

Introduce of Artificial Intelligence

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Deep learning - Introduction

ARTIFICIAL INTELLIGENCE

Early artificial intelligence
stirs excitement.

인공신경망(ANN)과
퍼셉트론(Perceptron)의 등장

MACHINE LEARNING

Machine learning begins
to flourish.

Multi-Layer
Perceptron(MLP)과
Backpropagation
알고리즘의 등장

DEEP LEARNING

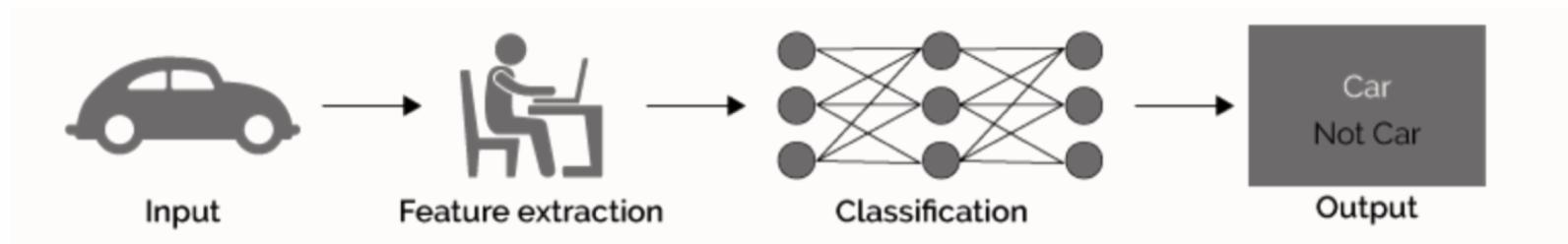
Deep learning breakthroughs
drive AI boom.

활성함수 ReLU와
심층신경망의 등장
딥러닝의 시대

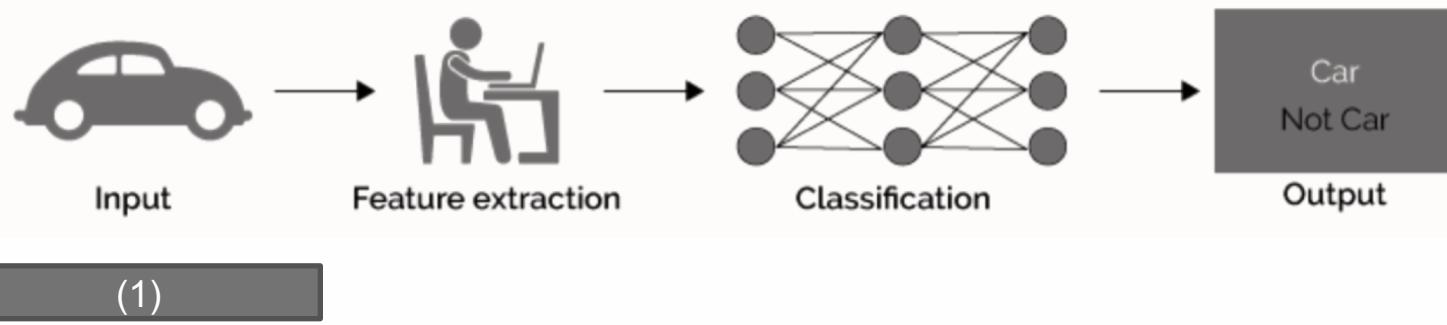
1950's 1960's 1970's 1980's 1990's 2000's 2010's

(출처: NVIDIA blog)

