IoT·인공지능·빅데이터 개론 및 실습

AI: 컴퓨터 비전

서울대학교 컴퓨터공학부
김건희

Contents

1. Introduction to CV
2. Computer Vision Tasks
3. Visual Recognition

Credits: 15-385 CMU Computer Vision
Ali Farhadi's CSE 576

What is Computer Vision?

- Teach machines to do what we can do with vision (as human)

Human Vision

› Can do amazing things like:

- Recognize people and objects
- Navigate through obstacles
- Understand mood in the scene
- Imagine stories from pictures
- …

Human Vision

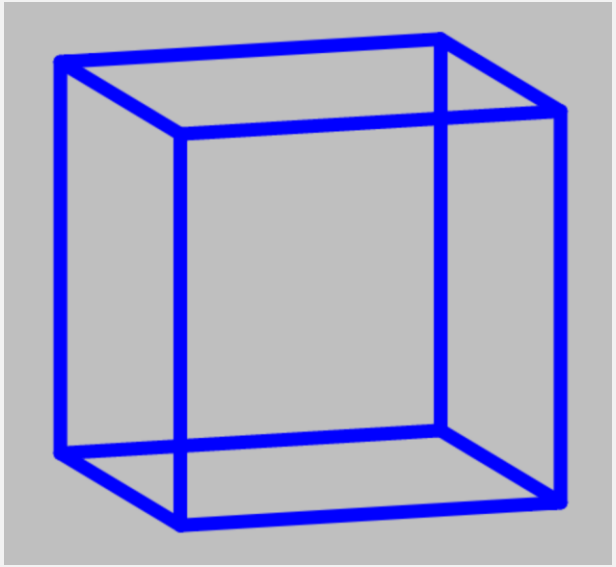
But still is not perfect

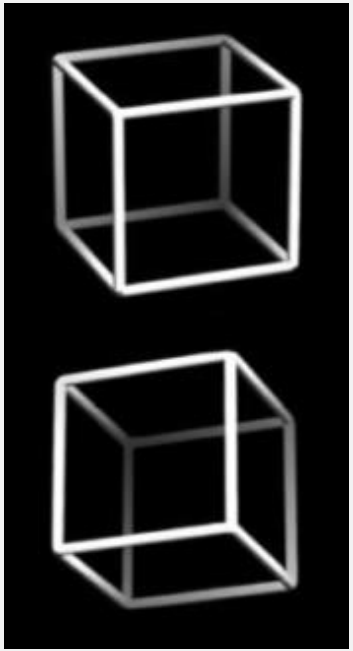
- Suffers from Illusions
- Ignores many details
- Ambiguous description of the world
- Does not care about accuracy of world
- Limited memory

Computers win!

