Looking Back, Moving Forward

Computational Photography

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Photo Credit
Lee Cullivan

Today

- Beyond this class…
- ICES forms
- Reminder: final project
  - Reports due Sun Dec 14 11:59pm
  - Presentations on Mon Dec 15 at 1:30pm
    - 4-5 min each project, quick summary of motivation/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 have extra office hours on Thurs 11-12.

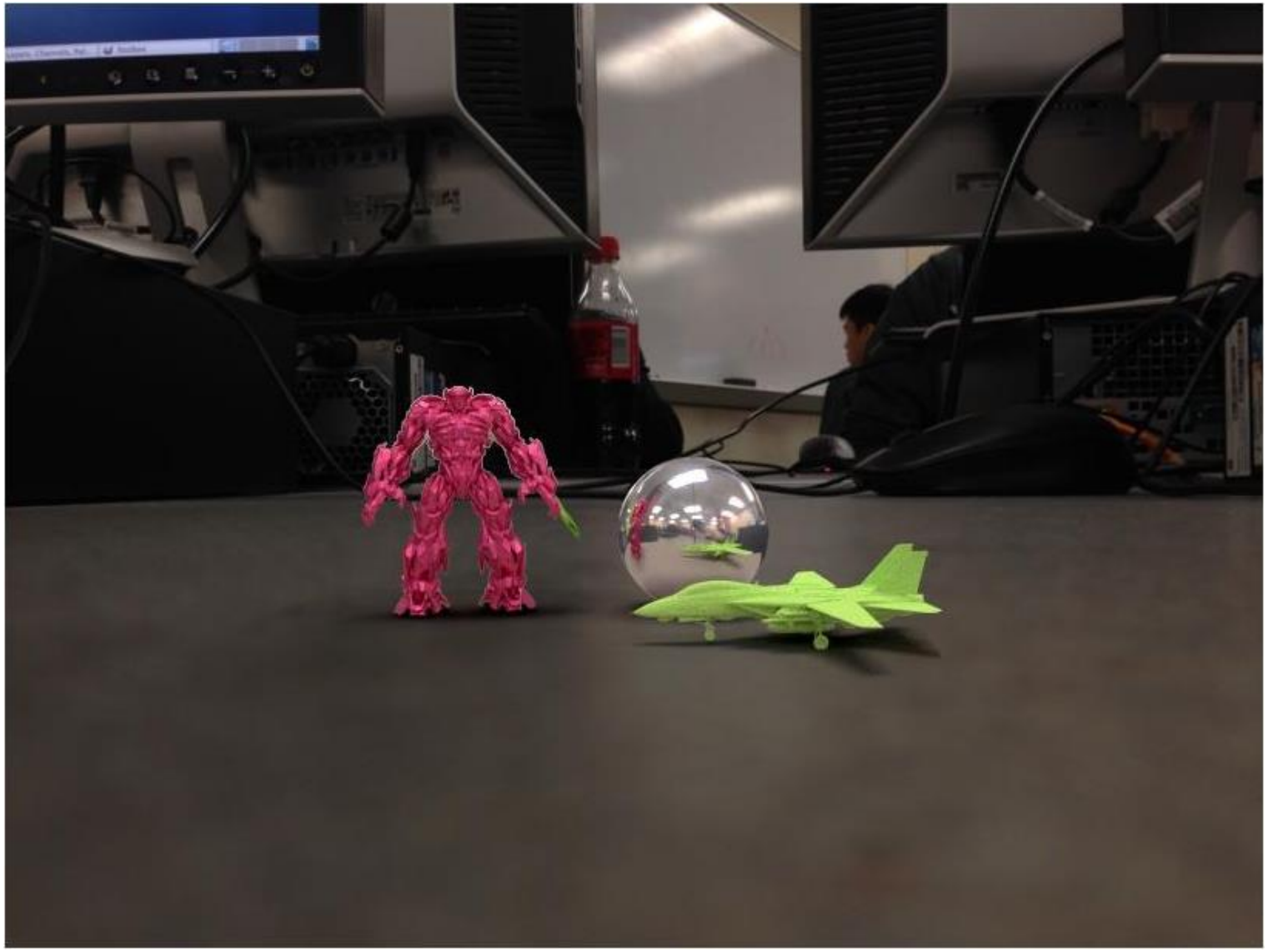
Final projects

1. Image retrieval – Hao Gao and Jacob Lin
2. Single-view 3D reconstruction – William Hempy
3. Single-view 3D reconstruction – Rachit Nandwani and Nishant Nayudu
4. Single-view 3D reconstruction – Elizabeth Weeks and Yifang Zhang
5. Face detection/recognition – Chenghao Liu
6. Face detection/recognition – Tai Lin Wu
7. Detecting and counting people in video – Annlin Sheih and Ka Wai Tsoi
8. Character detection/recognition – Joon Young Seo
9. SLAM/robot navigation – Bentic Sebastian
10. Saliency in 3D meshes – Daeyun Shin
11. Context-aware filling – Matthew Sucich
12. Video frame interpolation – David Turner
13. GPU implementation / interactive tools – Jane Wang
14. Motion synthesis/transfer: Aditya Deshpande
15. Auto Photo Stacking: Jeremy Goodsitt
16. Labeling structural components from point cloud – Yeritza Perez and Emmanuel Arregoitia-Diaz
17. Detecting deviations between CAD model and photos – Yizhi Zhu and Ruxiao Bao
18. 3d point cloud processing – Yi Liu
19. Face morphing and/or beautification: Ruichuan Zhang and Xinyu Zhang
20. Object morphing – Donald Cha and Sam Ricker
21. Seam carving or image morphing – Will Alexander

Project 4: incomplete list of excellent projects

https://courses.engr.illinois.edu/cs498dh3/fa2014/projects/ibl/results.html

- Dayun Shin: nice results, texture synthesis based photography removal
- David Turner, Jeremy Goodsitt: good layout and description
- Jane Wang: many results, nice transformations
- Yi Liu: interesting backgrounds
- Emmanuel Arregoitia-Diaz: interesting inserted objects



