Looking Back, Moving Forward

Computational Photography

Derek Hoiem, University of Illinois

Photo Credit
Lee Cullivan

Today

- Beyond this class…
- ICES forms
- Reminder: final project
  - Reports due Tues Dec 17
  - Presentations on Wed 1:30pm
    - 5 min each project, quick summary of approach + some results
    - Order decided on Tues – let me know if you can't make the whole time
    - I'll provide some kind of snack
  - I will be around for most of the week --- can stop by (preferred) or email me

This course has provided fundamentals

- How photographs are captured from and relate to the 3D scene
- How to think of an image as: a signal to be processed, a graph to be searched, an equation to be solved
- How to manipulate photographs: cutting, growing, compositing, morphing, stitching
- Basic principles of computer vision: filtering, correspondence, alignment

What else is out there?

Lots!

- Videos and motion
- Scene understanding
- Modeling humans
- Better/cheaper devices
- …

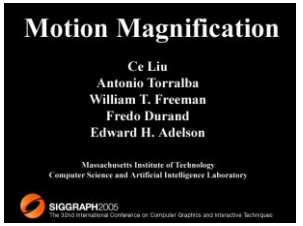
Smarter user assistance

- Handwriting beautification (Zitnick SG'13)

- 3D object modeling (Chen et al. SGA'13)

Video and motion

- Video = sequence of images
  - Track points → optical flow, tracked objects, 3D reconstruction
  - Look for changes → background subtraction
  - Find coherent space-time regions → segmentation
- Examples:
  - Point tracking
    - 2D3 / Boujou 1
  - "Motion Magnification" (Liu et al. 2005)



Scene understanding

Interpret image in terms of scene categories, objects, surfaces, interactions, goals, etc.

- Remove the guy lying down (Alyosha)
- Make the woman dance or the guy get up
- Fill in the window with bricks
- Find me images with only Alyosha and Piotro

Scene understanding

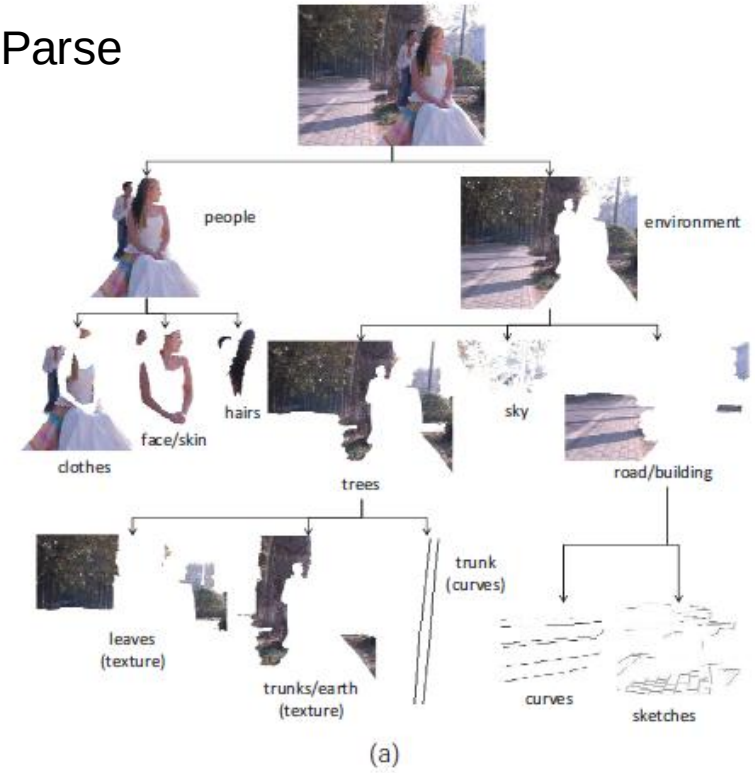
- Mostly unsolved, but we're getting there (especially for graphics purposes)
- Examples
  - "From Image Parsing to Painterly Rendering" (Zeng et al. 2010)
  - "Sketch2Photo: Internet Image Montage" (Chen et al. 2009)

Image Parsing to Painterly Rendering

Zeng et al. SIGGRAPH 2010

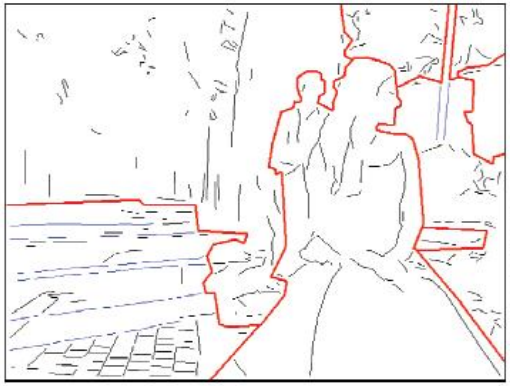
Image Parsing to Painterly Rendering

Parse



Brush Strokes

Sketch



Brush Orientations

Zeng et al. SIGGRAPH 2010

Image Parsing to Painterly Rendering

Zeng et al. SIGGRAPH 2010

Image Parsing to Painterly Rendering

More examples

- Sketch2photo: http://www.youtube.com/watch?v=dW1Epl2LdFM

- Animating still photographs

Chen et al. 2009

Modeling humans

- Estimating pose and shape
  - http://clothingparsing.com/
  - Parselets (Dong et al., ICCV 2013)

- Motion capture

- 3D face from image (Kemelmacher ICCV'13)
  - Face transfer

Questions, Looking Forward

- How can we get computers to understand scenes (make predictions, describe them, etc.)?
- How can we design programs where semi-smart computers and people collaborate?
- What if we just capture and store the whole visual world (think StreetView)?
- How will photography change if depth cameras become standard?

How can you learn more?

- Relevant courses
  - Production graphics (CS 419)
  - Machine learning (CS 446)
  - Computer vision (CS 543)
  - Optimization methods (w/ David Forsyth)
  - Parallel processing / GPU
  - HCI, data mining, NLP, robotics

Computer vision (w/ Lana Spring 2014)

Similar stuff to CP

- Camera models, filtering, single-view geometry, light and capture

New stuff

- Recognition
  - Object category recognition
  - Action/activity recognition
  - Edge detection, clustering, segmentation
- Videos
  - Tracking, optical flow
  - Structure from motion
- Multi-view geometry

How do you learn more?

Explore!

Thank you!