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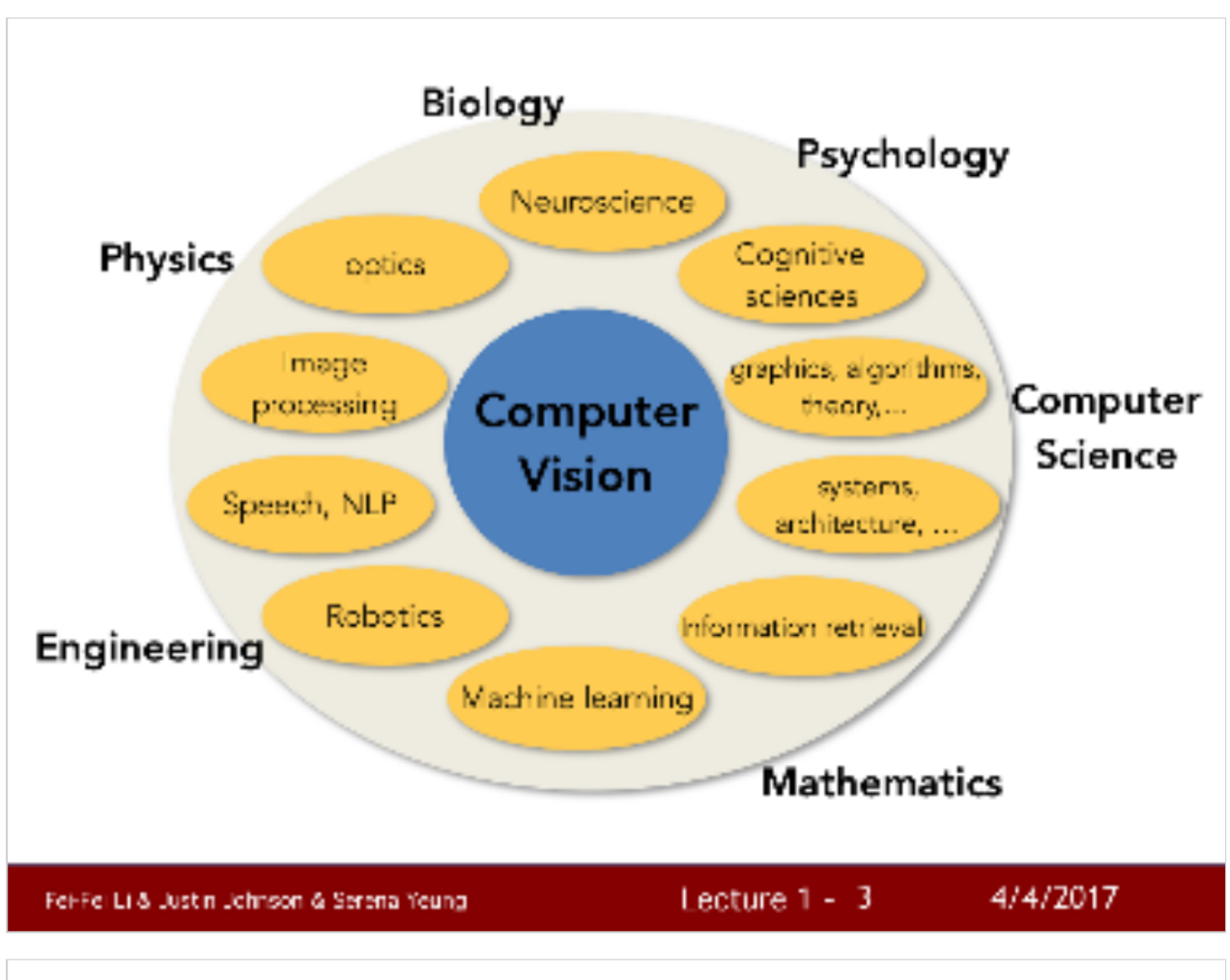
2022년 3월 4일 금요일 오후 10:04

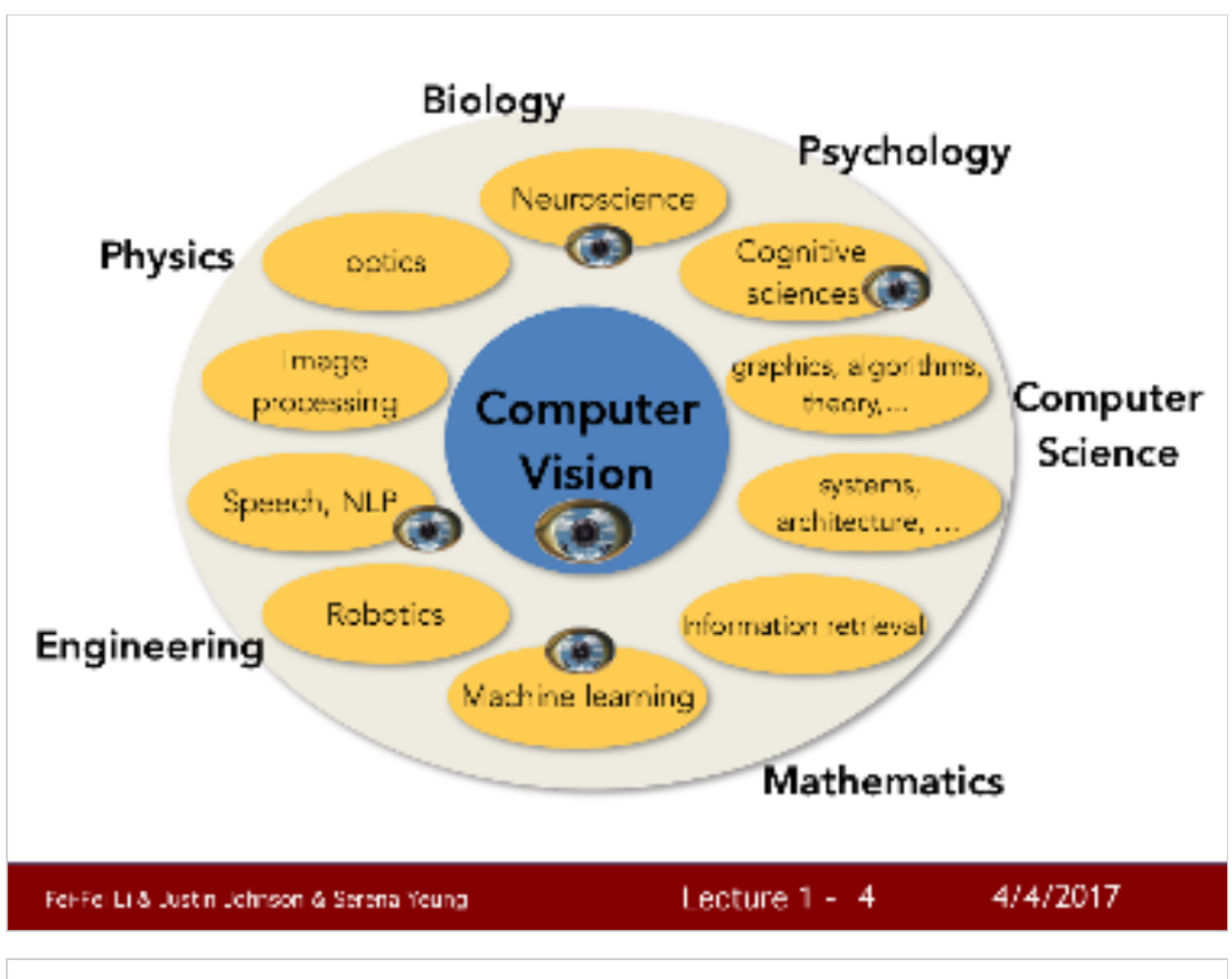
cs231n_2...

Lecture 1: Introduction

Welcome to CS231n



Biology
Psychology
Physics
Computer Science
Engineering
Mathematics
Neuroscience
optics
Cognitive sciences
image processing
Computer Vision
graphics, algorithms, theory,…
Speech, NLP
systems, architecture, …
Robotics
Information retrieval
Machine learning



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Related Courses @ Stanford

- CS131 (Fall 2016, Profs. Fei-Fei Li & Juan Carlos Niebles):
  - Undergraduate introductory class
- CS 224n (Winter 2017, Prof. Chris Manning and Richard Socher)
- CS231a (Spring 2017, Prof. Silvio Savarese)
  - Core computer vision class for seniors, masters, and PhDs
  - Topics include image processing, cameras, 3D reconstruction, segmentation, object recognition, scene understanding
- **CS231n (this term, Prof. Fei-Fei Li & Justin Johnson & Serena Yeung)**
  - **Neural network (aka "deep learning") class on image classification**
- And an assortment of CS331 and CS431 for advanced topics in computer vision

→ computer vision에 관한 것.

