

Computational Photography

End of Semester

- Today is the last lecture of new material
- Quiz on Friday 4/30
 - Sample problems are posted on website
- Final Project Presentations
 - Wednesday May 12 1-5pm, CII 4040
 - Attendance mandatory (please don't be late!)
 - No laptops allowed during your classmates' presentations
 - You will be giving each other written feedback & peer grade
 - Ask good questions (participation grade)
- Presentation 10pts (peers)
- Project Report 20pts (instructor)

Final Presentation

- Summarize prior work as necessary
 - You don't need to discuss papers we covered in class
- Be technical:
 - What were the challenges?
 - How did you solve them?
- Live demo / video / lots of images (depends on project)
 - Use examples (both of success & failure)
- Teams of 2:
 - All should present & make it clear who did what
- Practice! & time yourself!
 - We have a tight schedule
 - I will stop you midsentence if you run over

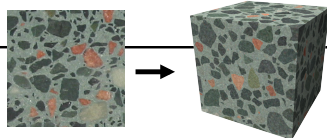
Final Presentation Schedule: *Wed May 12th*

1:00 eddie	2:15 bill	3:40 roy & ben
1:10 jeremy & mark	2:25 sloan & artem	3:55 stephen
1:25 jeff h.	2:40 chris	4:05 matt n. & christian
1:35 michael & jeff f.	2:50 kate & paul	4:20 matt t.
1:50 josh	3:05 ryan	4:30 rob & byron
2:00 devon & derek	3:15 lincoln & nick	4:45 tim
	3:30 kristoffe	4:55 done!

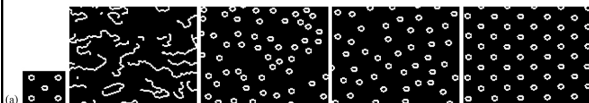
Total time (including setup & questions):
10 min (individual), 15 min (team of 2)

Last Time?

- Texture Synthesis
- Markov Model
- Image Completion
- Volumetric Texture Synthesis



"I spent an interesting evening recently with a grain of salt."



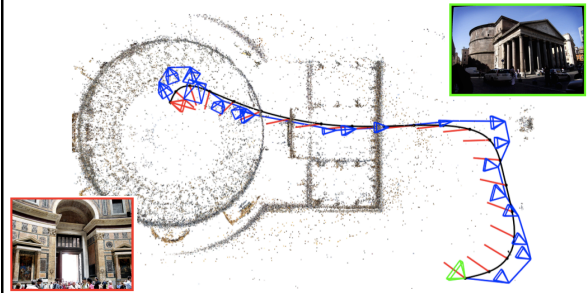
Today

- Structure From Motion
- Multi-viewpoint Rendering
- Matting & Compositing
- Helmholtz Reciprocity
- Light Fields

Structure From Motion

- Input: Sequence of frames (e.g., video) of a moving object (or moving camera)
- Output: Approximate geometry of object & camera pose for each frame
- How?
 - Automatically detect features in each frame
 - Determine correspondences between features
 - Infer camera calibration & object geometry
- Humans do it all the time... but it's a hard problem!

Photo Tourism



Finding Paths through the World's Photos,
Snavely, Garg, Seitz, & Szeliski, SIGGRAPH 2008
Photo tourism: Exploring photo collections in 3D,
Snavely, Seitz, & Szeliski, SIGGRAPH 2006

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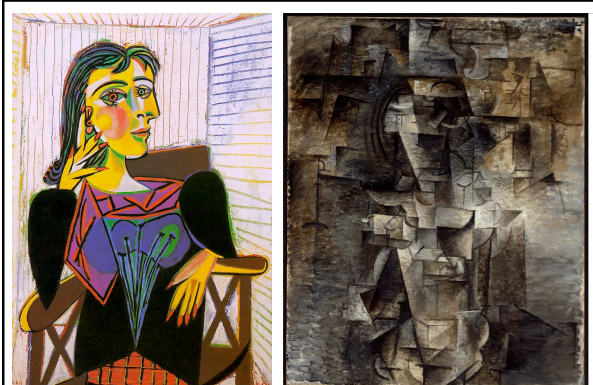
Reading for Today:

“Photographing long scenes with multi-viewpoint panoramas”, Agarwala, Agrawala, Cohen, Salesin, & Szeliski, SIGGRAPH 2006