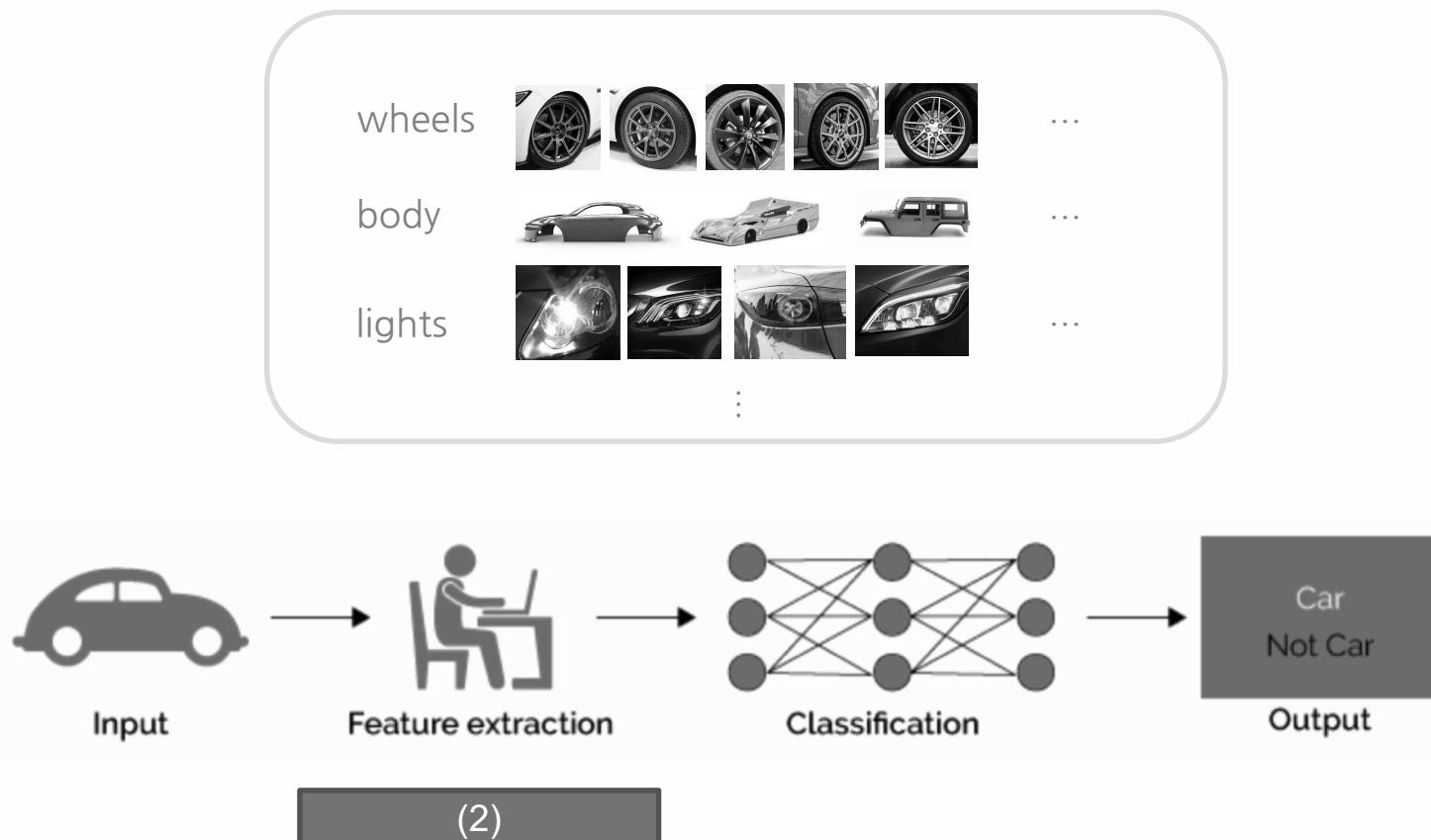
Previous Algorithm



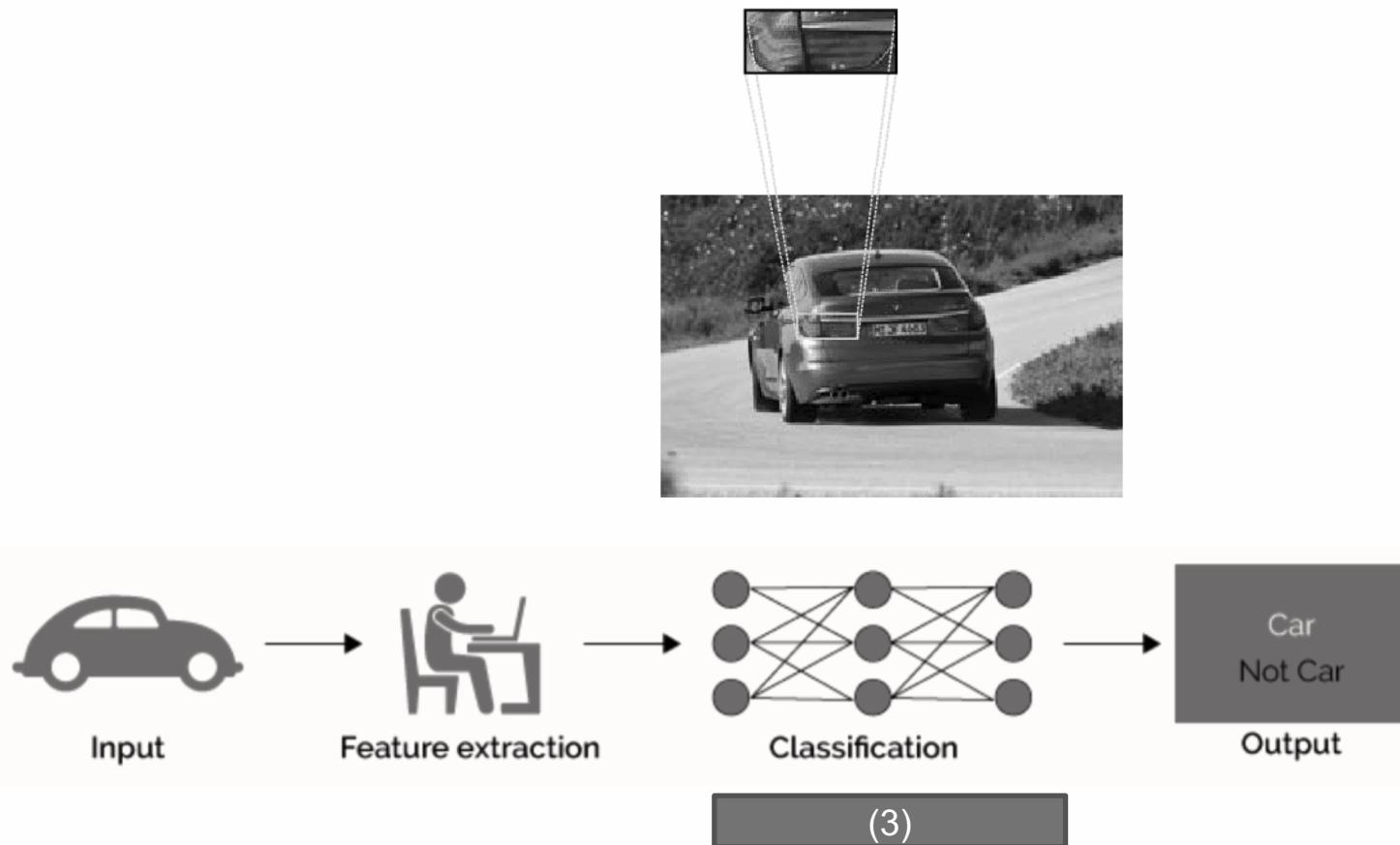
Previous Algorithm



Previous Algorithm

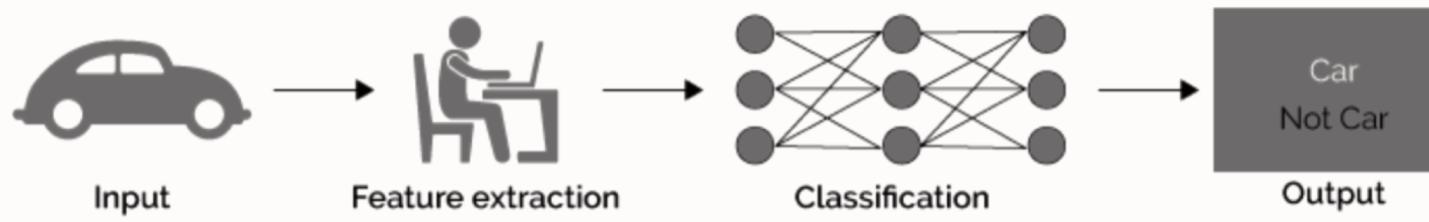


Previous Algorithm



Previous Algorithm

Car or Not



(4)

