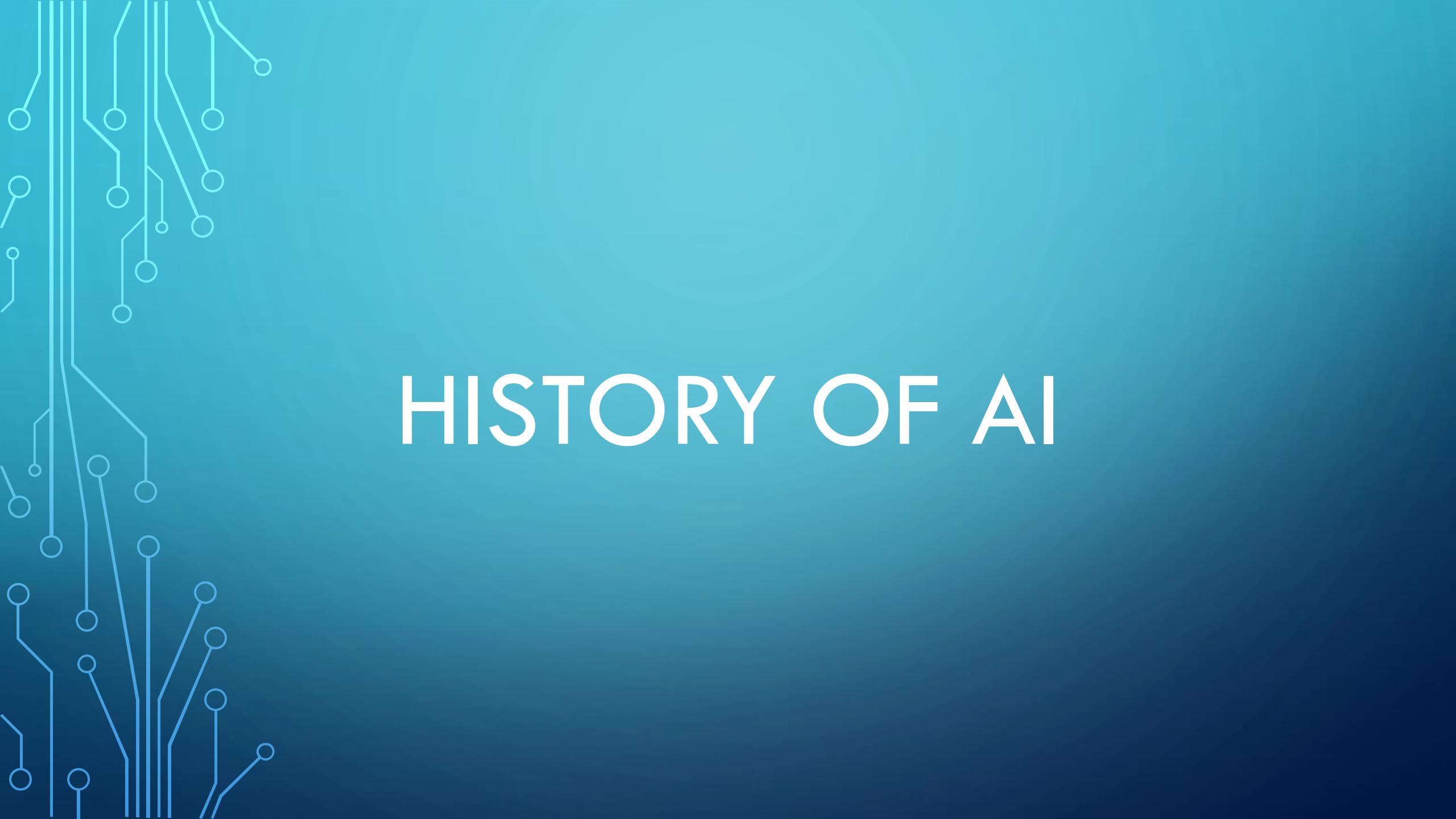
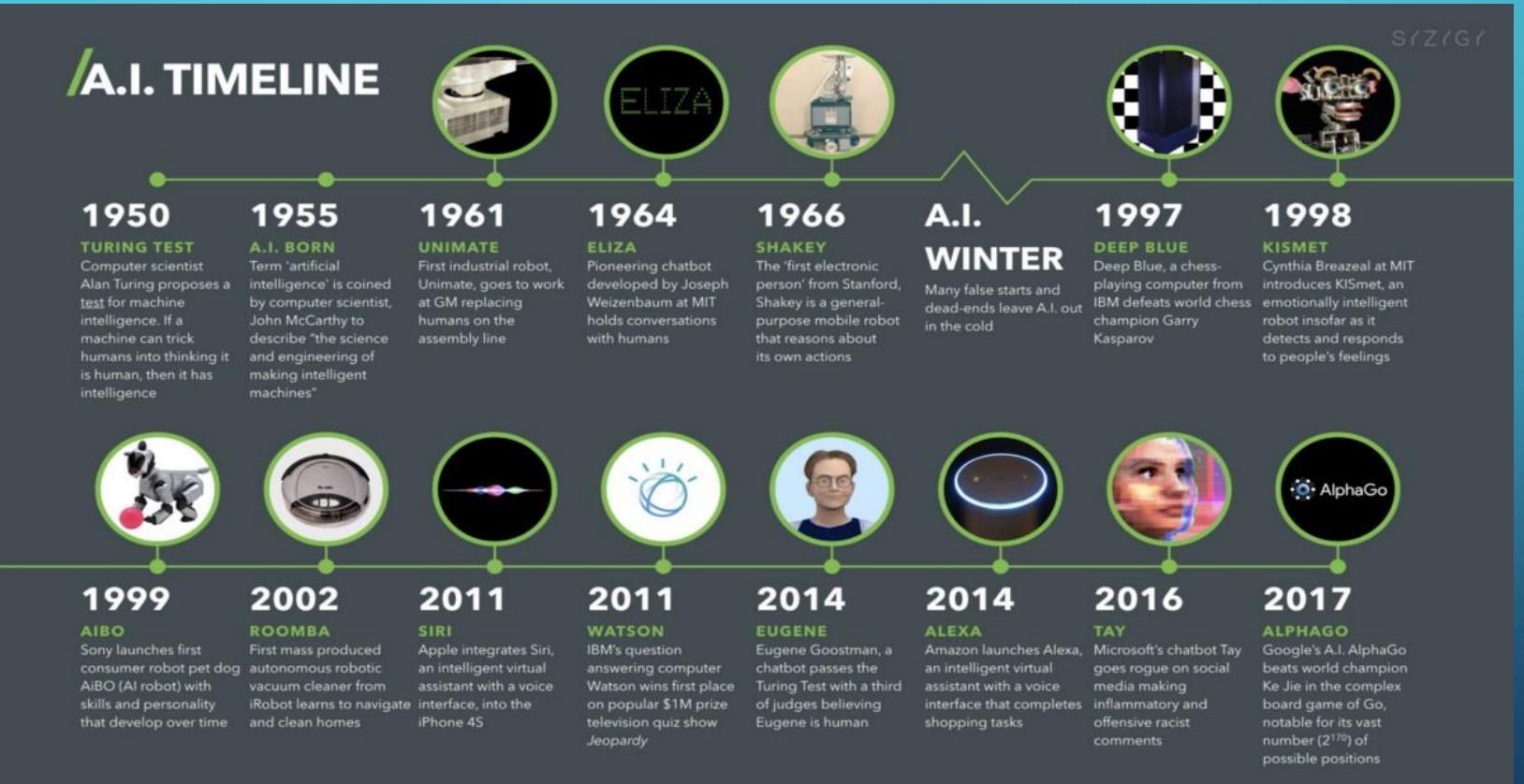