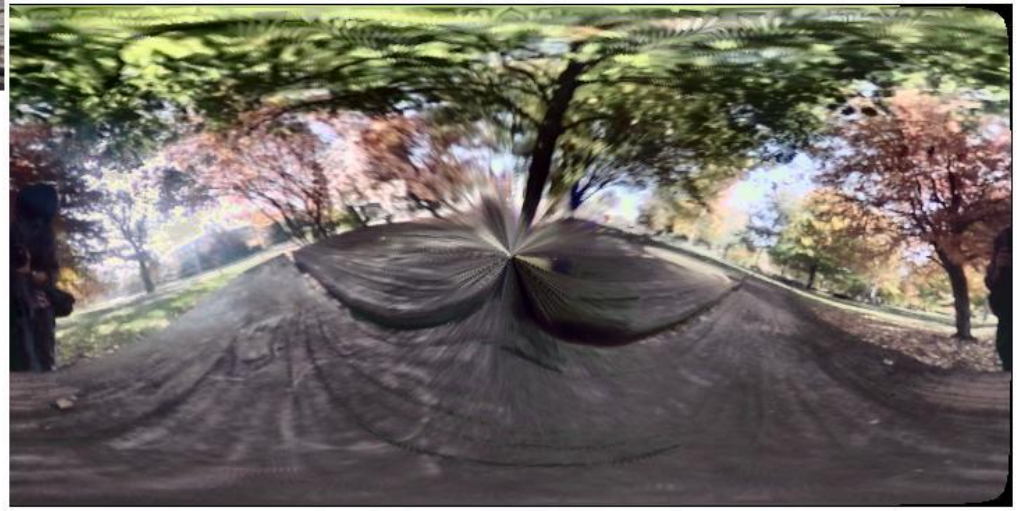
Donald Cha

Daeyun Shin

Matthew Sucich

David Turner

Emmanuel Arregoitia-Diaz



Xinyu Zhang

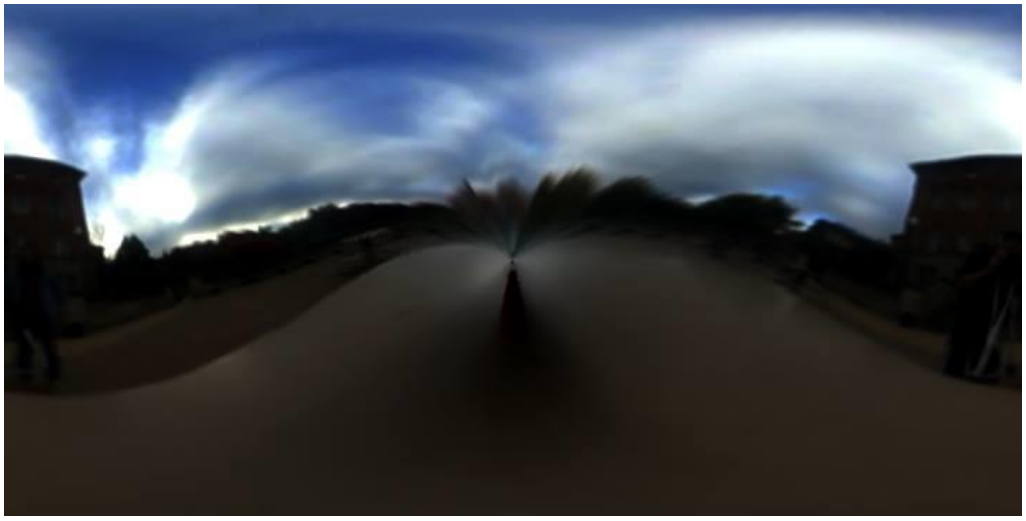
Photographer Removal

Daeyun Shin

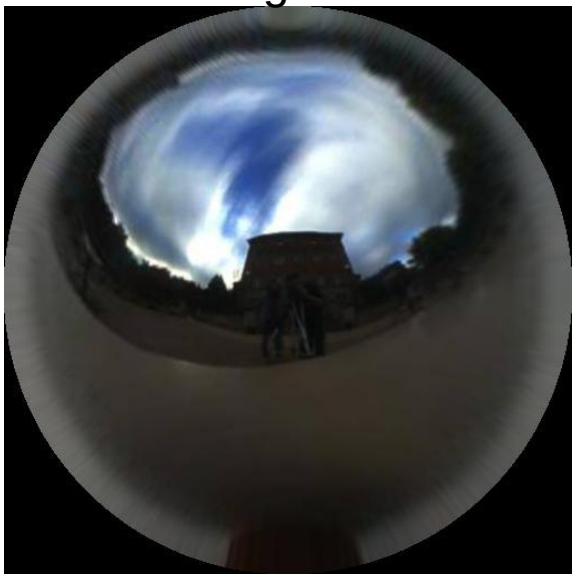
Transformations

