

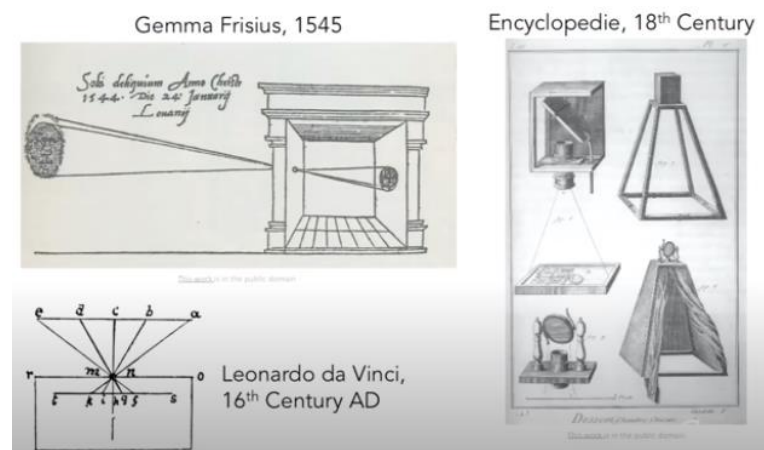
01 Brief History of Computer Vision

History

1. Eyes – Beginning of Vision

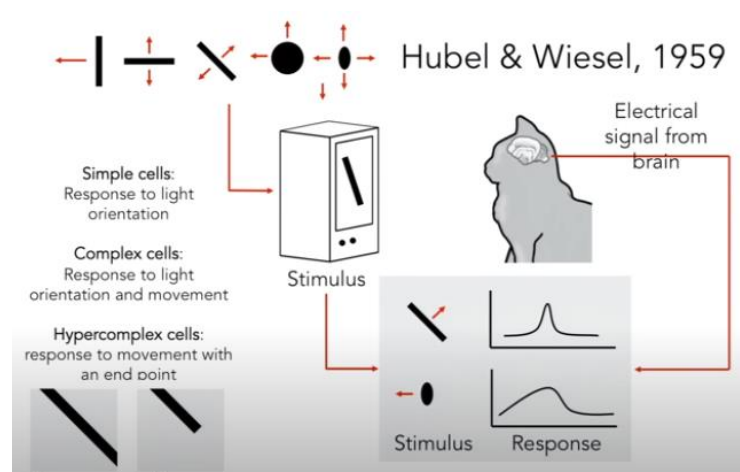
Human's 50% neuron -> Vision Processing

2. 초기 카메라의 등장

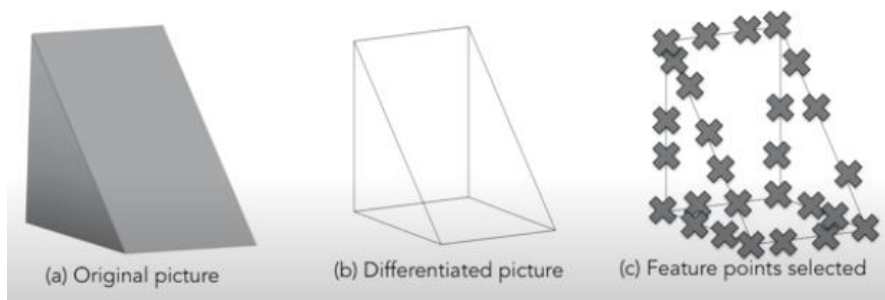


3. Hubel & Wiesel – 1959

What is the visual process mechanism?