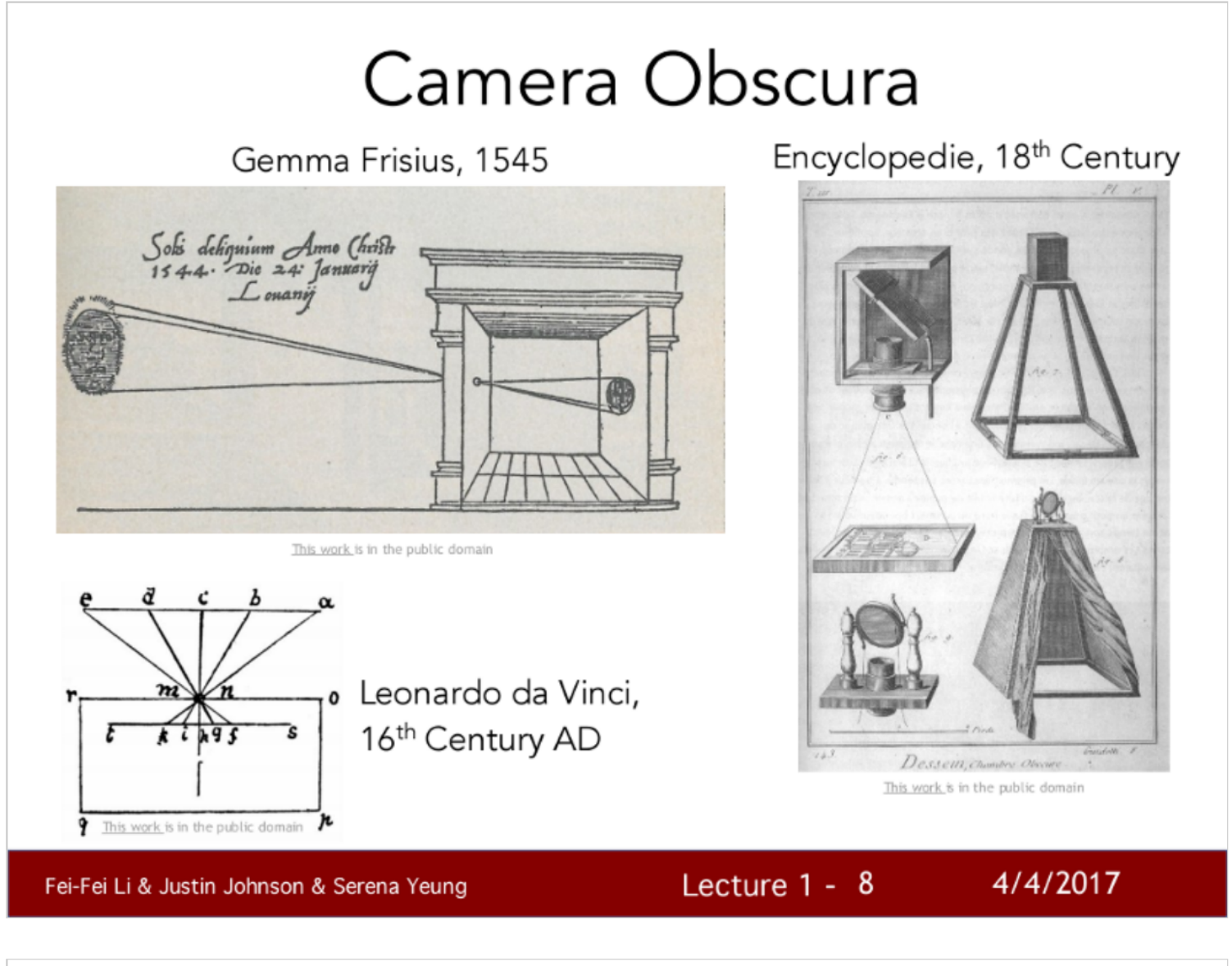
focusing on 3D reconstruction, matching robotic vision …

Today's agenda

- A brief history of computer vision
- CS231n overview

Evolution's Big Bang

543million years, B.C.



