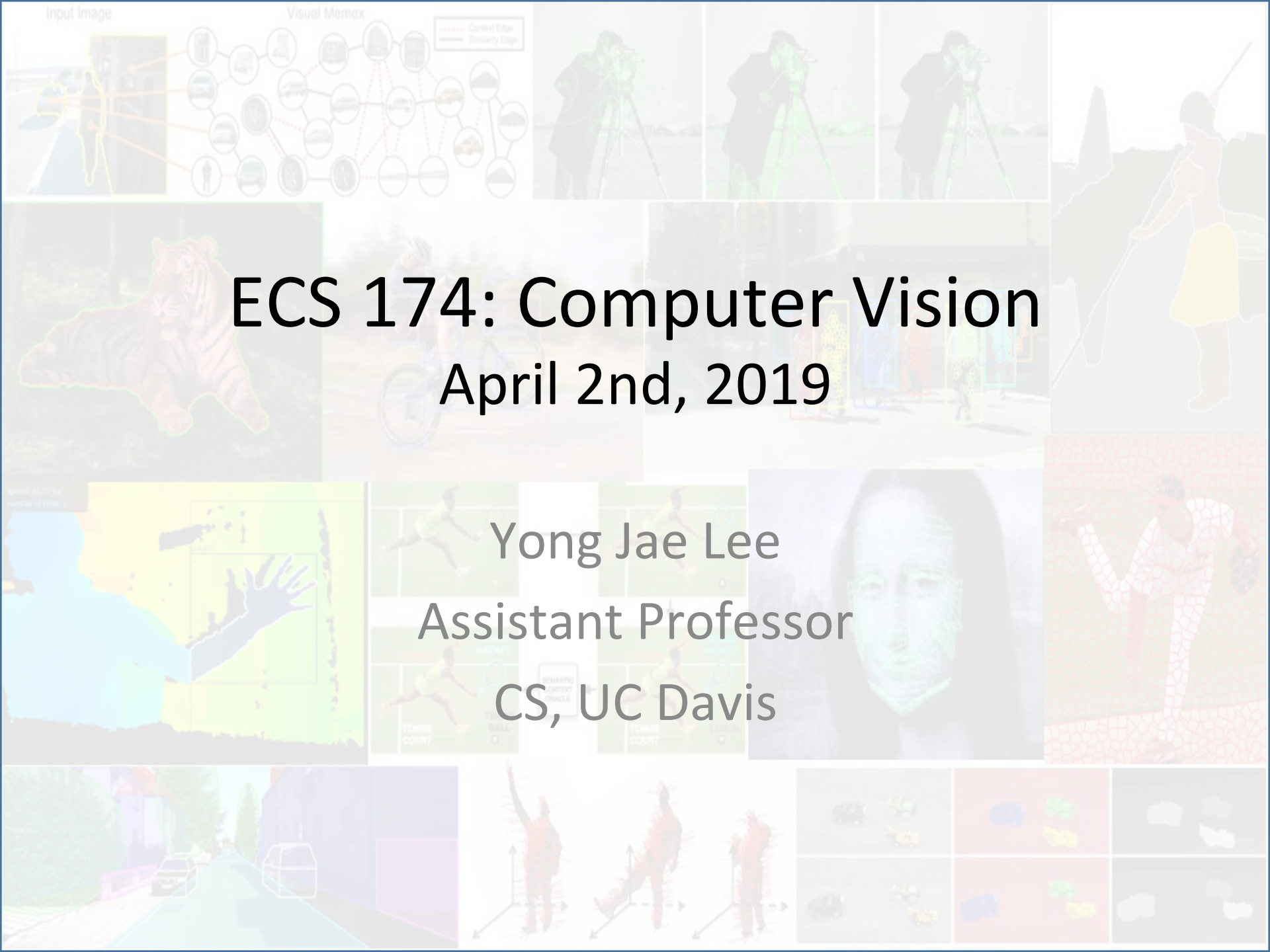


ECS 174: Computer Vision

April 2nd, 2019

Yong Jae Lee

Assistant Professor

CS, UC Davis

Plan for today

- Course overview
- Introduction to computer vision research
- Logistics and requirements

Introductions

- Instructor
  - Yong Jae Lee
  - yongjaelee@ucdavis.edu
  - Assistant Professor in CS, UC Davis since July 2014
  - Research areas: Computer vision and machine learning
    - Visual Recognition

Introductions

- TAs:
  - Xueyan Zou
  - zxyzou@ucdavis.edu
  - PhD student in CS

  - Yangming Wen
  - ymnwen@ucdavis.edu
  - MS student in CS

This course

- ECS 174 (4-units)
- Lecture: Tues & Thurs 4:40-6:00 pm, Giedt Hall 1001
- Discussion section: Mon 12:10-1pm, Hunt 100
- Office hours: Academic Surge 1044/2075
  - Yangming: Wed 11 am - 1 pm (AS 1044)
  - Xueyan: Thurs 11 am- 1 pm (AS 1044)
  - Yong Jae: Fri 3-5 pm (AS 2075)

