



# Computer vision

# Computer Vision

## Lecture 1: Introduction

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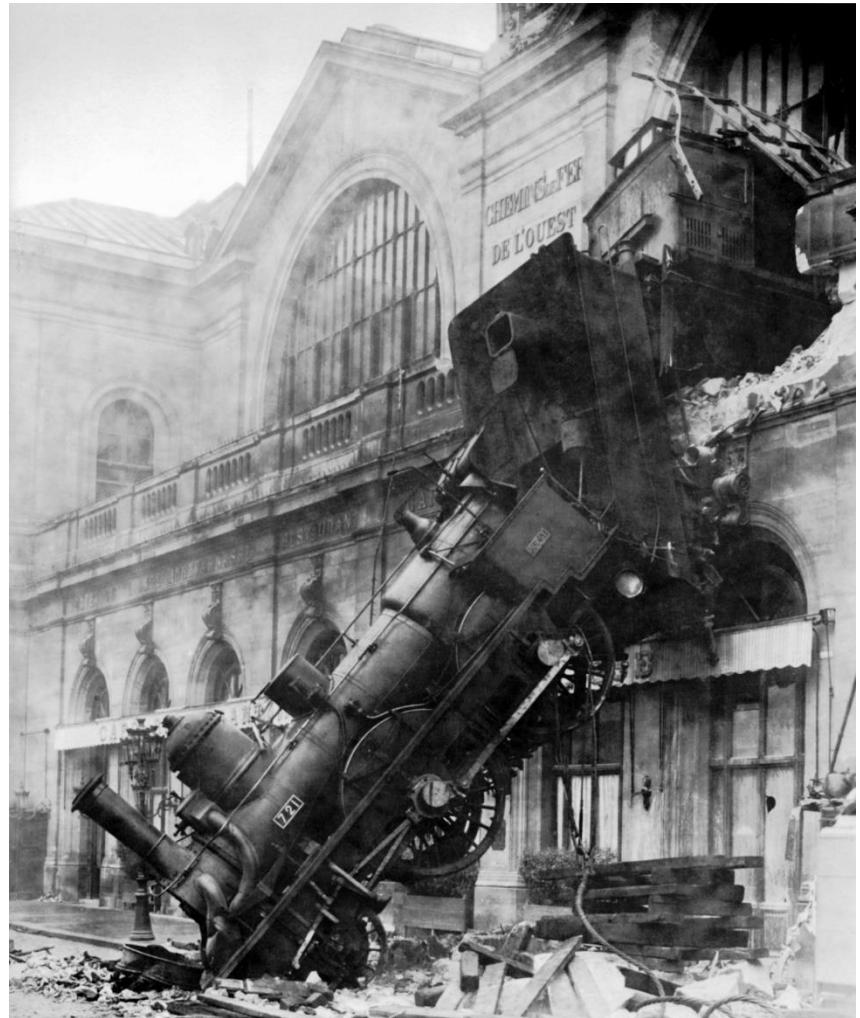
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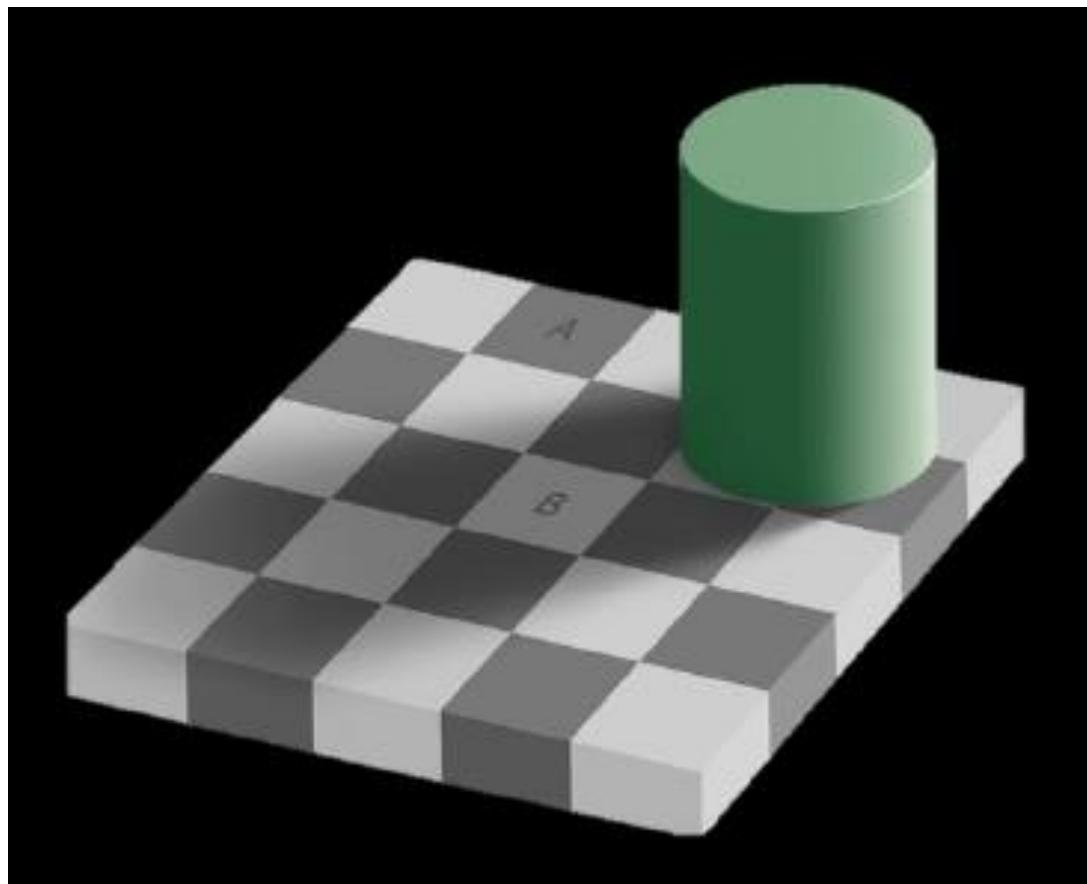
# What is Computer Vision

