Today’s Class

• A little about us

• Intro to Computational Photography

• Course outline and logistics
About me

Raised in “upstate” NY
About me

1998-2002
Undergrad at SUNY Buffalo
B.S., EE and CSE

2002-2007
Grad at Carnegie Mellon
Ph.D. in Robotics

2007-2008
Postdoc at Beckman Institute

2009-
Asst/Assoc Prof in CS at UIUC
My new baby Isla (born last Monday)
My research
My Research

Vehicle
- wheel

Animal
- head
- leg

Four-legged Mammal
- Can run, jump
- Is herbivorous
- Facing right

Move on road
Facing right

Farhadi et al. 2010
My Research

Recovering 3D layout and context

Hedau et al. 2009, 2010
My Research

3D scene model from RGB+D image

RGBD Image

3D Model

Guo and Hoiem, unpublished
My Research

Editing images as if they were 3D scenes

Karsch et al. 2011
Name: Daeyun Shin *(pronounced day-yoon)*
Email: dshin11@illinois.edu
Education
University of Illinois at Urbana-Champaign
B.S. in Computer Science 2011-2015
M.S. in Computer Science 2015-present

Industry Work
I worked with the Computer Vision team in Amazon.com’s Fulfillment Technologies division (Seattle, Summer 2013), Amazon Web Services in Palo Alto, CA (Summer 2014). I was at Google’s Pittsburgh office (Display/Video Ads team) this summer.
Research Interests
Vision, graphics, machine learning. 3D reconstruction, recognition, retrieval, and narrowing the gap between vision and graphics.

3D deformation  3D shape from images  Mesh from voxels
Name: Mariya Vasileva
Email: mvasile2@illinois.edu
Education

*California Institute of Technology*
B.S. in Mechanical Engineering 2009-2013

*University of Illinois at Urbana-Champaign*
M.S. in Applied Mathematics 2014-present
Ph.D. in Computer Science 2014-present

Work Experience
Research Interests

Vision, machine learning, natural language processing.

Object detection and recognition
View interpolation from multiple images
Image segmentation and spatial understanding
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)

East Doors (1452)

Lorenzo Ghiberti (1378-1455)
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

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

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

Newlyweds

http://salavon.com
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

Photo by Svetlana Lazebnik
Which parts are hard to model?
People

From “Final Fantasy”
Faces / Hair

From “Final Fantasy”

Photo by Joaquin Rosales Gomez
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
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/
Another example of blending reality with fantasy

Samsung Galaxy S6 regular and “beauty” selfie
Galaxy S6 beauty selfie

Reality

Reality++ (?)

Course outline

Prof: Derek Hoiem (dhoiem@illinois.edu), SC 3312
TAs: Mariya Vasileva (mvasile2@illinois.edu)
     Daeyun Shin (dshin11@illinois.edu)

Web page:
http://courses.engr.illinois.edu/cs445/
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, Snapchat, Ebay, 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: video alignment, stitching, and editing
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)

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

Office hours
• TBA: [http://doodle.com/8cqbis4qx52wm5fs](http://doodle.com/8cqbis4qx52wm5fs)

Matlab + linear algebra tutorial
• Wed 9/2, pick time:  
  [http://doodle.com/6drhrg3kdedu892x](http://doodle.com/6drhrg3kdedu892x)
• Discussion board:  
  [https://piazza.com/class/idbqt0ejczu4su](https://piazza.com/class/idbqt0ejczu4su)

Readings/textbook
Grades

• Written and programming assignments (55%)
  – Core projects worth total of 500 points, “bells and whistles” for additional points
  – Undergrads graded out of 525, grads out of 600
• Exam (25%)
• Final Project (20%)
• Participation

Late policy

• Up to five free days total – use them wisely!
• 10 point penalty 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 $$$

• Pro camera apps for smartphones
Feedback is welcome
Final comments

• Reasons to not take the course...

• To do now
  – Any Q’s or concerns, come talk to me!

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

• Next class: pixels and basic filtering