Today’s Class

• A little about me
• Intro to Computational Photography
• Course outline and logistics
• A little about you
About me

2005-2009
Undergrad at the University of Missouri
B.S., Math and CS

2009-
Grad at UIUC
Ph.D. in computer vision/graphics

2010-2012
MSR, Adobe Research
Intern

2012 Lemelson-MIT Student Prize Winner
Lemelson-MIT UIUC Student Prize

http://www.tec.illinois.edu/30kprize
My Research

Editing images as if they were 3D scenes
My Research

Material estimation
My Research

Depth / geometry estimation
Some background to computational photography and ...

The Pursuit of Realism
Depicting Our World: The Beginning

Prehistoric Painting, Lascaux Cave, France
~ 15,000 B.C.
The Empress Theodora with her court.
Ravenna, St. Vitale 6th c.
Depicting Our World: Middle Ages

Nuns in Procession. French ms. ca. 1300.
Depicting Our World: Renaissance

North Doors (1424)

Lorenzo Ghiberti (1378-1455)

East Doors (1452)
Depicting Our World: Renaissance

Paolo Uccello,
Miracle of the Profaned Host (c.1467-9)
Depicting Our World: Toward Perfection

Jan van Eyck, The Arnolfini Portrait (1426-1434)
Depicting Our World: Toward Perfection

Fig. 434

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

Still Life, Louis Jaques Mande Daguerre, 1837
Your own camera obscura?
Depicting Our World: Perfection!

*Still Life*, Louis Jaques Mande Daguerre, 1837
But is a photo really realistic?
Is reality what we want?
Better than realism?

City (westward)

http://salavon.com
Enter Computer Graphics...
Traditional Computer Graphics

3D geometry

physics

Simulation

GRAPHICS
Computer graphics

What’s wrong?
The richness of our everyday world
Which parts are hard to model?
People

From “Final Fantasy”
Faces / Hair

From “Final Fantasy”
Urban Scenes
Nature

River Cherwell, Oxford
The Realism Spectrum

Computer Graphics

+ easy to create new worlds
+ easy to manipulate objects/viewpoint
- very hard to look realistic

Photography

+ instantly realistic
+ easy to acquire
- very hard to manipulate objects/viewpoint
Computational Photography

How can I use computational techniques to capture light in new ways?

How can I use computational techniques to breathe new life into the photograph?

How can I use computational techniques to synthesize and organize photo collections?
Virtual Real World

Campanile Movie (1997)
http://www.debevec.org/Campanile/
Going beyond reality...

Benjamin Button (2008)

http://digitaldomain.com/projects/8/
Course outline

**Prof:** Derek Hoiem ([dhoiem@illinois.edu](mailto:dhoiem@illinois.edu)), SC 3312

**TA:** Kevin Karsch ([karsch1@illinois.edu](mailto:karsch1@illinois.edu)), SC 3238A

**Web page:**
[http://courses.engr.illinois.edu/cs498dh3/](http://courses.engr.illinois.edu/cs498dh3/)
Course objectives

1. You will have new abilities for visual creation.
Course objectives

2. You will get a foundation in computer vision.
Got job?

• Google, Facebook, Microsoft, Sony, iRobot, Amazon A9, tons of startups, etc.

Course objectives

3. You’ll better appreciate your own visual ability.

Is that a queen or a bishop?
Course objectives

4. You’ll have fun doing cool stuff!
Projects
Project 1: Hybrid Images
Project 2: Image Quilting for Texture Synthesis and Transfer
Project 3: Poisson Editing

Photos from James Hays
Project 3: Poisson Editing

Photos from Evan Wallace
Project 4: Image-Based Lighting
Project 5: Automatic Photo Stitching
Final Project

Something cool!
Project details

• Implement stuff from scratch and apply it to your own photos

• Reporting via web page (plus e-mail code)

• Afterwards, vote for class favorite(s)!

• Software/hardware
  – Matlab!
  – Machines available in EWS labs
Getting help outside of class

Office hours
• TBA: http://www.doodle.com/e9hzmy65k2icdi64

Matlab + linear algebra tutorial
• TBA: http://www.doodle.com/f7bien4sadwfzv64

Discussion board:
• http://groups.google.com/group/cs498-cp-uiuc

Readings/textbook
Grades

- Written and programming assignments (60%)
  - Core projects worth total of 500 points, “bells and whistles” for additional points
  - Undergrads graded out of 525, grads out of 600
- Exam (20%)
- Final Project (20%)
- Participation

Late policy

- Up to five free days total – use them wisely!
- 10 points per day after that
Academic Integrity

• Can discuss projects, but don’t share code

• Don’t look up code (even to get hints) or copy from a friend

• If you’re not sure if it’s allowed, ask

• Acknowledge any inspirations

• If you get stuck, come talk to me
Other comments

Prerequisites

• **Linear algebra**, plus some basic calculus and probability
• Experience with graphics, image processing, or Matlab will help but is not necessary

Your own camera

• Strongly recommended – can get decent cameras for reasonable $$$, e.g., **Canon A1300** ($100)
• Pro camera apps for smartphones
Feedback is welcome
Introduce yourselves
Final comments

• Reasons to not take the course...

• To do now
  – Please fill out the feed-forward forms
  – Any Q’s or concerns, come talk to me!

• To do later
  – Look over syllabus, etc.
  – Sign up for discussion group

• Next class: pixels and basic filtering