Camera Obscura

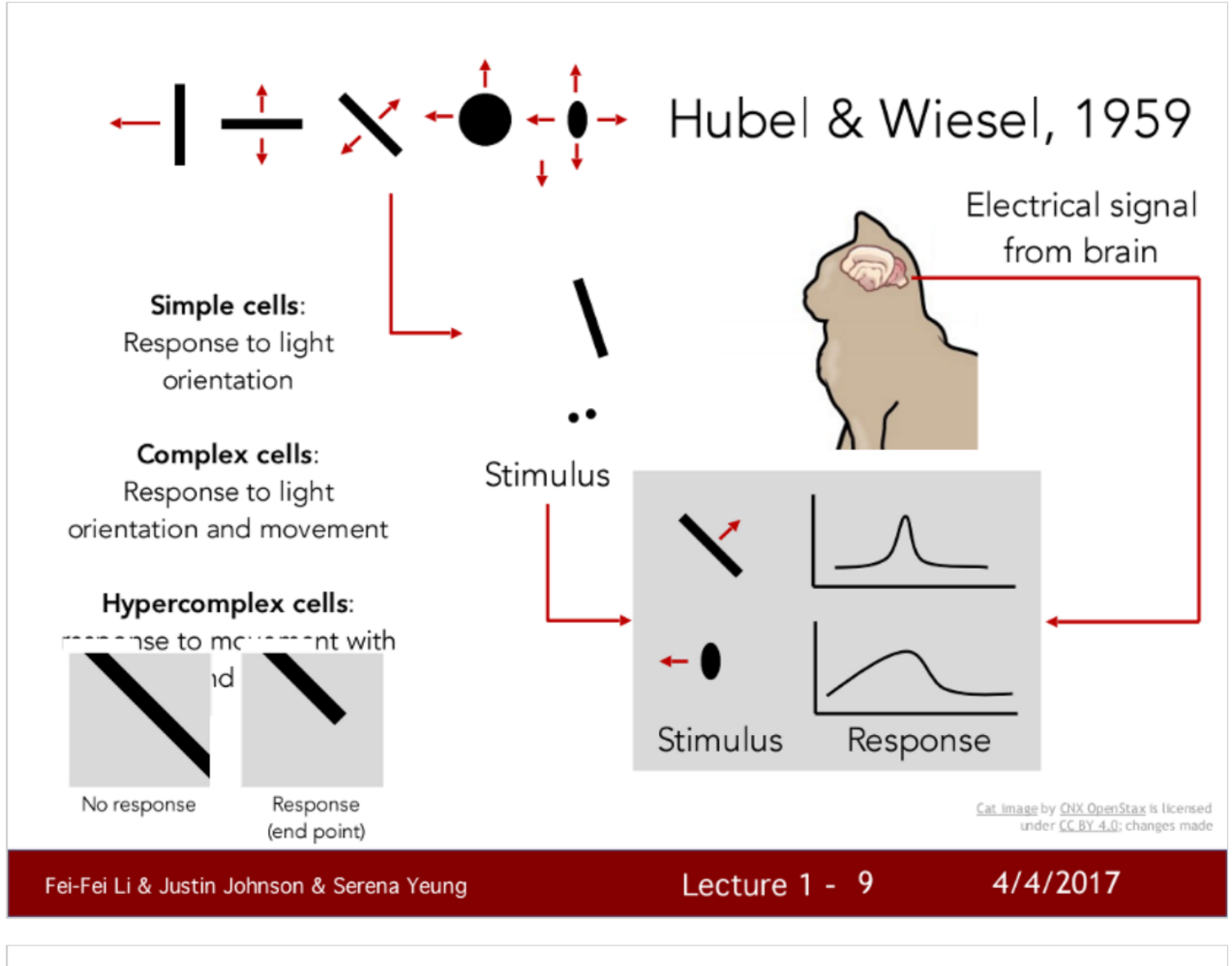
Gemma Frisius, 1545

Encyclopedie, 18th Century

Leonardo da Vinci, 16th Century AD

This work is in the public domain

Solis deliquium Anno Christi 1544. Die 24. Januarij Lonanij



Hubel & Wiesel, 1959

Electrical signal from brain

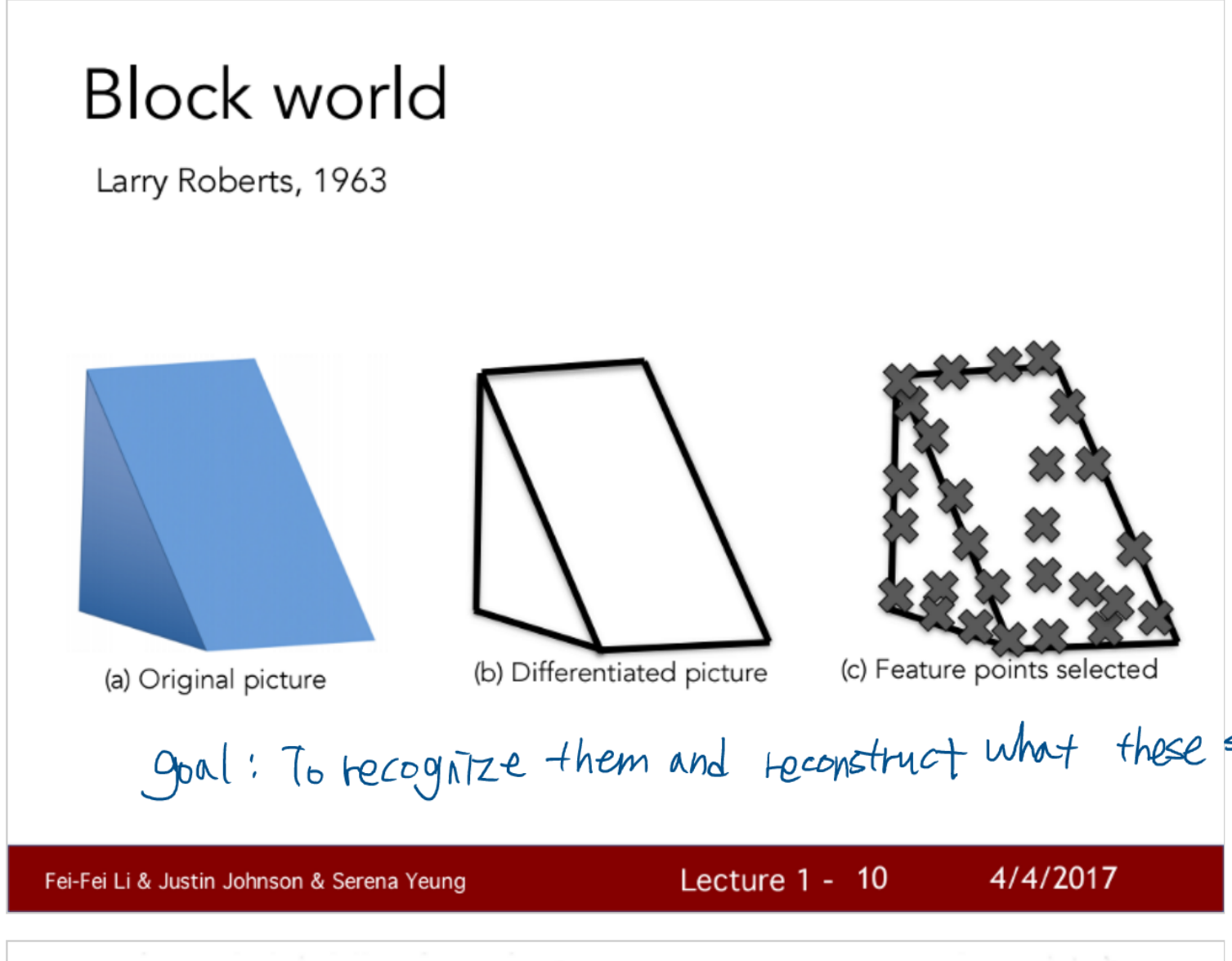
Simple cells: Response to light orientation

Complex cells: Response to light orientation and movement

Hypercomplex cells: response to movement with an end point

Stimulus

Cat image by CNX OpenStax is licensed under CC BY 4.0; changes made

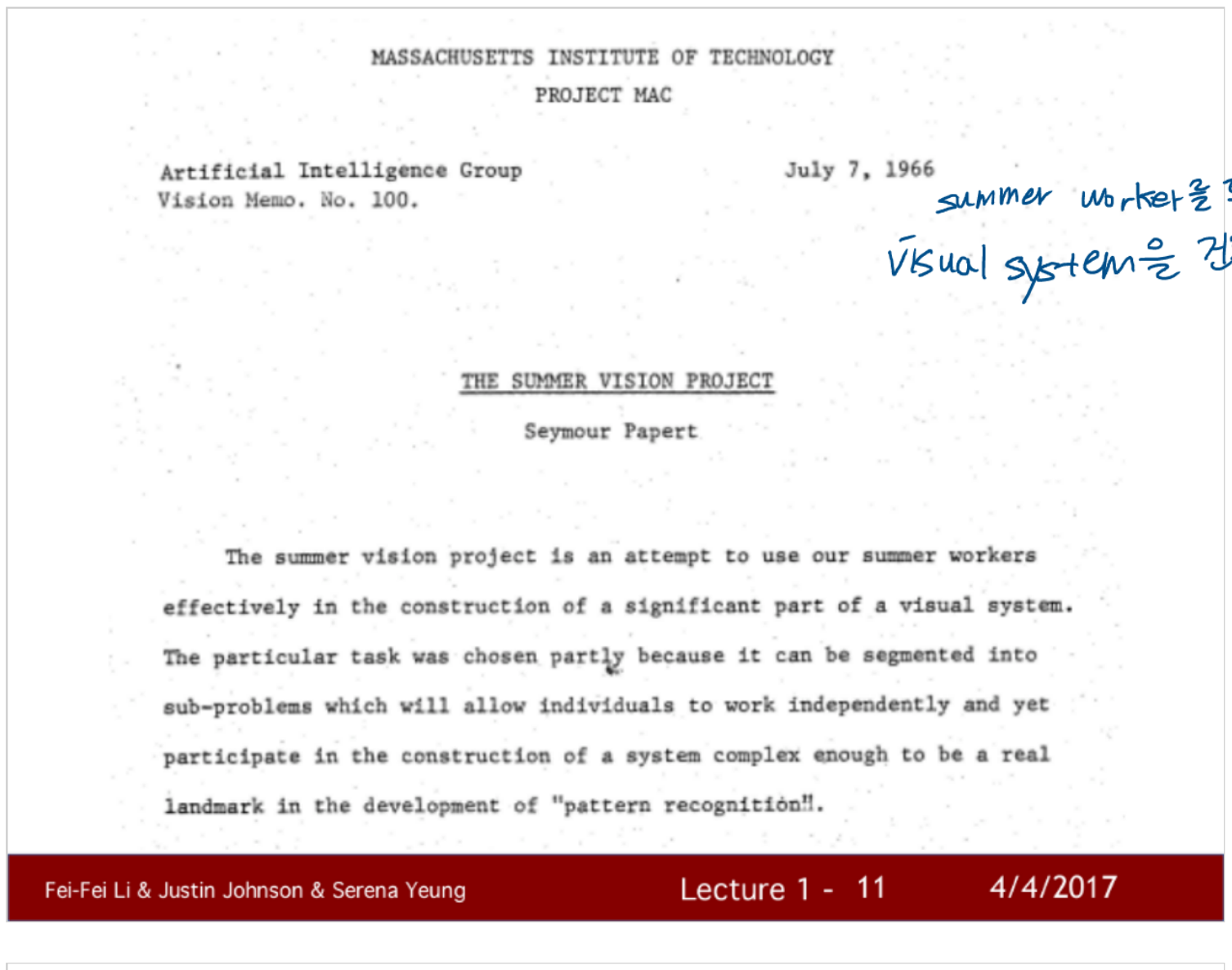


Block world

Larry Roberts, 1963

(a) Original picture (b) Differentiated picture (c) Feature points selected

goal : To recognize them and reconstruct what these shapes are.