Illusion

› Necker's Cube Reversal

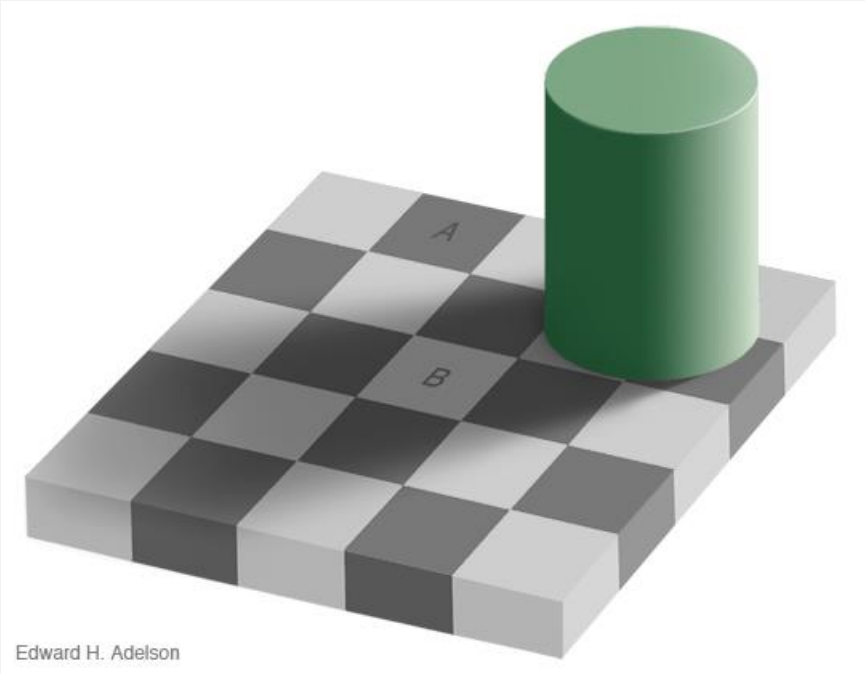




[출처] http://www.michaelbach.de/ot/sze-Necker/index.html

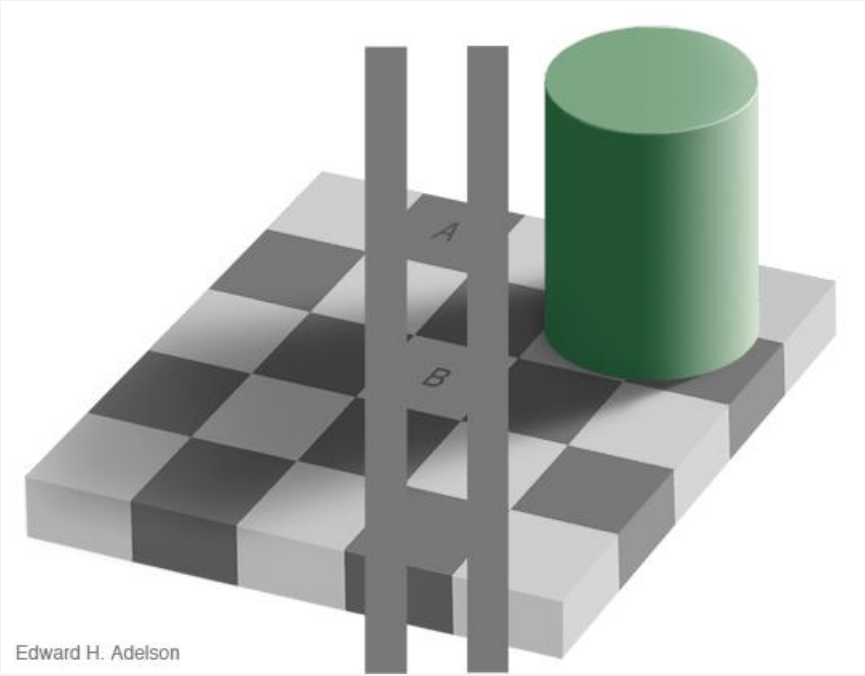
Illusion

› Checker Shadow Illusion - [E. H. Adelson]

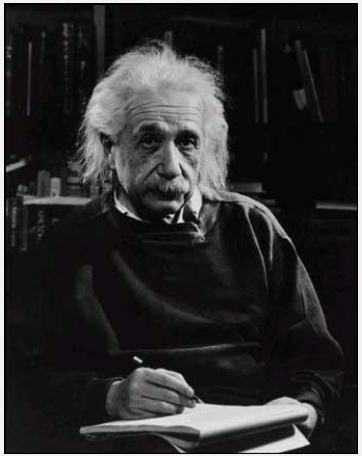


Illusion

› Checker Shadow Illusion - [E. H. Adelson]



Computer Vision



What we see

0	3	2	5	4	7	6	9	8
3	0	1	2	3	4	5	6	7
2	1	0	3	2	5	4	7	6
5	2	3	0	1	2	3	4	5
4	3	2	1	0	3	2	5	4
7	4	5	2	3	0	1	2	3
6	5	4	3	2	1	0	3	2
9	6	7	4	5	2	3	0	1
8	7	6	5	4	3	2	1	0

What a computer sees

1 Intro to CV

What is Computer Vision?

- Teach machines to do what we can do with vision
- Intelligent interpretation of imagery
- Building an artificial Visual Cortex
- Inverse optics
- No matter what your definition is…
  - Vision is hard
  - But is fun…

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2 CV Tasks

Computer Vision Hierarchy

Low-level

- Image → Image
- e.g. image processing, edge-detection, optical flow computation