This course

- Course webpage

  https://sites.google.com/a/ucdavis.edu/ecs-174-computer-vision---spring-2019/

- Canvas (assignment submission, grades)
  https://canvas.ucdavis.edu/courses/349152

- Piazza

  piazza.com/uc_davis/spring2019/ecs174

Goals of this course

- Introduction to primary topics in Computer Vision
- Basics and fundamentals
- Practical experience through assignments
- Views of computer vision as a research area

Prerequisites

- Upper-division undergrad course

- Basic knowledge of probability and linear algebra
- Data structures, algorithms
- Programming experience

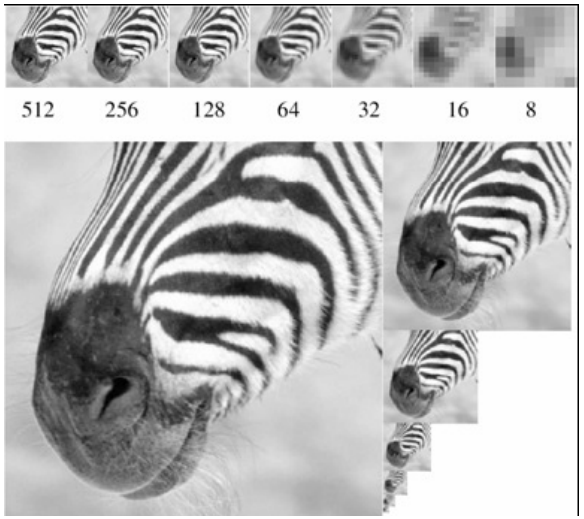
- Experience with image processing or Matlab will help but is not necessary

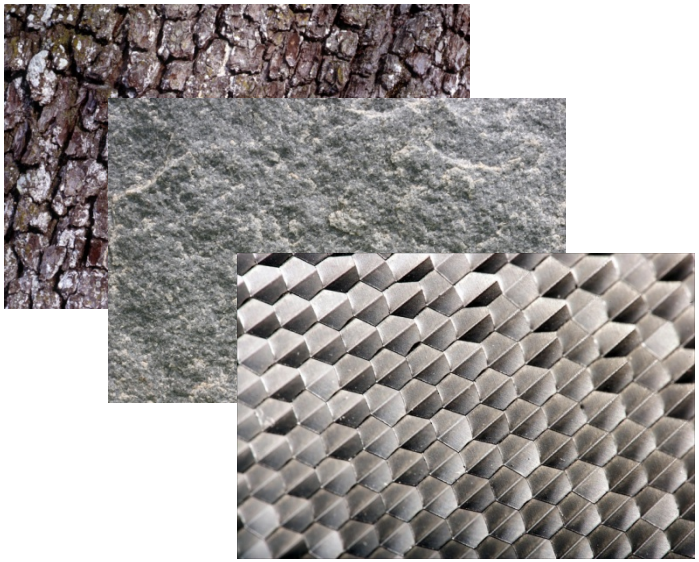
Topics overview

- Features and filters
- Grouping and fitting
- Recognition and learning

Focus is on algorithms, rather than specific systems

Features and filters

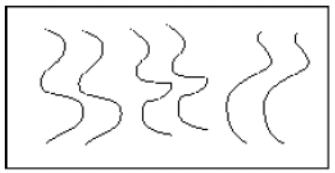




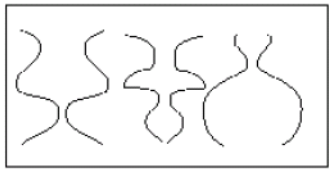
Transforming and describing images; textures, edges