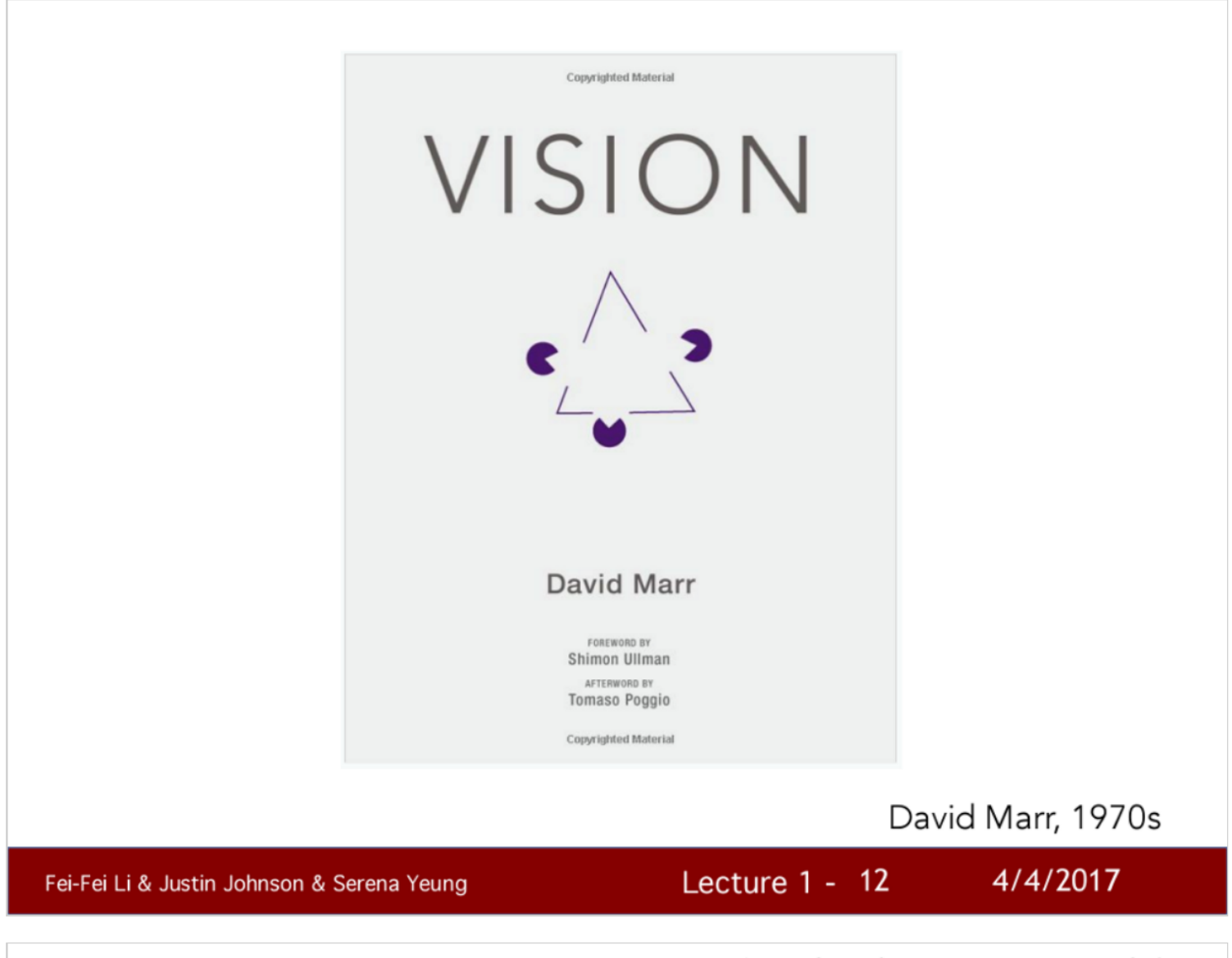
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
PROJECT MAC

Artificial Intelligence Group July 7, 1966
Vision Memo. No. 100.

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".