Photo

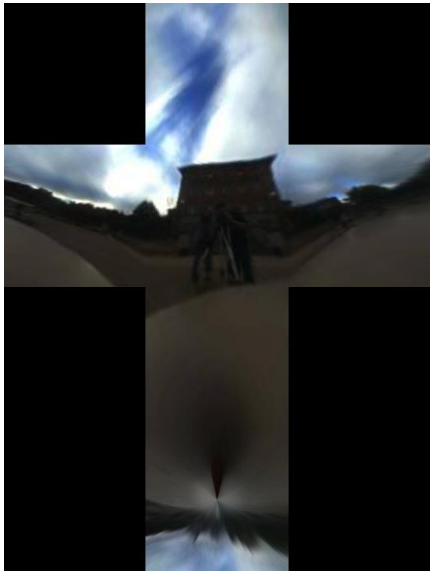
Equirectangular



Angular

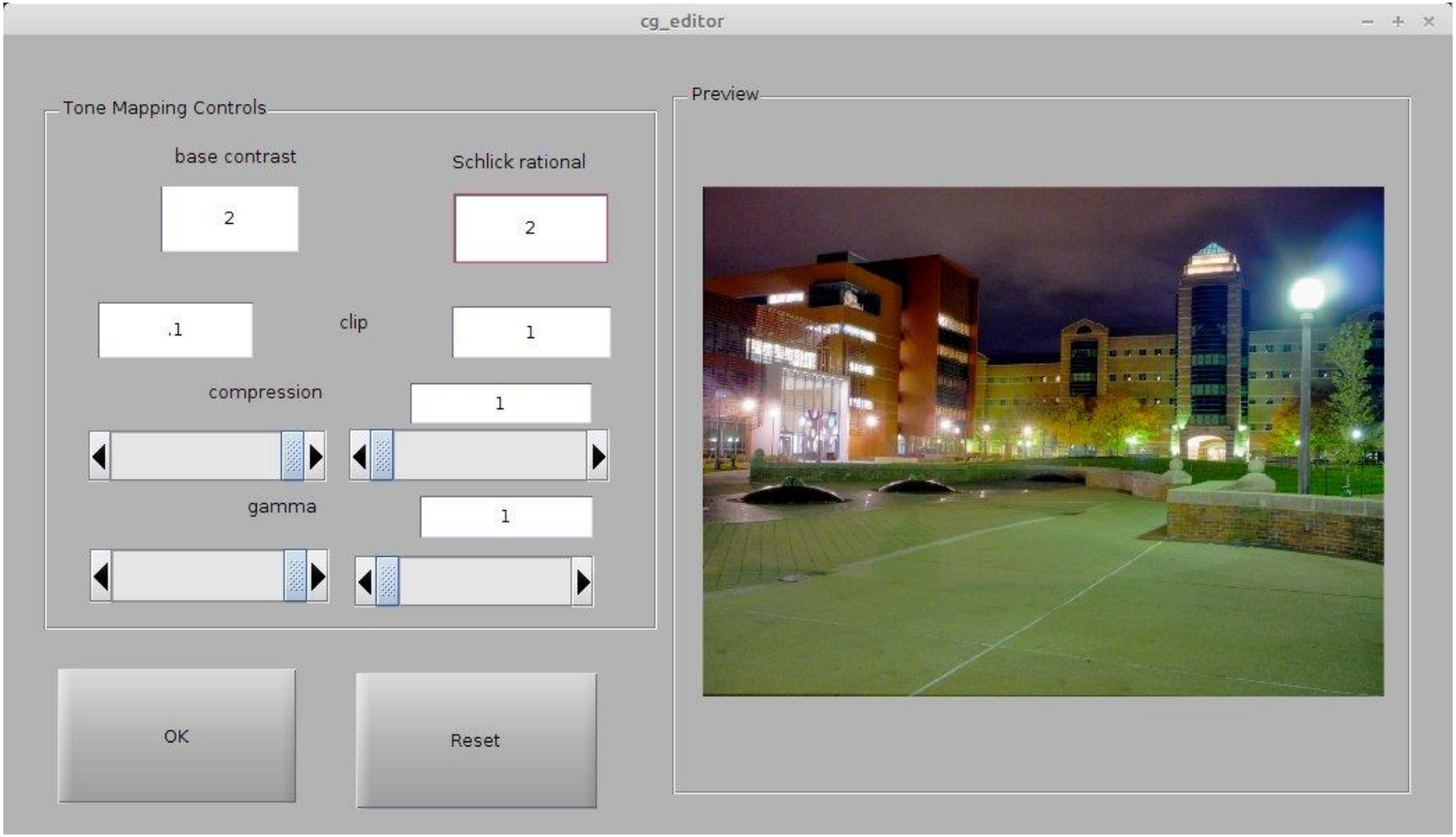


Cubic



Jane Wang

Tone mapping



Eric Huber

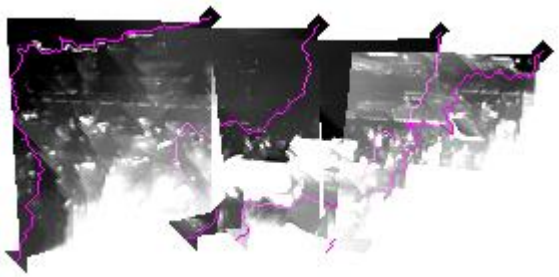
Project 5: incomplete list of excellent projects

https://courses.engr.illinois.edu/cs498dh3/fa2014/projects/video/results.html

- Rachiti Nanwandi: quad video
- Sam Ricker: nice foreground results
- Daeyun Shin: seam finding for stitching
- Emmanuel Arragoitia-Diaz: super-crowded street
- Yeritza Perez: foreground, wide video