Slide credit: Kristen Grauman

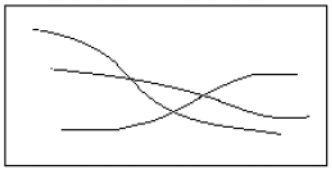
Grouping and fitting



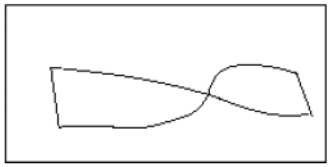
Parallelism



Symmetry

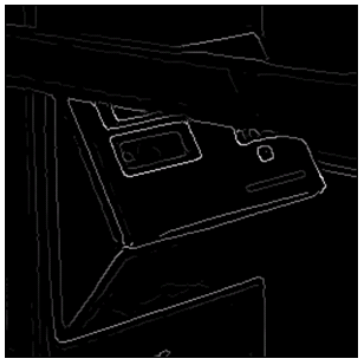


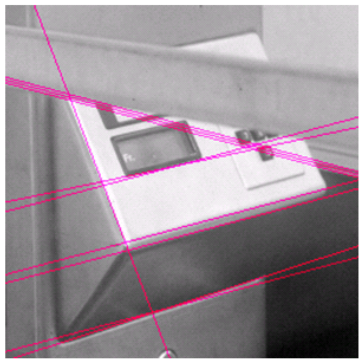
Continuity

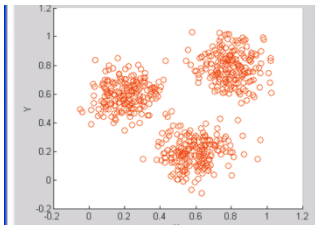


Closure

[fig from Shi et al]



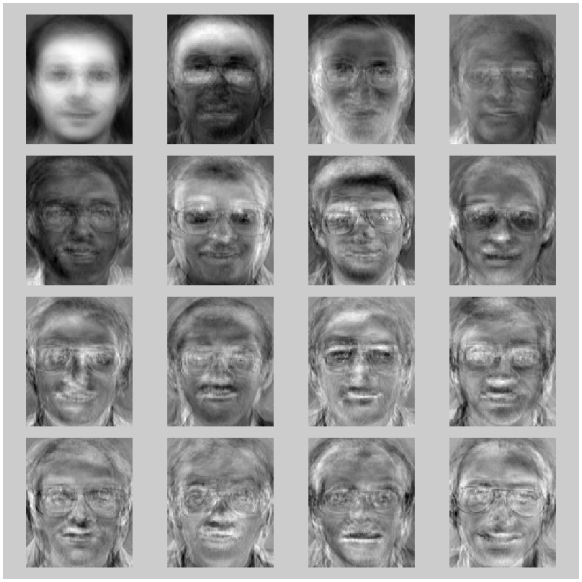


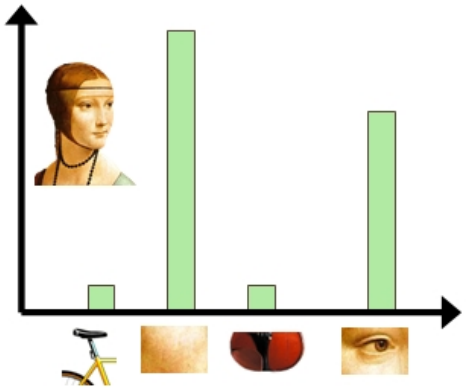


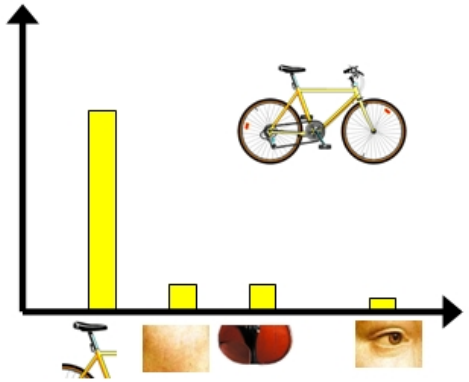
Clustering, segmentation, fitting; what parts belong together?