summer worker를 통해 visual system을 건축해보는것

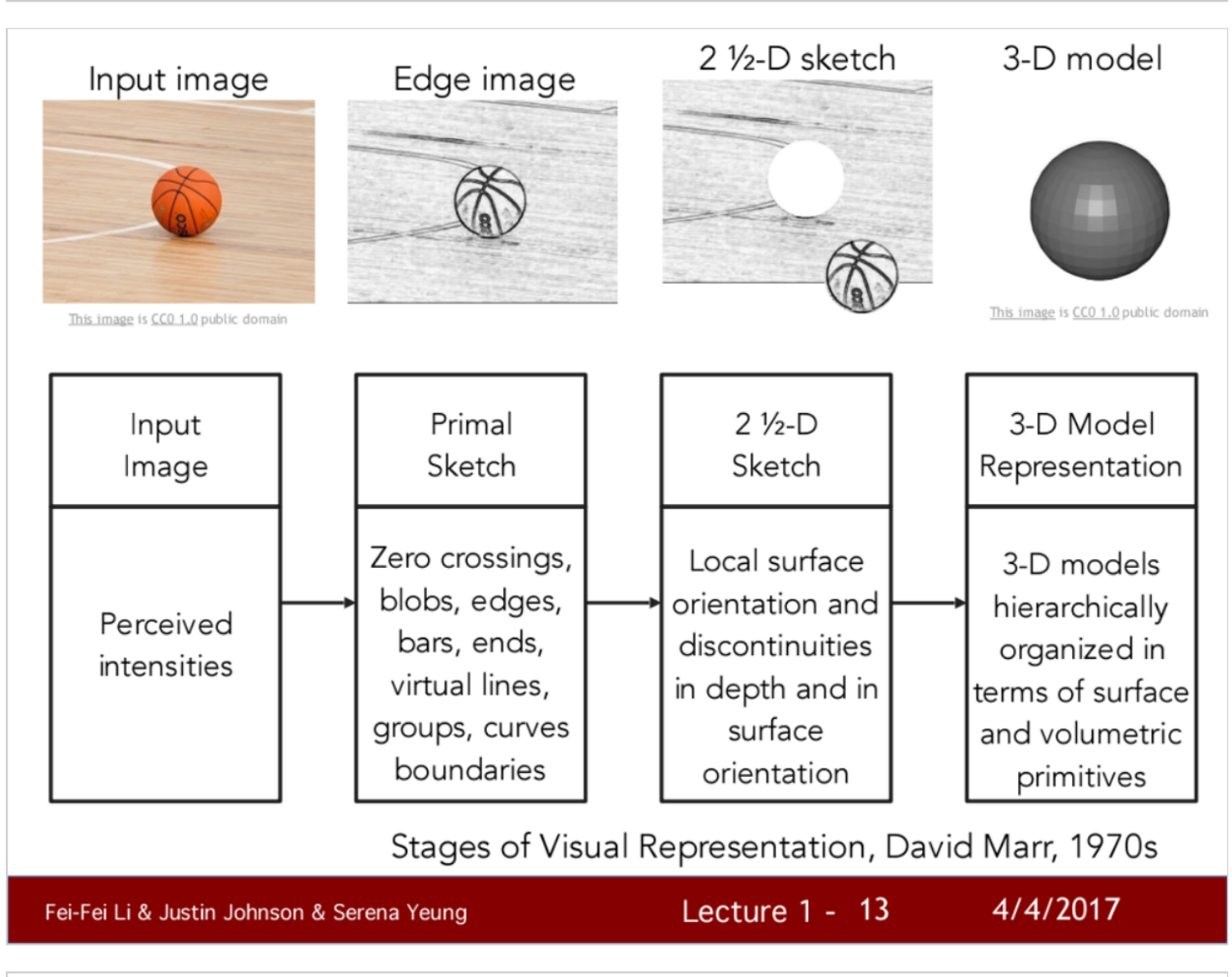


VISION

David Marr

FOREWORD BY Shimon Ullman
AFTERWORD BY Tomaso Poggio

David Marr, 1970s



Input image
Edge image
2 ½-D sketch
3-D model

Input Image → Primal Sketch → 2 ½-D Sketch → 3-D Model Representation

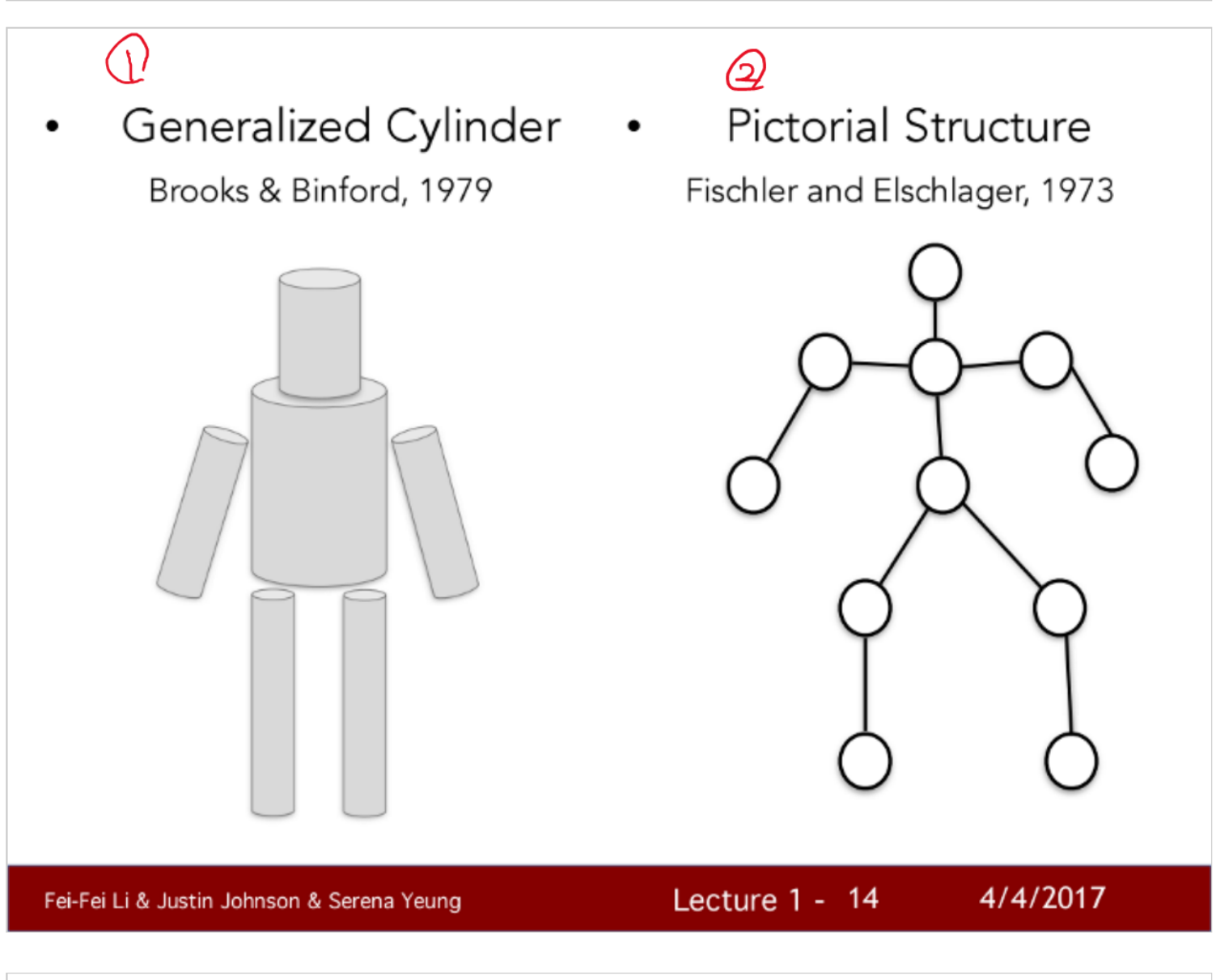
Perceived intensities

Zero crossings, blobs, edges, bars, ends, virtual lines, groups, curves boundaries

Local surface orientation and discontinuities in depth and in surface orientation

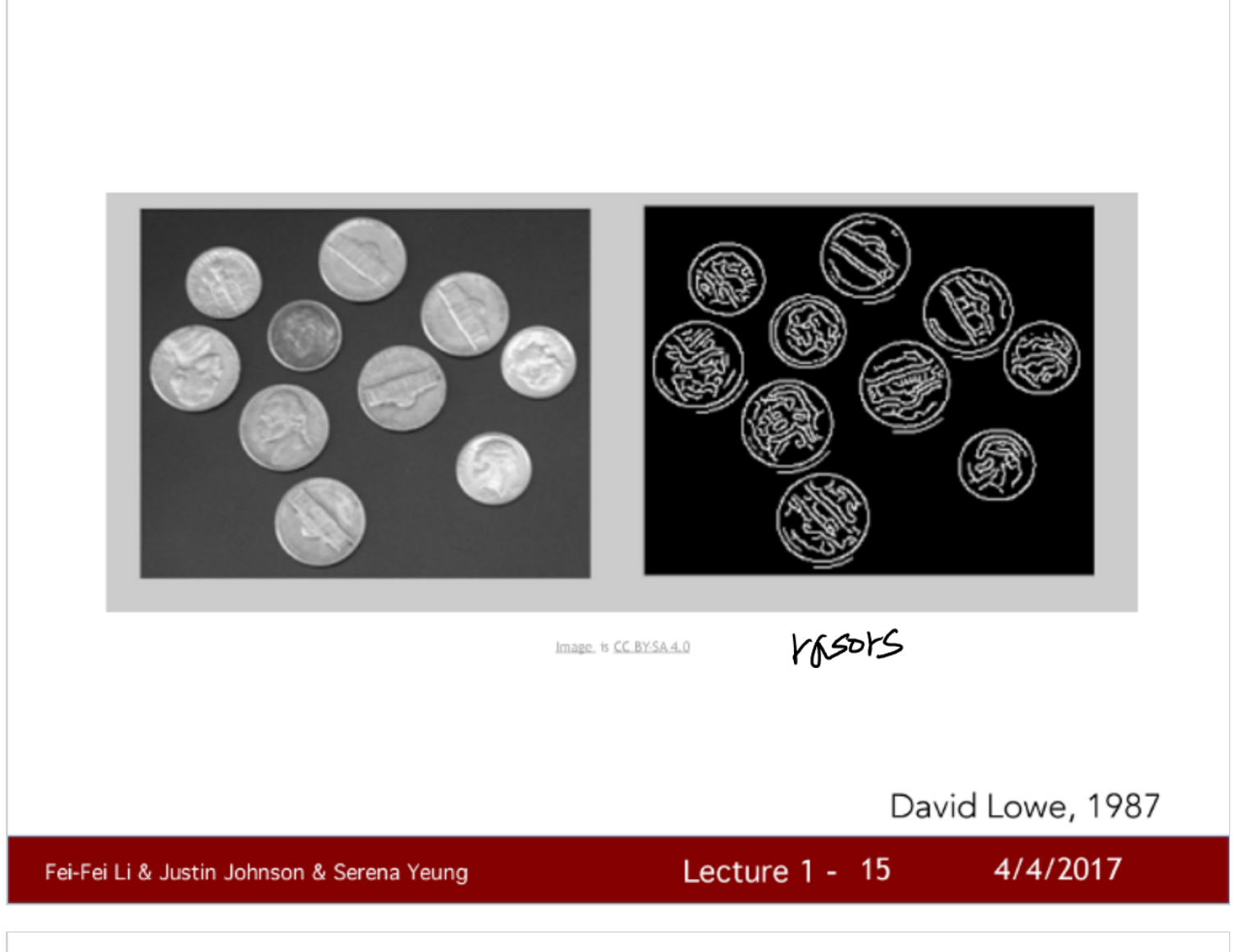
3-D models hierarchically organized in terms of surface and volumetric primitives

Stages of Visual Representation, David Marr, 1970s



①
- Generalized Cylinder
  Brooks & Binford, 1979

②
- Pictorial Structure
  Fischler and Elschlager, 1973



rasors

David Lowe, 1987

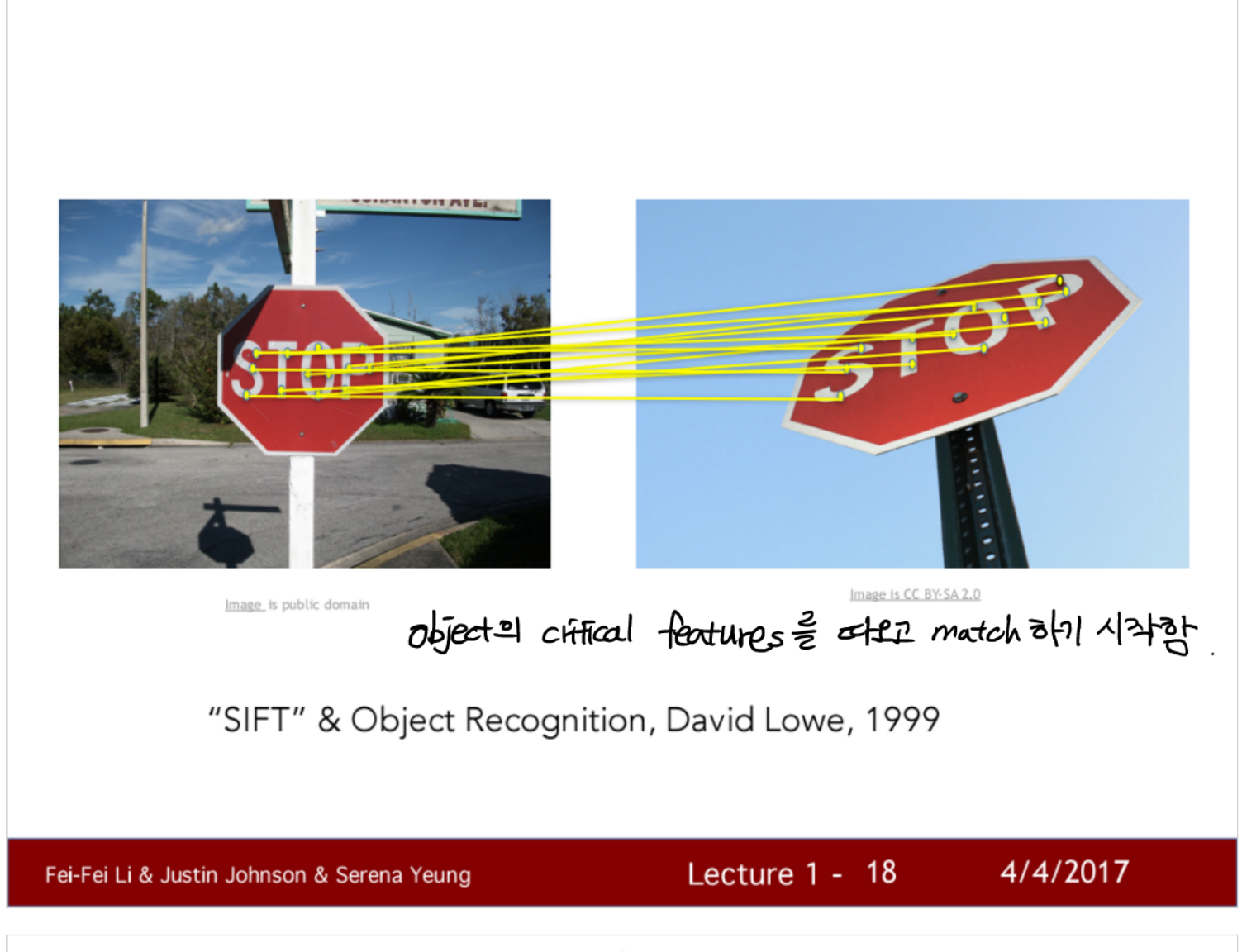
Normalized Cut (Shi & Malik, 1997)

