15-463 (15-862): Computational Photography
15-463 (15-862): Computational Photography

Staff

- Prof: Alexei Efros (efros@cs), 4207 NSH
- TAs: Alvaro Collet (acollet@cs) and Laura Trutoiu (trutoiu@cs)

Web Page

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

Discussion Forum:

- googlegroups
Today

Introductions
Why Computational Photography?
Overview of the course
Administrative stuff
A bit about me

Alexei (Alyosha) Efros
Assistant Professor in Robotics and CSD
also work with colleagues in Paris and Oxford

Teaching
The plan is to have fun and learn cool things, both you and me!
Social warning: I don’t see well

Research
Graphics, Vision
Antonio’s son cannot walk but he can fly 😊
More recent work

Derek Hoiem, Alexei Efros, Martial Hebert
Why Computational Photography?

A super-brief History of Art and its futile Search for Realism
Depicting Our World: The Beginning

Prehistoric Painting, Lascaux Cave, France
~ 13,000 -- 15,000 B.C.
The Empress Theodora with her court.
Ravenna, St. Vitale 6th c.
Nuns in Procession. French ms. ca. 1300.
Depicting Our World: Renaissance

North Doors (1424)

Lorenzo Ghiberti (1378-1455)

East Doors (1452)
Piero della Francesca, 
*The Flagellation* (c.1469)
Depicting Our World: Toward Perfection

Jan van Eyck, *The Arnolfini Marriage* (c.1434)
Depicting Our World: Toward Perfection

Lens Based Camera Obscura, 1568
Depicting Our World: Perfection!

Still Life, Louis Jaques Mande Daguerre, 1837
Depicting Our World: Realism?
Flickr Paris
Real Paris
Real Notre Dame
Depicting Our World: Ongoing Quest

Pablo Picasso

David Hockney
Better than realism?

David Hockney, Place Furstenberg, (1985)
Which one is right?

Multiple viewpoints

David Hockney,
Place Furstenberg, 1985

Single viewpoint

Alyosha Efros
Place Furstenberg, 2009
Depicting Our World: Ongoing Quest

Enter Computer Graphics...
Traditional Computer Graphics

3D geometry

physics

projection

Simulation

GRAPHICS
State of the Art

- Amazingly real
- But so sterile, lifeless, *futuristic* (why?)
The richness of our everyday world
Beauty in complexity
Which parts are hard to model?
People

From “Final Fantasy”

On the Tube, London
Faces / Hair

From “Final Fantasy”
Hyper-humans
Urban Scenes

Virtual LA (SGI)

Photo of LA
Nature

River Cherwell, Oxford
The Realism Spectrum

Computer Graphics
+ easy to create new worlds
+ easy to manipulate objects/viewpoint
- Very hard to look realistic

Computational Photography
Realism Manipulation Ease of capture

Photography
+ instantly realistic
+ easy to acquire
- very hard to manipulate objects/viewpoint
Virtual Real World

Campanile Movie

http://www.debevec.org/Campanile/
Course Outline
Programming Project 0

The Vertigo Effect
Programming Project 1

Images of the Russian Empire -- colorizing the Prokudin-Gorskii photo collection
Programming Project 2

Image Resizing by Scene Carving
Programming Project 3

Face warping and morphing
Programming Project 4

Photo Mosaics

Full screen panoramas (cubic):  http://www.panoramas.dk/
Programming Project 4

Automatic Mosaic Stitching
Programming Project 5
Tour Into the Picture
Final Project

Something cool!!!
Administrative Stuff

Grading
- Written and Programming Assignments (60%)
- Exam (20%)
- Final Project (20%)
- Class Participation: priceless

Late Policy
- Five late days total, to be spent wisely
- 20% off from each extra late day

Cheating
- Let’s not embarrass ourselves

Hardware/Software
- CMU clusters
- MATLAB!!!
General Comments

Prerequisites
   • Linear algebra!!!
   • Some computer graphics, vision, or image processing is useful, but not required.

Emphasis on programming projects!
   • Building something from scratch (Matlab!)

Why you should not take this class? plenty of reasons…
Cameras

Really cool
Not too expensive nowadays (<$150)

e.g. Canon A1100