Mid-level

- Image → feature
- e.g. boundary detection, segmentation, sfm

High-level

- Image → Semantics
- e.g. object recognition, scene understanding

Low-level Vision Examples

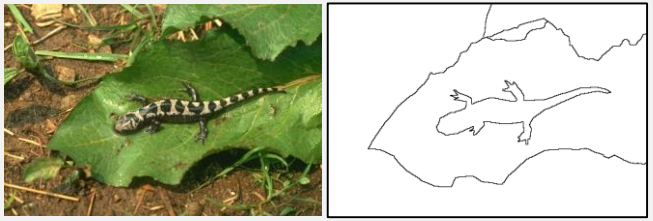
Deblurring

Edge detection

Super-resolution

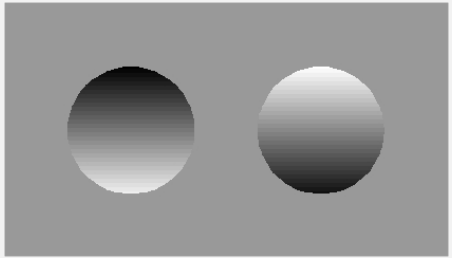
Colorization

Mid-level Vision Examples



Boundary detection

Segmentation



Shape from shading

Alignment

High-level Vision Examples

Image classification

Object detection

Image captioning

Pose detection

Computer Vision vs Image Processing

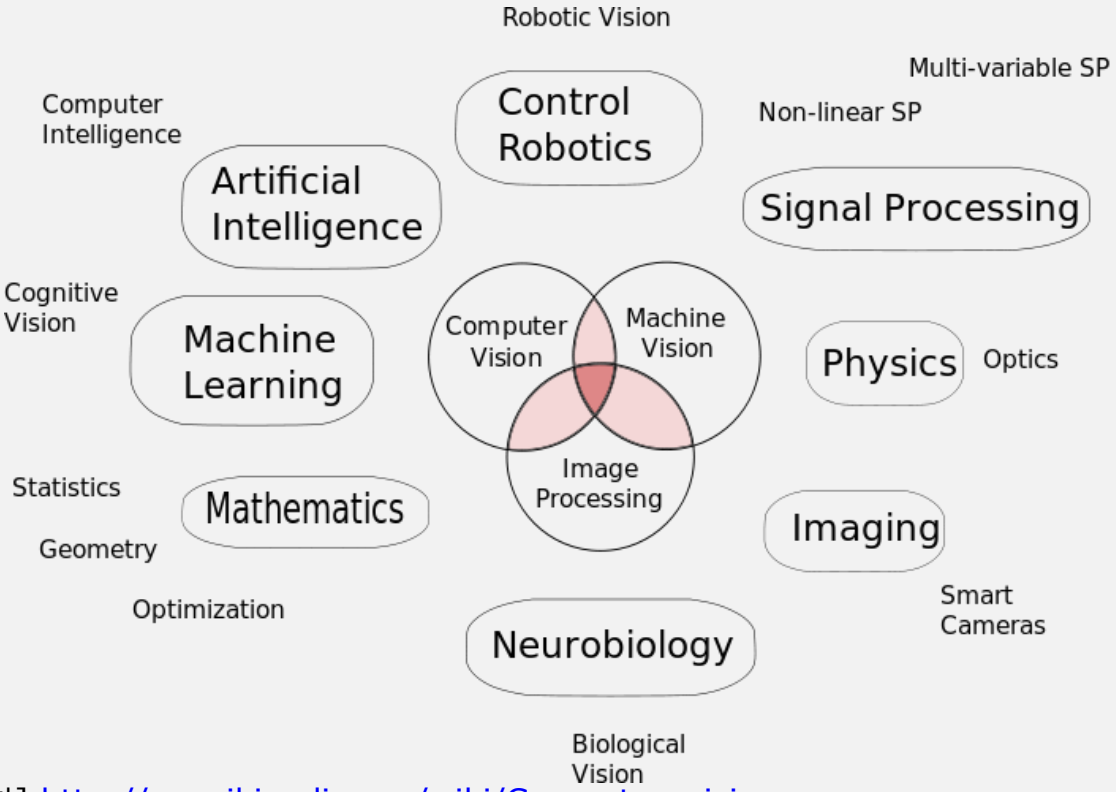
Image processing

- Study image-to-image transformation
- Input and output are both images
- Image compression/restoration/enhancement

Computer vision

- Actively use IP techniques
- The output is a description or an interpretation of image content
- High-level intelligence

Computer Vision is Interdisciplinary



[출처] http://en.wikipedia.org/wiki/Computer_vision

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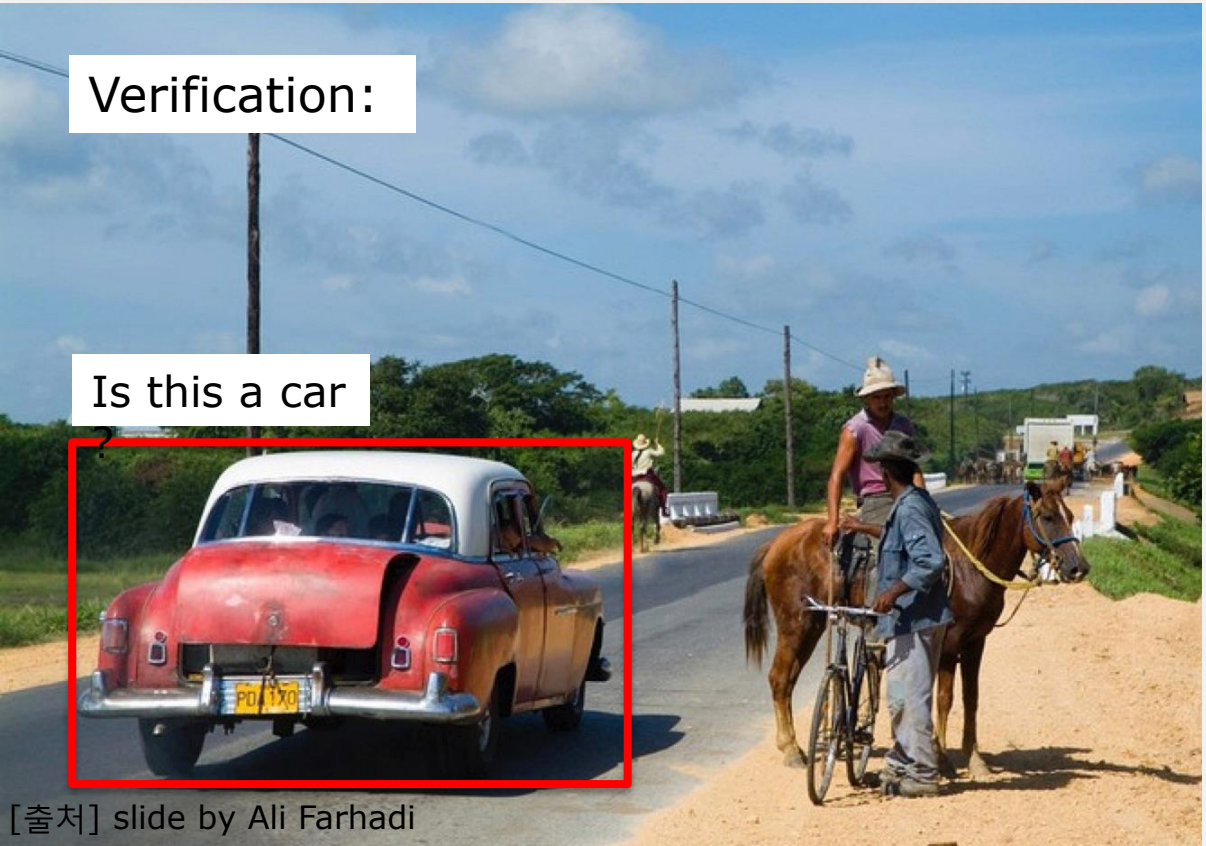
❸Visual Recognition



