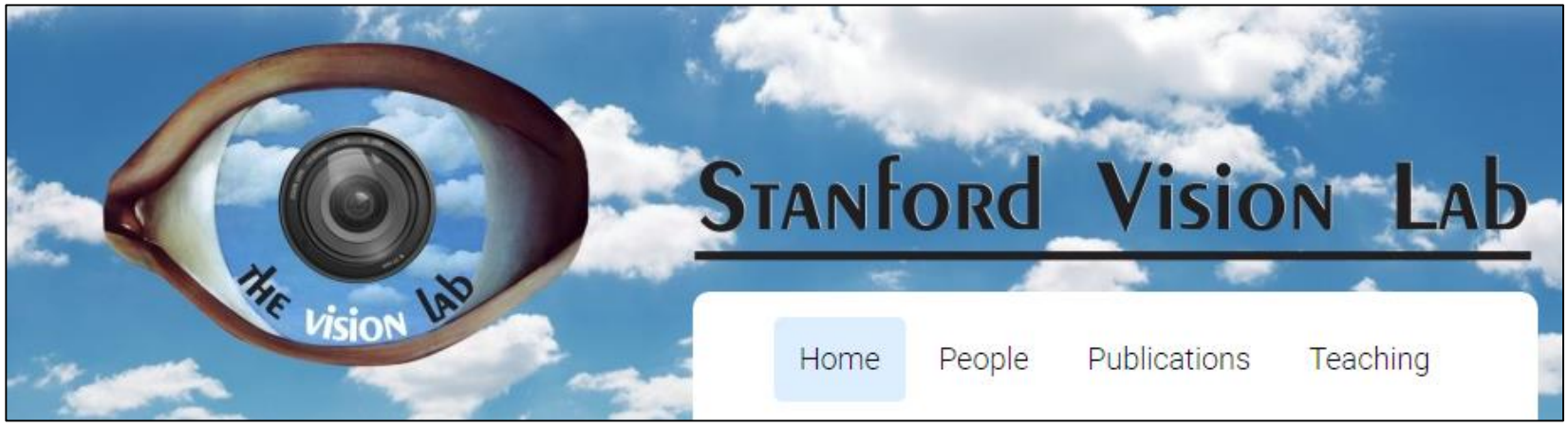
Introduction

Data Science & Business Analytic Lab

KyoungHyun Mo

CS231n Vision history

Stanford Vision Lab



Fei-Fei Li

Andrej Karpathy

Justin Johnson

Fei-Fei Li

class : 1

Introduction

Andrej Karpathy

class : 2~7, 9~10, 14

Linear Classification, Optimization, Neural Networks, Convolutional Neural Network, Visualization, Recurrent Neural Network

Justin Johnson

class : 8, 11~13

Localization and Detection, Deep Learning libraries, Segmentation, Unsupervised Learning

Jeff Dean

class : 15

Invited Talk

CS231n focuses on one of the most important problems of **visual recognition**, especially **image classification**

Visual recognition problem

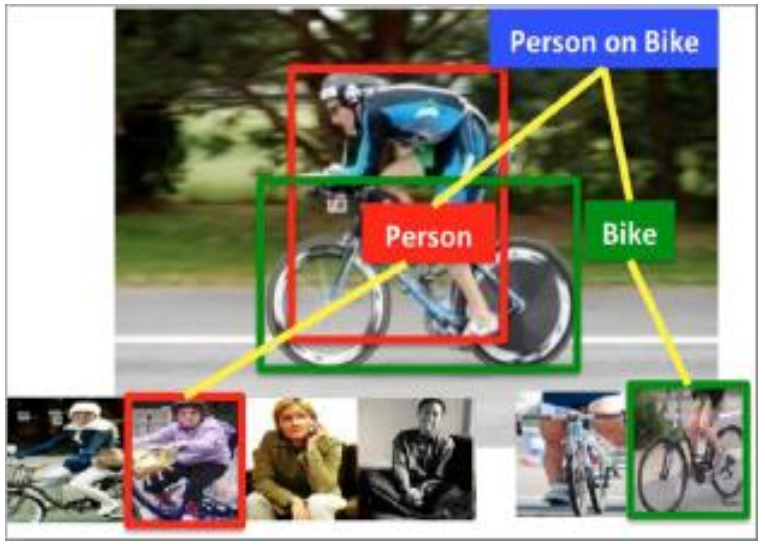
- Image classification
- 3D modeling
- Grouping
- Segmentation

Image classification focus on the **whole big image**

There is a number of visual recognition problems that are related to image classification, such as **object detection**, **image captioning**

