Goals of Computer Vision

Get a computer to understand
Goal: Naming
Goal: Naming

The picture shows a building with many windows and grass in front of it. There is a person walking on the right...
Goal: 3D
Goal: Actions
Seems Obvious, Right?

• **Key concept to keep in mind throughout the course**: you see with both your eyes **and** your brain.
Why is it Hard?
Why is it Hard?
Goal of computer vision
Despite This, We’ve Made Progress

• Few of these problems are solved (and there are lots of dangers to pretending things are solved when they aren’t)

• But we do have systems with performance ranging from non-embarrassing to super-human (with the right caveats)
Look at Your Phone

Graphics

https://affinelayer.com/pixsrv/

Isola et al. *Image-to-Image Translation with Conditional Adversarial Networks*. CVPR 2017
Recognition

Video Credit: Karol Majek (https://www.youtube.com/watch?v=OOT3UIXZztE)
3D

Administrivia

- Waitlist
- Prerequisites
- Websites
- Textbook
- Evaluation
- Academic Integrity
Meetings

• Class:
  • Mon/Wed 5:30pm – 7pm, 1571 GGBL

• Discussion Sections
  • Thursday 4:00PM - 5:00PM, 1018 DOW
  • Friday 10:30AM - 11:30AM, 1200 EECS
  • Friday 12:30PM - 1:30PM, 1012 FXB

• Office Hours
  • Five office hours!
  • Show up with a concrete question
General Advice

• Lectures are recorded and you can show up or not – you’re all adults.

• You can also eat ice cream for every meal until you develop scurvy. This is one of the difficulties of being an adult

• Falling behind in this class is really not fun. Don’t fall behind.
Doing Well

• Study and work in groups. I’ve made a thread for this. Read the syllabus for what’s allowed.
• Invest in learning how to debug well early on.
• Start early.
• Read the tips.
• If you’re mathematically far behind, you’re going to have a bad time.
• Some fraction will be head-bangingly difficult and not fun, but not all learning is fun.
Waitlist Policy

• The waitlist is huge. I am limited by room capacity and ability to hire course staff

• Policies:
  • I do not reorder the waitlist –this leads to me making arbitrary decisions with limited information
  • If you are a MS, there are no more slots. Take 442 next semester, or 504 next semester
Prerequisites

You **absolutely** need: EECS 281 and corresponding programming ability.

You will **struggle continuously** without: Basic knowledge of linear algebra, calculus. Linear algebra is a prerequisite for future iterations. I will teach a two-class refresher course in it.

You’ll have to learn: Numpy+PyTorch, a little tiny bit of continuous optimization
Prerequisites

Suppose $K$ in $\mathbb{R}^{3\times3}$, $x$ in $\mathbb{R}^3$. Should know:

- How do I calculate $Kx$?
- When is $K$ invertible?
- What is $x$ if $Kx = \lambda x$ for some $\lambda$?
- What’s the set $\{y: x^Ty = 0\}$ geometrically?

You should also be able to remember some notion of a derivative
Websites

• Course website:  
  http://web.eecs.umich.edu/~fouhey/teaching/ECS442_F19/

• Piazza:  
  https://piazza.com/umich/fall2019/eecs442/

• We’ll be using Piazza for all communication apart from canvas for code submission and gradescope for writeup submission. Sign up
Piazza

• Please ask questions on Piazza so we can answer the question once, officially, and quickly
• We will monitor Piazza in a systematic way, but we do not guarantee instant response times
• Same goes for email
Textbooks

No textbook, but Szeliski, *Computer Vision: Algorithms and Applications*, is a good reference and available online.

http://szeliski.org/Book/
Evaluation

• Practicals assignment (5%) – make all your mistakes in a low-stakes setting.

• Homework (6x10%) – six mini-project homeworks with a writeup

• Project (5%+10%+20%) – a semester-long project done in a team
Evaluation: Homework Late Policy

• Penalty: 1% per hour, rounded to nearest
• Example:
  • Due: Midnight Mon. (1s after 11:59:59pm Mon)
  • Submitted at 12:15am Tue: No penalty!
  • Submitted at 6:50am Tue: 7% penalty (specifically 90% -> 83%)
• Exceptions only for exceptional circumstances.
• Everyone gets 72 free late hours, applied automatically
Copying: Better Options Exist

• Read the syllabus – it pays
• Copying is usually *painfully* obvious and I don’t have many options
• Submit it late (*that’s why we have late days*), half-working (*that’s why we have partial credit*), or take the zero on the homework – I guarantee you won’t care about one bad homework in a year
• If you’re overwhelmed, talk to us
Evaluation: Term Project

• Work in a team of 3-5 to do *something cool*
• There will be a piazza thread for pairing up
• Could be:
  • Applying vision to a problem you care about
  • Independent re-implementation of a paper
  • Trying to build and extend an approach
• Should be 2 homeworks worth of work per person