[출처] slide by Ali Farhadi

❸Visual Recognition

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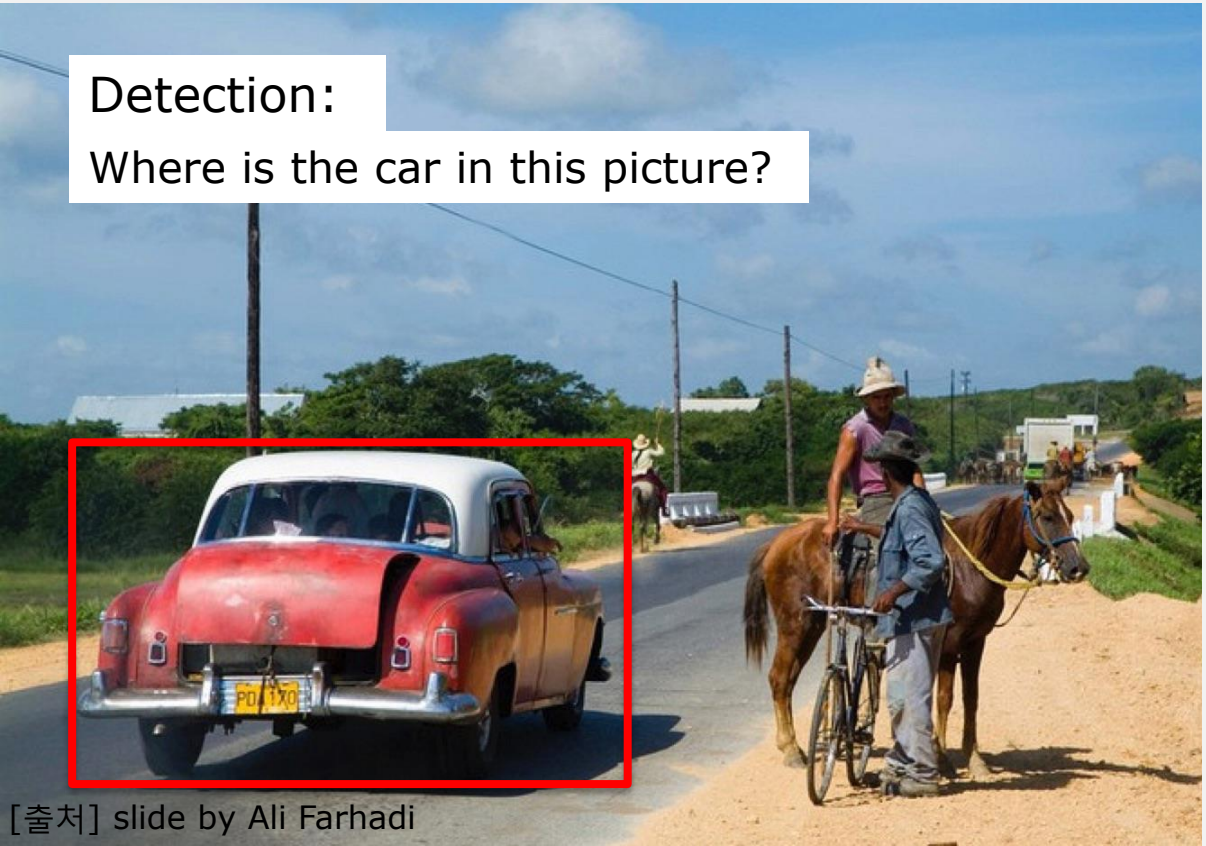
❸Visual Recognition



