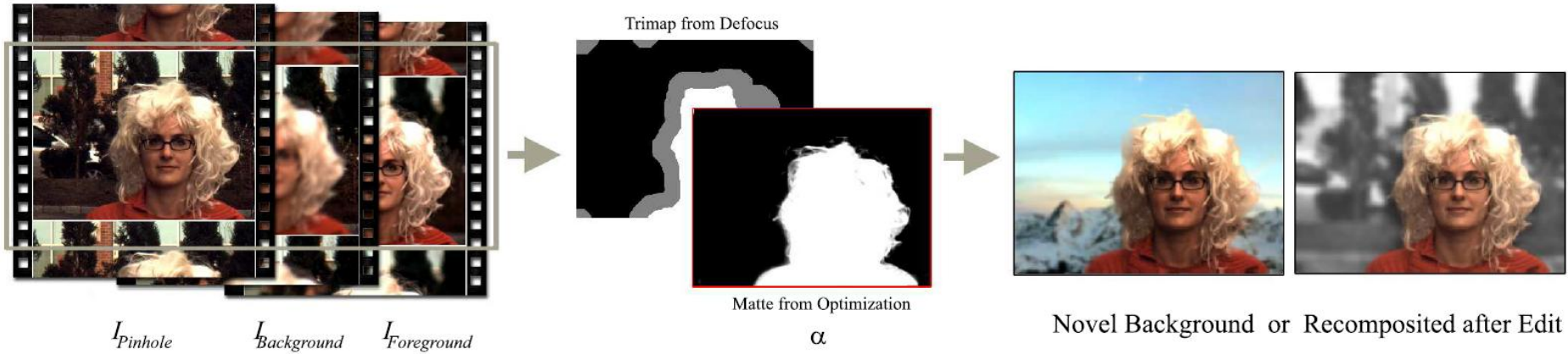
Photomontage



Panoramic images



Defocus matting



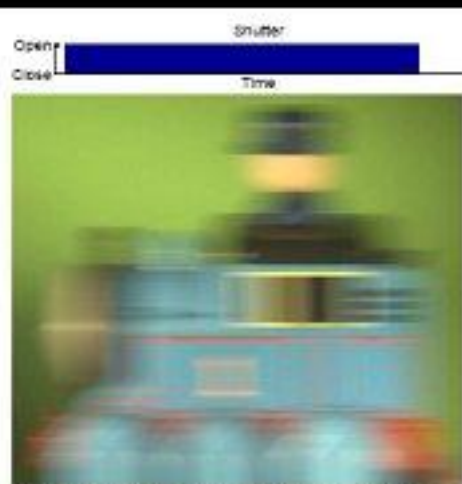
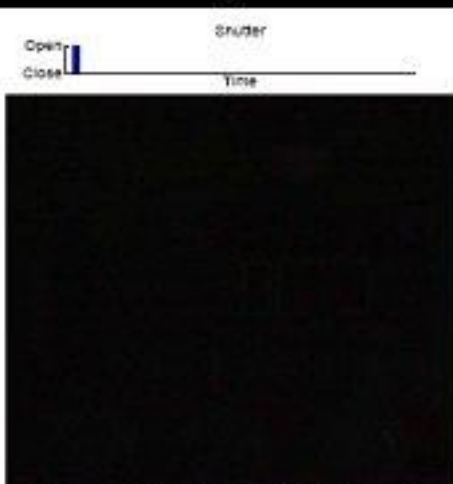
Coded Exposure Photography: Assisting Motion Deblurring using Fluttered Shutter

Raskar, Agrawal, Tumblin (Siggraph2006)