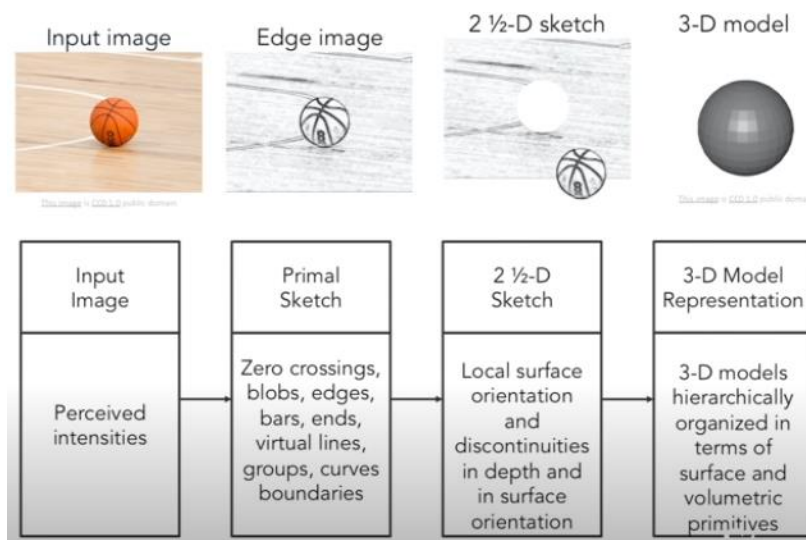


4. Block World – Larry Roberts, 1963



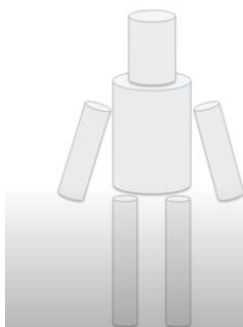
5. Summer Vision Project – 1966

6. Stage of Visual Representation (To 3D) - David Marr, 1970s

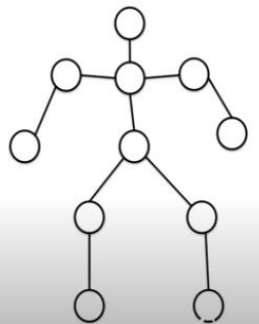


7. 이미지의 Block화 – 1973, 1979

- Generalized Cylinder
Brooks & Binford, 1979



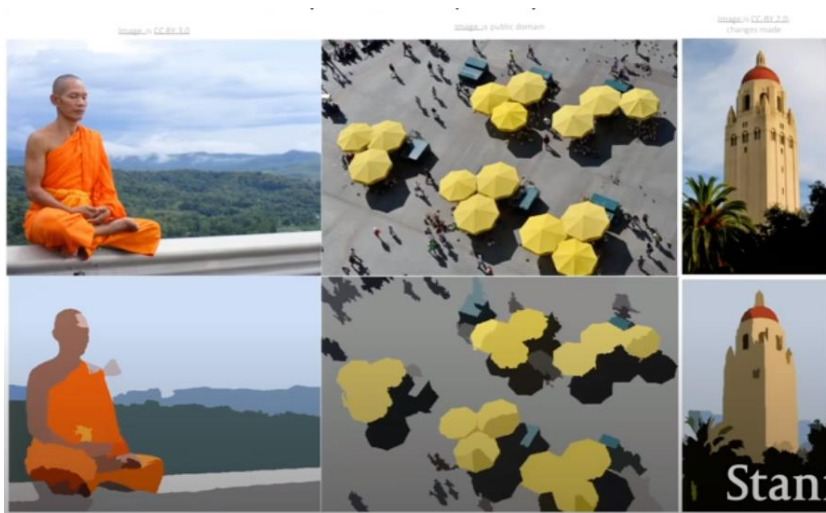
- Pictorial Structure
Fischler and Elschlager, 1973



8. Edge – David Lowe, 1987



9. Normalized Cut – Shi & Malik, 1997



10. Face Detection – Viola & Jones, 2001

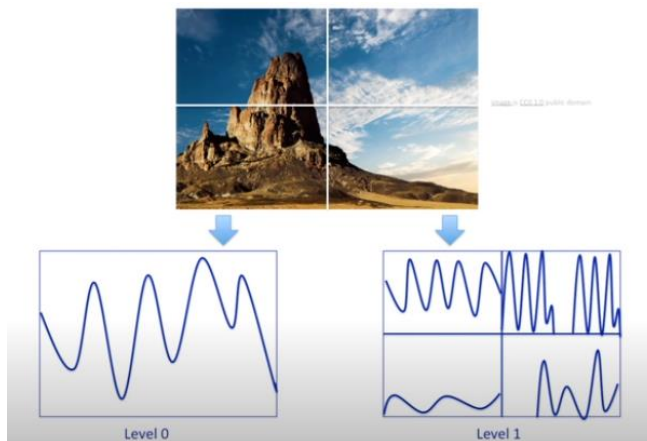


11. SIFT & Object Recognition – David Lowe, 1999



12. Spatial Pyramid Matching, Lazebnik, Schmid & Ponce, 2006

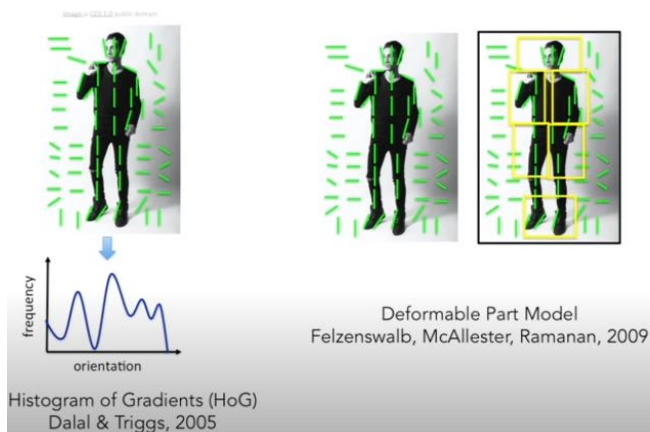
: Image' feature can give us clues of scene (ex) Using SVM)