Slide credit: Kristen Grauman

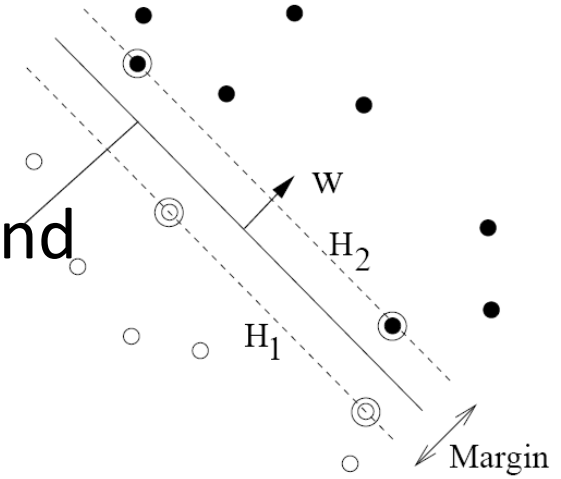
Recognition and learning





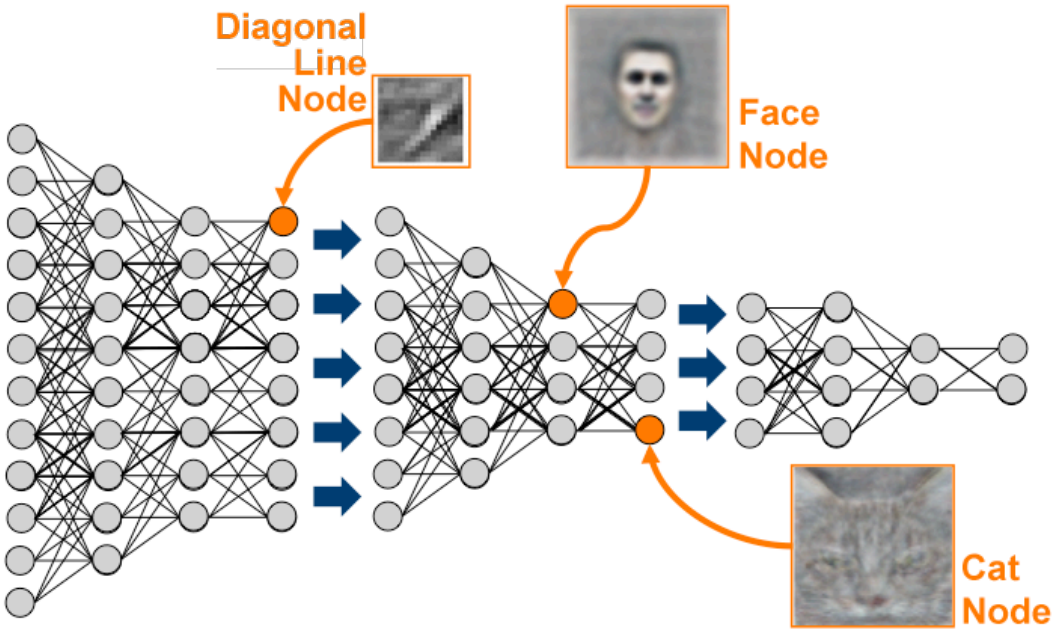


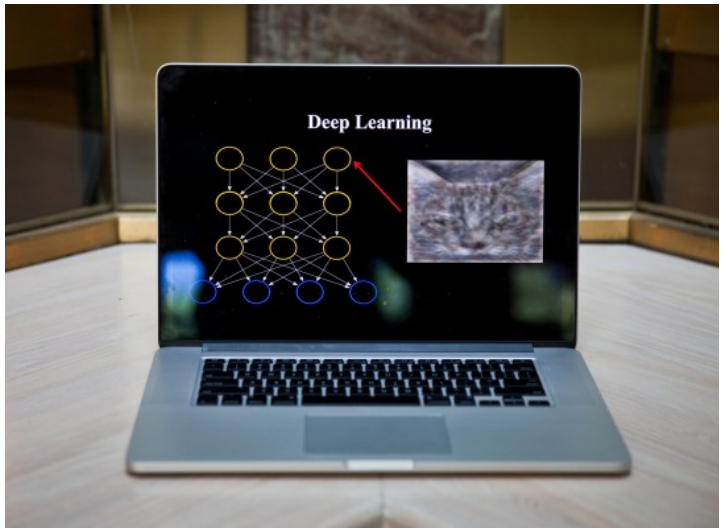
Recognizing objects and categories, learning techniques



Slide credit: Kristen Grauman

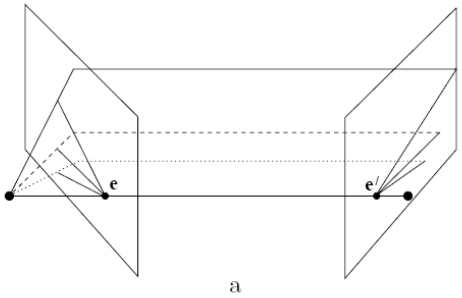
Recognition and learning





Deep learning

Not covered: Multiple views and motion



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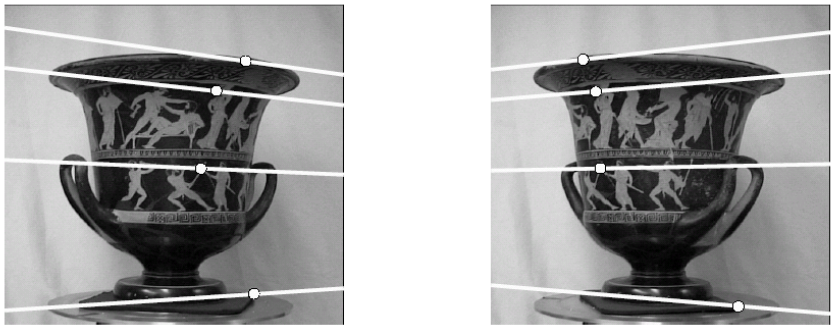
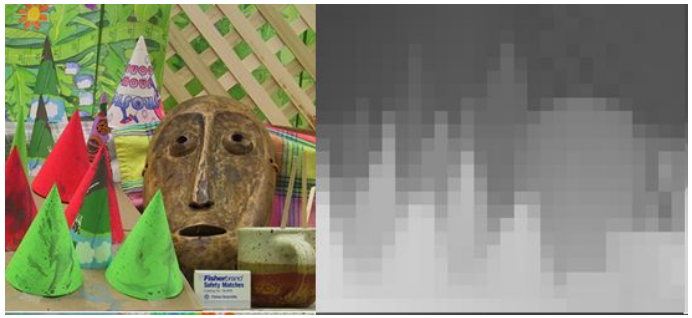


