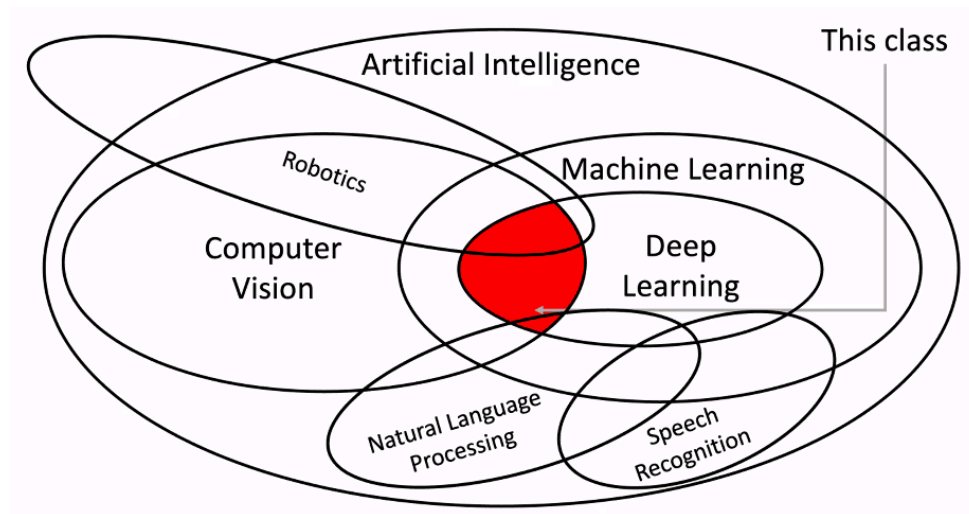


# Lecture 1- Introduction

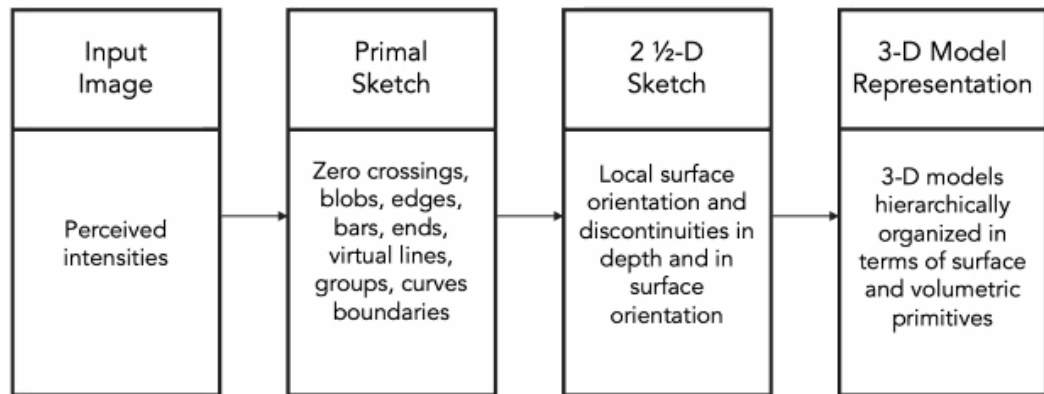
- **Deep Learning for Computer Vision**

- Computer Vision: Building artificial systems that process, perceive, and reason about visual data
- Learning: Building artificial systems that learn from data and experience
- Deep Learning: Hierarchical learning algorithms with many “layers”, (very) loosely inspired by the brain