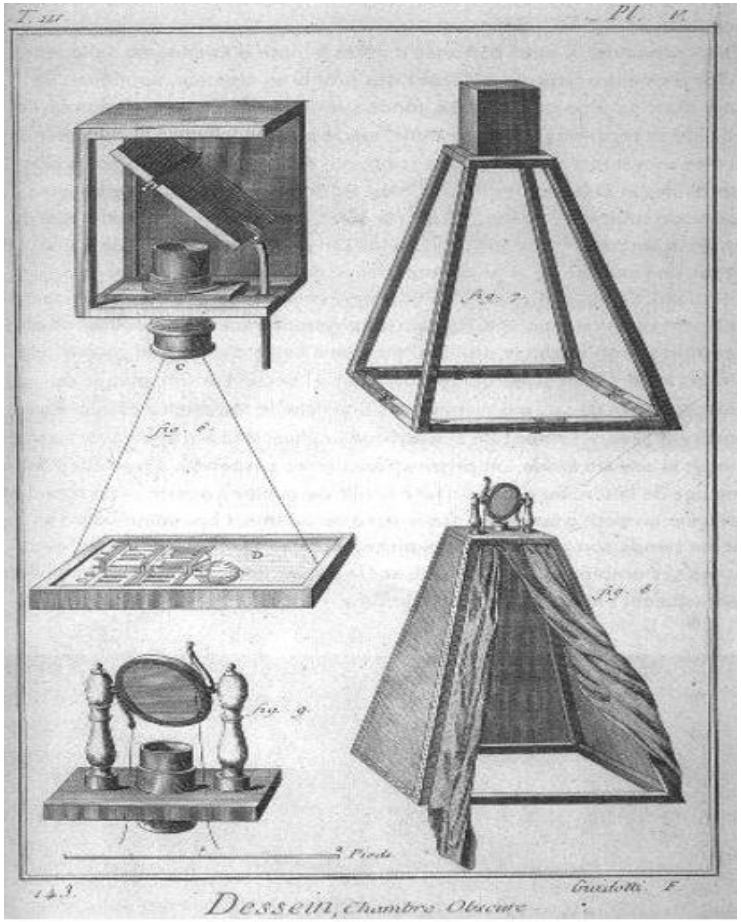
Object Detection

Image Captioning



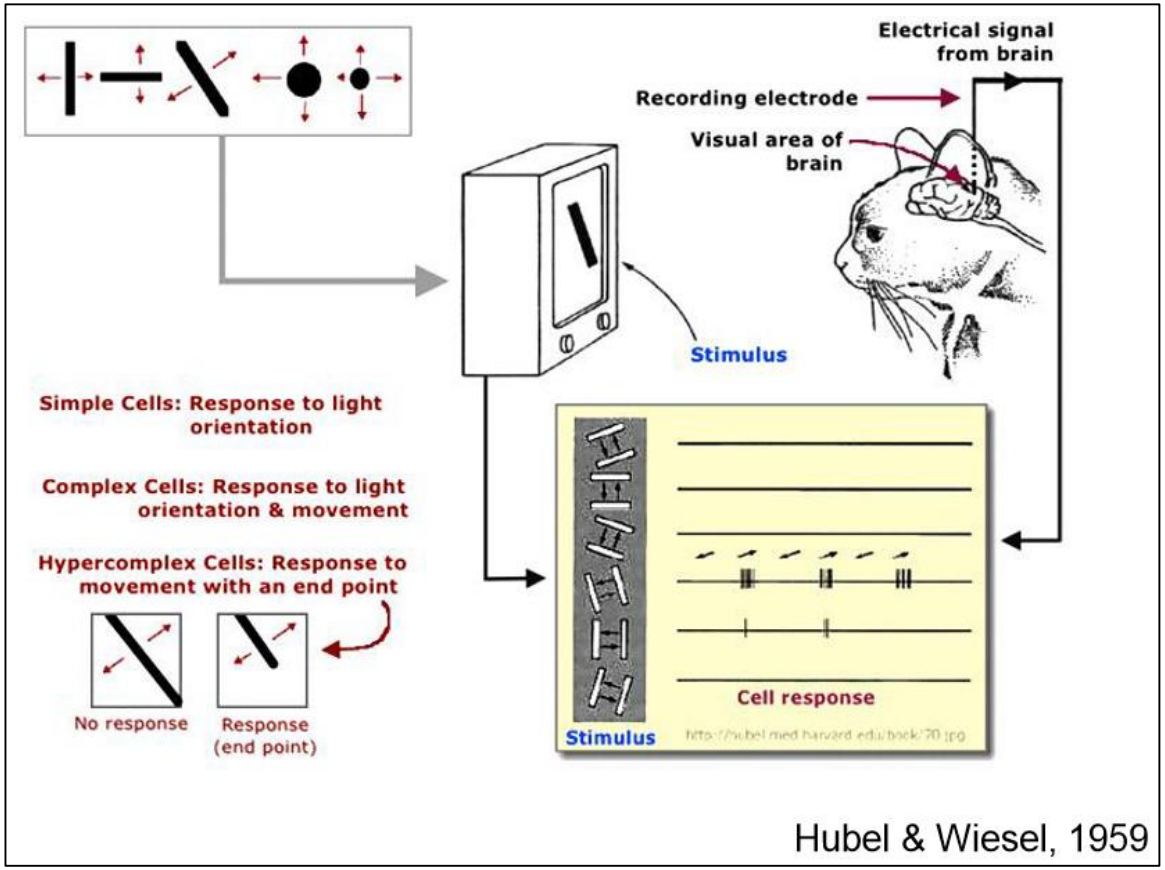
Vision History

- 생명체에 Vision Capacity가 생김
- Leonardo da Vinci의 카메라 모델로 engineering vision이 시작



Vision History

- 생물학적 Vision Processing에 대한 의문
- Hubel & Wiesel의 실험
- Vision Processing의 첫 단계는 심플한 구조에 뉴런이 반응을 한다

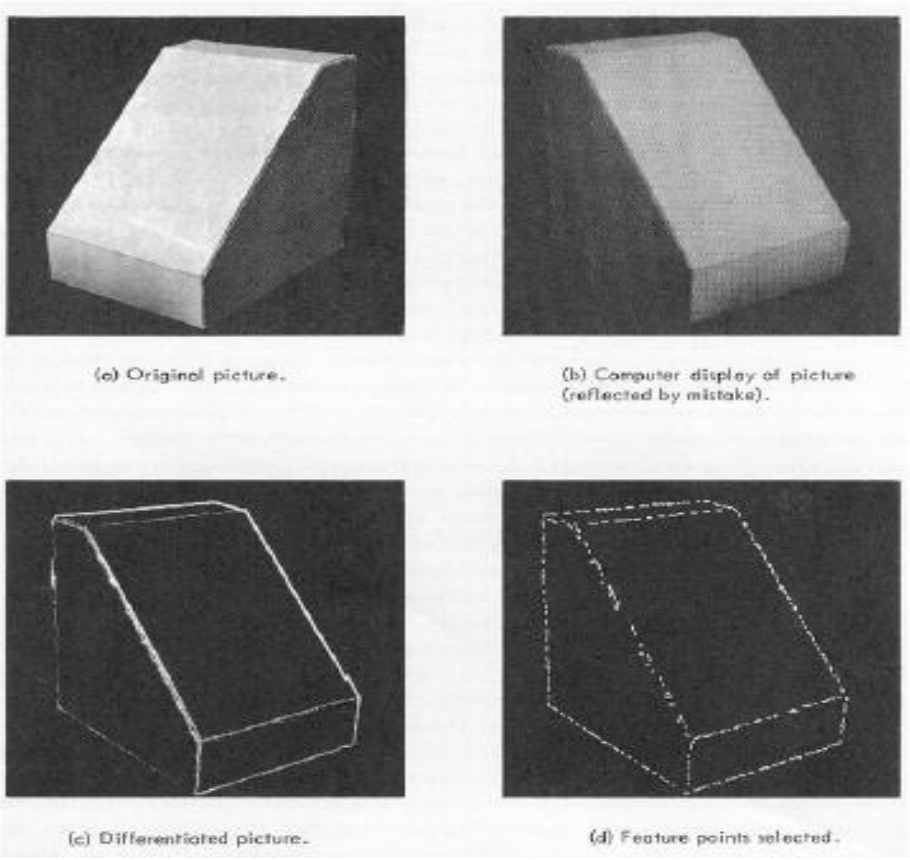


Vision History

- 1963년 Larry Roberts의 Object의 Edge를 추출하는 실험
- Edge는 어떤 Interior보다 Object의 Shape를 정확히 정의할 수 있음

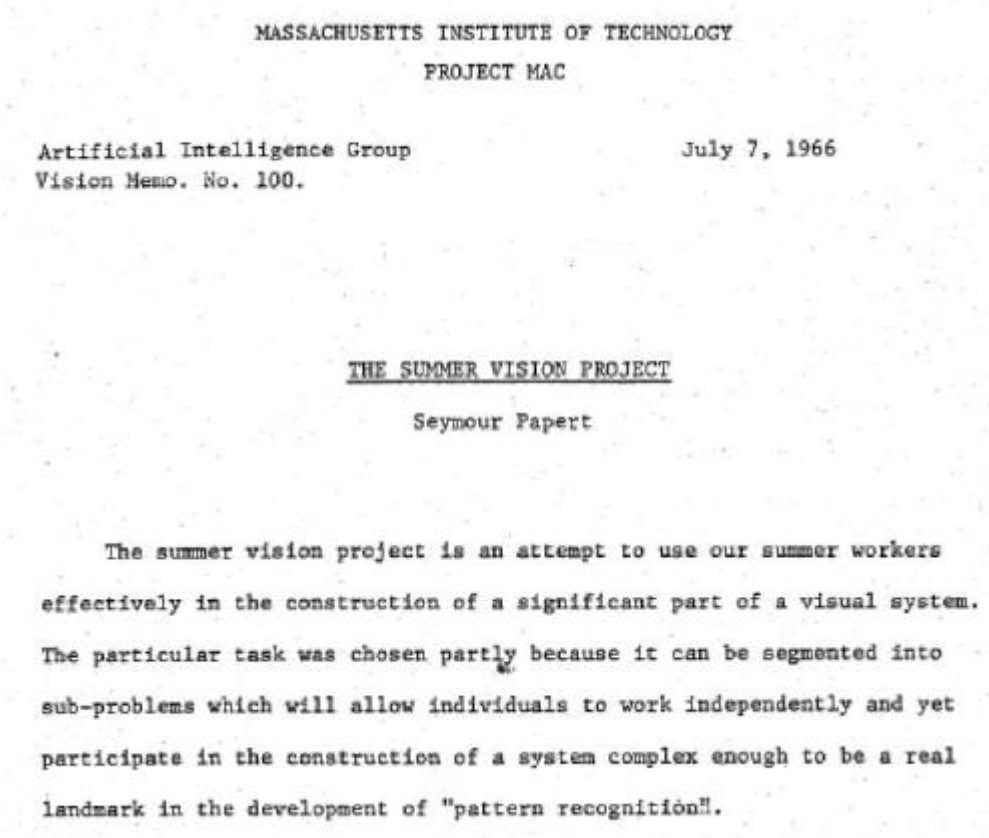
Block world

Larry Roberts, 1963



Vision History

- 1960년 First AI Lab (MIT의 Marvin Minskey / Stanford의 John McCarthy)
- 1966년 Artificial Intelligence Lab
- The Summer Vision Project부터 시작하여 CVPR, ICCV 등 유명학 학회로 발전



MASSACHUSETTS INSTITUTE OF TECHNOLOGY
PROJECT MAC

Artificial Intelligence Group
Vision Memo. No. 100.

July 7, 1966

THE SUMMER VISION PROJECT

Seymour Papert

The summer vision project is an attempt to use our summer workers effectively in the construction of a significant part of a visual system. The particular task was chosen partly because it can be segmented into sub-problems which will allow individuals to work independently and yet participate in the construction of a system complex enough to be a real landmark in the development of "pattern recognition".