AGENDA

- History of AI
- Mathematics in Machine Learning
- What is Machine Learning and its fields
- Gradient Descent Algorithm
- Linear Regression

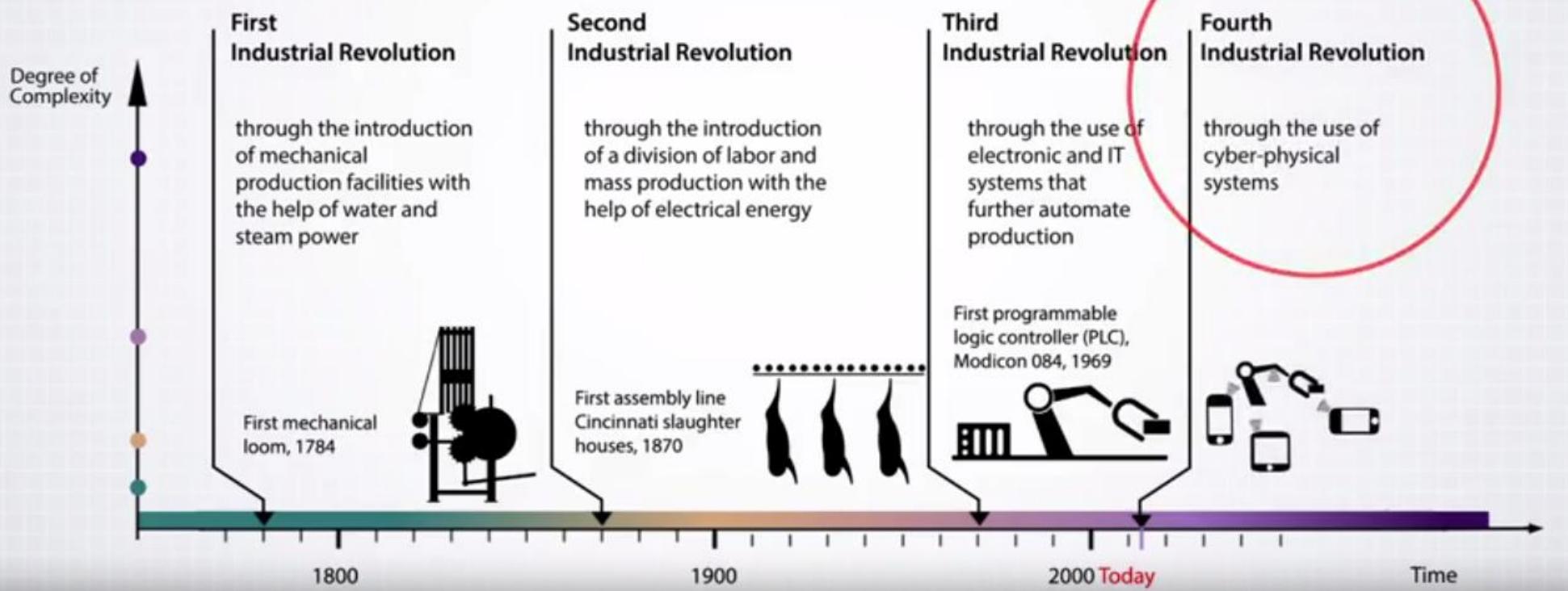


HISTORY OF AI



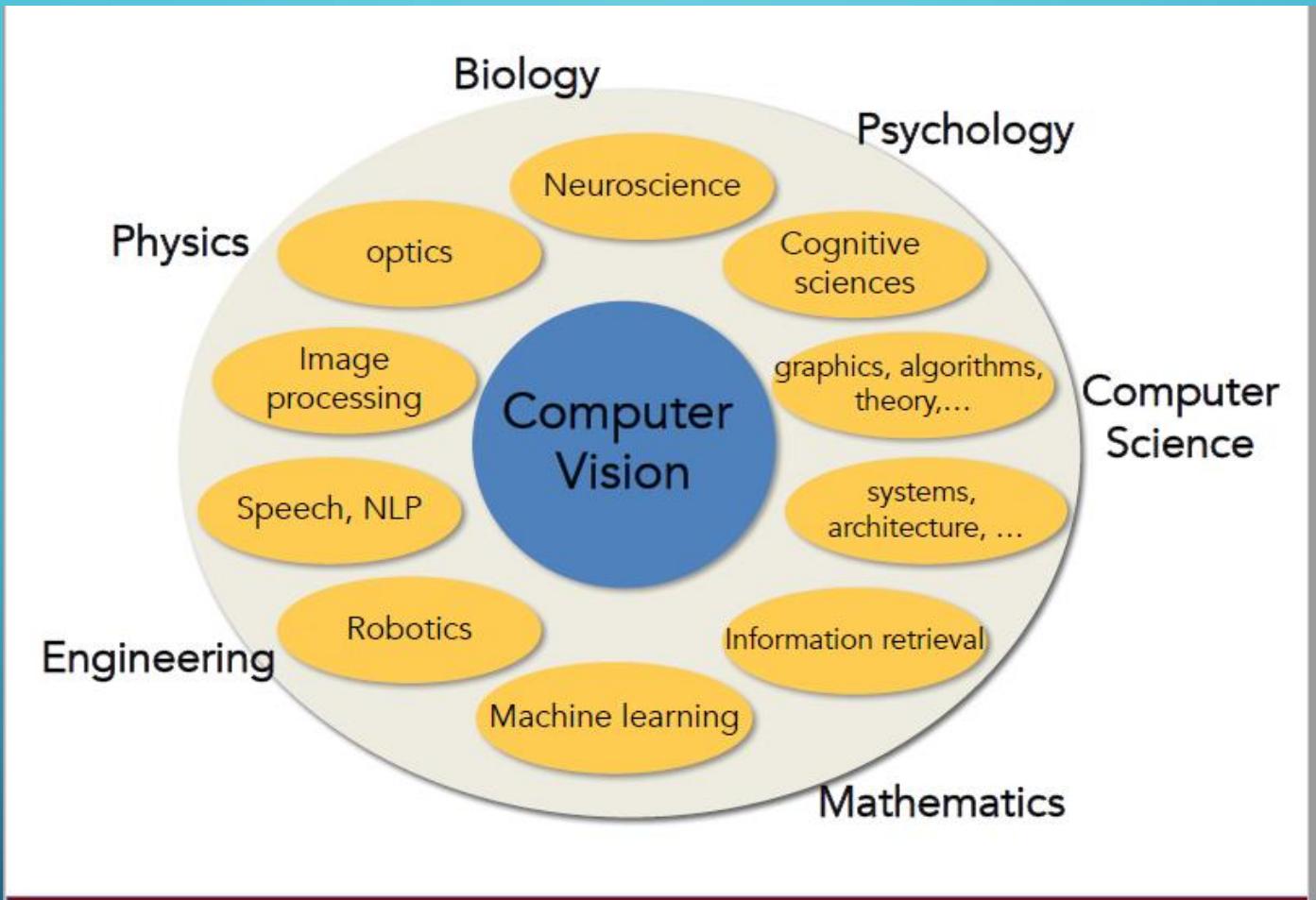
Industrial Revolution

From Industry 1.0 to Industry 4.0



HISTORY OF COMPUTER VISION





Evolution's Big Bang



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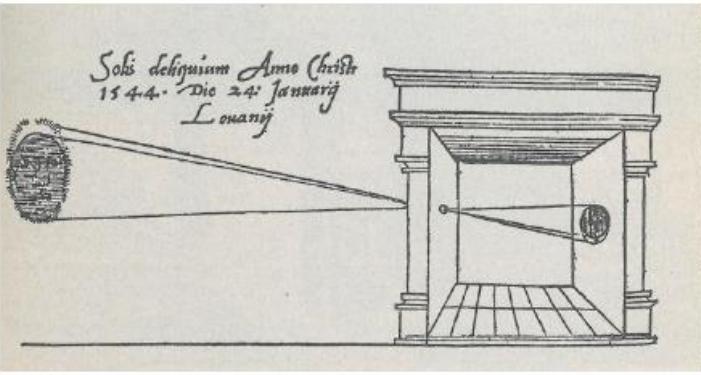