- It is about interpreting and analyzing the scene

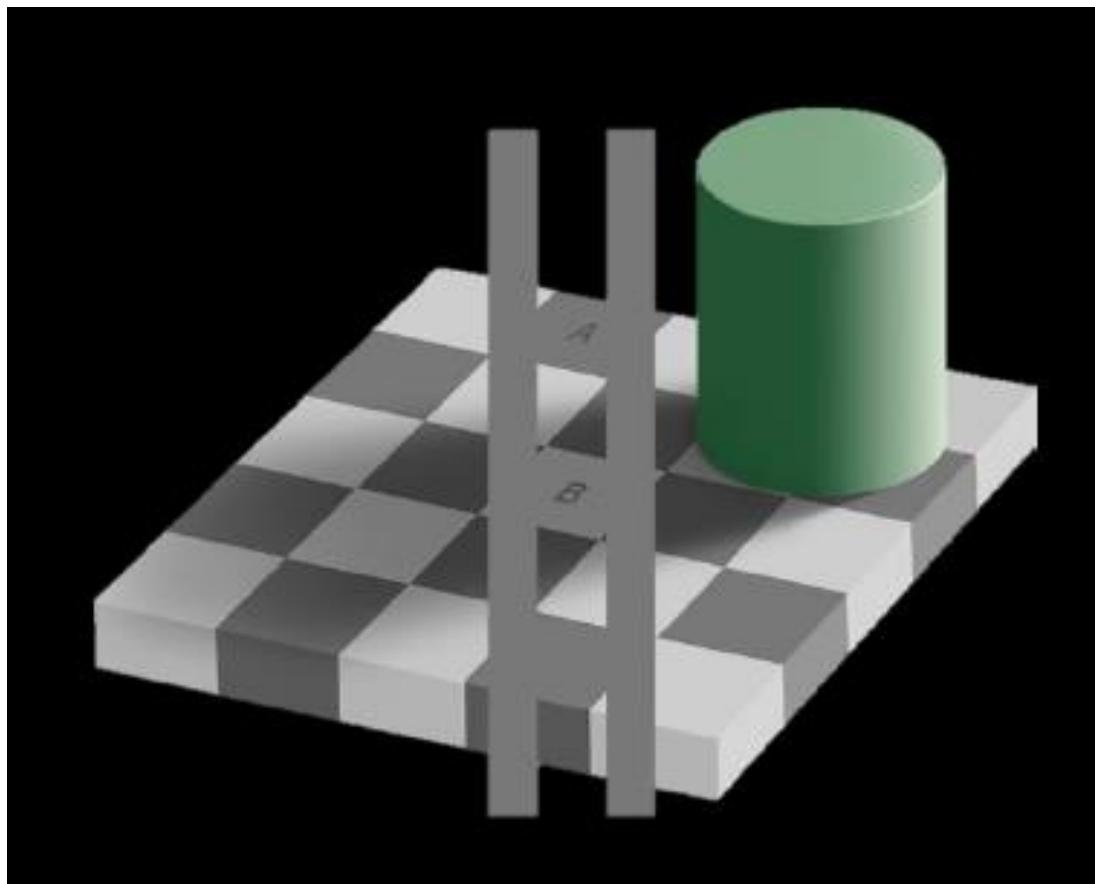
(Scene Understanding)