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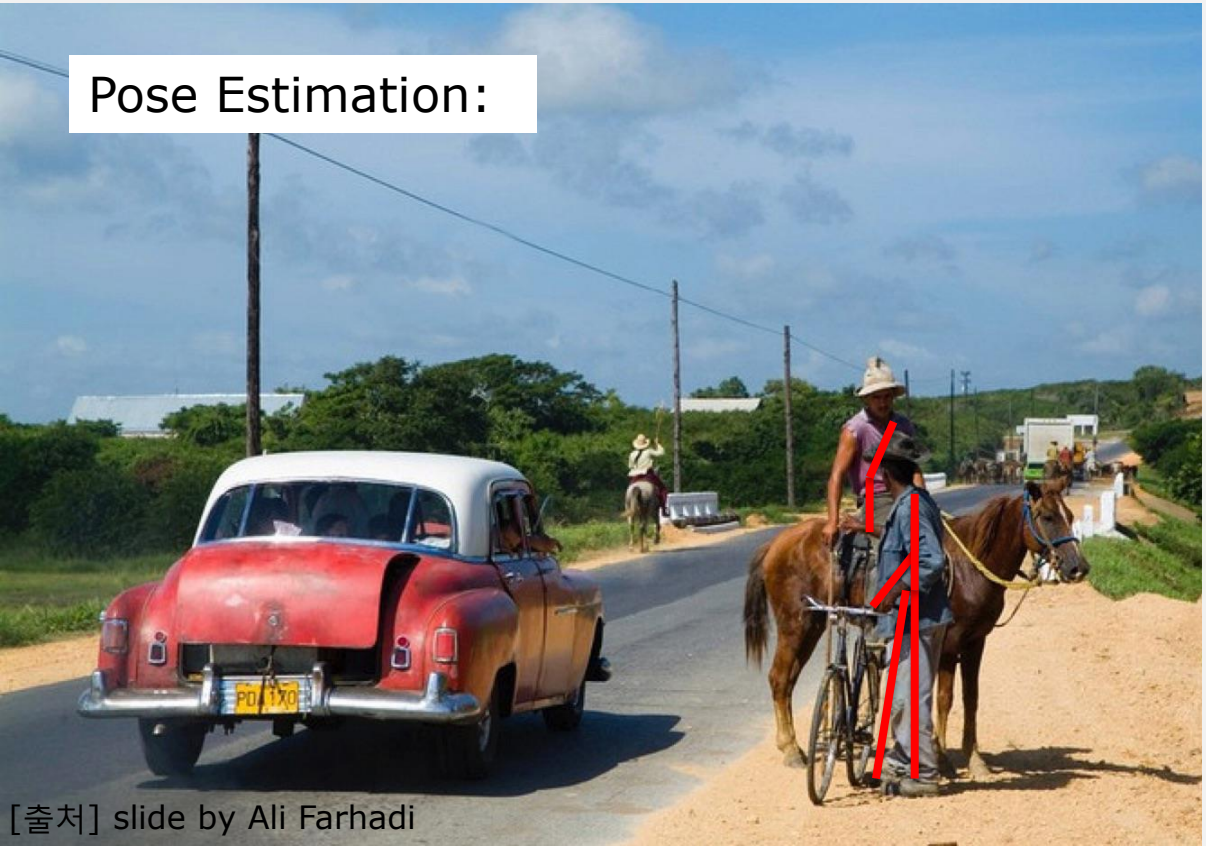
❸Visual Recognition



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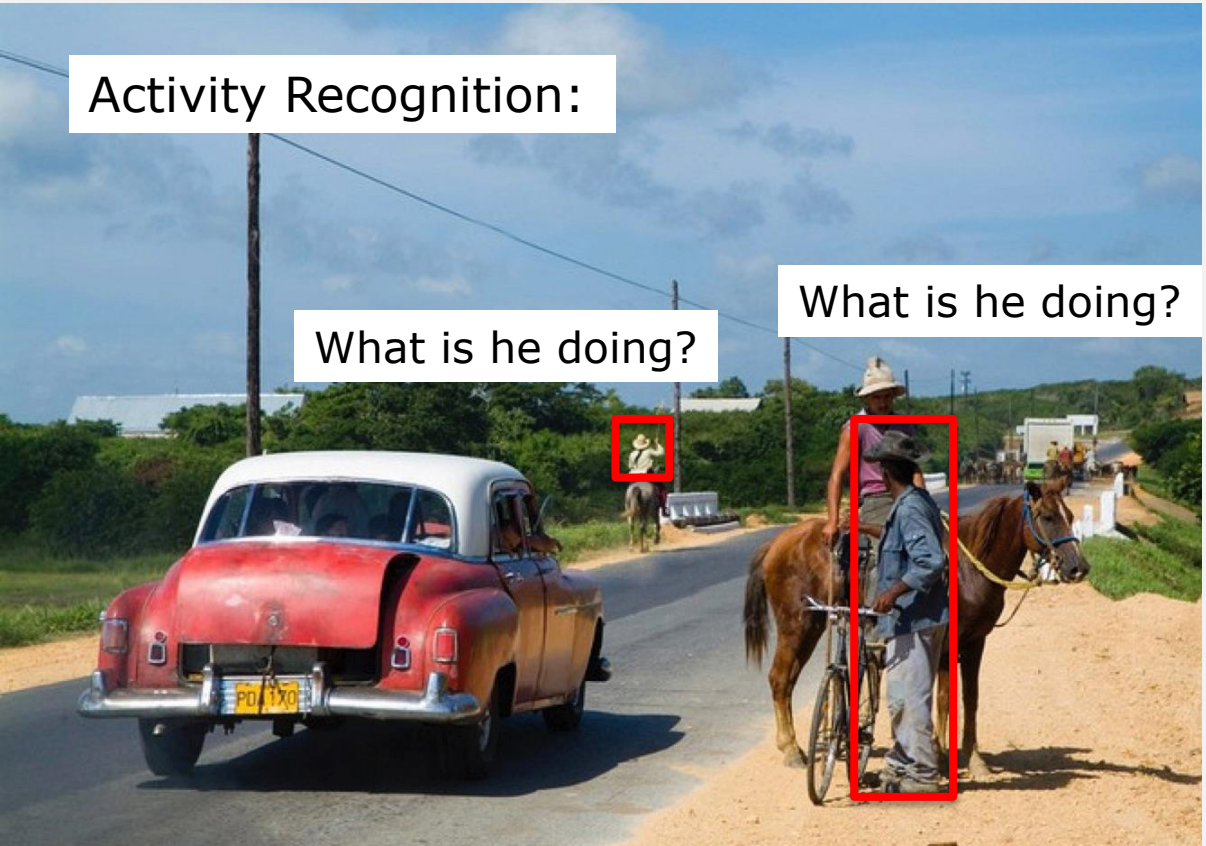