CVPR 2017

ABOUT

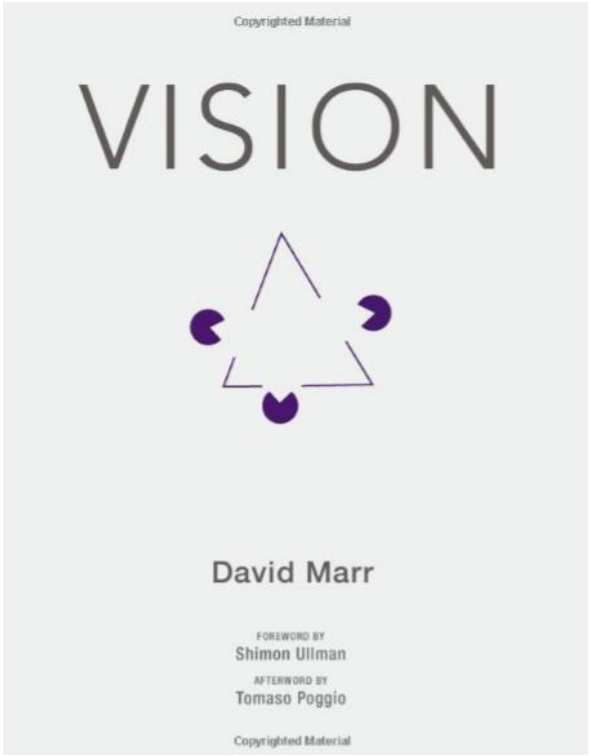
CVPR is the premier annual computer vision event comprising the main conference and several co-located workshops and short courses. With its high quality and low cost, it provides an exceptional value for students, academics and industry researchers.

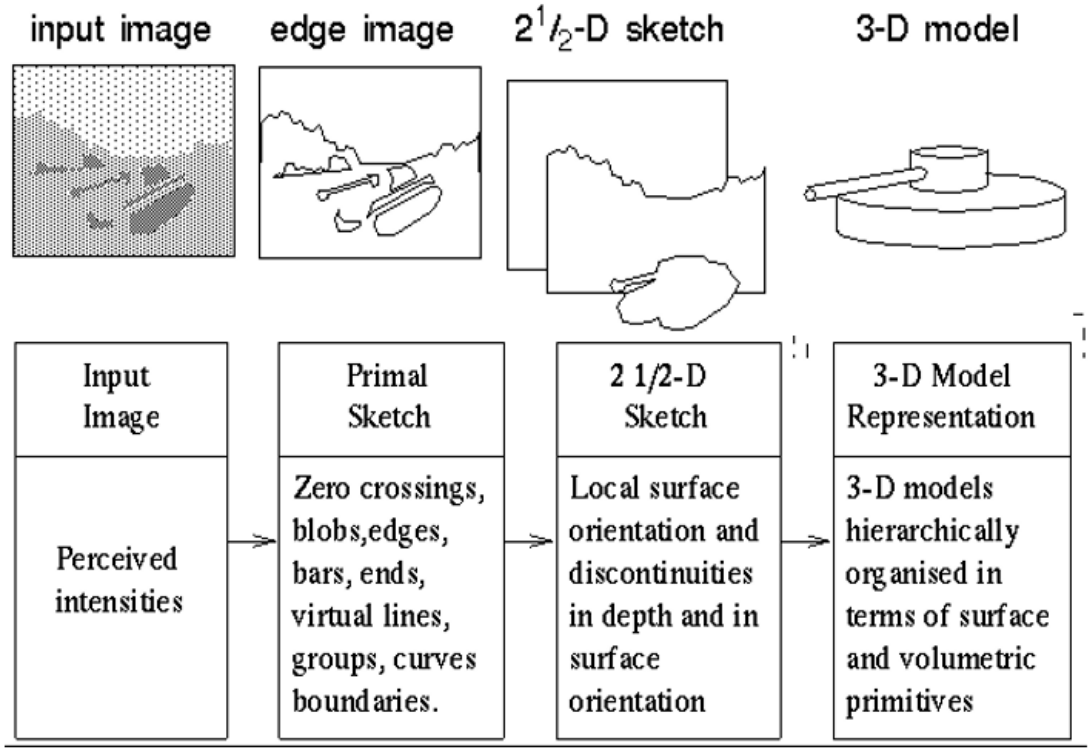
ICCV 17

ICCV is the premier international computer vision event comprising the main conference and several co-located workshops and tutorials. With its high quality and low cost, it provides an exceptional value for students, academics and industry researchers.

Vision History

- Computer Vision에서 Influential Book
- Vision 분야에 큰 Insight를 제공
- Hierarchical Model을 제시



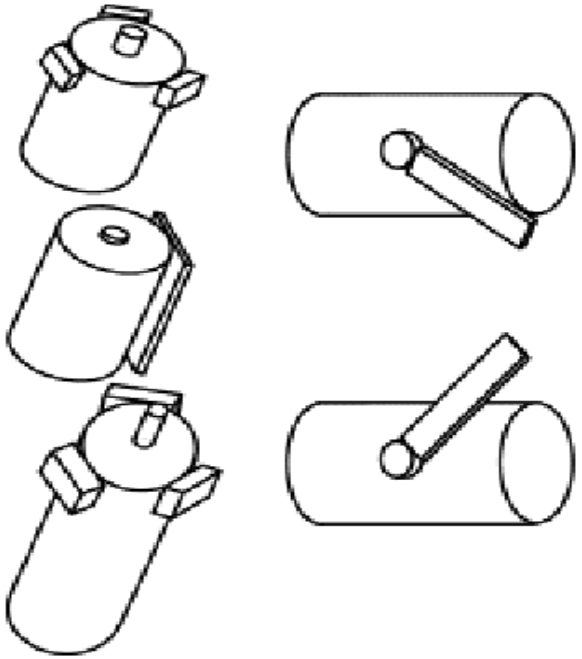


Vision History

- 3D 모델을 인식하기 위한 방법론
- Generalizaed Cylinder : 단순한 Object의 결합
- Pictorial Structure : Variability Concept을 설명