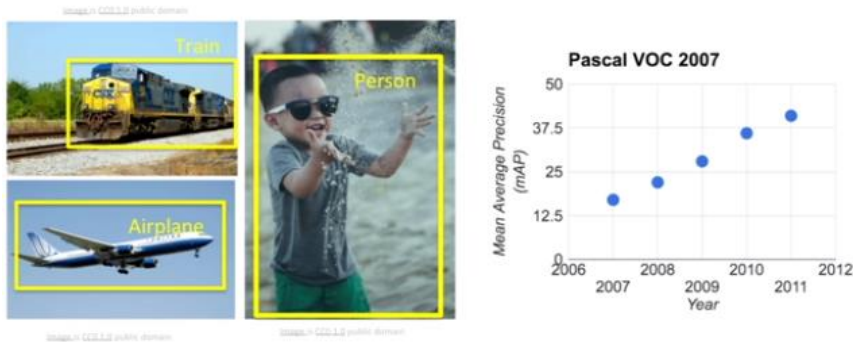
13. Human Recognition

Histogram of Gradients, Deformable Part Model.

Quality of Image가 점점 달라지기 시작한다.



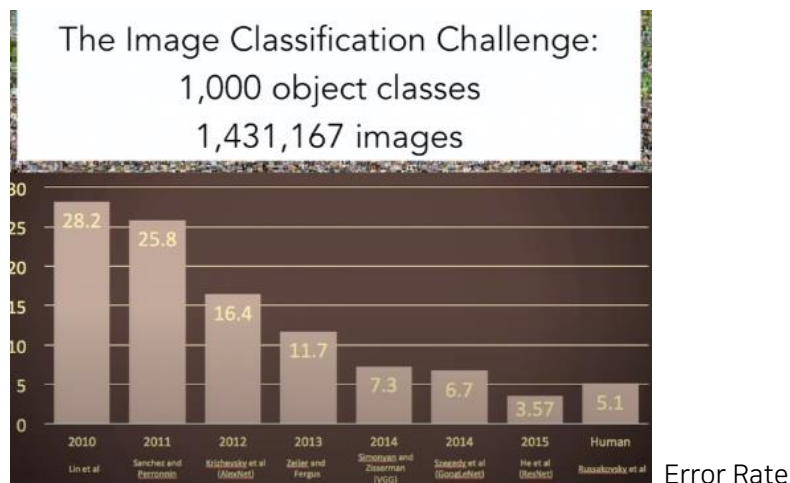
14. PASCAL Visual Object Challenge (20 object categories)



15. 세상의 모든 것을 인식할 수 있는가?

AdaBoost, SVM ... 당시의 것들은 Train Data에 Overfitting 되어 있기 때문에 generalization이 잘 되지 않는 문제가 있었다.

- IMAGENET Challenge



- 2012 Error의 급격한 감소 -> Deep Learning의 등장(Convolutional Neural Network)

Breakthrough Point!!

Computer Vision Issue

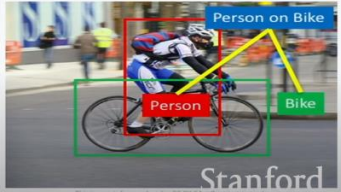
- Object detection
- Action classification
- Image captioning
- ...



- Object detection
- Action classification
- Image captioning
- ...



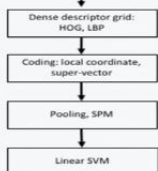
Person
Hammer



Person on Bike
Person
Bike
Stanford

IMAGENET Large Scale Visual Recognition Challenge

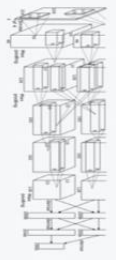
Year 2010
NEC-UIUC



[Lin CVPR 2011]

Loan image by Swisshof is licensed under CC BY 3.0

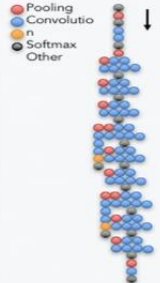
Year 2012
SuperVision



[Krizhevsky NIPS 2012]

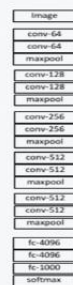
Figure copyright Alex Krizhevsky, Ilya Sutskever, and Geoffrey Hinton, 2012. Reproduced with permission.