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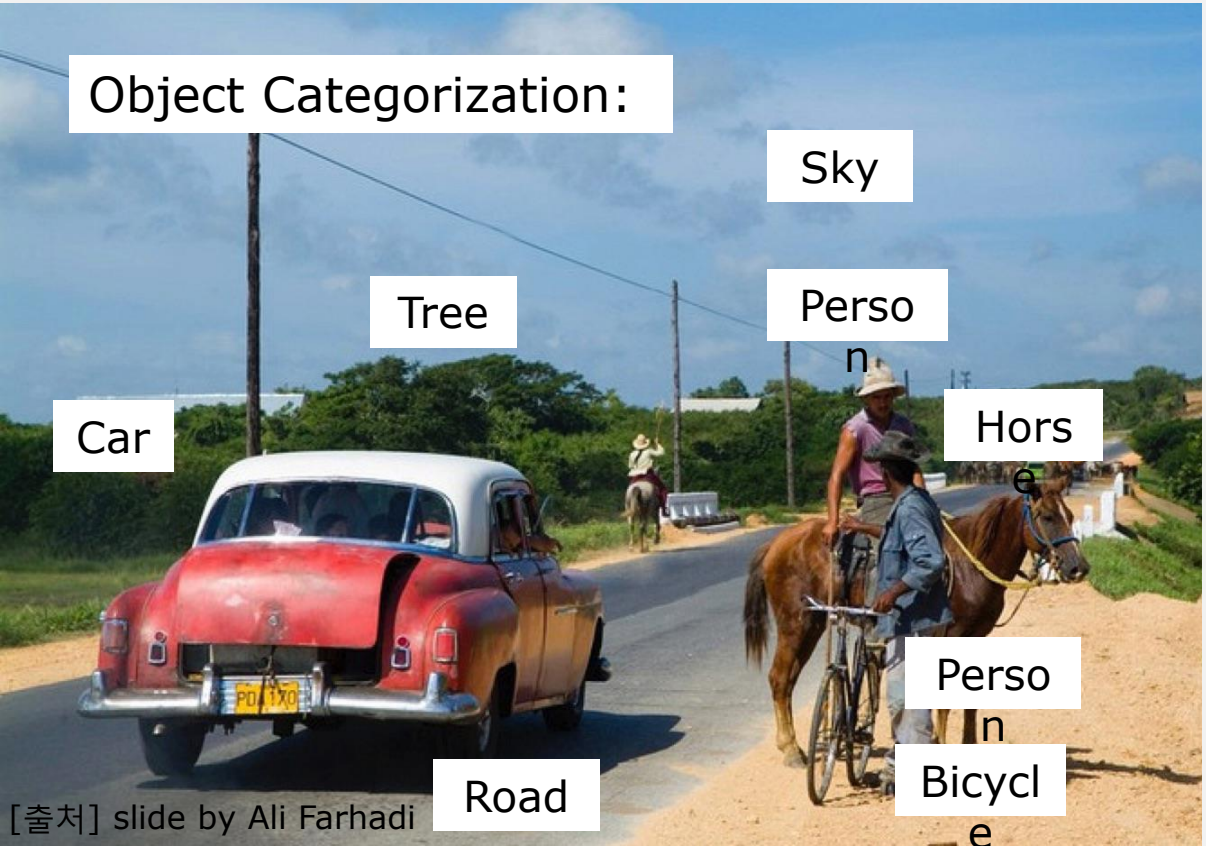