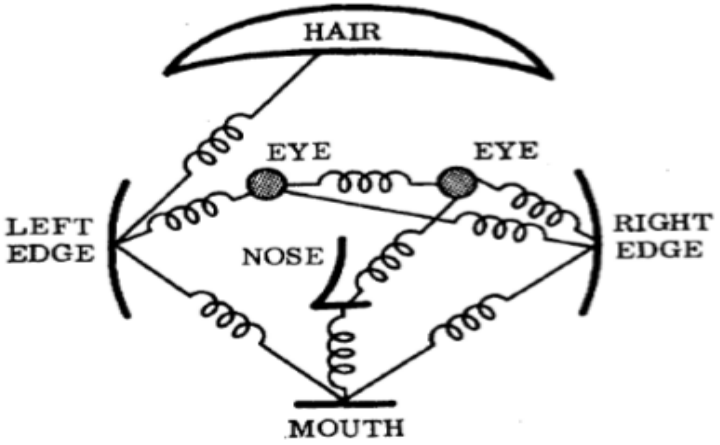
- **Generalized Cylinder**

Brooks & Binford, 1979



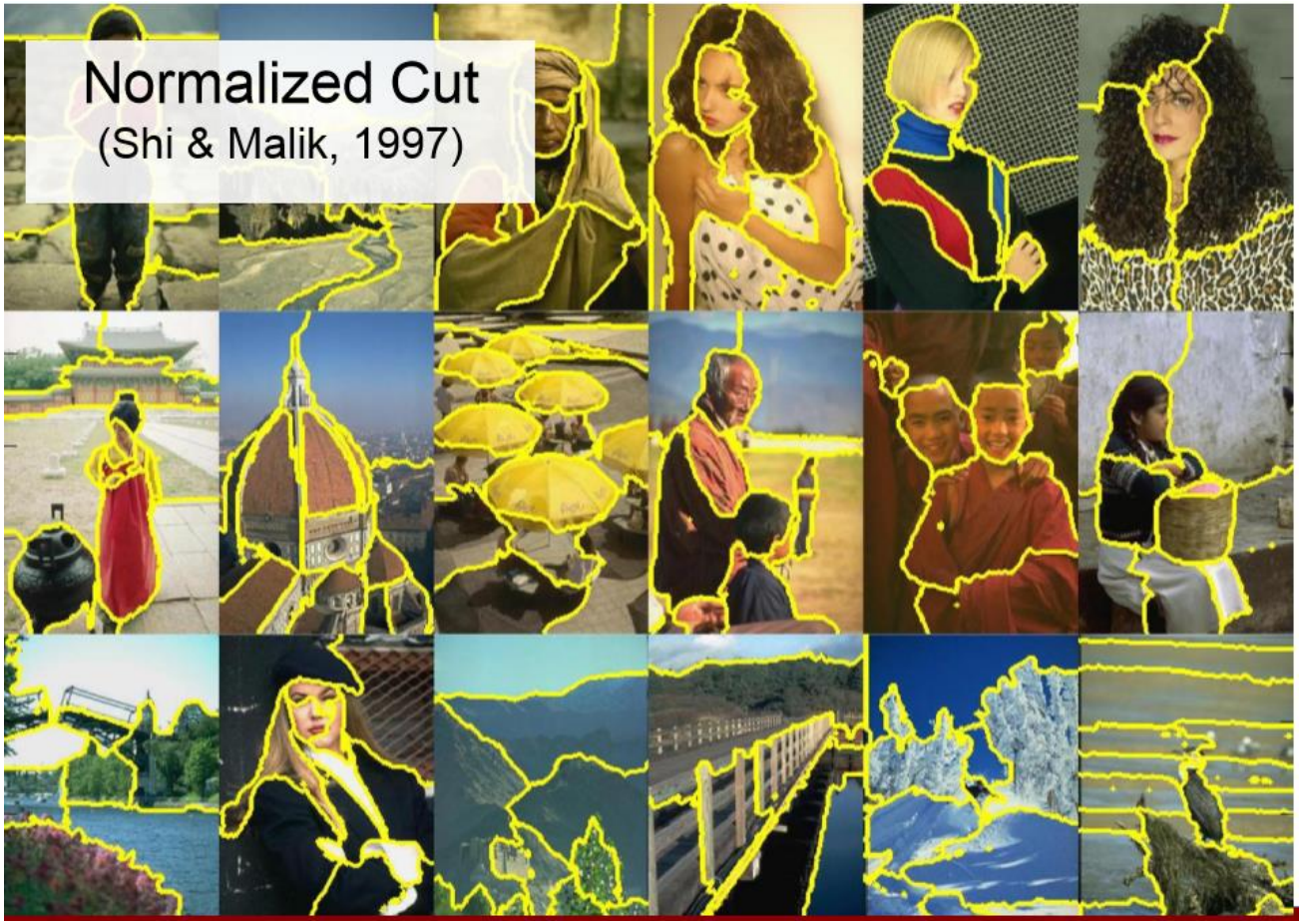
- **Pictorial Structure**

Fischler and Elschlager, 1973



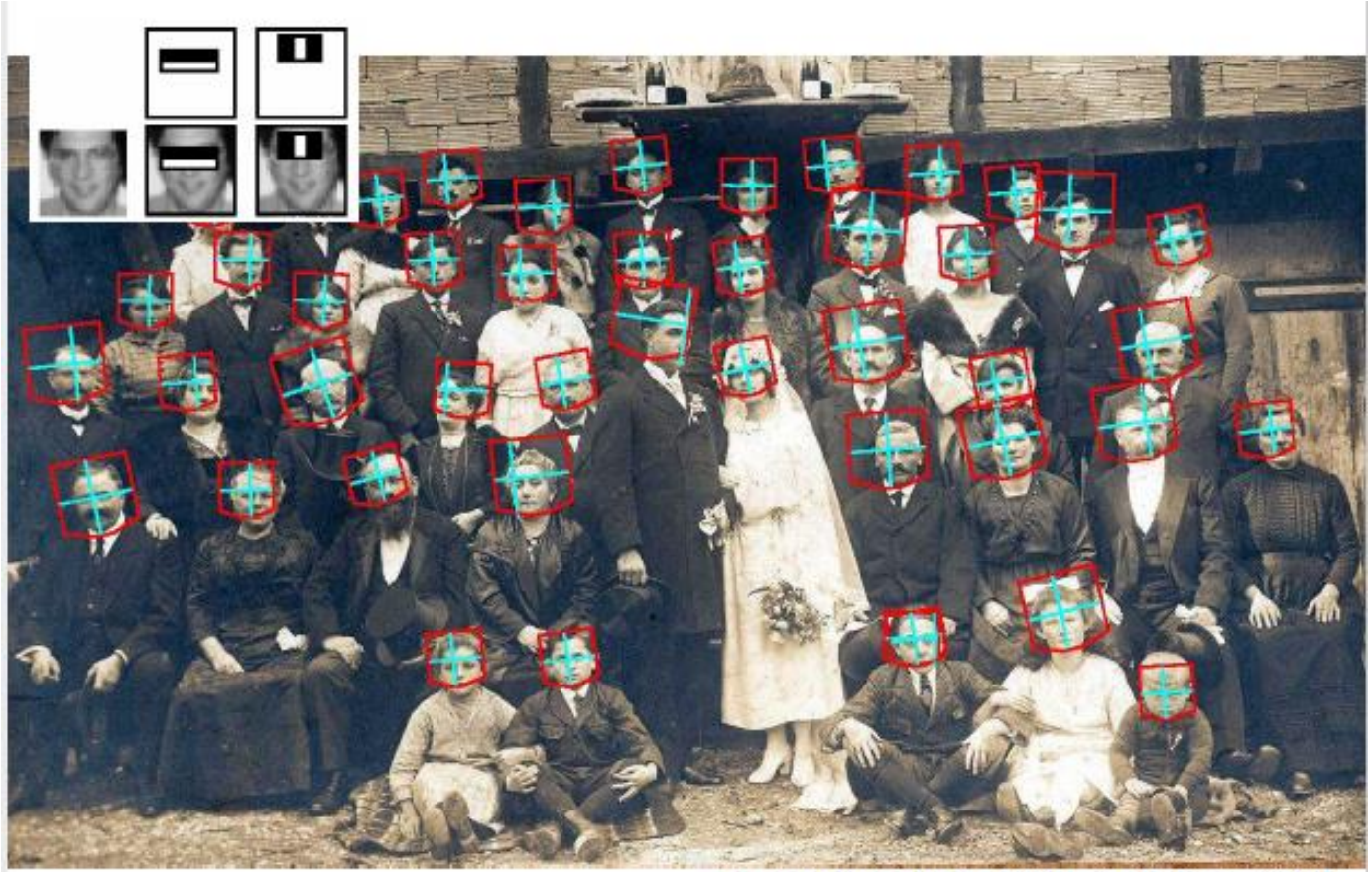
Vision History

- Colorful Image를 사용하기 시작
- Grouping Problem : 아직 해결되지 않은 Computer Vision 분야의 문제



Vision History

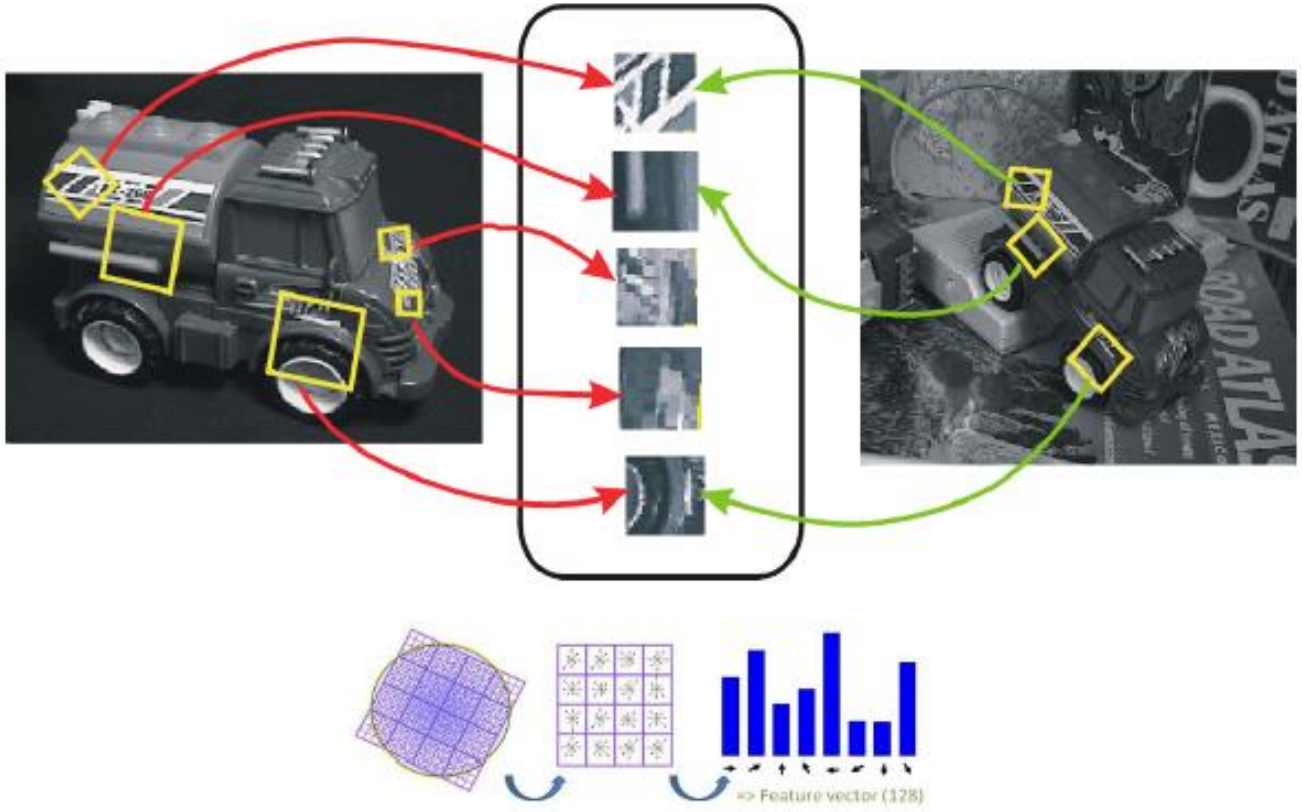
- 처음으로 Consumer Product에 Computer Vision이 적용된 알고리즘
- Localization과 관련
- Focus of Computer Vision이 3D Modeling에서 Object Recognition으로 이동