# Why is this hard?



# Why is this hard?



# Why is this hard?

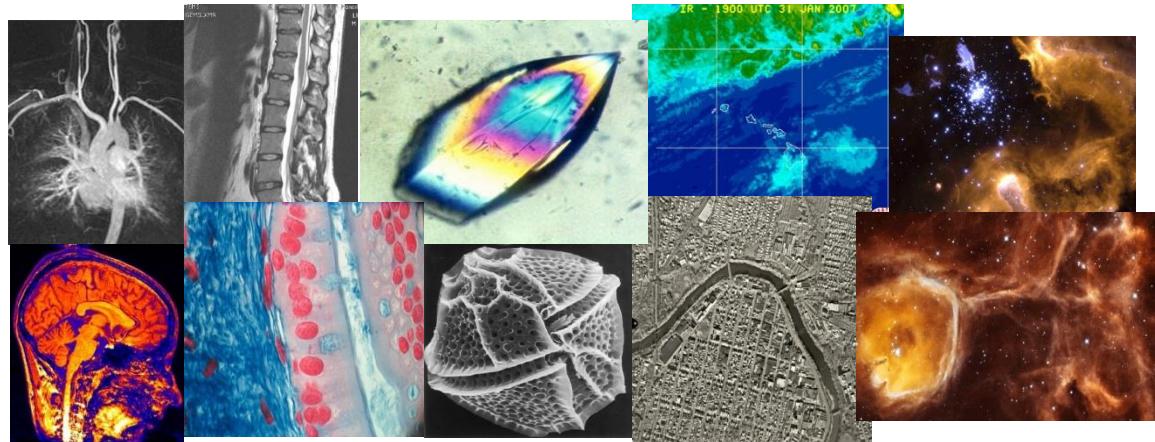


# Vision is NOT Image Processing

- In the previous example, the two squares have exactly the same *measurement* of intensity.
- So, seeing is not the same as measuring properties in the image.
- Rather, “seeing” is building a *percept* of what is in the world based upon the measurements made by an imaging sensor.

# Why study Computer Vision?

- Vision is useful: Images and video are everywhere!