Machine Learning vs Deep Learning

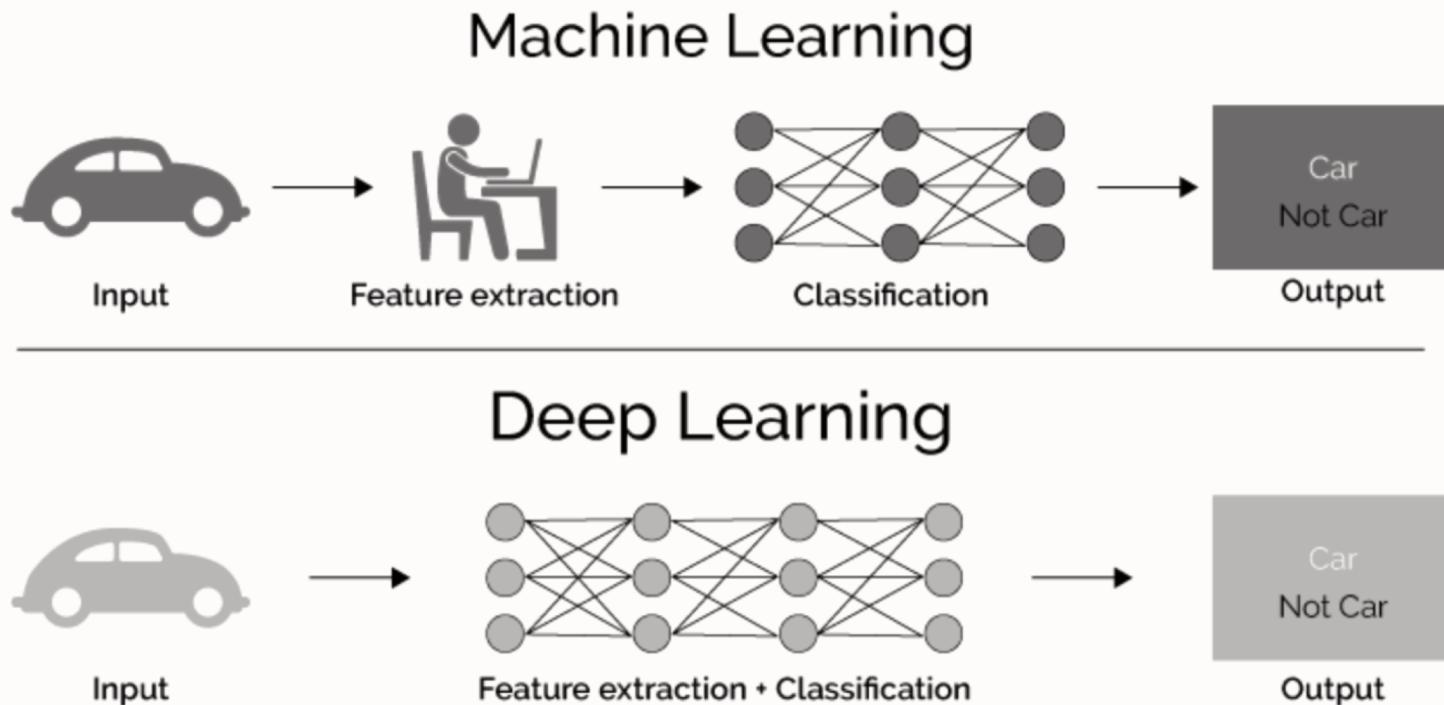


Figure 1: Machine Learning VS Deep Learning

Deep learning - Introduction

Reasons for sudden rise

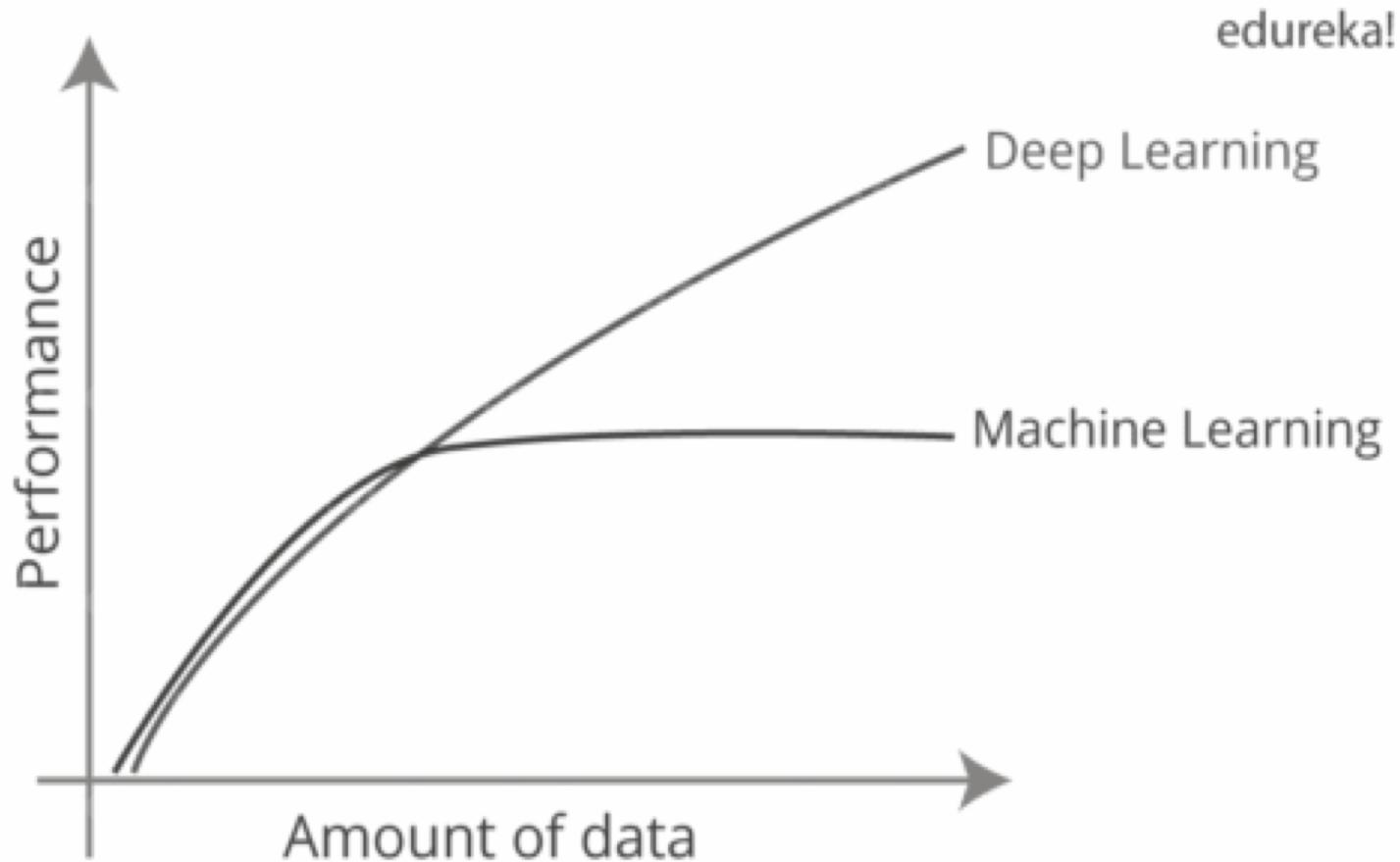