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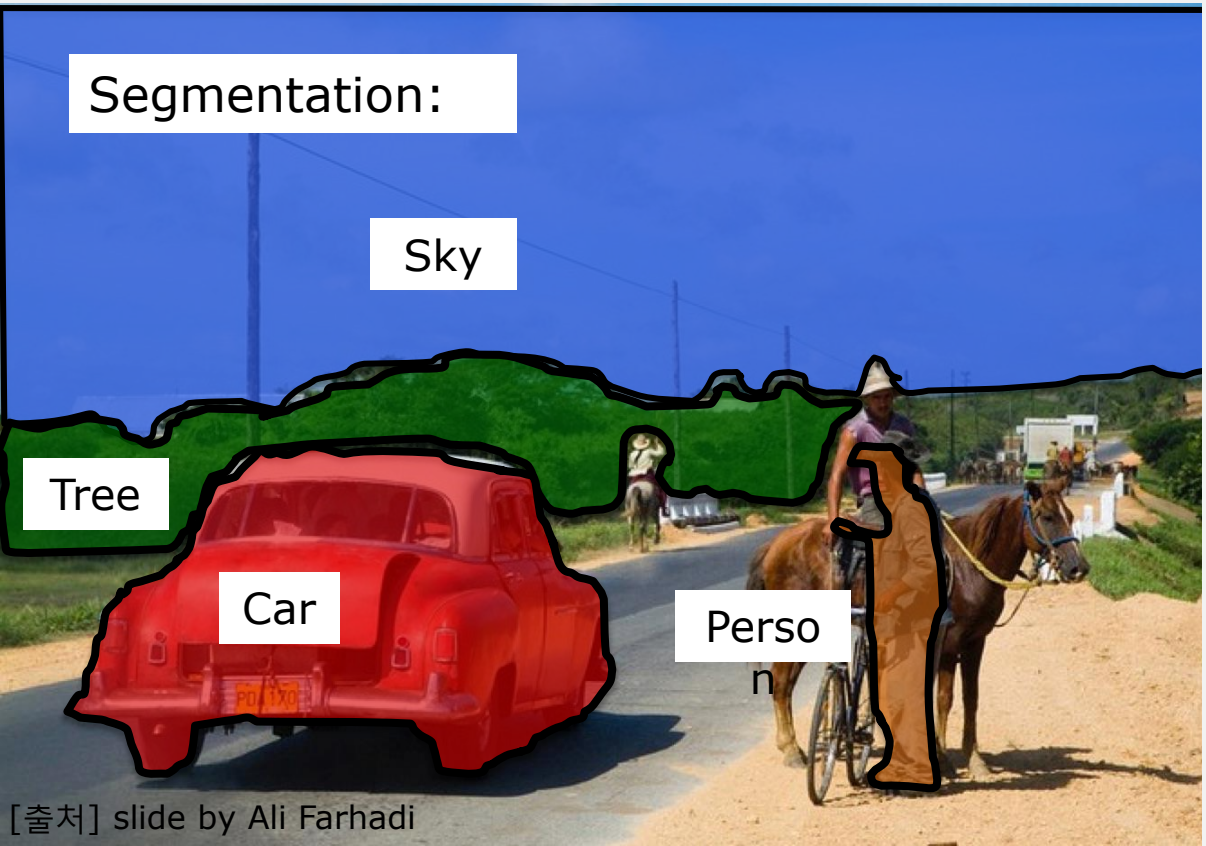
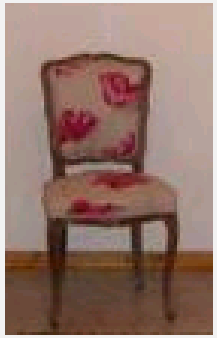
❸Visual Recognition



[출처] slide by Ali Farhadi

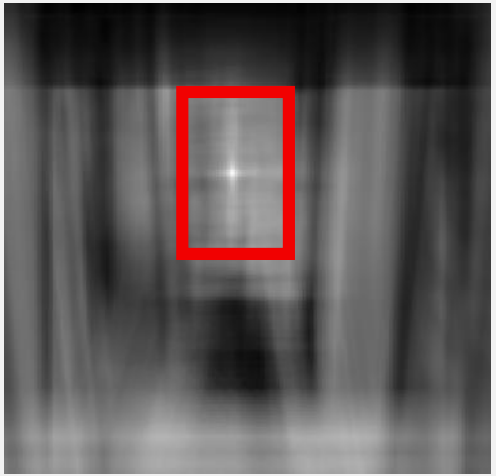
Object Recognition – Is It Really so Hard?

This is a chair



Find the chair in this image

Output of normalized correlation



Object Recognition - Is It Really so Hard?

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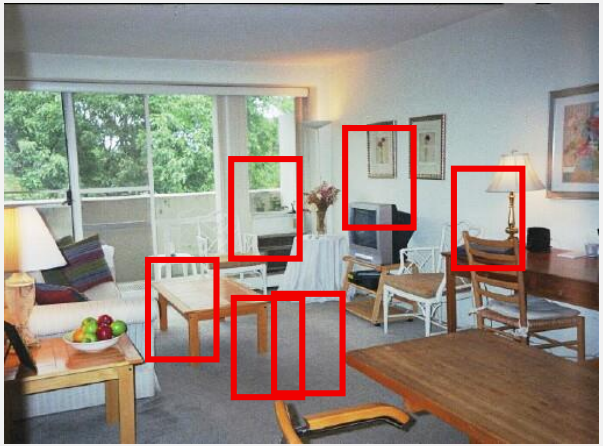
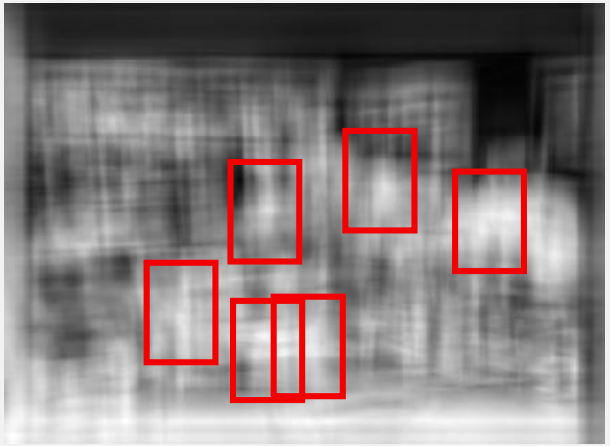