Short Exposure

Traditional

Coded



← Shutter →



← Captured Photos →



← Deblurred Results →



Image is dark and noisy

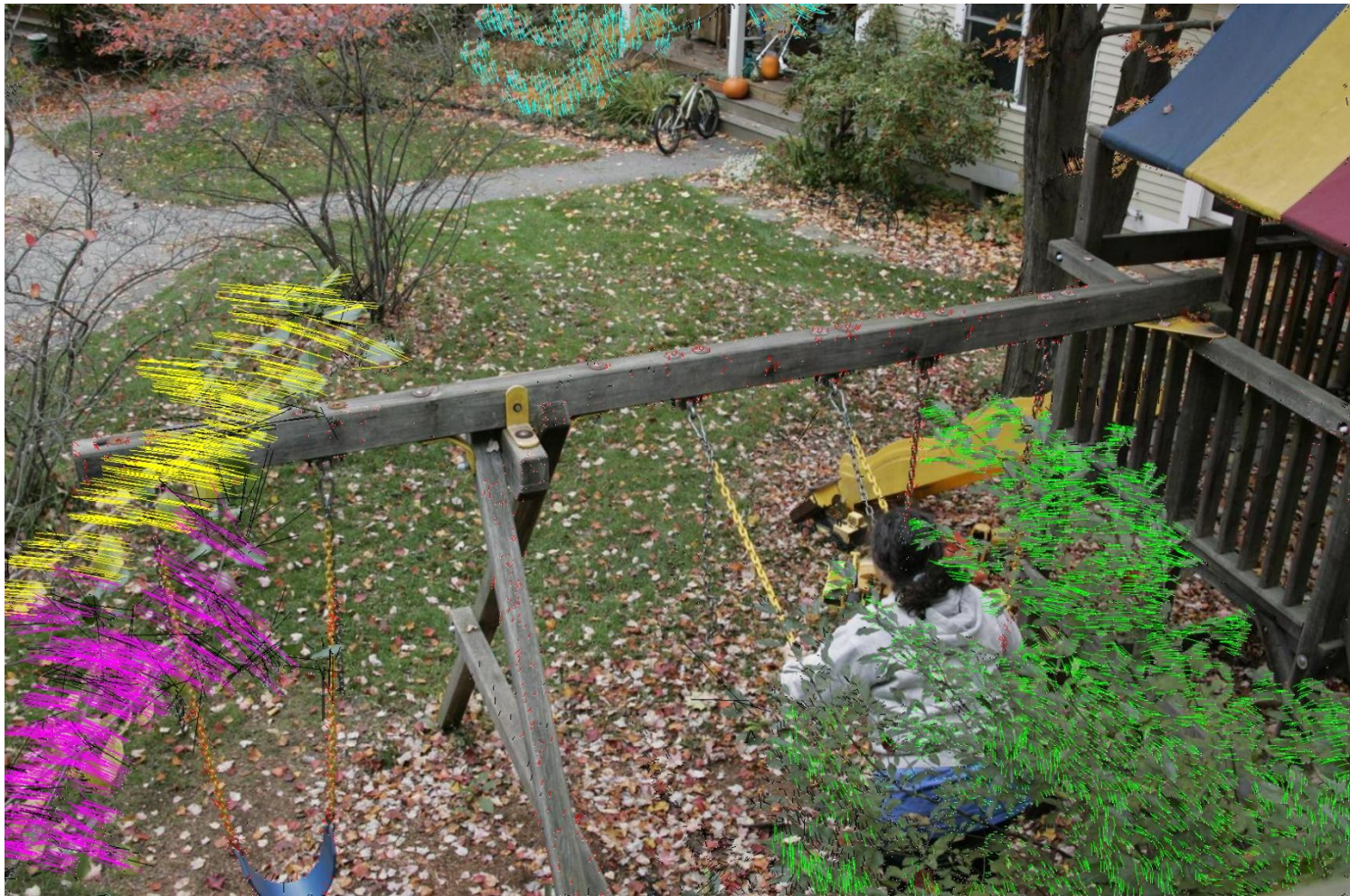
Result has Banding Artifacts and some spatial frequencies are lost