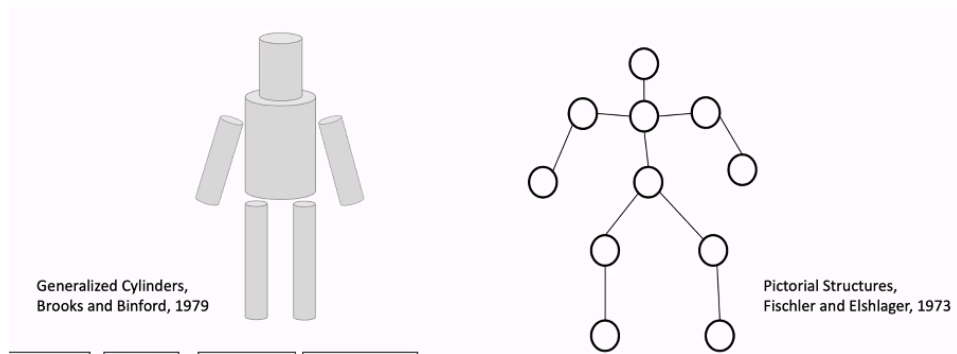


- **Vision History**

- Hubel 1959: edges are important in vision stimulus
- Larry Roberts 1963: differentiate an image and extract features, then use **feature points** to reconstruct the picture
- David Marr 1970s: **layered procedure** --> blueprint pipeline for computer vision systems



- Generalized Cylinders 1979: recognition via **Parts** --> recognize people

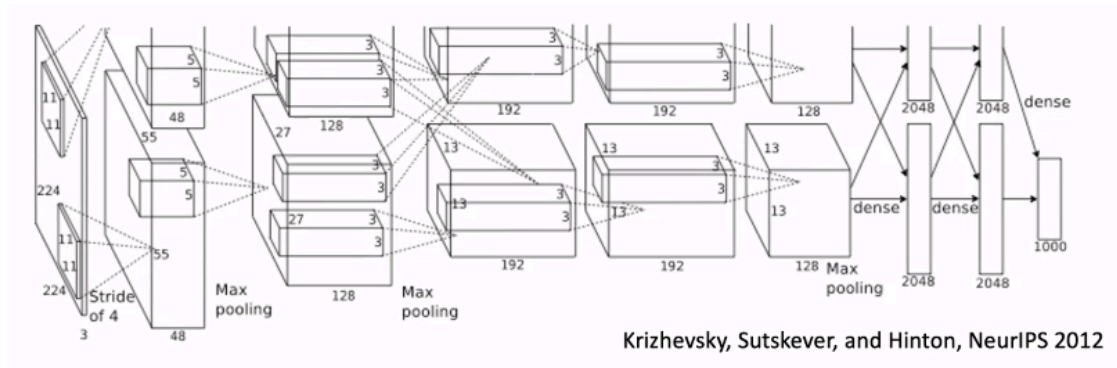


- John Canny 1986: recognition via **Edge Detection** --> template matching
- Normalized cuts 1997: recognition via **Grouping** --> match the object into the images (group pixels into clusters)
- SIFT 2000s: Recognition via **Matching** --> recognize key points in the image --> write little visual descriptor --> even the camera moves or conditions change, key points are the same

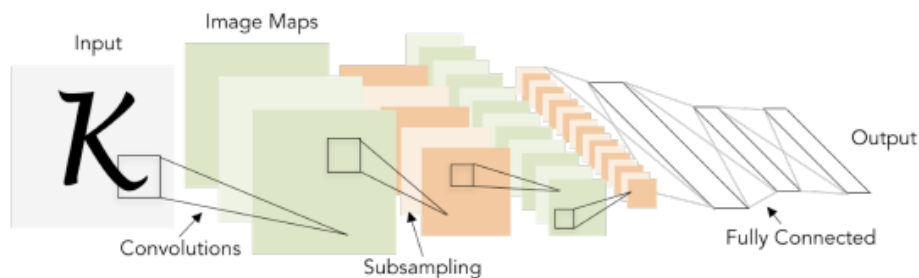


- Viola and Jones 2001: Face Detection --> first successful application

- PASCAL 2007: Visual Object Challenge (object detection) --> set up standardized benchmarks (dataset, metrics)
- IMAGENET 2009: image classification challenge
- AlexNet 2012: deep neural network **[Deep Learning Breakthrough]**



- Deep Learning History
  - **Perceptron** 1958: One of the earliest algorithms that could learn from data, implemented in hardware --> **linear classifier**
  - Neocognitron: Fukushima 1980
  - **Backpropagation** 1986: compute gradients in neural networks --> Successfully trained perceptrons with multiple layers
  - **Convolutional Networks**: Lecun et al, 1998



### Algorithm + Data + Computation

- CV can Cause Harm
  - Harmful stereotypes
  - Affect people's life
  - Find the motive, physics and logics of the story behind an image