Stable video from Eric Huber: https://www.youtube.com/watch?v=p1wL3VsqTxI

Seam finding for stitching



Daeyun Shin

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)
- 3D object modeling (Kholgade et al. SG'14)

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
  - Recognizing actions and events
- Examples:
  - Point tracking for structure-from-motion
    - 2D3 / Boujou 1
  - Facial transfer: Xu et al. SG2014

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

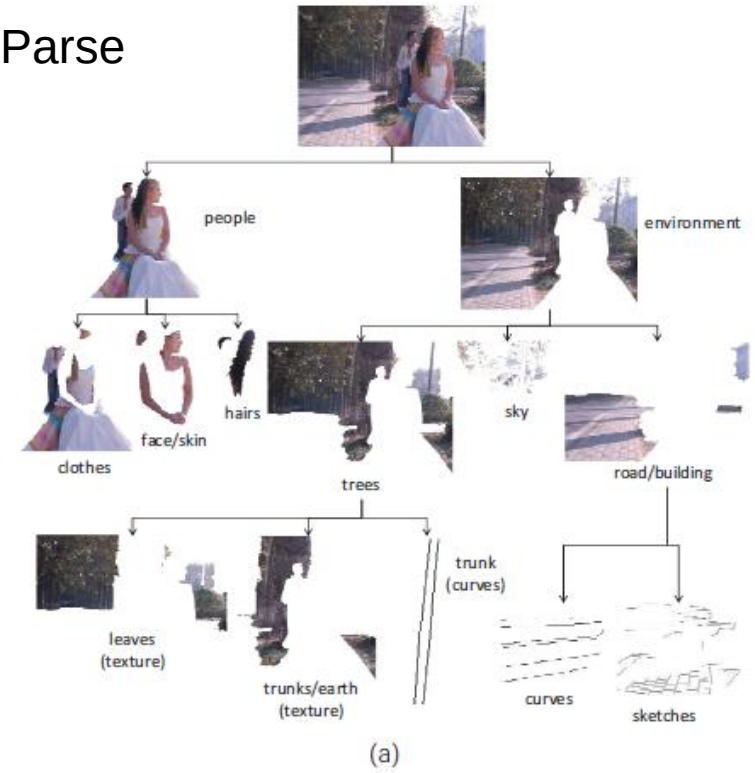
- Mostly unsolved, but we're getting there (especially for graphics purposes)
- Examples
  - "From Image Parsing to Painterly Rendering" (Zeng et al. 2010)
  - "Sketch2Photo: Internet Image Montage" (Chen et al. 2009)
  - Editing via scene attributes (Laffont et al. 2014)

Image Parsing to Painterly Rendering

Zeng et al. SIGGRAPH 2010

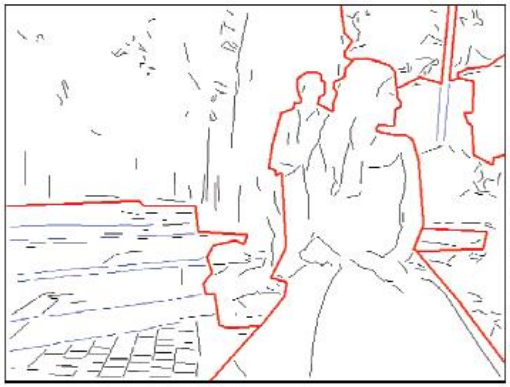
Image Parsing to Painterly Rendering

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)

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 and others)
  - Computer vision (CS 543)
  - Optimization methods (w/ David Forsyth)
  - Parallel processing / GPU
  - HCI, data mining, NLP, robotics

Computer vision (with me Spring 2015)

Similar stuff to CP

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

New stuff

- Mid-level vision
  - Edge detection, clustering, segmentation
- Recognition
  - Image features and classifiers
  - Object category recognition
  - Action/activity recognition
- Videos
  - Tracking, optical flow
  - Structure from motion
- Multi-view geometry

How do you learn more?

Explore!

Thank you!