Surveillance and security

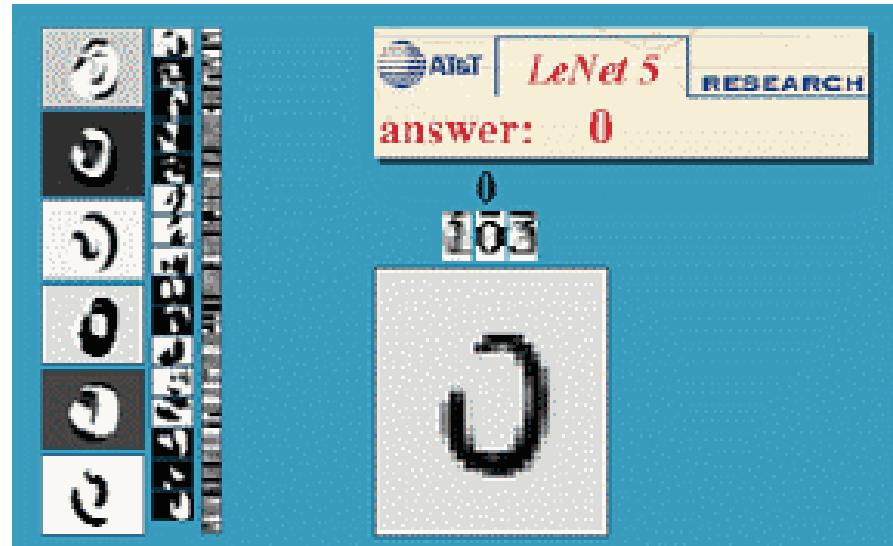
Medical and scientific images

# What CV is for?

Optical Character Recognition (OCR)



License plate readers



Handwritten Digit recognition

# Face Detection



# Face Recognition



# Posing Visual Queries



# Finding Visually Similar Objects

ALL SHOES BAGS WOMEN'S APPAREL MEN'S APPAREL KIDS ACCESSORIES JEWELRY & WATCHES HOME & FASHION

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An easy-to-wear open-toe features a soft leather upper with a subtle pebbled texture and a matching platform. COLOR: BLACK, TAN, DARK CHOCOLATE, WHITE, WITH A PEWTER, BLACK, GOLD, SILVER, PATENT, LEATHER. BRAND: NINE WEST. DESIGNER: NINE WEST. MATERIAL: LEATHER. SIZE: 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 10.5, 11, 11.5, 12, 12.5, 13, 13.5, 14, 14.5, 15, 15.5, 16, 16.5, 17, 17.5, 18, 18.5, 19, 19.5, 20, 20.5, 21, 21.5, 22, 22.5, 23, 23.5, 24, 24.5, 25, 25.5, 26, 26.5, 27, 27.5, 28, 28.5, 29, 29.5, 30, 30.5, 31, 31.5, 32, 32.5, 33, 33.5, 34, 34.5, 35, 35.5, 36, 36.5, 37, 37.5, 38, 38.5, 39, 39.5, 40, 40.5, 41, 41.5, 42, 42.5, 43, 43.5, 44, 44.5, 45, 45.5, 46, 46.5, 47, 47.5, 48, 48.5, 49, 49.5, 50, 50.5, 51, 51.5, 52, 52.5, 53, 53.5, 54, 54.5, 55, 55.5, 56, 56.5, 57, 57.5, 58, 58.5, 59, 59.5, 60, 60.5, 61, 61.5, 62, 62.5, 63, 63.5, 64, 64.5, 65, 65.5, 66, 66.5, 67, 67.5, 68, 68.5, 69, 69.5, 70, 70.5, 71, 71.5, 72, 72.5, 73, 73.5, 74, 74.5, 75, 75.5, 76, 76.5, 77, 77.5, 78, 78.5, 79, 79.5, 80, 80.5, 81, 81.5, 82, 82.5, 83, 83.5, 84, 84.5, 85, 85.5, 86, 86.5, 87, 87.5, 88, 88.5, 89, 89.5, 90, 90.5, 91, 91.5, 92, 92.5, 93, 93.5, 94, 94.5, 95, 95.5, 96, 96.5, 97, 97.5, 98, 98.5, 99, 99.5, 100, 100.5, 101, 101.5, 102, 102.5, 103, 103.5, 104, 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# Finger Print Recognition