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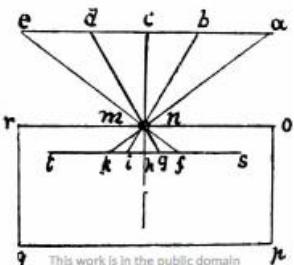
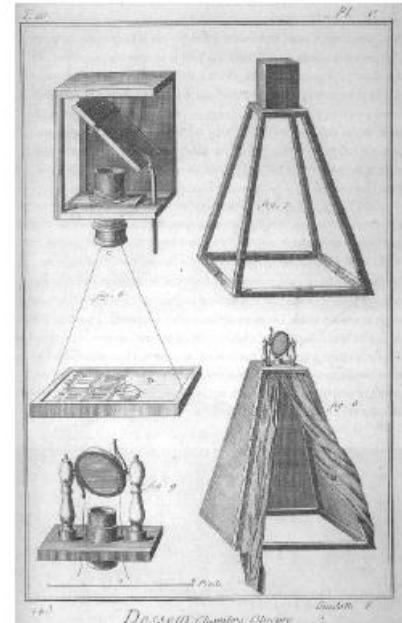
543 million years, B.C.

Camera Obscura

Gemma Frisius, 1545



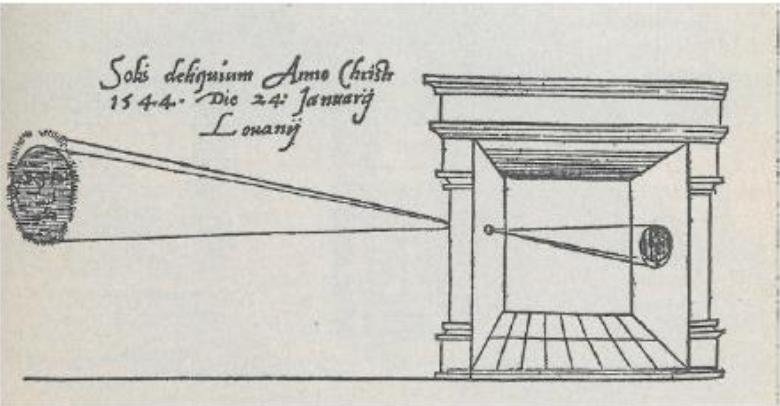
Encyclopedie, 18th Century



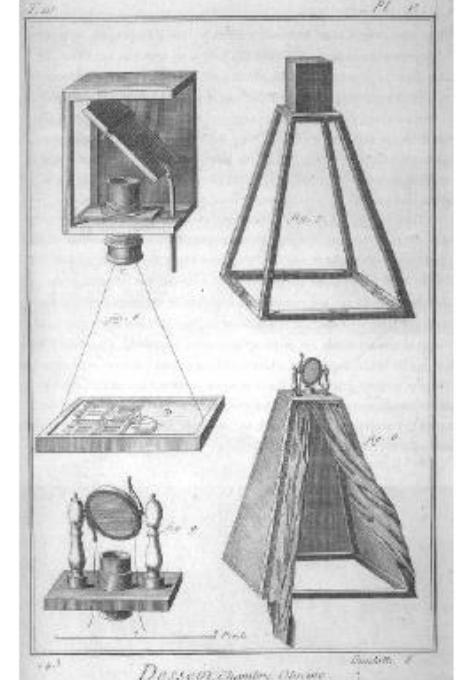
Leonardo da Vinci,
16th Century AD

Camera Obscura

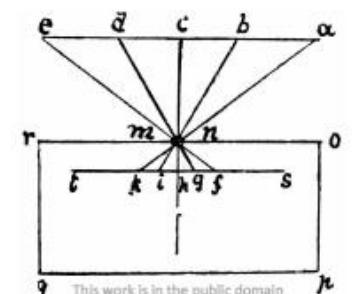
Gemma Frisius, 1545

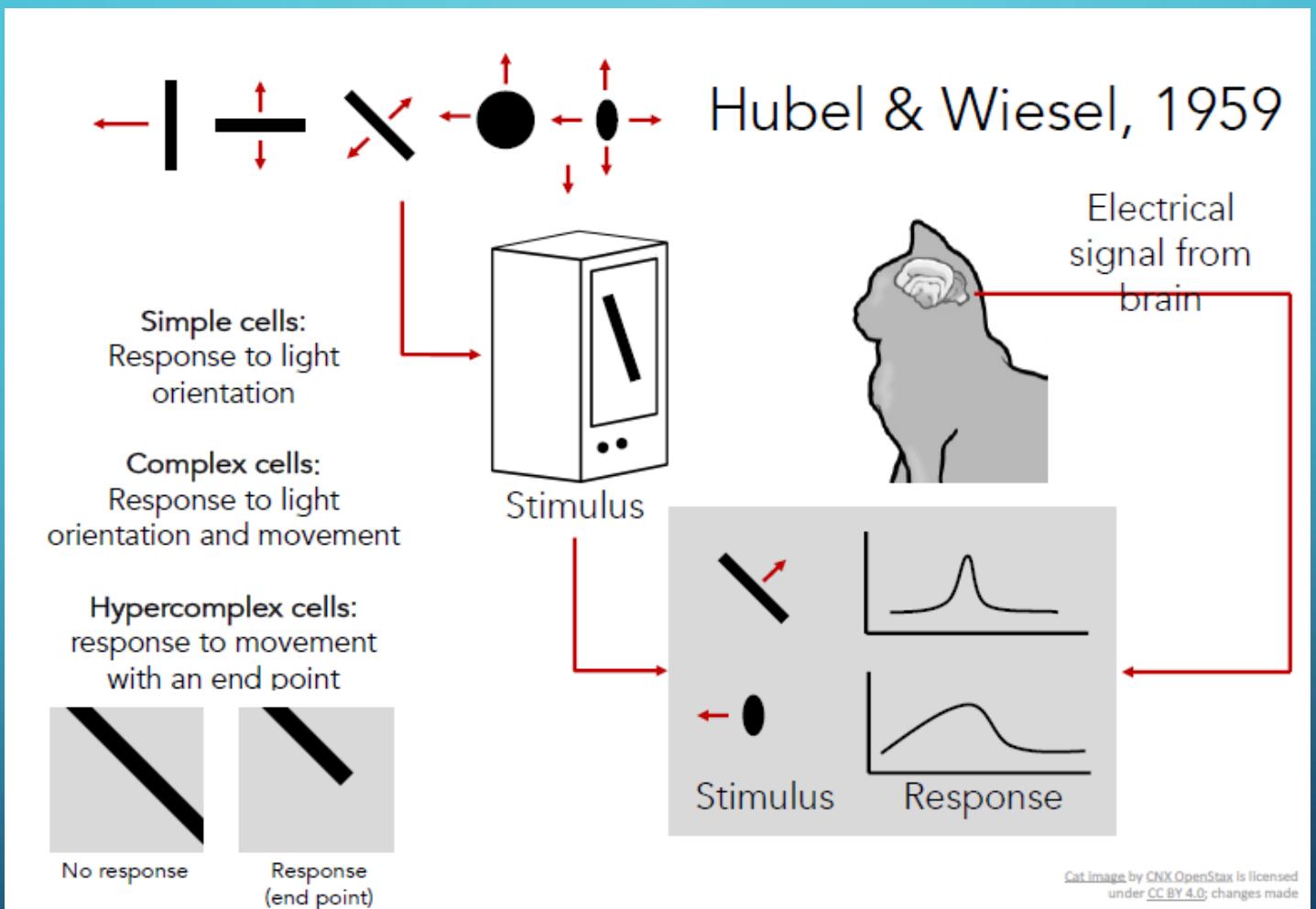


Encyclopedie, 18th Century



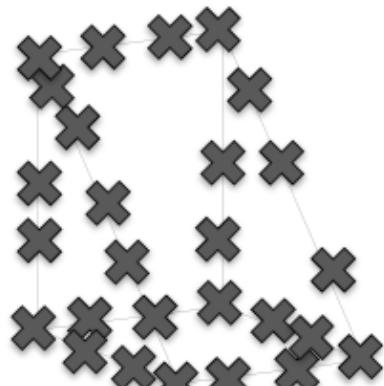
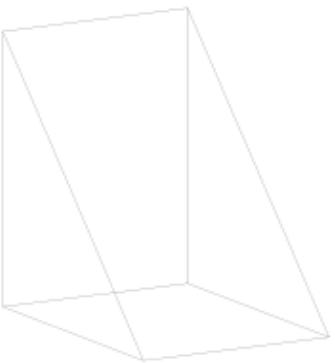
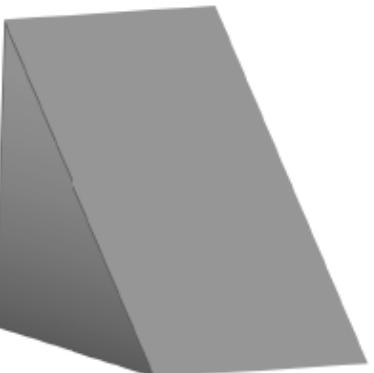
Leonardo da Vinci,
16th Century AD