Big Data

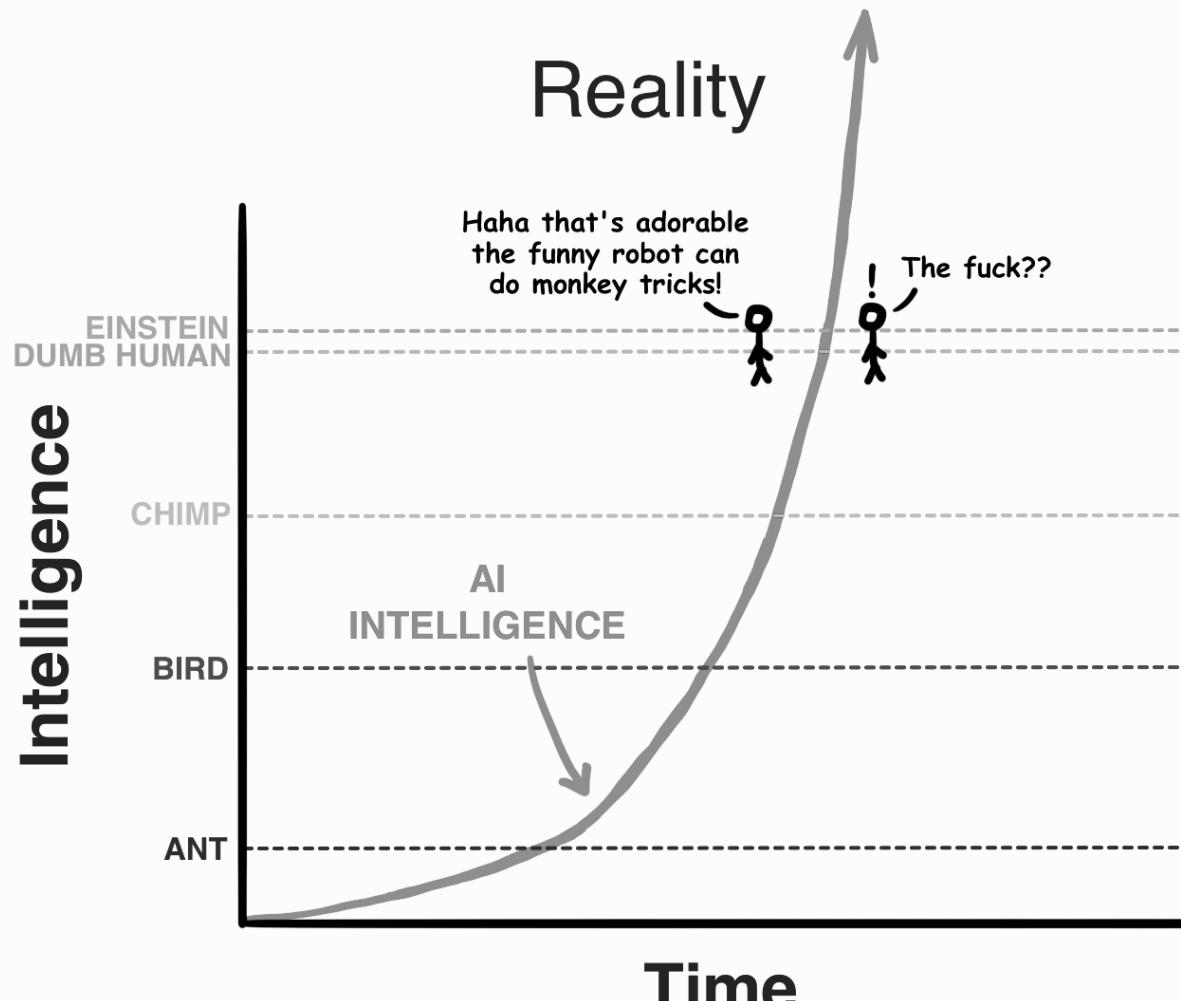


GPU

Why Deep Learning



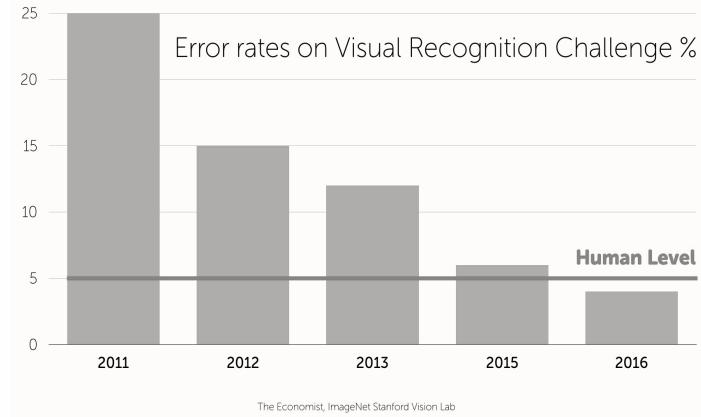
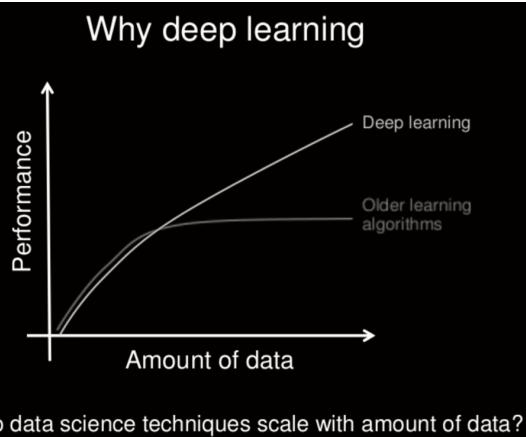
Why Deep Learning