do object segmentation

image segmentation

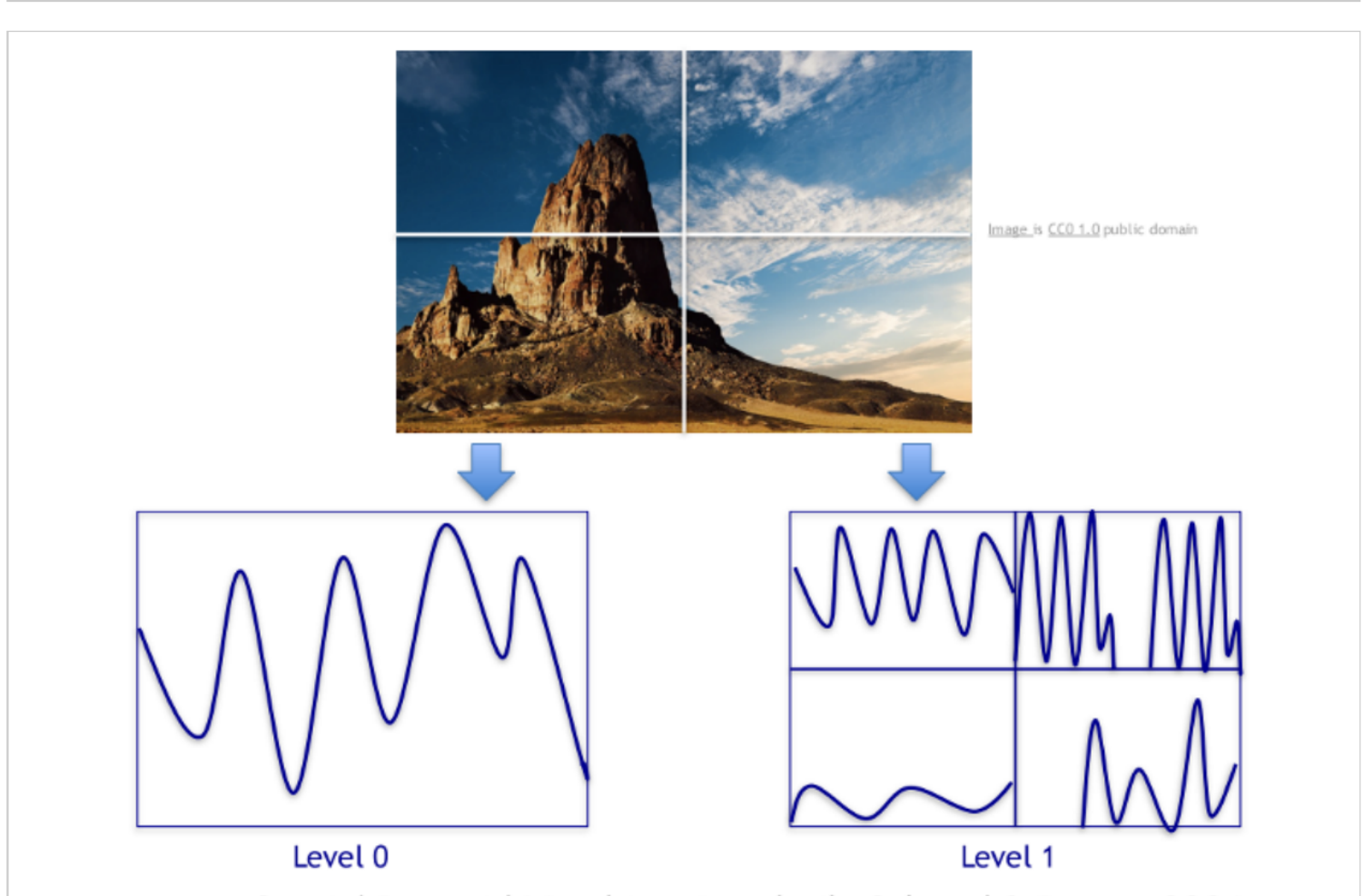
Face Detection, Viola & Jones, 2001

Adaboost algorithm
→ to do real-time face detection



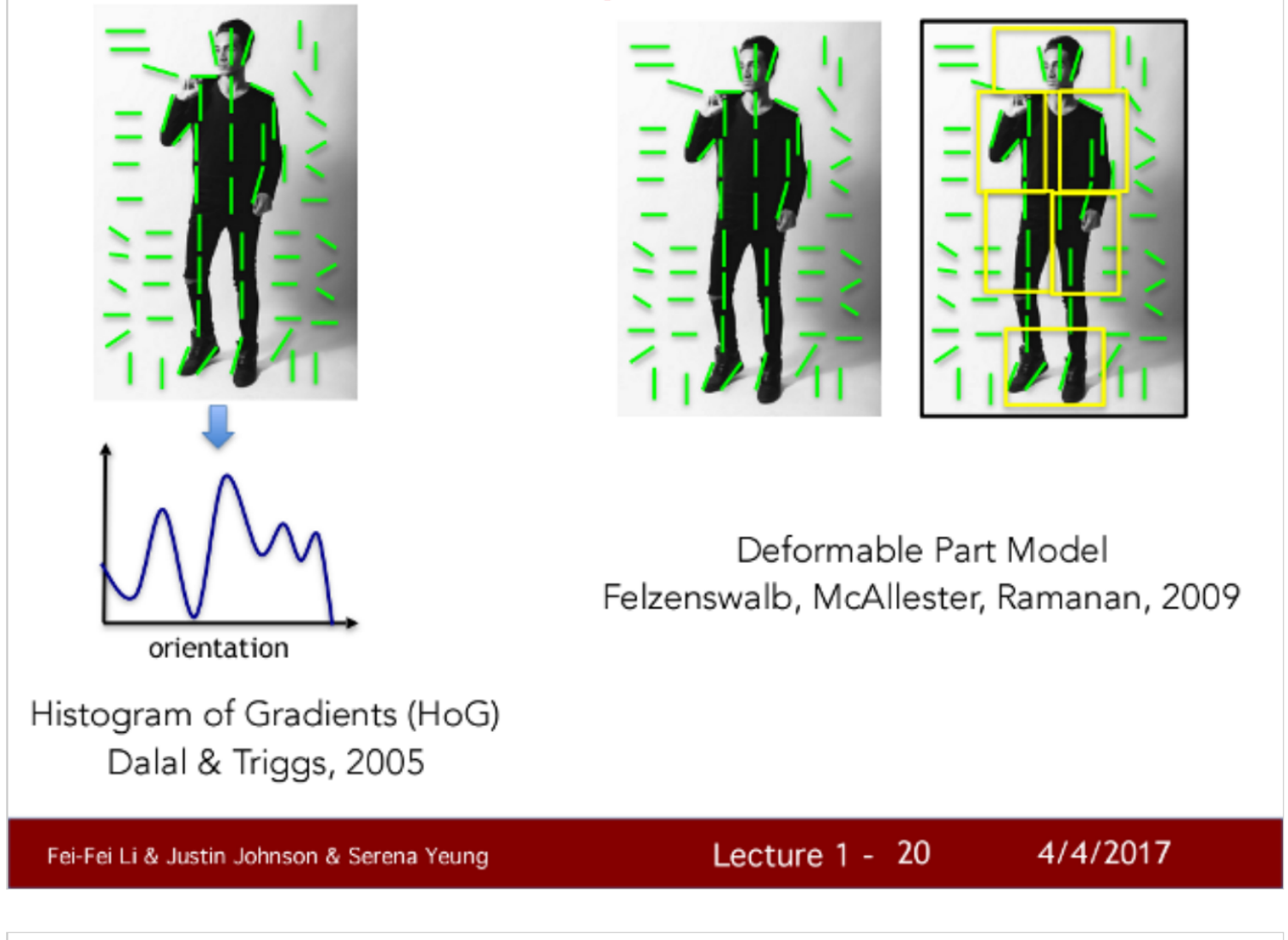
object의 critical features를 따오고 match하기 시작함.