Face Detection, Viola & Jones, 2001

Vision History

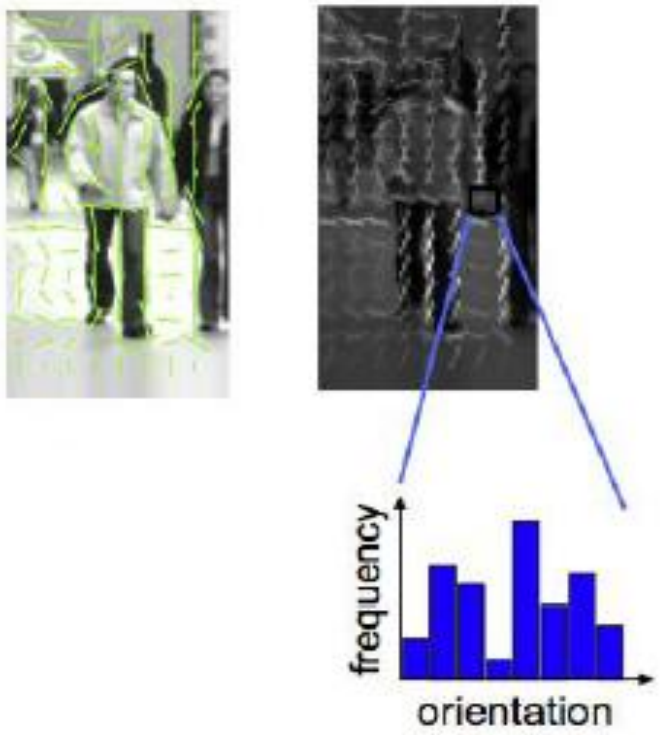
- Important Feature Extract
- Object Recognition을 위해서 Global Shape를 알아야 하는 것이 아님



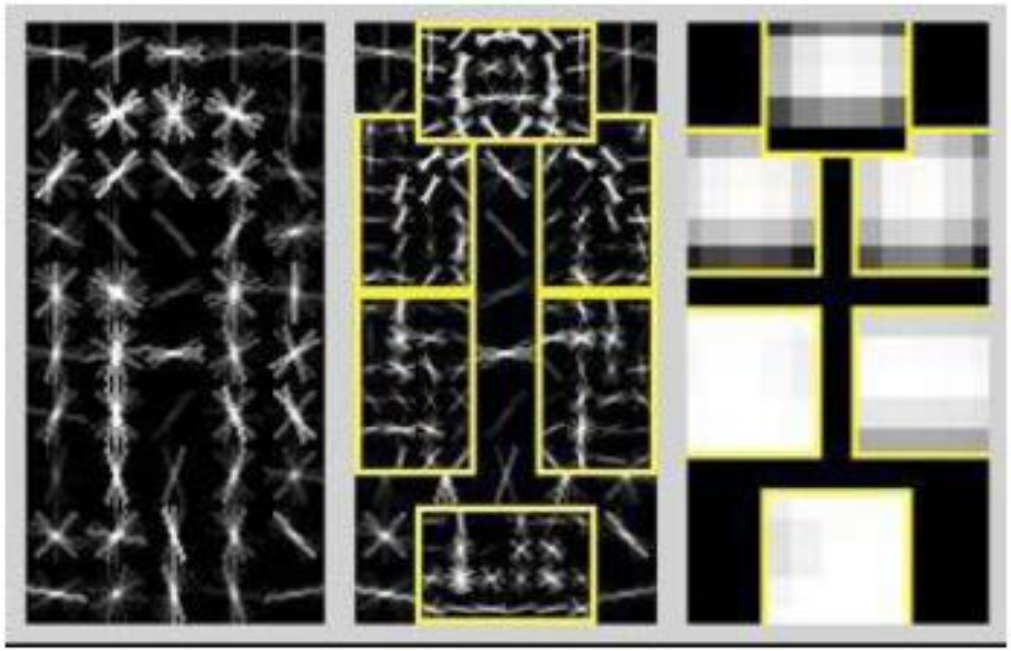
"SIFT" & Object Recognition, David Lowe, 1999

Vision History

- 2000년대 Object Recognition을 위해서 Machine Learning 적용



Histogram of Gradients (HoG)
Dalal & Triggs, 2005



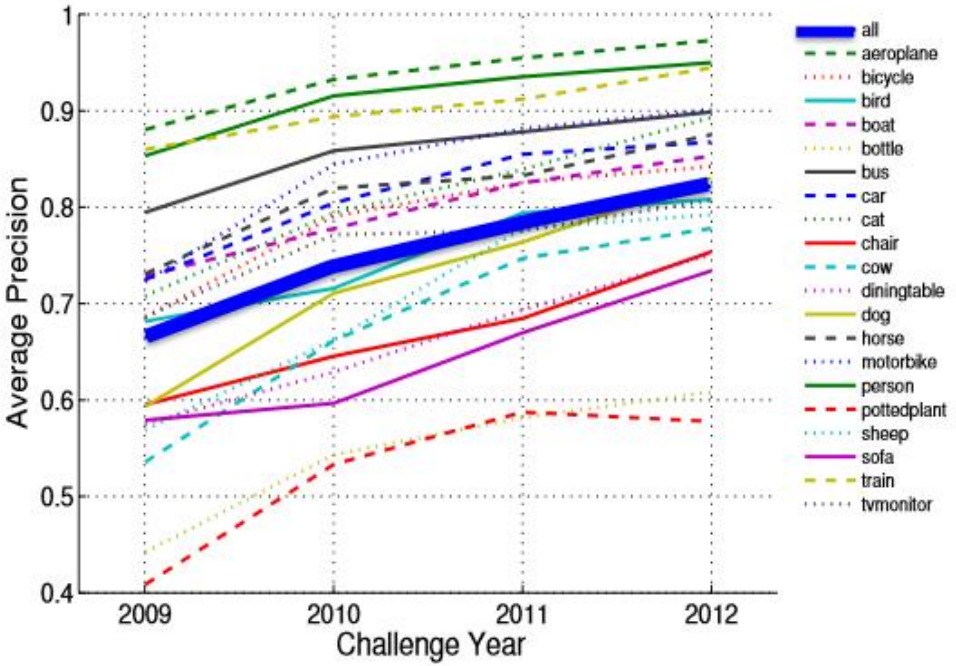
Deformable Part Model
Felzenswalb, McAllester, Ramanan, 2009