waitbutwhy.com

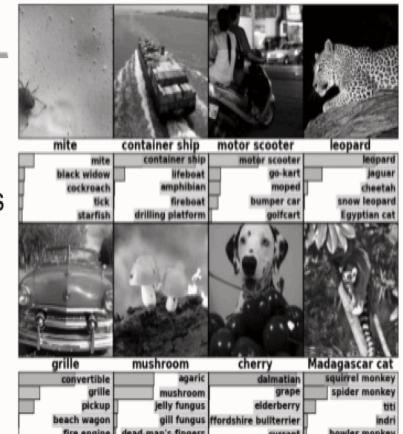
Deep learning - Introduction

Why we should learn deep learning?



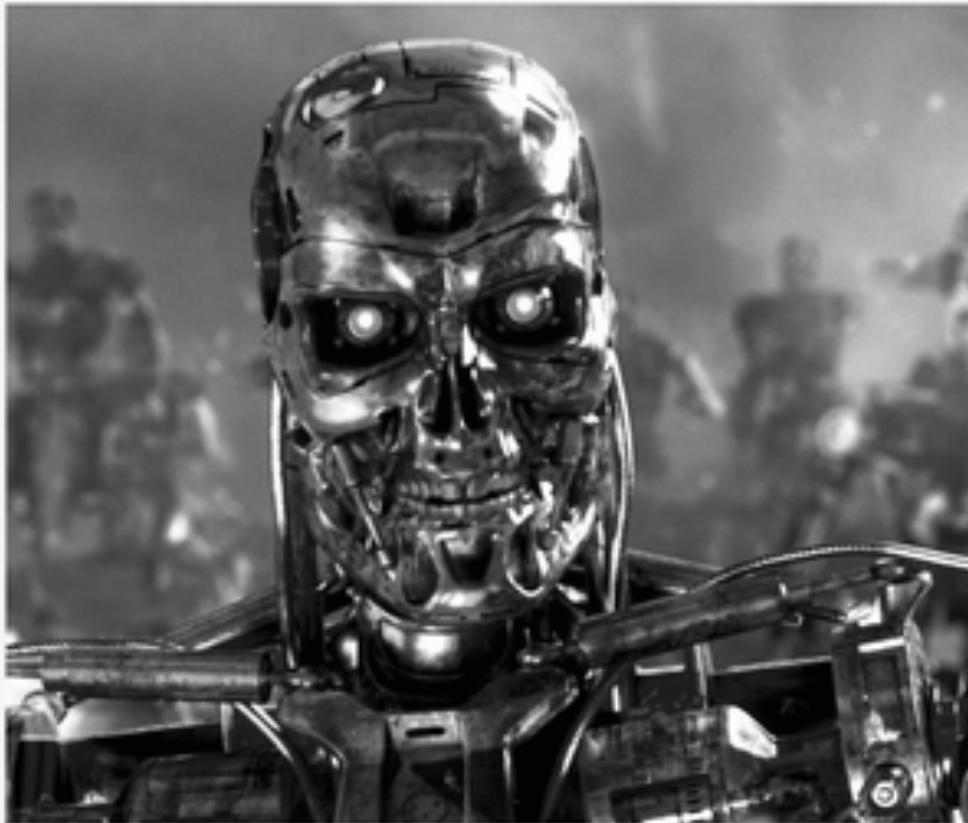
ImageNet Challenge

IMAGENET



- 1,000 object classes (categories).
- Images:
 - 1.2 M train
 - 100k test.

Deep learning - Introduction



strong AI vs

weak AI

What's the weather like this weekend?

Are you on a boat? Because I was not able to find any results for that location.

What's the weather like in Brooklyn this weekend?

The weather in Brooklyn, NY is 46°F and clear.

This weekend?

Excusez-moi?

WEEKEND

Sorry, dozed off for a second. What were you saying?