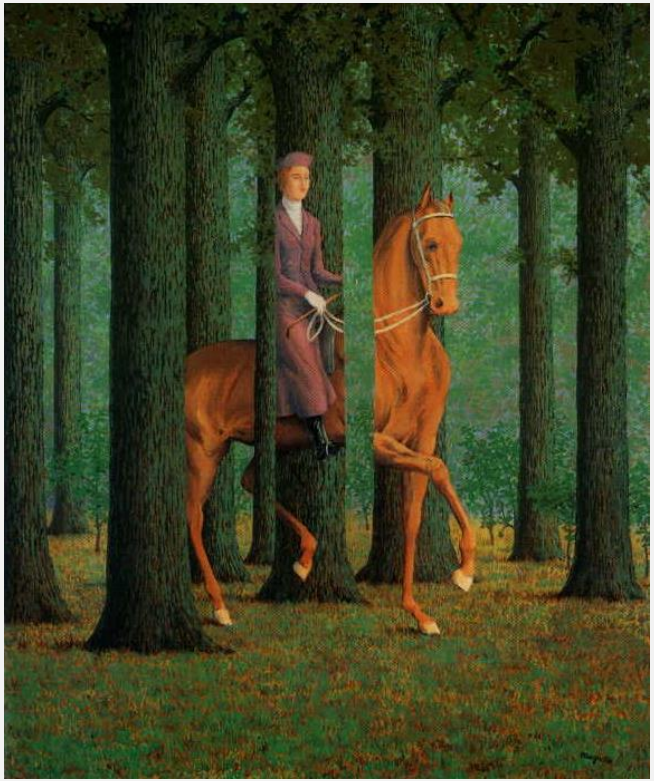


Pretty much garbage:
simple template matching
is not going to make it

Challenges 2: Illumination

[출처] slide by Fei Fei, Fergus & Torralba

Challenges 3: Occlusion



Magritte, 1957

[출처] slide by Fei Fei, Fergus & Torralba

Challenges 4: Scale

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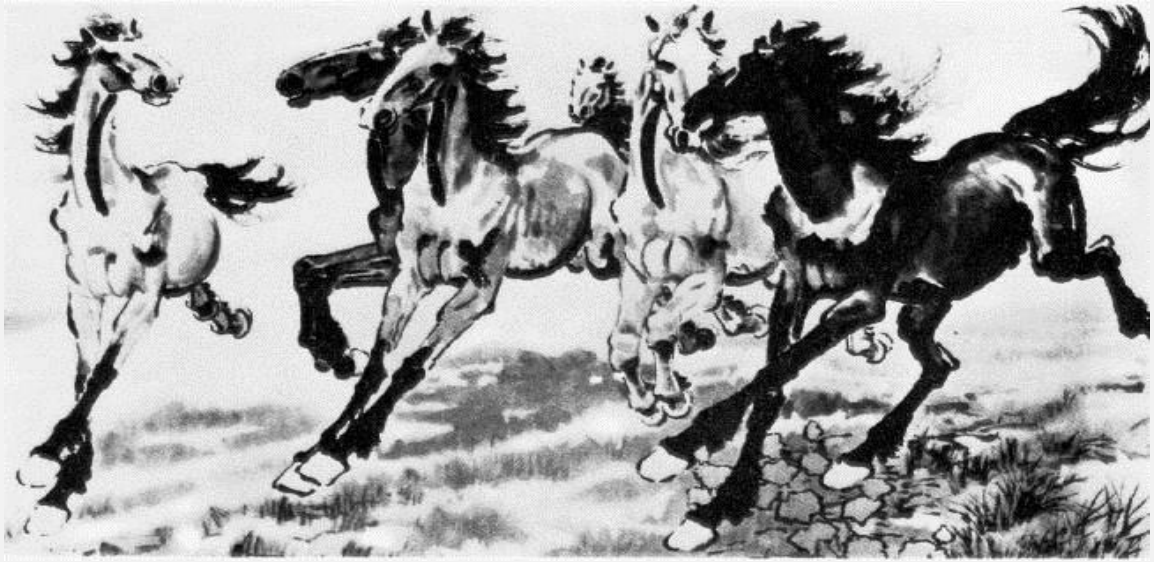
Challenges 5: Deformation



Xu, Beihong 1943

[출처] slide by Fei Fei, Fergus & Torralba

Challenges 6: Background Clutter

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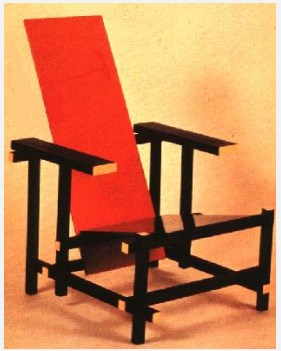
Klimt, 1913

Challenges 7: Object Intra-Class Variation



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