Hartley and Zisserman

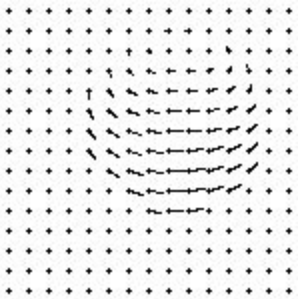
Multi-view geometry, stereo vision

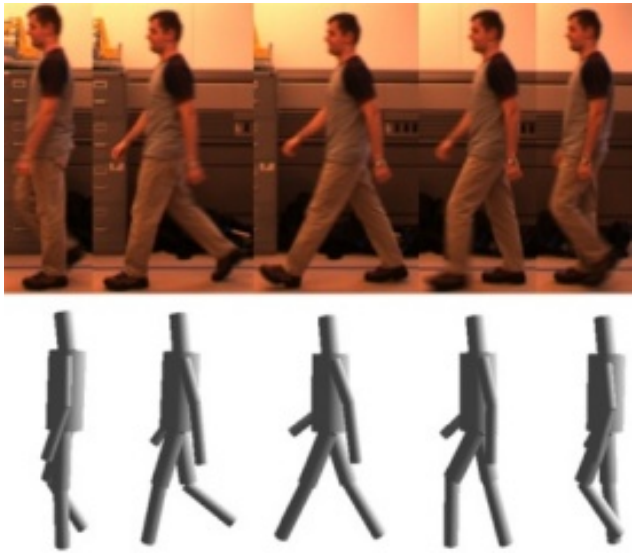


Slide credit: Kristen Grauman

Not covered: Video processing

Tracking objects, video analysis, low level motion, optical flow





Tomas Izo

Slide credit: Kristen Grauman

Plan for today

- Course overview
- **Introduction to computer vision research**
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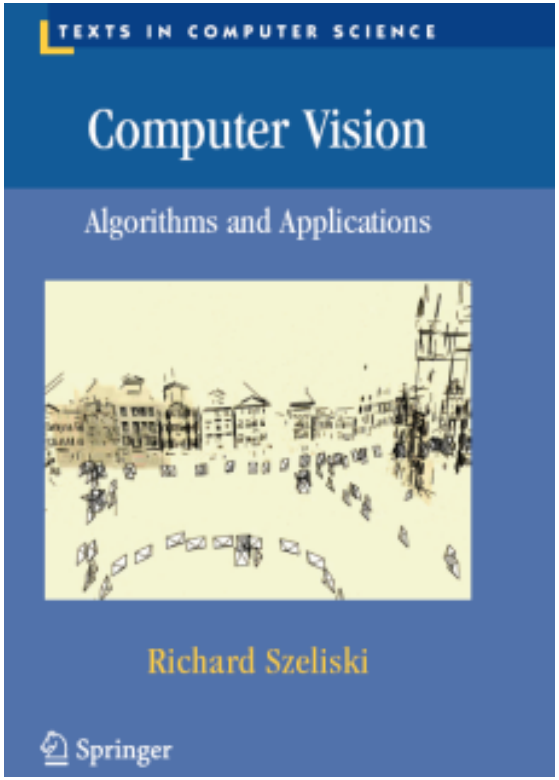
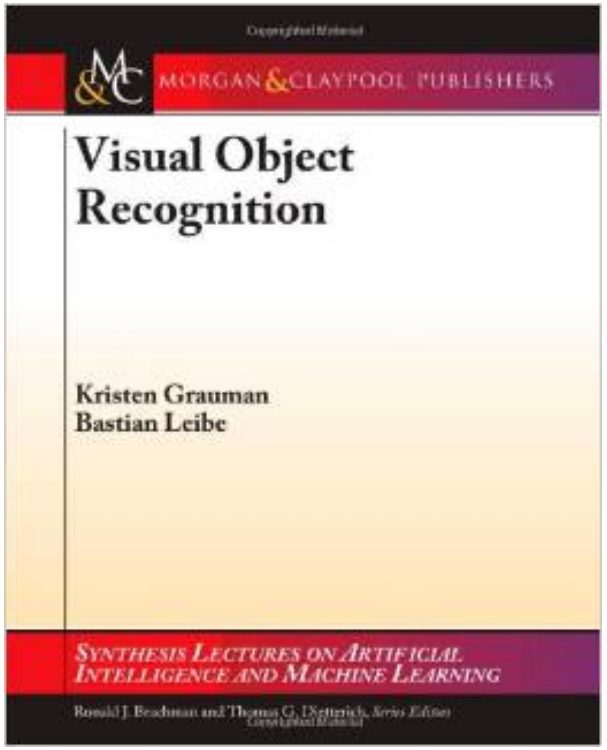
Textbooks