# Object Recognition (in supermarkets)



# Amazon Go



# Object Recognition (in mobile devices)



# Special Effects

**Shape Capture**



The Matrix movies, ESC Entertainment

**Motion Capture**

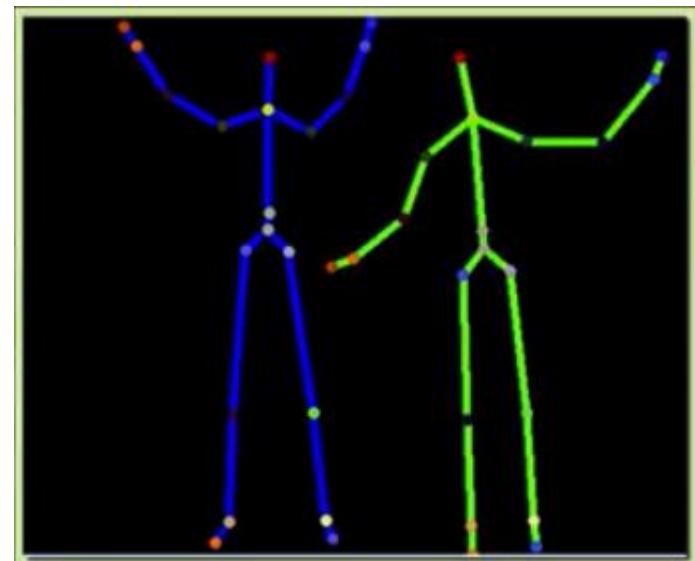


*Pirates of the Caribbean*  
Industrial Light and Magic

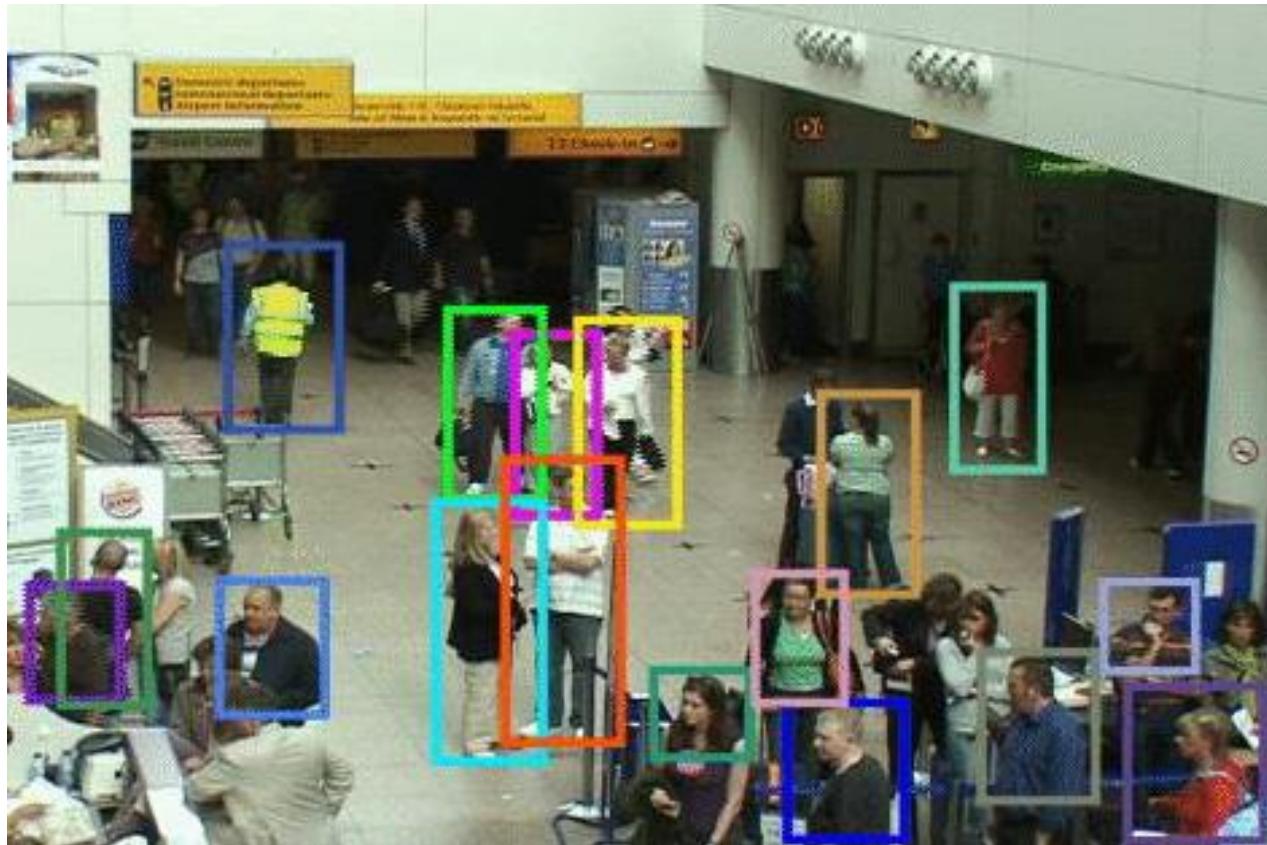
# Vision-based Interaction (and games)