Multi-Viewpoint Panoramas

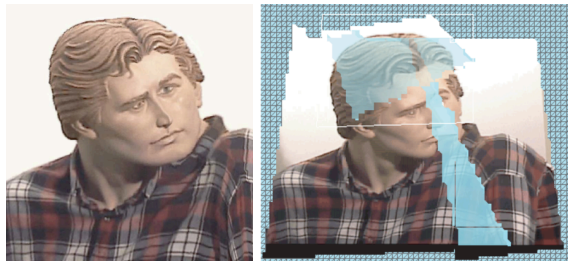
- Like many non-photorealistic rendering methods, this paper aims to mimic the style of a particular artist or style of art
- Well designed user interface:
 - Most components automated
 - User can adjust dominant plane, view selection, seams, & inpainting



Portrait of Dora Maar
Pablo Picasso

Portrait of a Woman
Pablo Picasso

Multi-Perspective Rendering



J. Yu & L. McMillan
"A Framework for Multiperspective Rendering"
Eurographics Symposium on Rendering 2004

Opening Scene from Disney's Pinocchio



Photo Montage

- David Hockney



http://www.hockneypictures.com/photos/photos_collages_05_large.php

Questions?



Zac Bubnick <http://www.princetonol.com/groups/iad/lessons/high/cubismphoto.htm>

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Reading for Today:

"Environment Matting and Compositing"
Zongker, Werner, Curless, & Salesin, SIGGRAPH 1999

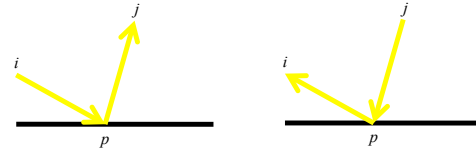


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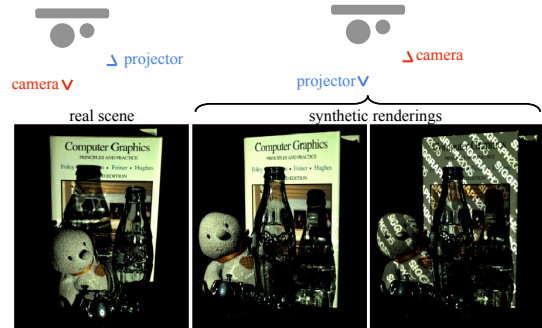
- Structure From Motion
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Helmholtz Reciprocity

- BRDF is symmetric: % of light reflected from direction i off surface point p to direction j is the same as the % of light reflected from direction j off surface point p to direction i



Helmholtz Reciprocity

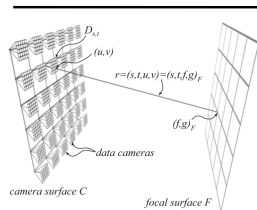


“Dual Photography”, Sen, Chen, Garg, Marschner, Horowitz, Levoy, & Lensch, SIGGRAPH 2005

Today

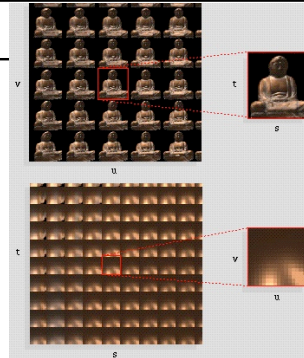
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- **Light Fields**

Light Fields



Plenoptic Modeling: An Image-Based Rendering System, McMillan & Bishop, SIGGRAPH 1995

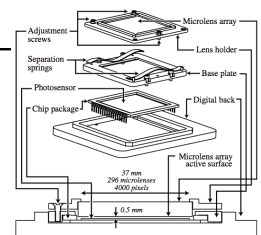
Dynamically reparameterized light fields, Isaksen, McMillan, & Gortler, SIGGRAPH 2000



Light Field Rendering, Levoy & Hanrahan, SIGGRAPH 1996

Light Field Camera

- *After* taking the photograph, we can:
 - Adjust focus
 - Change viewpoint
 - Change illumination
 - & more?



Light Field Photography with a Hand-Held Plenoptic Camera, Ng, Levoy, Bredif, Duval, Horowitz, & Hanrahan, Stanford Tech Report, 2005

Questions?