"SIFT" & Object Recognition, David Lowe, 1999



Spatial Pyramid Matching, Lazebnik, Schmid & Ponce, 2006

human bodies를 현실과 인식된 이미지와의 비교

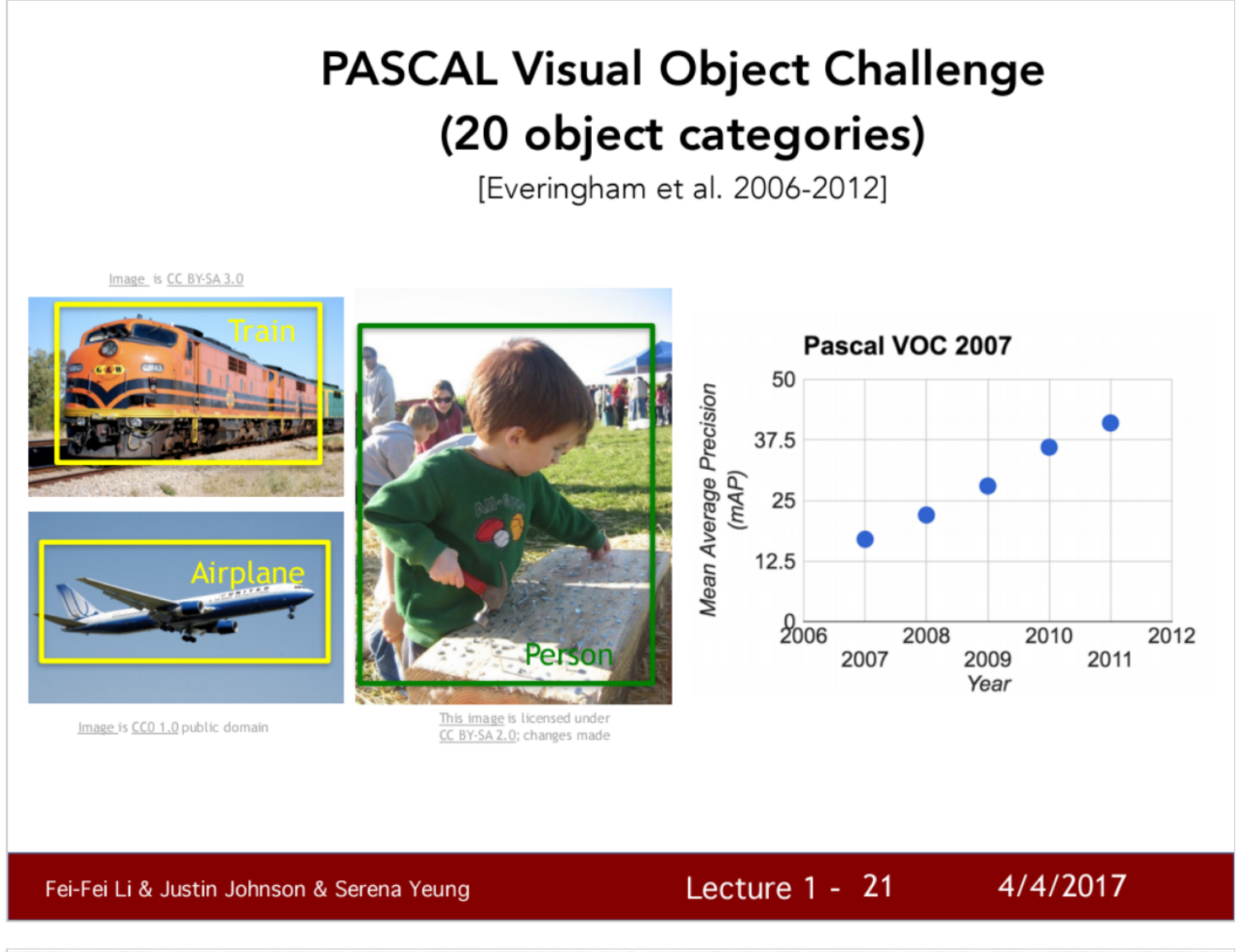


①

Histogram of Gradients (HoG)
Dalal & Triggs, 2005

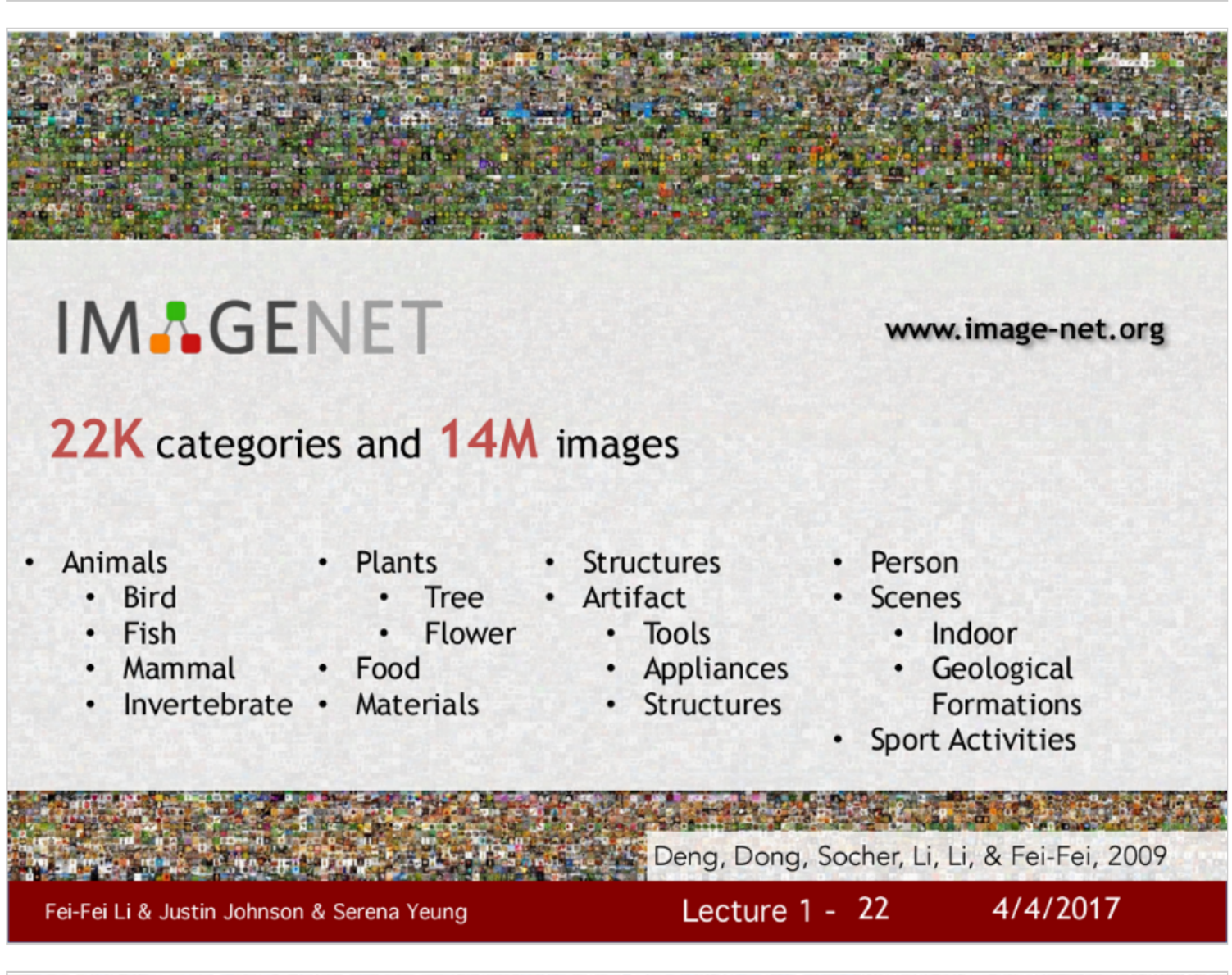
②

Deformable Part Model
Felzenswalb, McAllester, Ramanan, 2009



PASCAL Visual Object Challenge (20 object categories)