By Rick Szeliski

http://szeliski.org/Book/



By Kristen Grauman, Bastian Leibe

Visual Object Recognition

Requirements / Grading

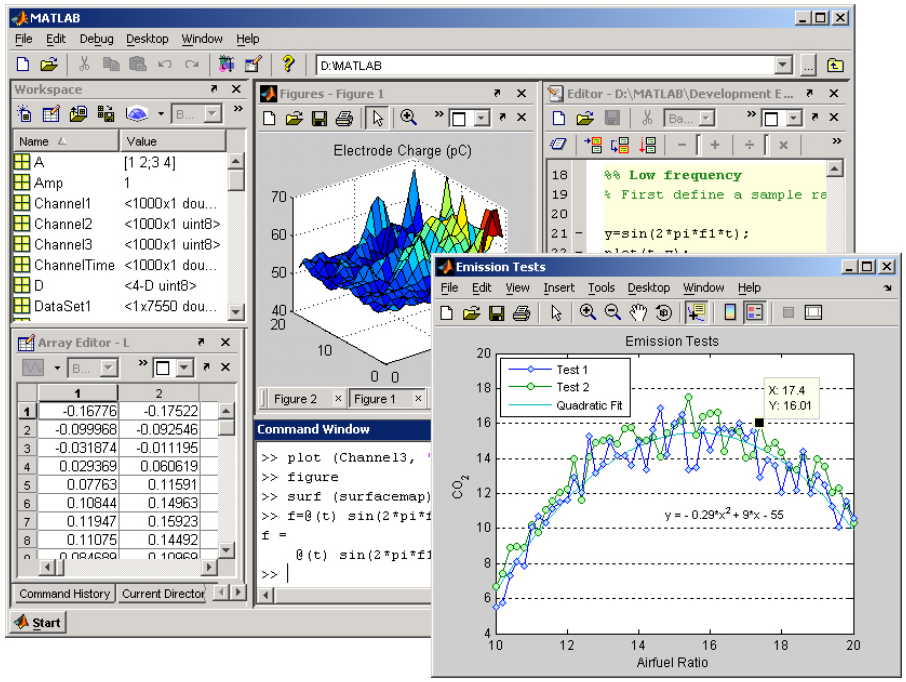
- Problem sets (60%)
- Final exam (37%)
  - comprehensive (cover all topics learned in class)
- Class and Piazza participation (3%)
  - Piazza: participation points for posting (sensible) questions and answers

Problem sets

- Some short answer concept questions
- Matlab programming problems
  - Implementation
  - Explanation, results
- Follow instructions; points will be deducted if we can't run your code out of the box
- Ask questions on Piazza first
- Submit to Canvas
- The assignments will take significant time to do
- Start early

- TA will go over problem set during discussion sections after release (others will be used as extra office hours)

Matlab



- Built-in toolboxes for low-level image processing, visualization
- Compact programs
- Intuitive interactive debugging
- Widely used in engineering

Slide credit: Kristen Grauman

Matlab

- CSIF labs 67, 71, 75 (pc1-pc60)
- Academic Surge 1044 and 1116
- Lab schedule (reservations) and remote access info found on class website