Decoded image is as good as image of a static scene

Video Textures



Motion Magnification



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Logistics

- Staff
 - Dr. Tim Weyrich
 - Dr. Gabriel Brostow
 - Frederic Besse
- Time and location:
 - Lectures: Tuesdays 12-13 in MPEB 1.03
 Thursdays 9-11 in MPEB 1.03
 - Labs: Tuesdays 16-18 in MPEB 1.05/1.21
 (except 17–19 on **18th Jan.**, **1st Feb.**, and **8th March** only)
- Webpage:
<http://www.cs.ucl.ac.uk/teaching/3085/>

Mailing List

To join, sign up on Moodle:

- “COMP[3085 | GV15 | M085]: Computational Photography and Capture”

Course Organization

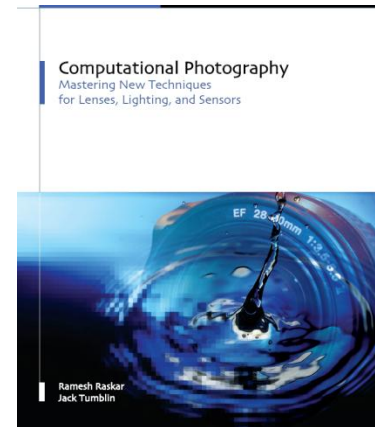
- Lectures
- Labs
 - Most assignments ungraded
 - 2 graded assignments depend on other labs
- Individual work
 - Exceptions only by explicit agreement
 - Honor system

Grading policy

- 70% final exam
- 30% homeworks (GV15 need 50% of 30 = 15%)
- Late policy:
 - Late < 1 day: 100% becomes 95%
 - Late < 2 days: 100% becomes 80%
 - Late > 2 days: 100% becomes 0%
 - “day” == working days

Textbook

- No textbook required
- Slides available on course webpage
 - Many more resources online
- Interesting references:
 - Computational Photography: Mastering New Techniques for Lenses, Lighting, and Sensors.* Raskar and Tumblin, (soon)
- See new conference: [ICCP](#)
- See also: *Multiple View Geometry*
 - by Hartley & Zisserman
- See also: *Pattern Recognition and Machine Learning*
 - by Chris Bishop



Tools / Languages

- Linear algebra (good ref: Strang's Linear Algebra [lectures](#))
- Matlab
 - with .mex
- Nuke
- Useful beyond this class / good to know:
 - C++
 - Maya / 3DS Max
 - QT
 - Python

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Image: Canon.