[Everingham et al. 2006-2012]

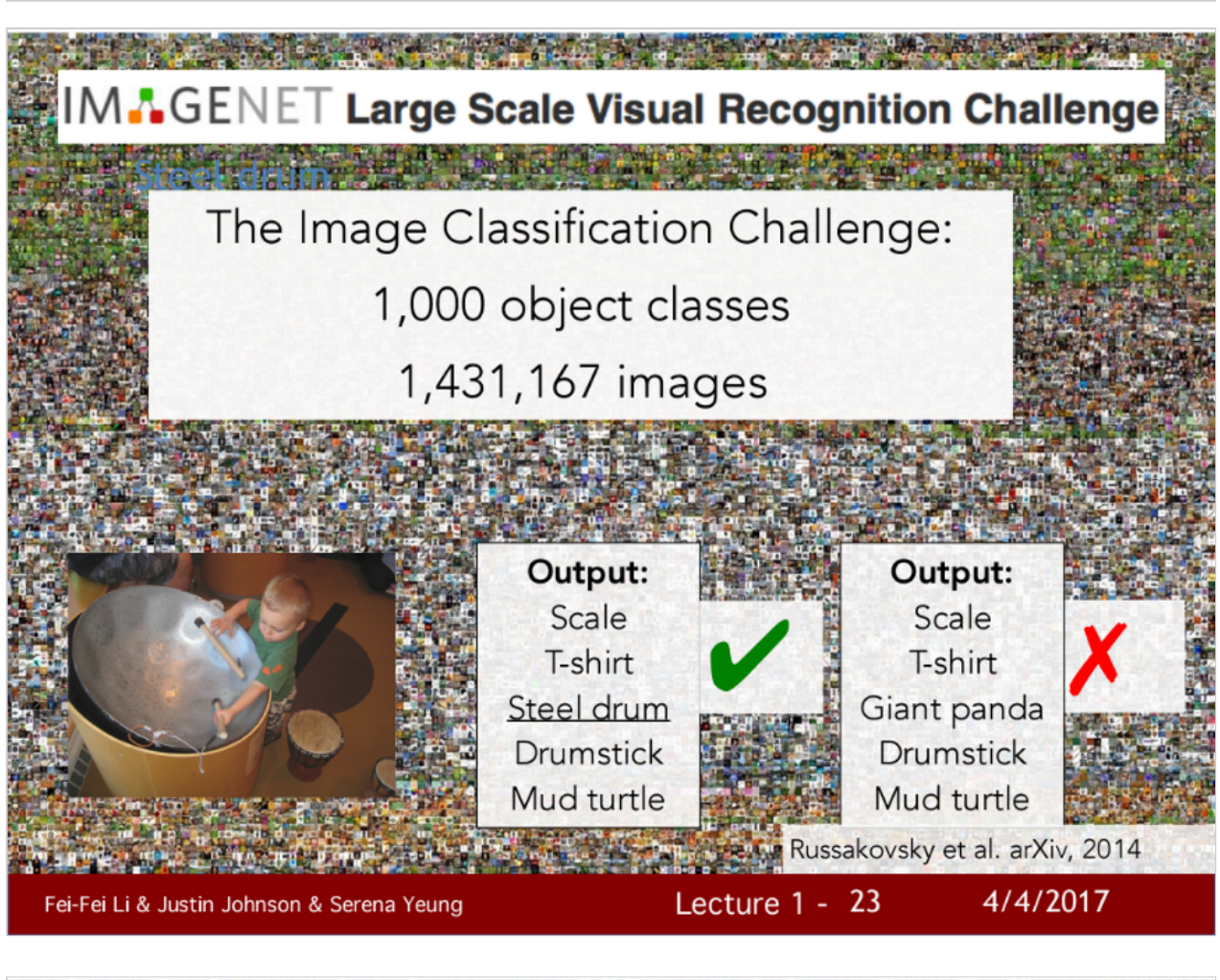


IMAGENET www.image-net.org

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



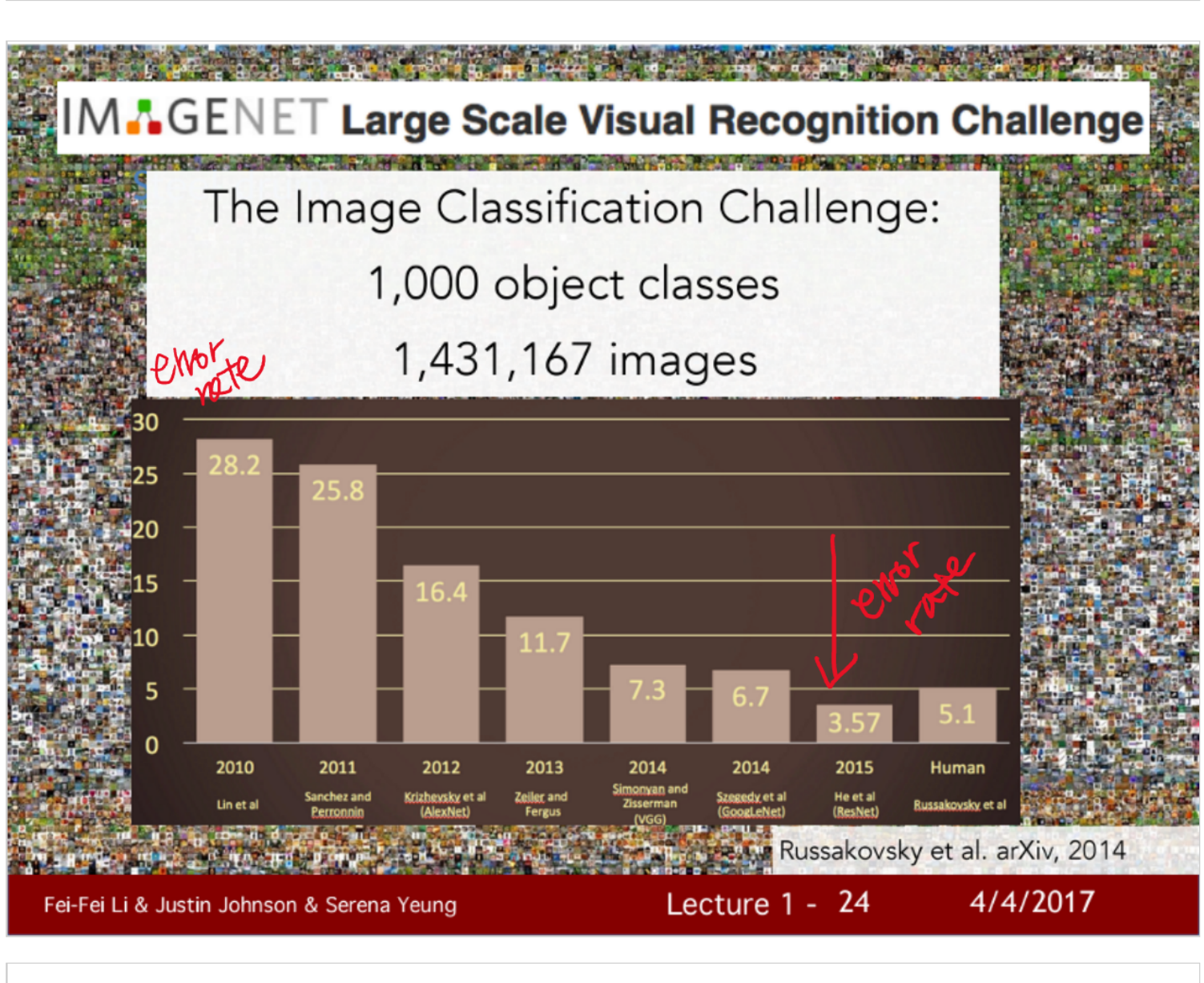
IMAGENET Large Scale Visual Recognition Challenge

The Image Classification Challenge:
1,000 object classes
1,431,167 images

Output:
Scale
T-shirt
Steel drum
Drumstick
Mud turtle
✓

Output:
Scale
T-shirt
Giant panda
Drumstick
Mud turtle
✗

Russakovsky et al. arXiv, 2014



IMAGENET Large Scale Visual Recognition Challenge

The Image Classification Challenge:
1,000 object classes
1,431,167 images

error rate

error rate

Russakovsky et al. arXiv, 2014

CNN 알고리즘이 성능이 좋았다.

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