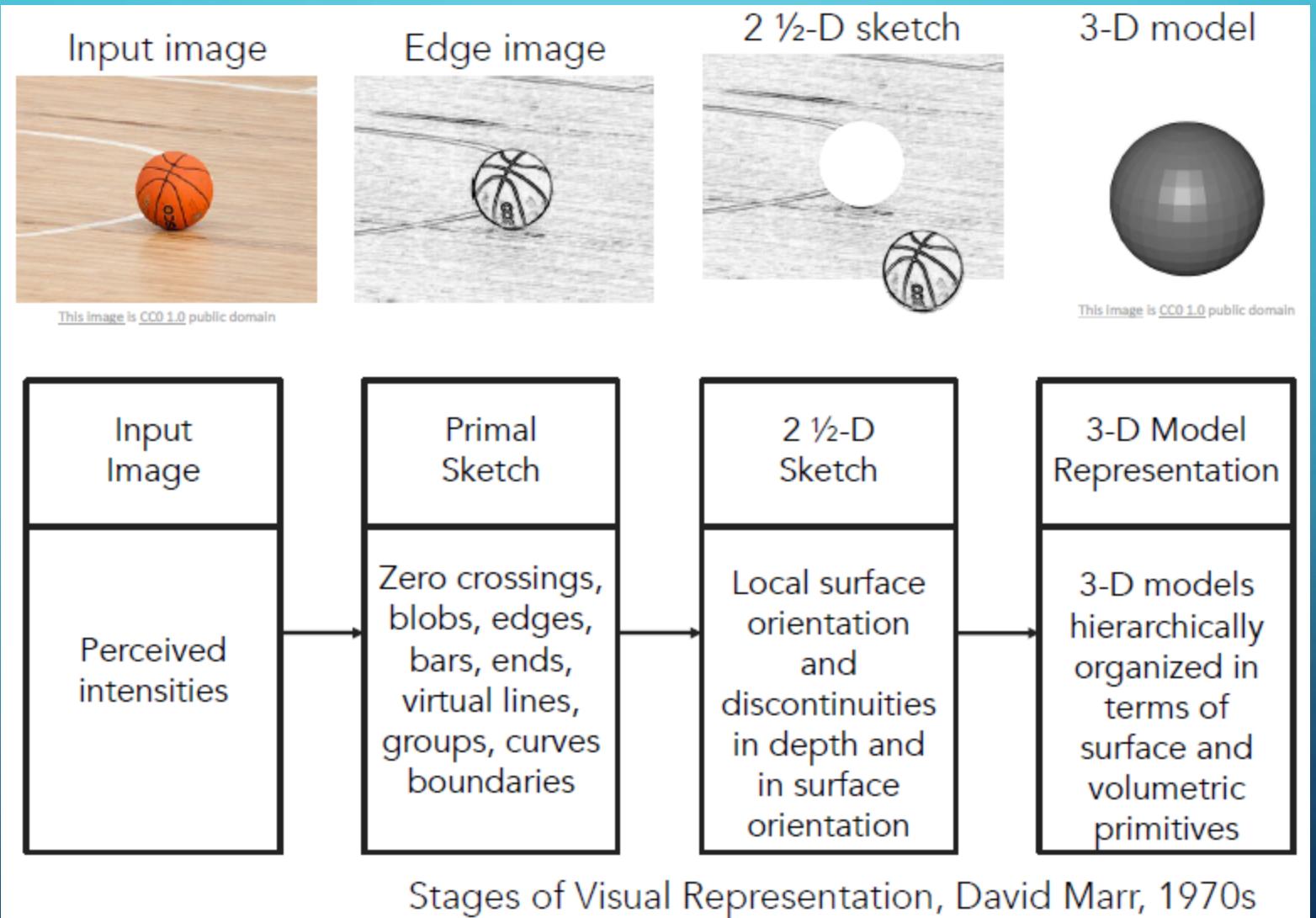




Block world

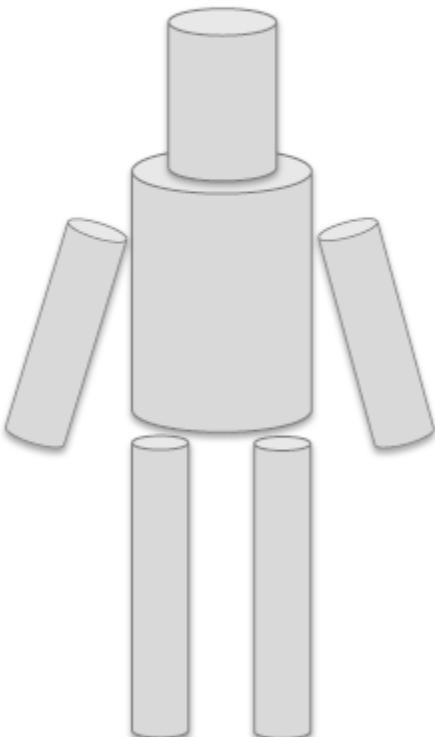
Larry Roberts, 1963





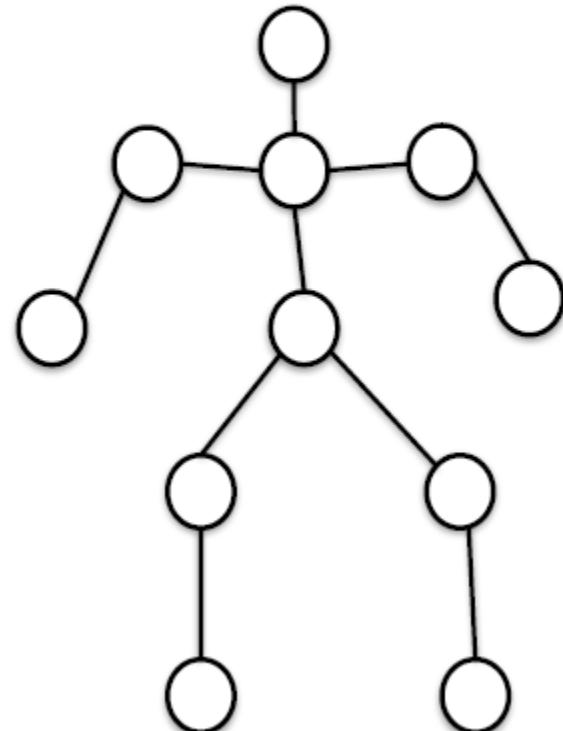
- Generalized Cylinder

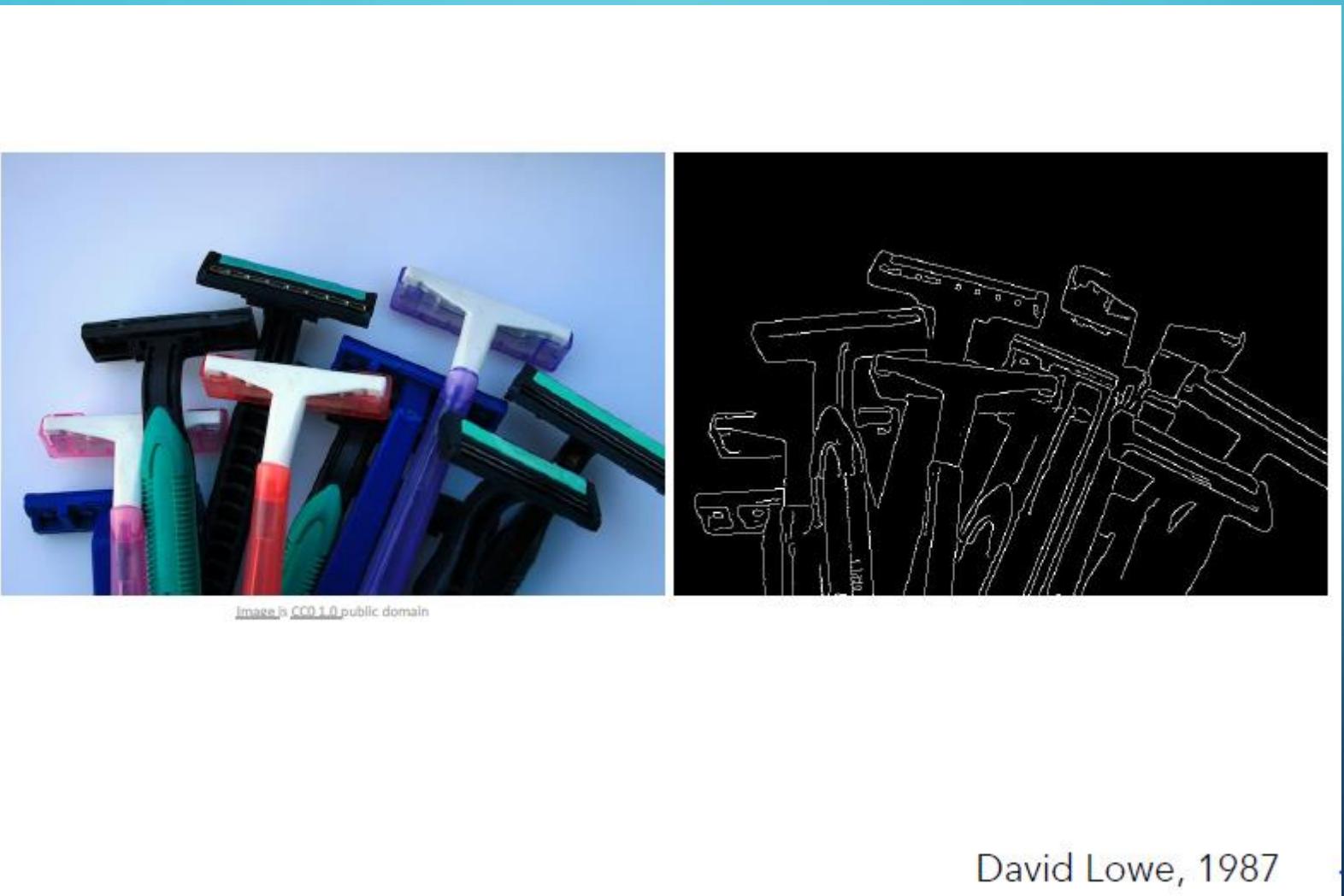
Brooks & Binford, 1979



- Pictorial Structure

Fischler and Elschlager, 1973





David Lowe, 1987

Normalized Cut (Shi & Malik, 1997)

Image is CC BY 3.0



Image is public domain



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changes made

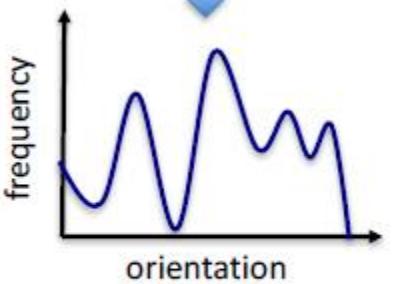