Year 2014
GoogLeNet



[Szegedy arxiv 2014]

VGG



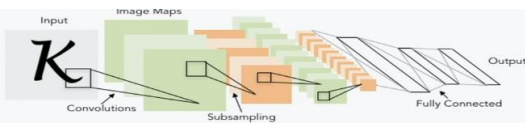
[Simonyan arxiv 2014]

Year 2015
MSRA

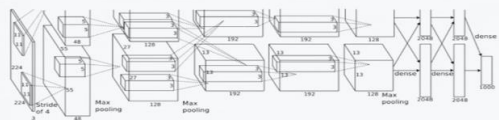


[He K C / Z 11]

1998
LeCun et al.

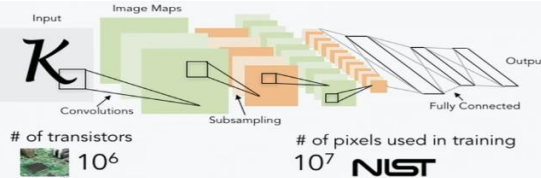


2012
Krizhevsky et al.



1998년(LeCun)에도 존재하였는데 왜 2012년부터 주목을 받기 시작했는가?

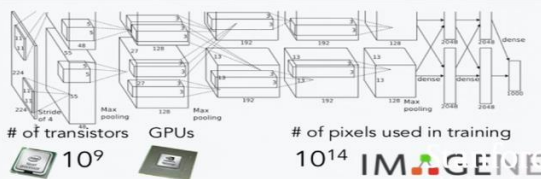
1998
LeCun et al.



of transistors
10⁶
pentium II

of pixels used in training
10⁷
NIST

2012
Krizhevsky et al.

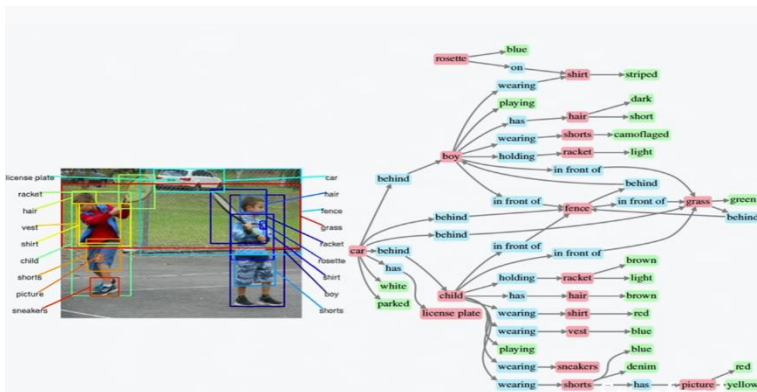
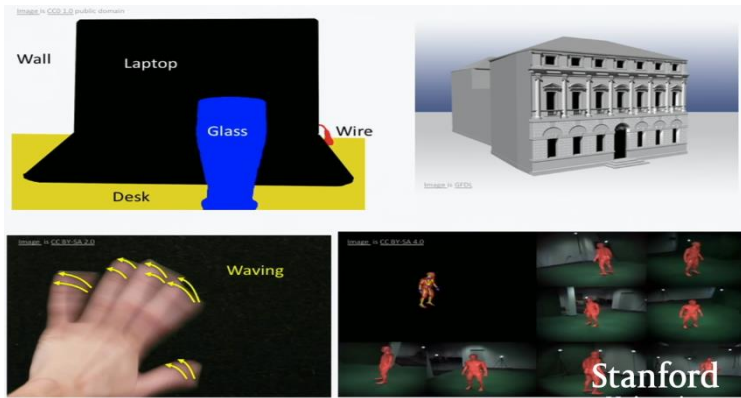


of transistors
10⁹
GPUs

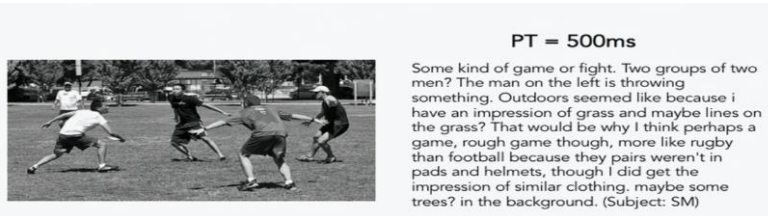
of pixels used in training
10¹⁴
IMAGENET

GPU, Memory 용량 증가로 계산 성능 증가!

Quest



Understanding of Image



[출처] [Convolutional Neural Networks for Visual Recognition \(Spring 2017\)](#)