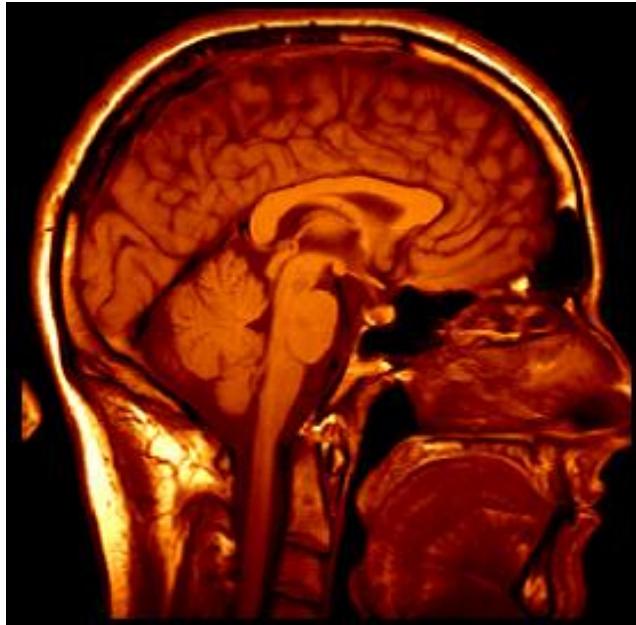
KINECT  
for XBOX 360 Windows



# Security and Surveillance



# Medical Imaging



3D imaging  
MRI, CT



Image guided surgery  
Grimson et al., MIT

# Augmented Reality



# Virtual Reality

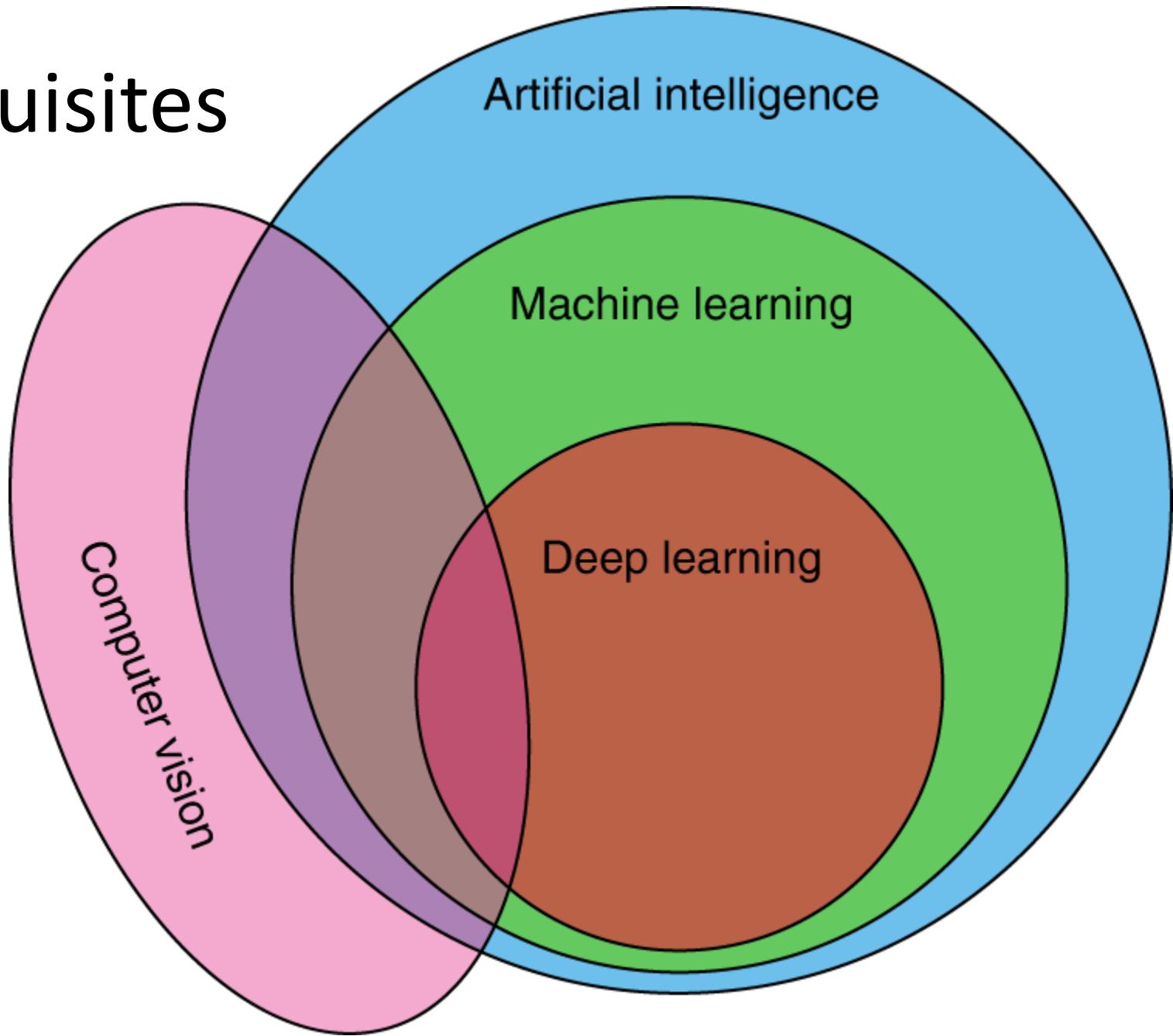


@DamJess

# Self-driving Cars



# Perquisites



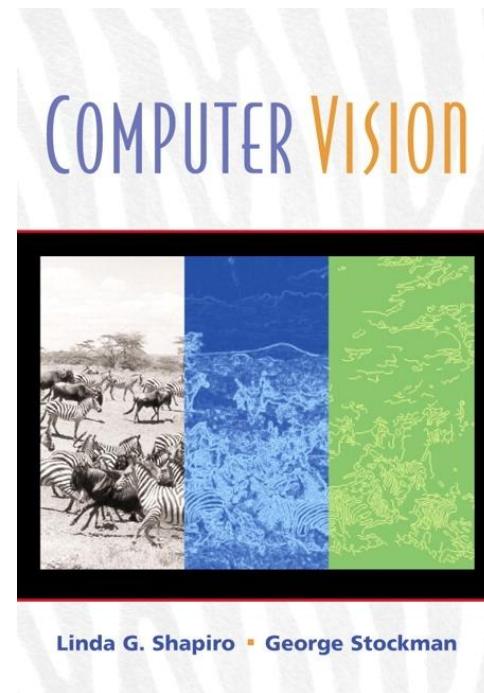
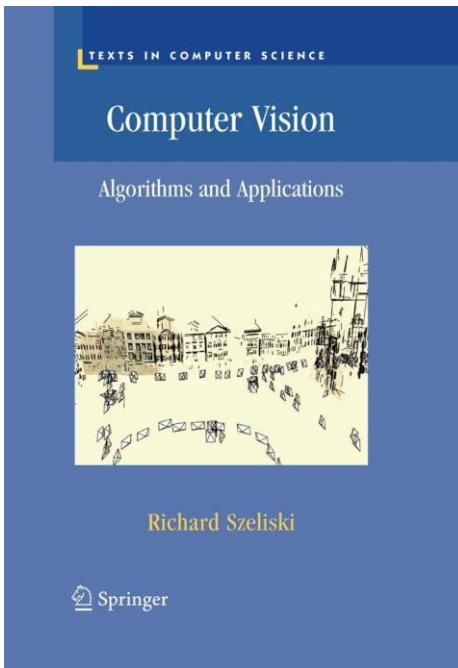
# Material

- Basic Courses:
  - CS 6476 “Introduction to Computer Vision” by University of Georgia Tech - (Udacity)  
<https://www.udacity.com/course/introduction-to-computer-vision--ud810>
  - CS131 “Computer Vision: Foundations and Applications” by University of Stanford (Fall 2019)  
[http://vision.stanford.edu/teaching/cs131\\_fall1920/](http://vision.stanford.edu/teaching/cs131_fall1920/)