<https://chatbot.fail/>

Applications: Classification

airplane



automobile



bird



cat



deer



dog



frog



horse



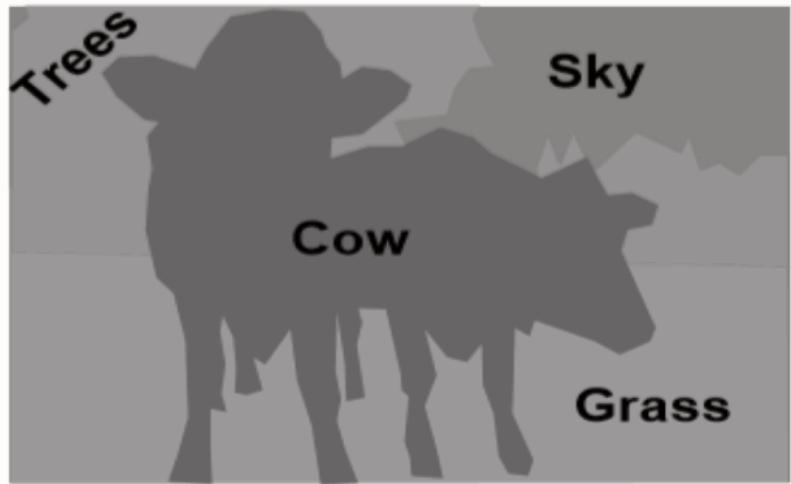
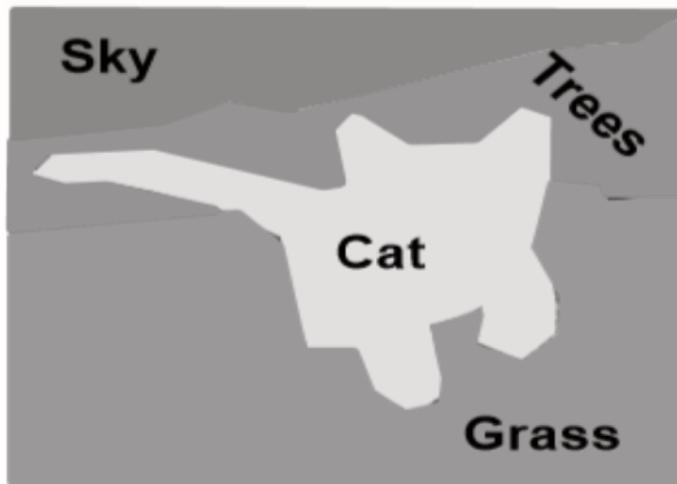
Applications: Detection and Classification



Applications: Segmentation



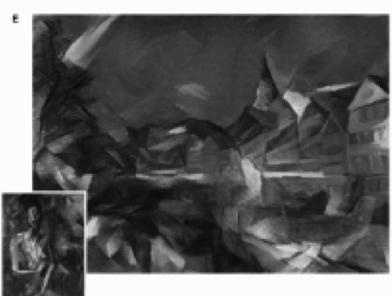
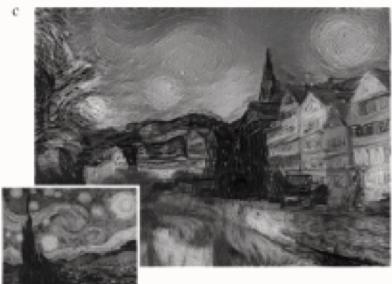
[This image is CC0 public domain](#)