- Matlab available for free from campus software site

Problem Set 0

- Matlab warmup
- Basic image manipulation
- Out tonight, due 4/12

Preview of some problem sets

resize: castle squished

crop: castle cropped

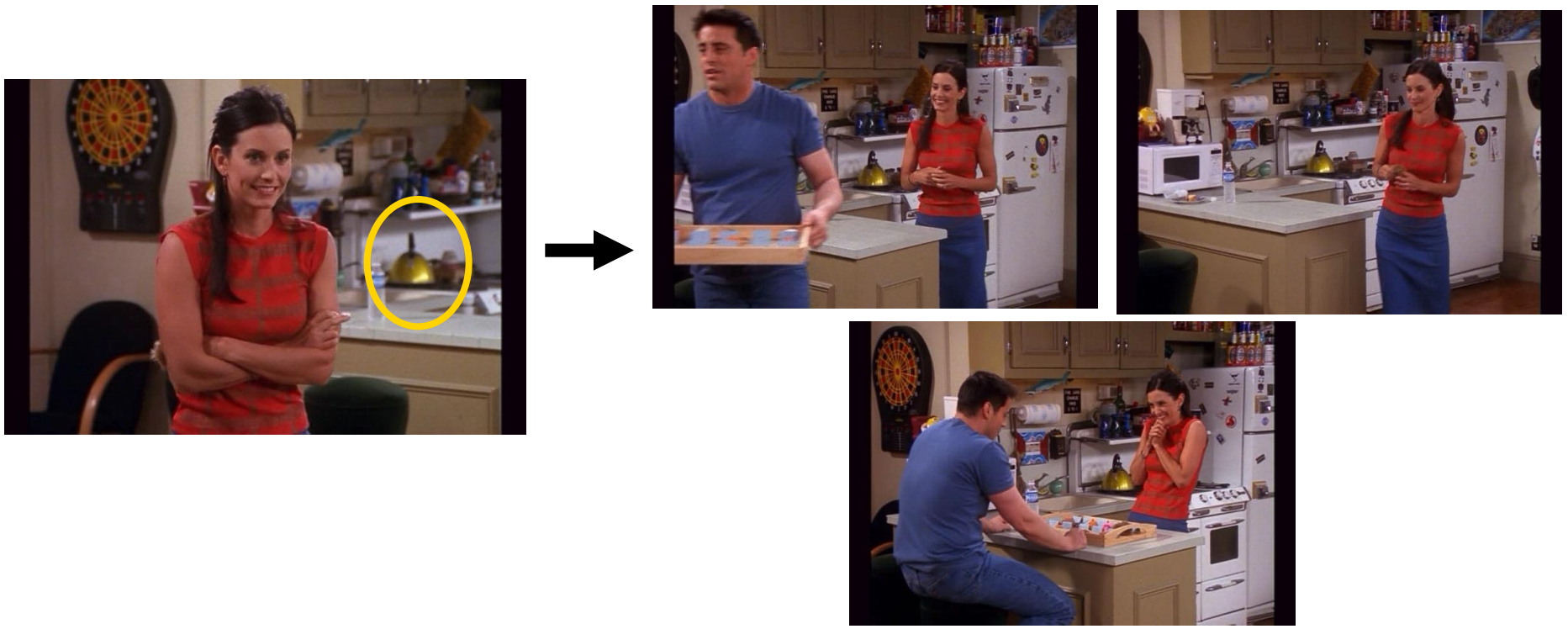
content aware resizing:

seam carving

Preview of some problem sets

Grouping

Preview of some problem sets



Object search and recognition

Problem set deadlines

- Problem sets due 11:59 PM
  - Follow submission instructions given in assignment
  - Submit to Canvas; no hard copy submissions
  - Deadlines are firm. We'll use Canvas timestamp. Even 1 minute late is late.

- Late submissions: 1 point deduction for every hour after the deadline up to 72 hours; after 72 hours, you will receive a 0

- If your program doesn't work, clean up the code, comment it well, explain what you have, and still submit. Draw our attention to this in your answer sheet.