# Material

- Advanced Courses:
  - “Advanced Machine Learning Specialization” by National Research University Higher School of Economics, Russia – (*Coursera*)  
Course 5: Deep Learning in Computer Vision – (5 weeks)  
<https://www.coursera.org/specializations/ml>
  - CS231n “Convolutional Neural Networks for Visual Recognition”  
- University of Stanford
    - <http://cs231n.stanford.edu/>
    - <https://www.youtube.com/playlist?list=PLC1qU-LWwrF64f4QKQT-Vg5Wr4qEE1Zxk>
  - CAP5415 “Computer Vision” University of Central Florida, Center of Research in Computer Vision (UCF CRCV), Fall 2020
    - <https://www.crcv.ucf.edu/courses/cap5415-fall-2020/schedule/?fbclid=IwAR3xx4xKMCJPtdXLu0ahM8xBtojMYux9eSjJT1vhvG3oSM1hlx-wUWUS9CQ>
    - [https://www.youtube.com/watch?v=LLRx2anvn1E&list=PLd3hISJsX\\_Ikm5il1HgmDB\\_z62BeoikFX](https://www.youtube.com/watch?v=LLRx2anvn1E&list=PLd3hISJsX_Ikm5il1HgmDB_z62BeoikFX)

# Source Books



- [http://szeliski.org/Book/drafts/SzeliskiBook\\_20100903\\_draft.pdf](http://szeliski.org/Book/drafts/SzeliskiBook_20100903_draft.pdf)
- **Szeliski, Computer Vision, Algorithms and Applications, 2010.**
- <ftp://91.193.236.10/pub/docs/linux-support/computer%20science/computer%20vision/Computer%20Vision%20-%20Linda%20Shapiro.pdf>
- **Shapiro and Stockman, Computer Vision, 2001.**

# Course Syllabus

1. Introduction
2. Features
3. Object Recognition
4. Object Detection
5. Image Segmentation
6. Video Analysis
  - Motion Estimation (Optical Flow)
  - Object Tracking & Activity Recognition
7. Image Generation

# Grades

- Year Work 35%
    - Midterm (10)
    - Lab Hands-on + Assignments
    - Practical/Project
  - Final 65%
- 