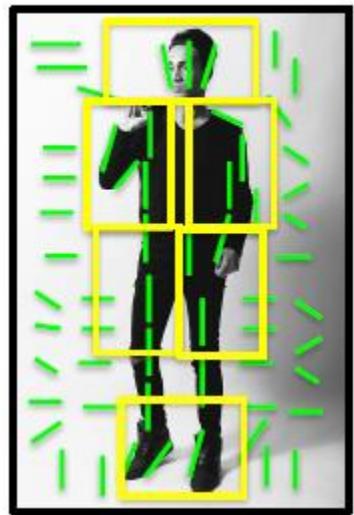


"SIFT" & Object Recognition, David Lowe, 1999

[Image is CC0 1.0 public domain](#)



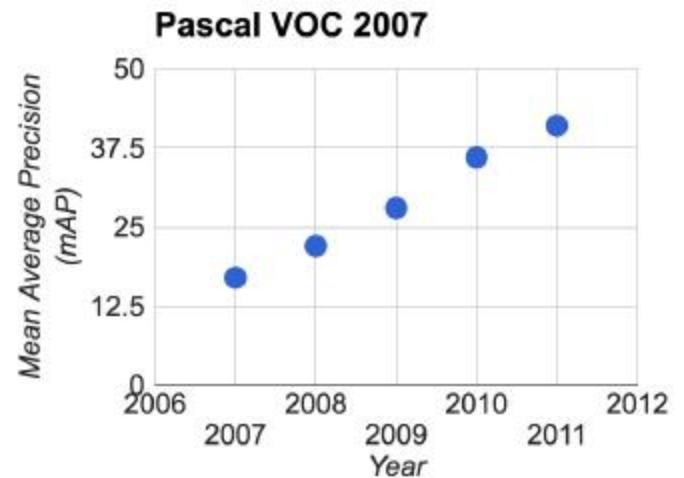
Histogram of Gradients (HoG)
Dalal & Triggs, 2005



Deformable Part Model
Felzenswalb, McAllester, Ramanan, 2009

PASCAL Visual Object Challenge (20 object categories)

[Everingham et al. 2006-2012]





IM³GENET

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

IMAGENET Large Scale Visual Recognition Challenge

The Image Classification Challenge:

1,000 object classes

1,431,167 images



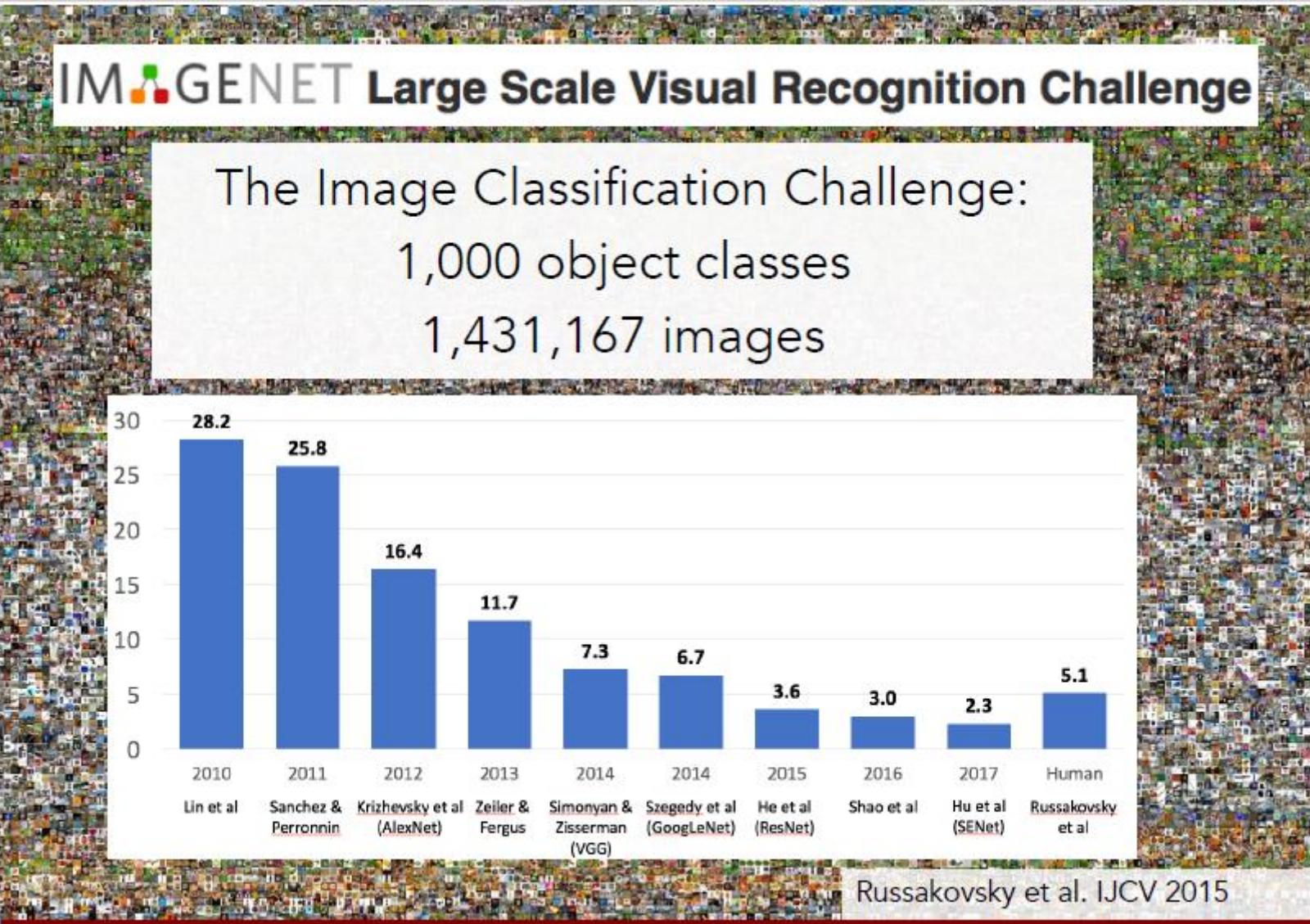
Output:
Scale
T-shirt
Steel drum
Drumstick
Mud turtle



Output:
Scale
T-shirt
Giant panda
Drumstick
Mud turtle

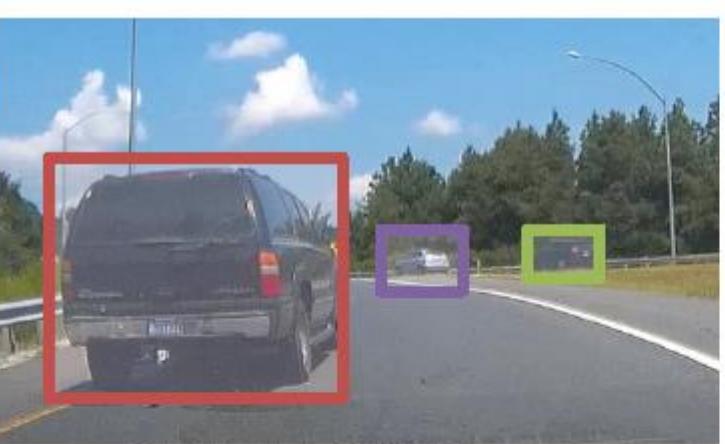


Russakovsky et al. IJCV 2015



There are many visual recognition problems that
are related to image classification, such as
object detection, image captioning

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

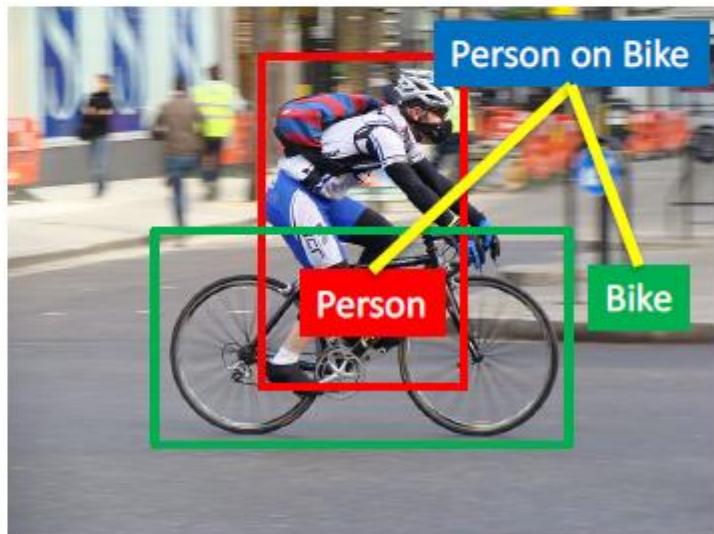


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Person
Hammer

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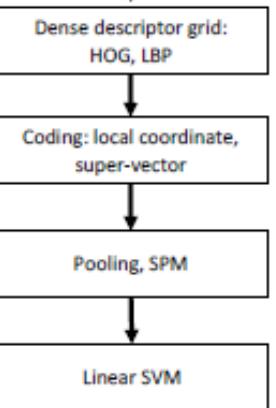
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Convolutional Neural Networks (CNN) have become an important tool for object recognition

IMAGENET Large Scale Visual Recognition Challenge

Year 2010

NEC-UIUC

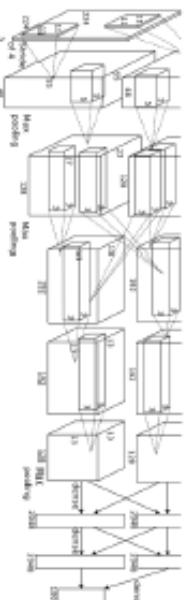


[Lin CVPR 2011]