Vision History

- Computer Vision 분야의 성숙
- Global Standard의 필요성 대두

PASCAL Visual Object Challenge (20 object categories)

[Everingham et al. 2006-2012]



Vision History

IMAGENET

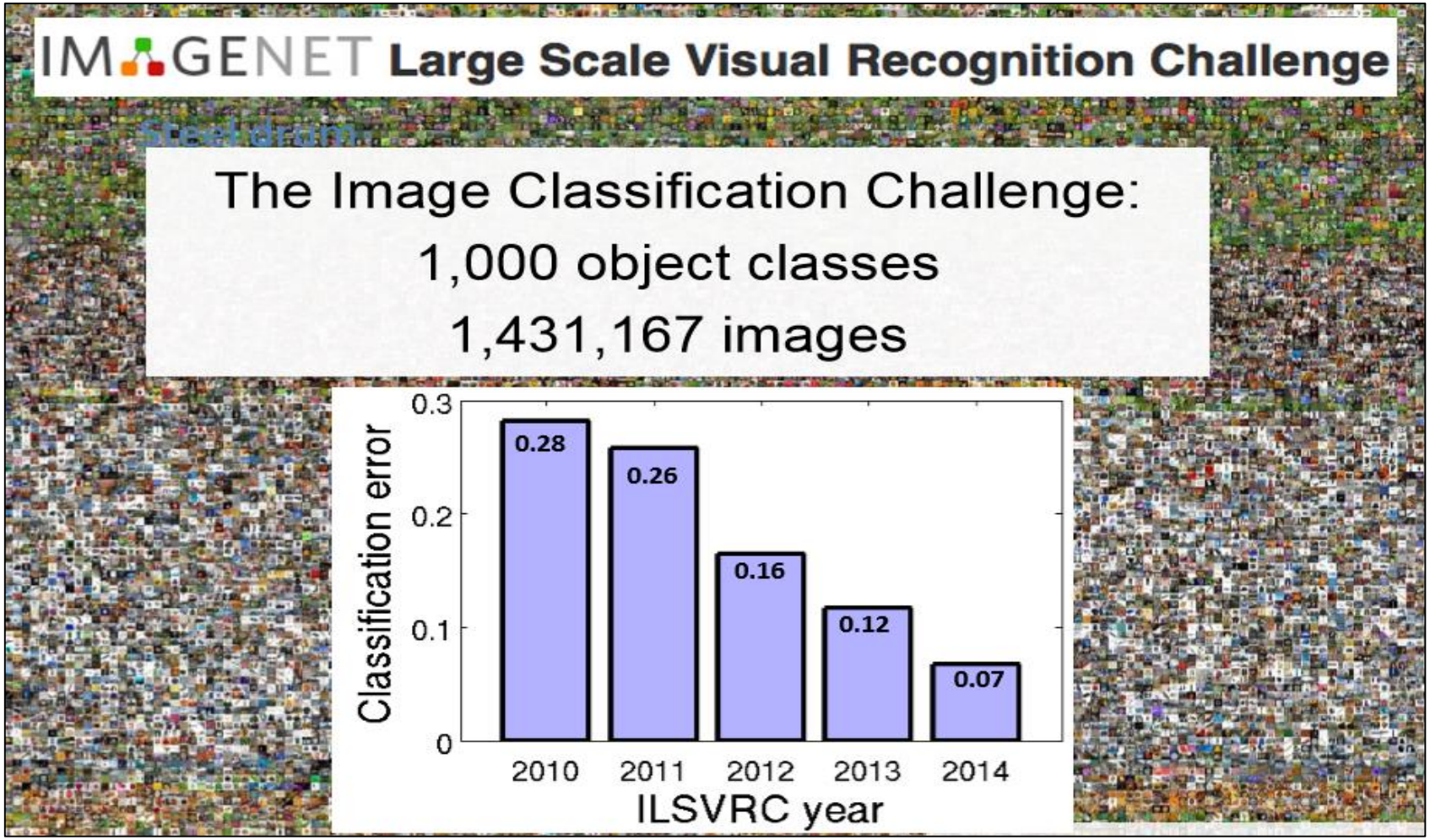
www.image-net.org

22K categories and **14M** images

- Animals
  - Bird
  - Fish
  - Mammal
  - Invertebrate
- Plants
  - Tree
  - Flower
- Food
- Materials
- Structures
- Artifact
  - Tools
  - Appliances
  - Structures
- Person
- Scenes
  - Indoor
  - Geological Formations
- Sport Activities

Deng, Dong, Socher, Li, Li, & Fei-Fei, 2009

Vision History



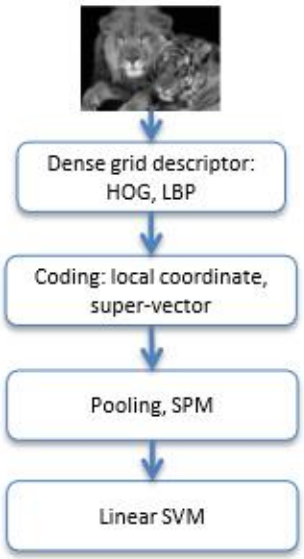
CNN(Convolutional Neural Network) **win!!**

Vision History

IMAGENET Large Scale Visual Recognition Challenge

Year 2010

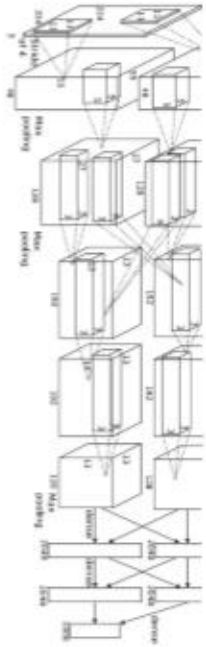
NEC-UIUC



[Lin CVPR 2011]

Year 2012

SuperVision



[Krizhevsky NIPS 2012]

Year 2014

GoogLeNet

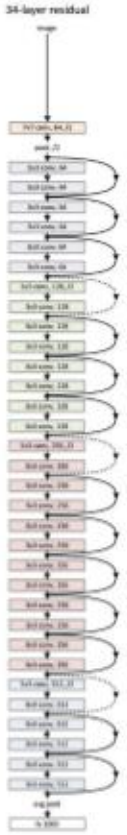
[Szegedy arxiv 2014]

VGG

[Simonyan arxiv 2014]