Image: ids.com



Image: Al Seib / Los Angeles Times

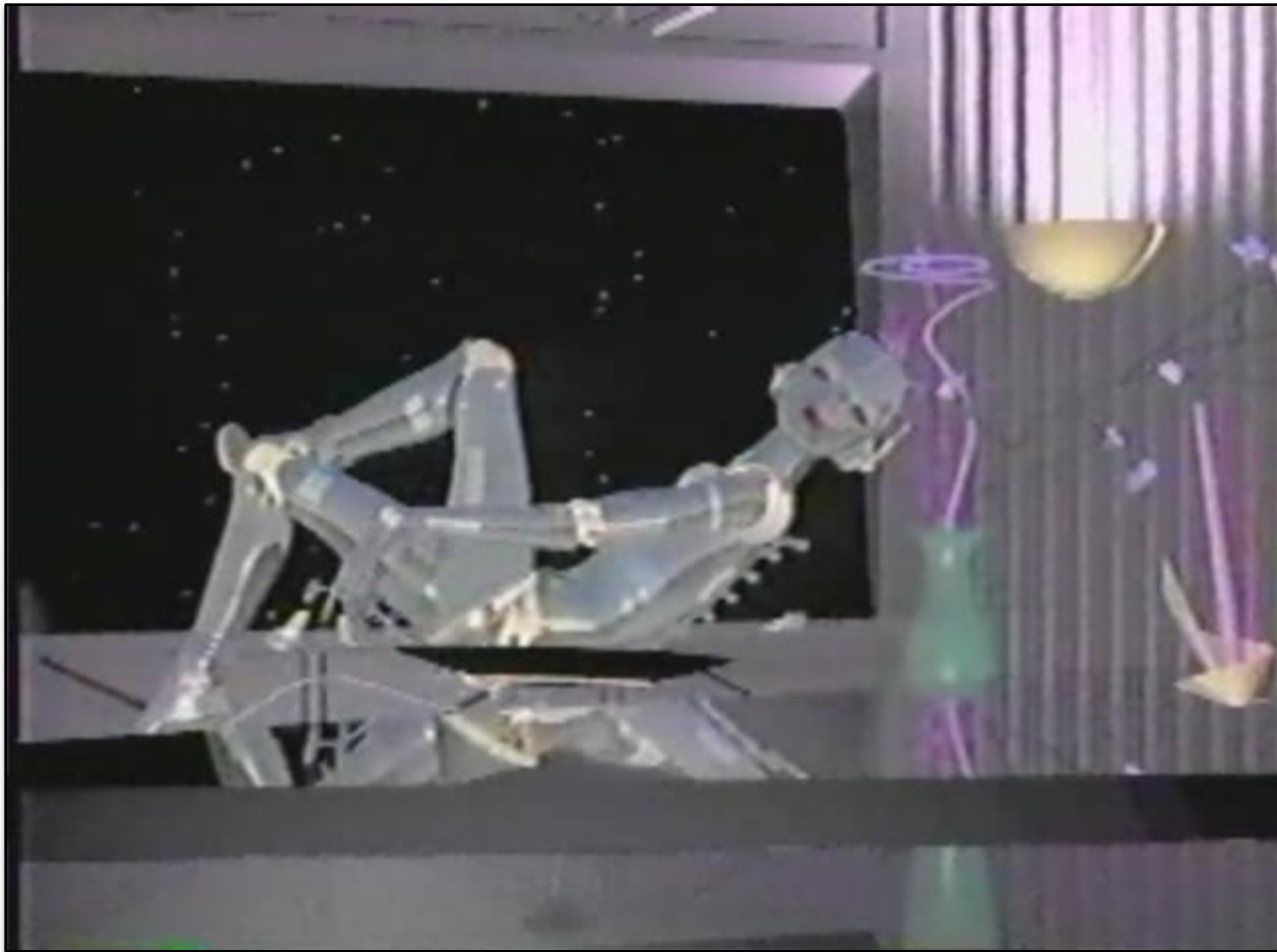


Visual Modeling for Archaeology



Visual modeling with a hand-held camera, Pollefeys et al. 2004

Motion Capture



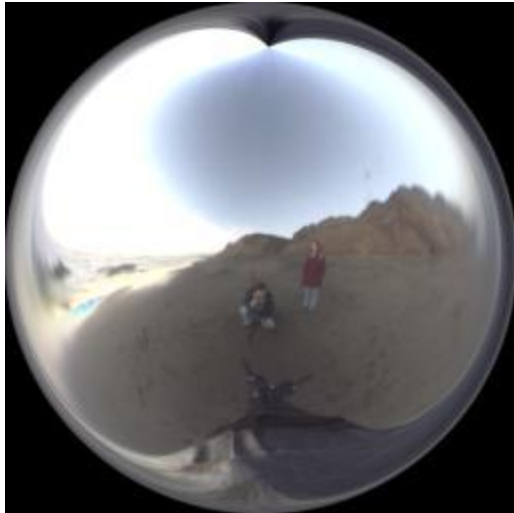
"Brilliance" by Abel and Associates, 1985

Motion Capture



Michael Jackson - Ghost

Environment Maps



Funston Beach, at Sunset



Paul Debevec, Light Probes (examples by Terrence Walker)

Environment Maps



Galileo's Tomb,
Santa Croce, Florence



Paul Debevec, Light Probes (examples by Terrence Walker)

Photometric Stereo: Pixels \rightarrow Normals

(using 3 colored lights)