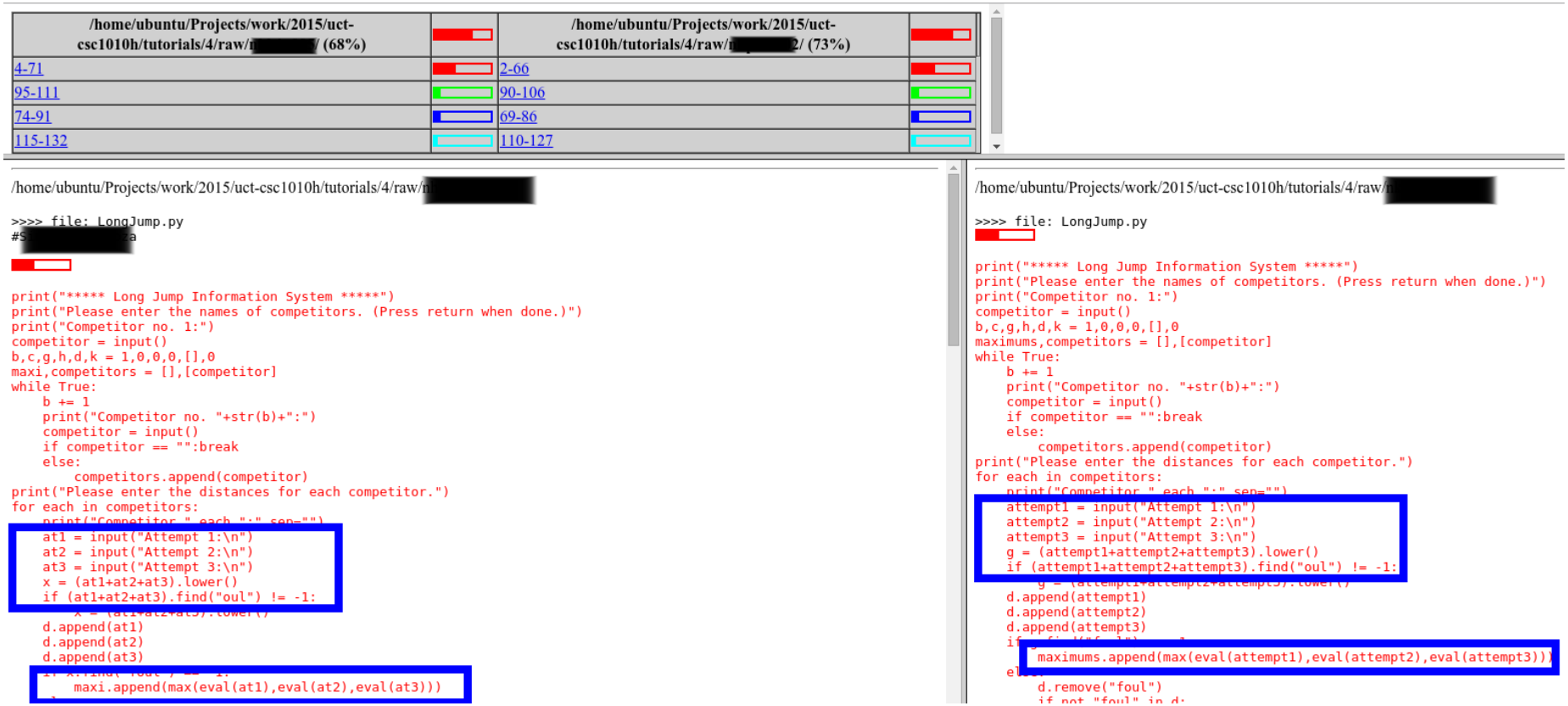
Collaboration policy

- **All responses and code must be written individually or in pairs (a group of 2)**

- Students submitting answers or code found to be identical or substantially similar (due to inappropriate collaboration) risk failing the course
  - We will be using MOSS to check for cheating!
  - Copying online solutions also counts as cheating!
  - Please don't cheat… you are going to get caught!

- Read and follow UC Davis code of conduct

MOSS



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4-71		2-66	
95-111		90-106	
74-91		69-86	
115-132		110-127	

/home/ubuntu/Projects/work/2015/uct-csc1010h/tutorials/4/raw/[redacted]

>>>> file: LongJump.py

#S[redacted]a

```
print("***** Long Jump Information System *****")
print("Please enter the names of competitors. (Press return when done.)")
print("Competitor no. 1:")
competitor = input()
b,c,g,h,d,k = 1,0,0,0,[],0
maxi,competitors = [],[competitor]
while True:
    b += 1
    print("Competitor no. "+str(b)+":")
    competitor = input()
    if competitor == "":break
    else:
        competitors.append(competitor)
print("Please enter the distances for each competitor.")
for each in competitors:
    print("Competitor " each ":" sep="")
    at1 = input("Attempt 1:\n")
    at2 = input("Attempt 2:\n")
    at3 = input("Attempt 3:\n")
    x = (at1+at2+at3).lower()
    if (at1+at2+at3).find("oul") != -1:
        x = (at1+at2+at3).lower()
    d.append(at1)
    d.append(at2)
    d.append(at3)
    if x.find("foul") == -1:
        maxi.append(max(eval(at1),eval(at2),eval(at3)))
```

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print("Please enter the names of competitors. (Press return when done.)")
print("Competitor no. 1:")
competitor = input()
b,c,g,h,d,k = 1,0,0,0,[],0
maximums,competitors = [],[competitor]
while True:
    b += 1
    print("Competitor no. "+str(b)+":")
    competitor = input()
    if competitor == "":break
    else:
        competitors.append(competitor)
print("Please enter the distances for each competitor.")
for each in competitors:
    print("Competitor " each ":" sep="")
    attempt1 = input("Attempt 1:\n")
    attempt2 = input("Attempt 2:\n")
    attempt3 = input("Attempt 3:\n")
    g = (attempt1+attempt2+attempt3).lower()
    if (attempt1+attempt2+attempt3).find("oul") != -1:
        g = (attempt1+attempt2+attempt3).lower()
    d.append(attempt1)
    d.append(attempt2)
    d.append(attempt3)
    if g.find("foul") == -1:
        maximums.append(max(eval(attempt1),eval(attempt2),eval(attempt3)))
    else:
        d.remove("foul")
        if not "foul" in d:
```

Miscellaneous

- Check class website regularly for assignment files, notes, announcements, etc.
- Come to lecture on time
- No laptops, phones, tablets, etc. in class please
- Please interrupt with questions at any time

Coming up

- Read the class webpage carefully
- Next class (Thurs): Matlab tutorial
- PS0 out tonight, due 4/12
- No office hours on Friday