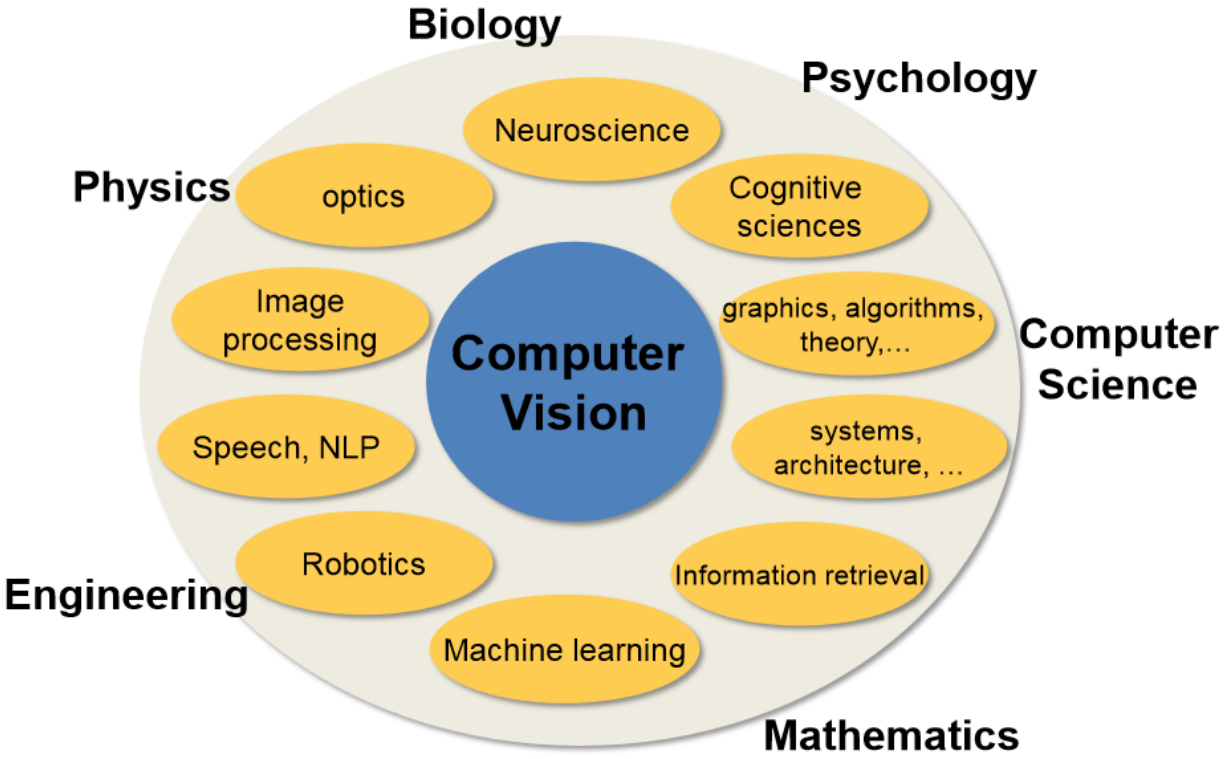
Year 2015

MSRA



Vision History

Convolutional Neural Network(CNN) is not invented overnight

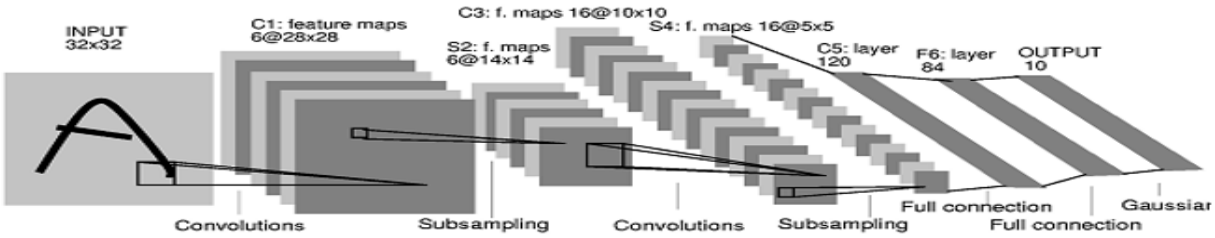


Vision History

Convolutional Neural Network(CNN) is not invented overnight

1998

LeCun et al.



# of transistors

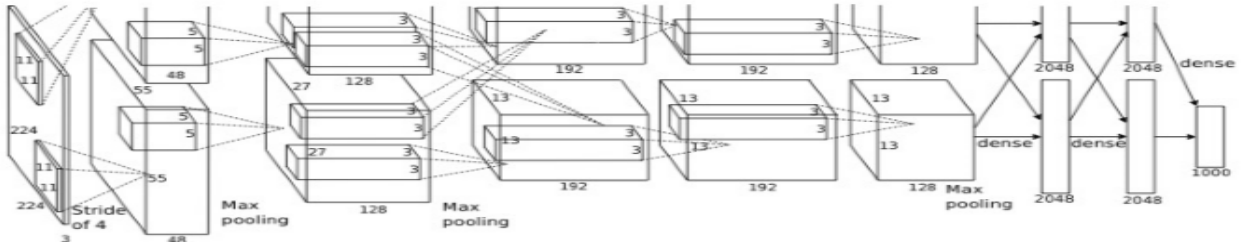
10^6

# of pixels used in training

10^7 NIST

2012

Krizhevsky et al.



# of transistors GPUs

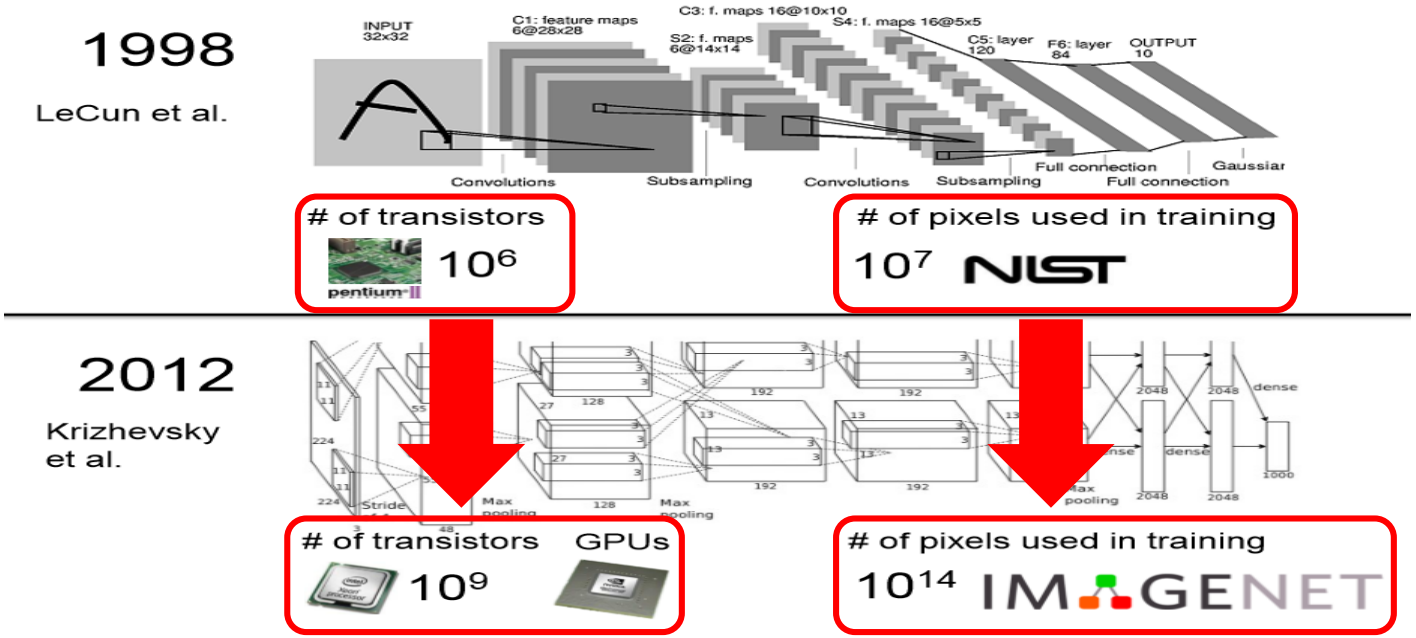
10^9

# of pixels used in training

10^{14} IMAGENET

Vision History

Convolutional Neural Network(CNN) is not invented overnight

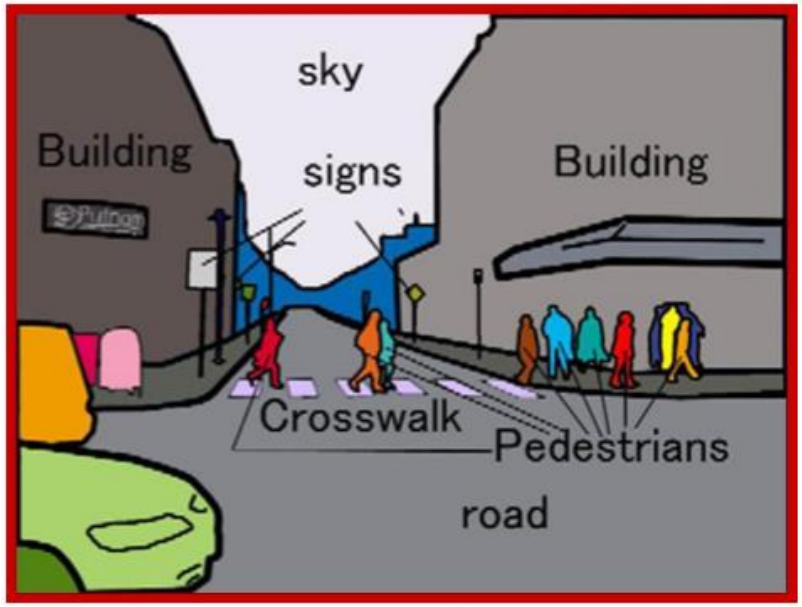


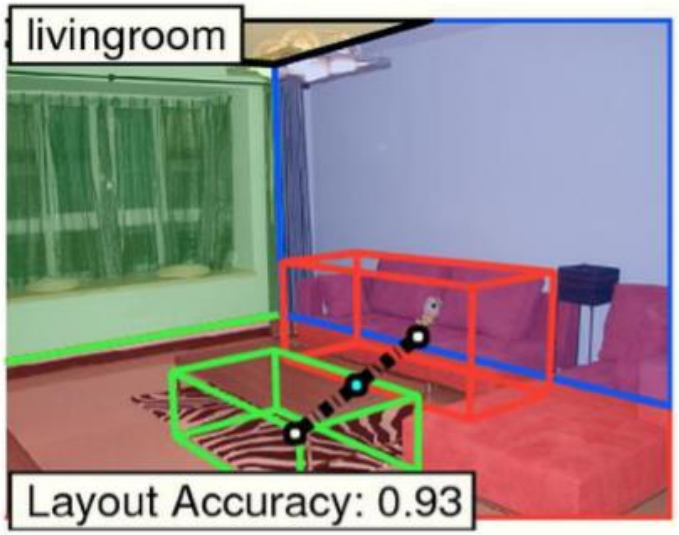
1. Hardware performance
2. Availability of data