Lion image by Swissfrog 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

VGG

- Pooling
- Convolution
- n
- Softmax
- Other

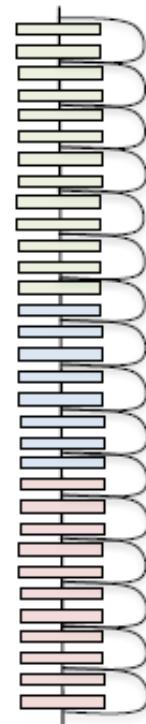


[Szegedy arxiv 2014]

[Simonyan arxiv 2014]

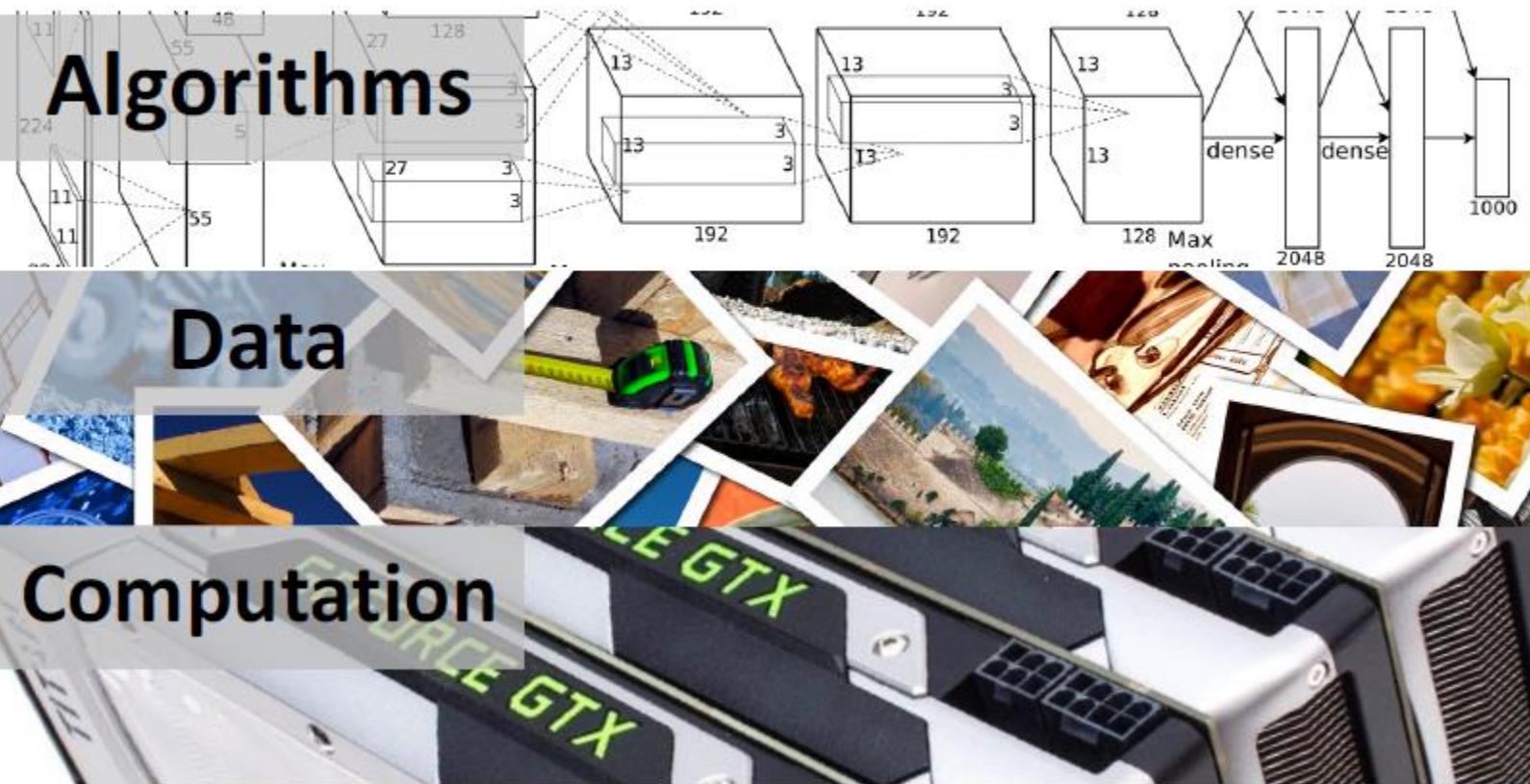
Year 2015

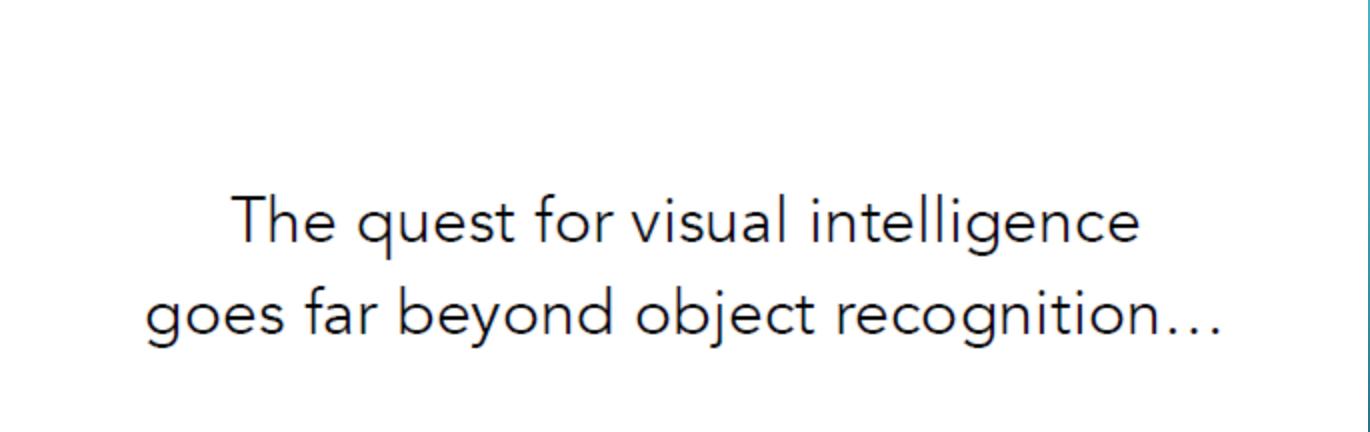
MSRA



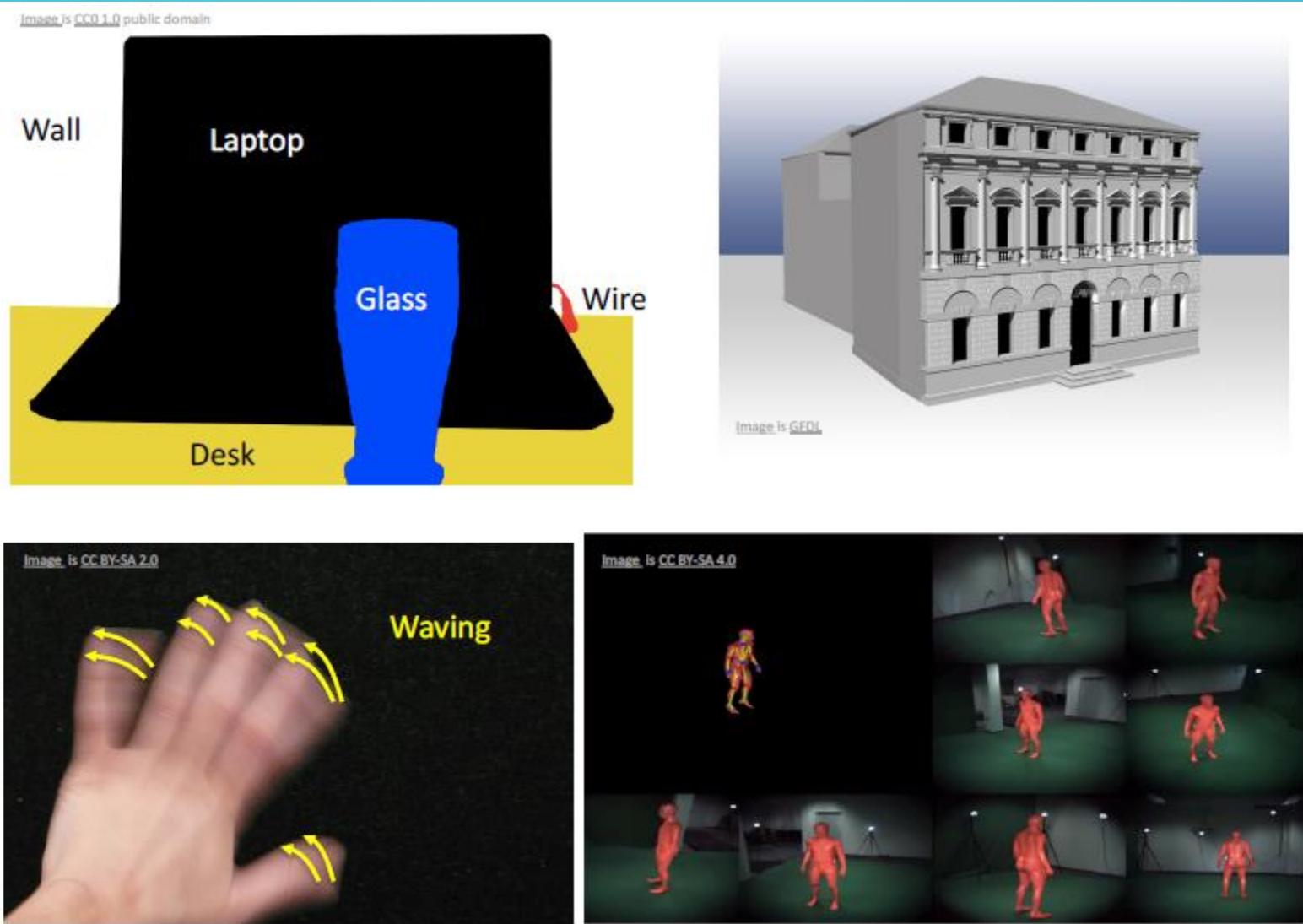
[He ICCV 2015]

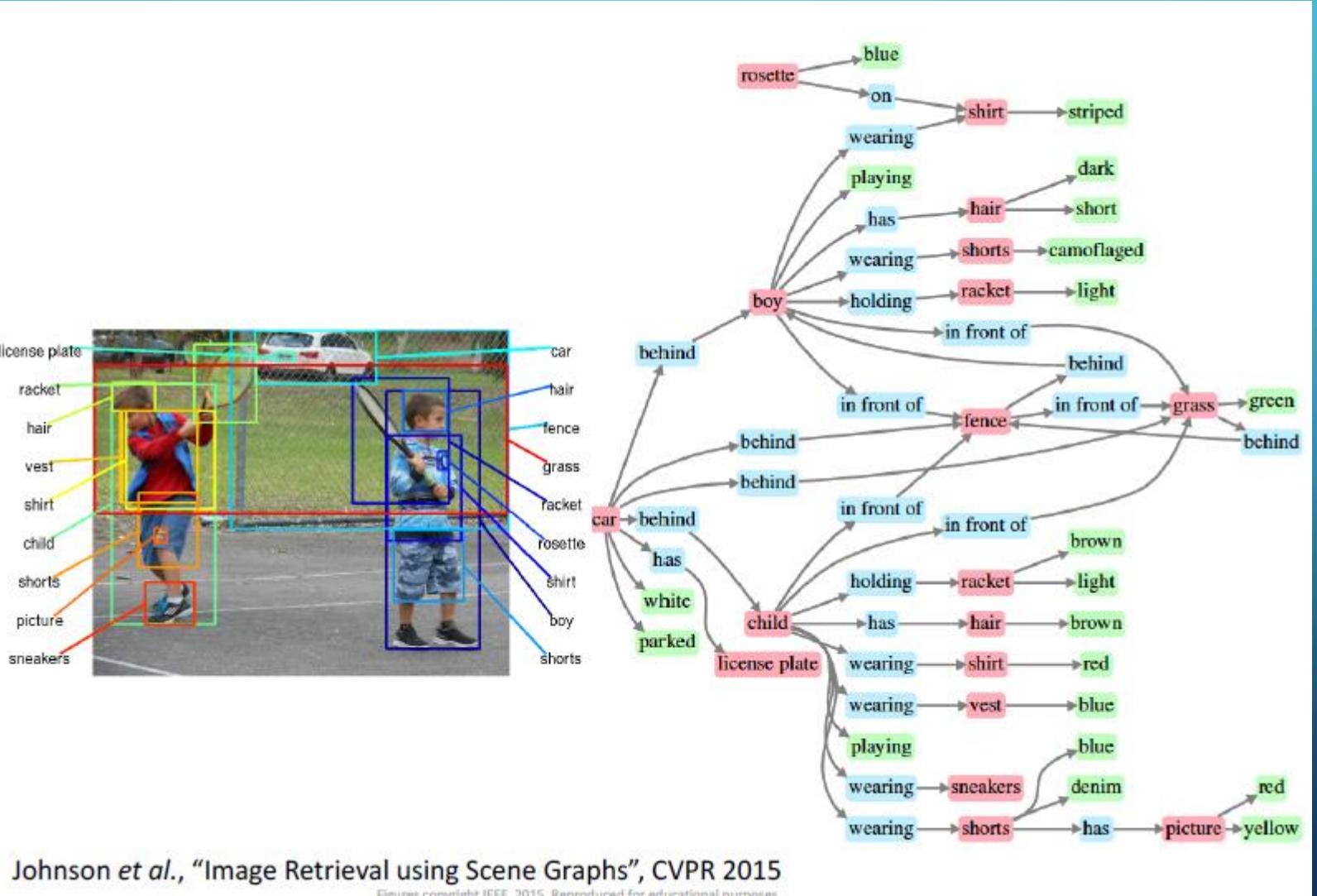
Ingredients for Deep Learning





The quest for visual intelligence
goes far beyond object recognition...







PT = 500ms

Some kind of game or fight. Two groups of two men? The man on the left is throwing something. 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)







COMPUTER VISION IS NOT EVERYTHING



Machine Learning

- Grew out of work in AI
- New capability for computers

Examples:

- Database mining
 - Large datasets from growth of automation/web.
E.g., Web click data, medical records, biology, engineering
- Applications can't program by hand.
 - E.g., Autonomous helicopter, handwriting recognition, most of Natural Language Processing (NLP), Computer Vision.
- Self-customizing programs
 - E.g., Amazon, Netflix product recommendations
- Understanding human learning (brain, real AI).

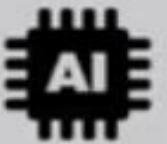


The revolution in AI
has been profound,
it definitely surprised
me, even though I was
sitting right there.

Sergey Brin
Google co-founder

BUZZWORDS

- Artificial Intelligence
- Machine Learning
- Data Mining
- Big Data



ARTIFICIAL INTELLIGENCE

It involves machines achieving human-level performance at specific tasks (credit approval, face recognition, speech recognition etc.)



MACHINE LEARNING

These are (a heart of modern AI) algorithms that teach a computer to perform a task from experience.



DATA MINING

It uses ML to find pattern in data in a quest for actionable data.



BIG DATA

It is data mining on large sets of structured (numerical) and unstructured (text, speech) data