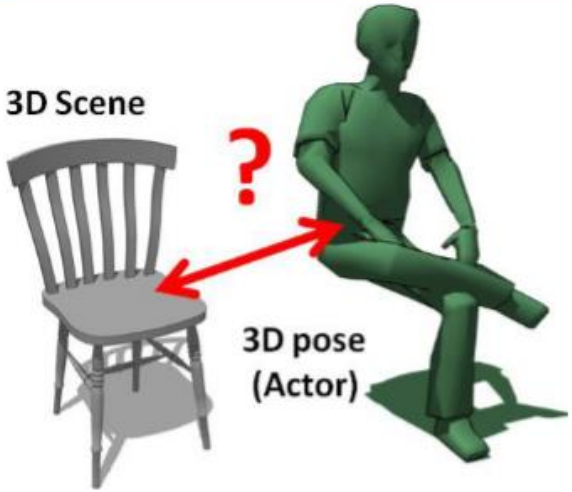
The quest for **visual intelligence**

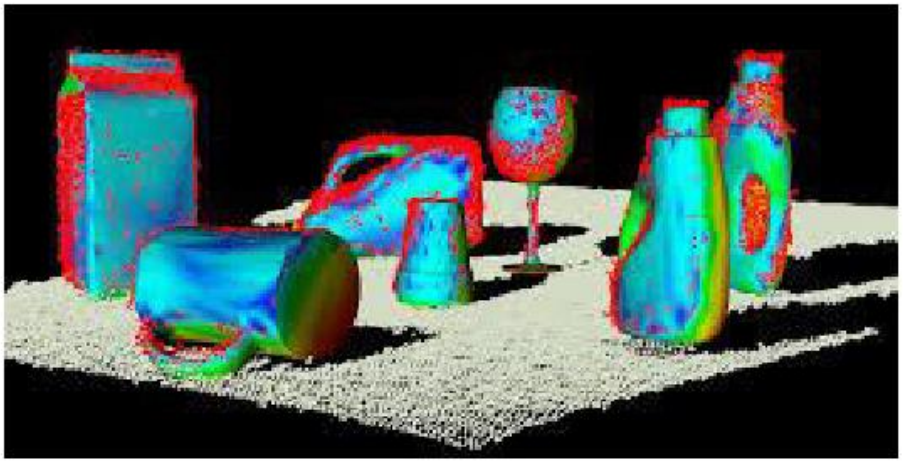
goes far beyond object recognition…

1. Labeling of an entire scene, 3D modeling

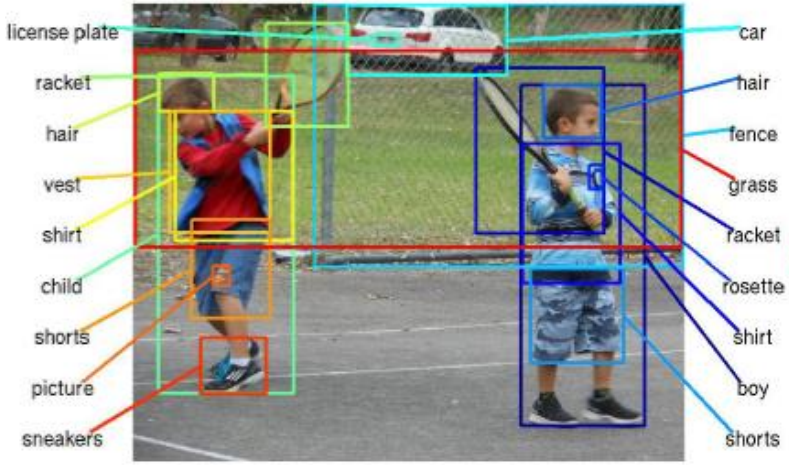


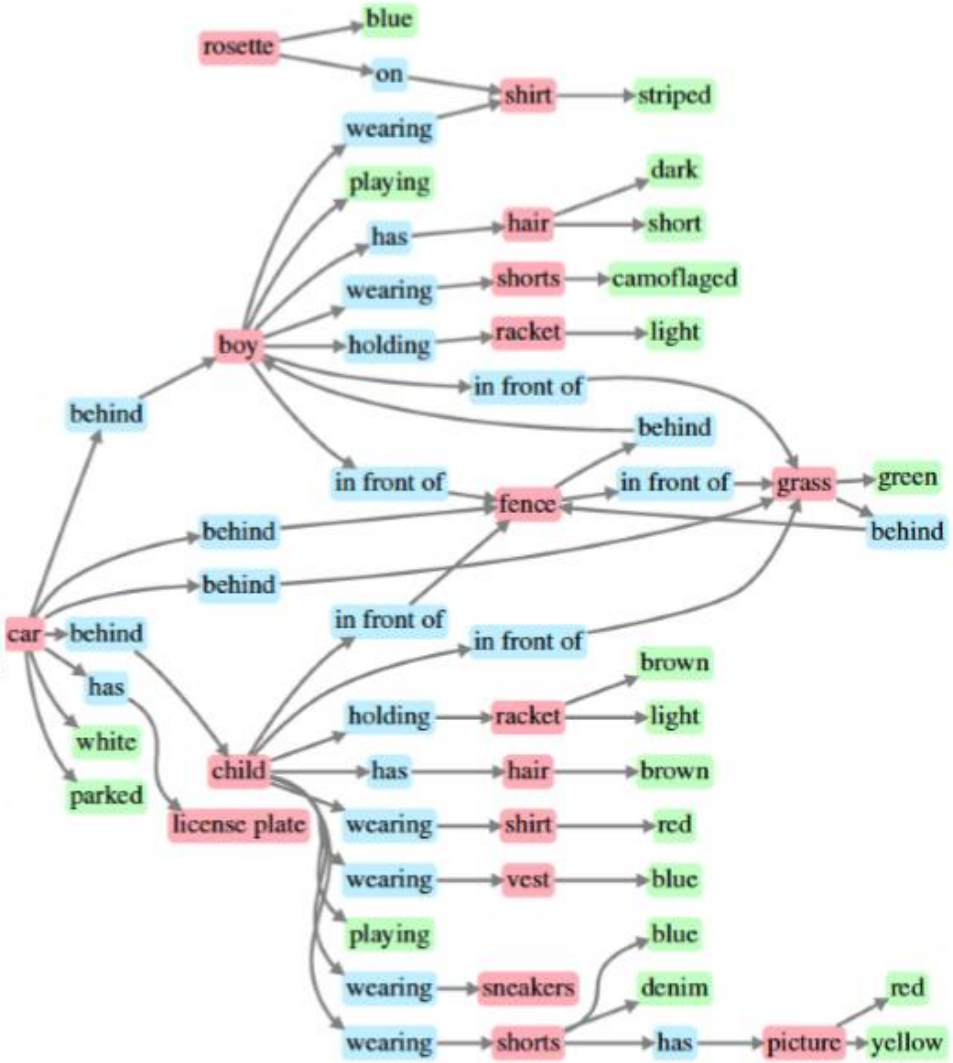






2. Visual genome, explain relationship betweenb object





3. Give one picture and outcome a description

PT = 500ms

Some kind of game or fight. Two groups of two men? The foregound pair looked like one was getting a fist in the face. Outdoors seemed like because i have an impression of grass and maybe lines on the grass? That would be why I think perhaps a game, rough game though, more like rugby than football because they pairs weren't in pads and helmets, though I did get the impression of similar clothing. maybe some trees? in the background. (Subject: SM)

4. Explain the socializing and understand the world

Thank you