Applications: Image Enhancement



Applications: Art



Zebras ↘ Horses

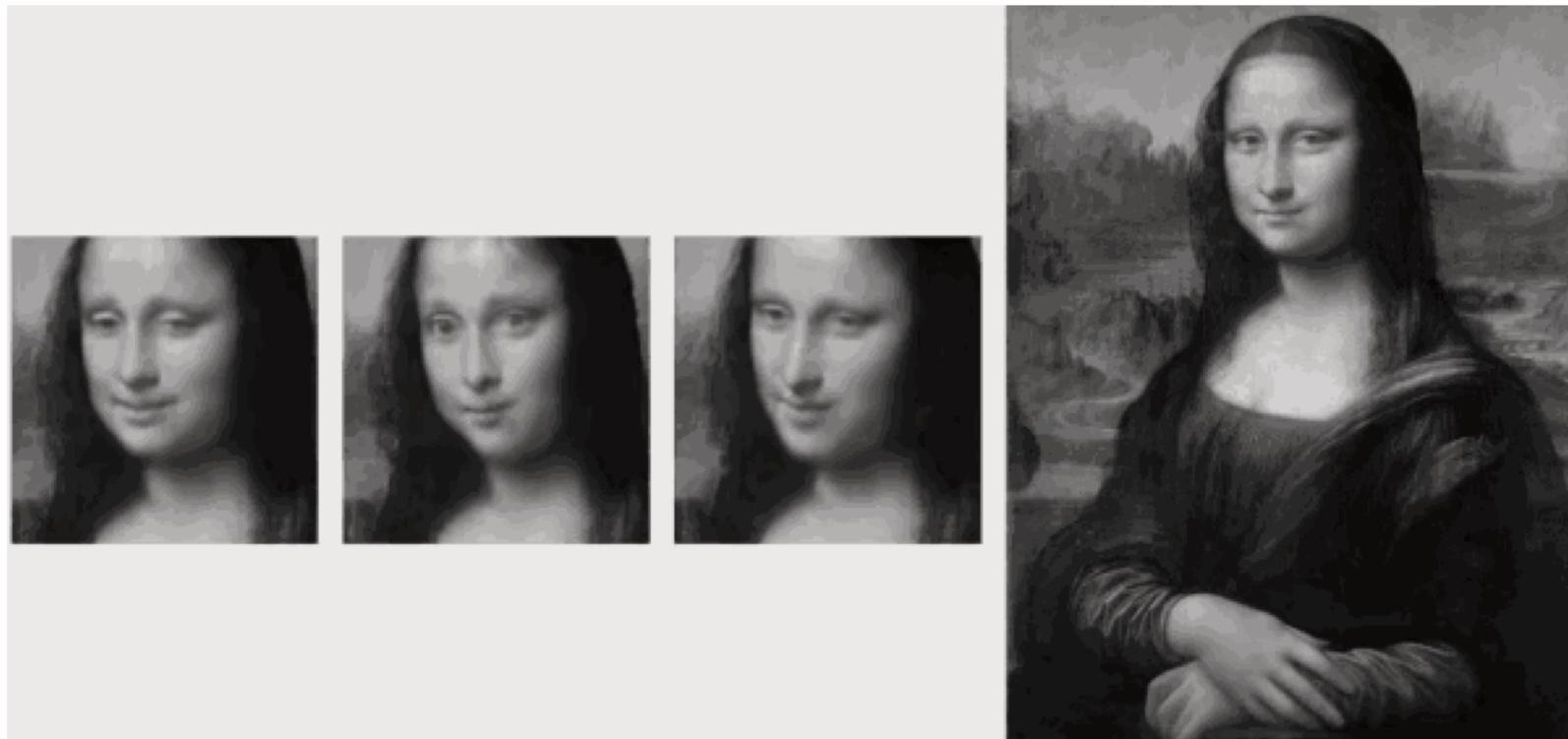


zebra → horse



horse → zebra

Applications: Art

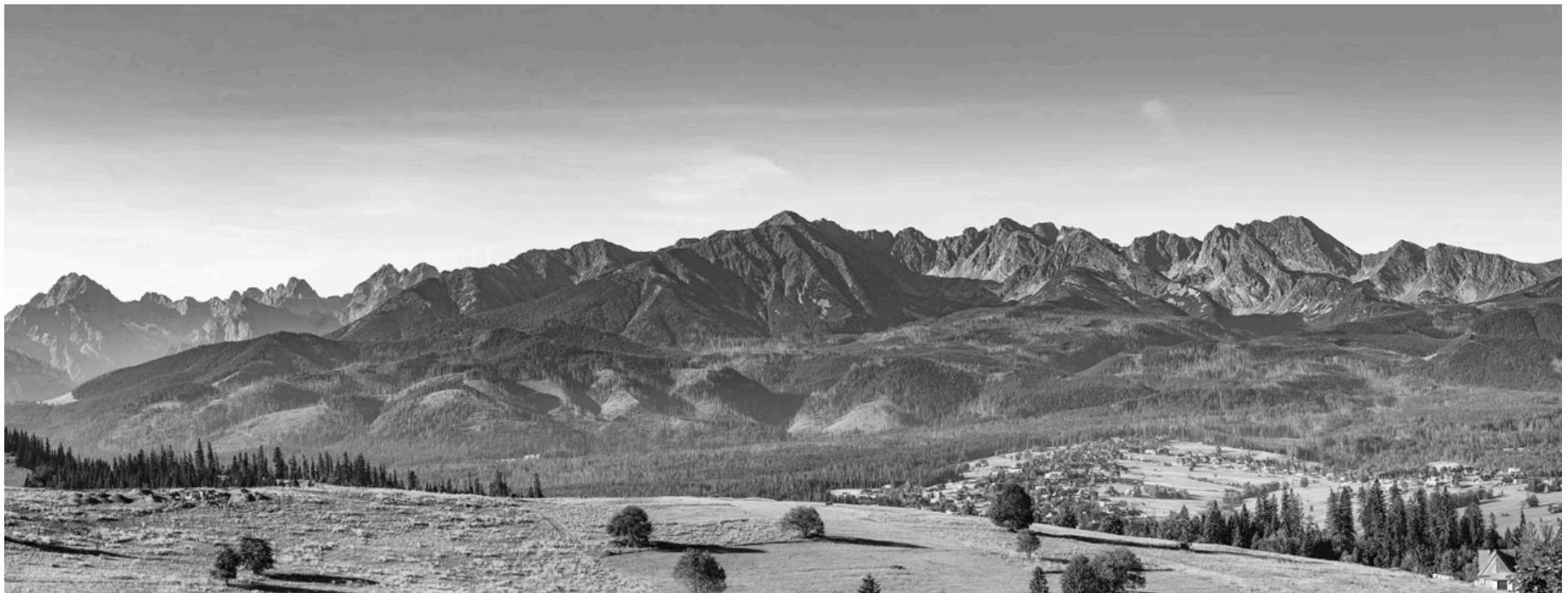


Applications : Doing voice



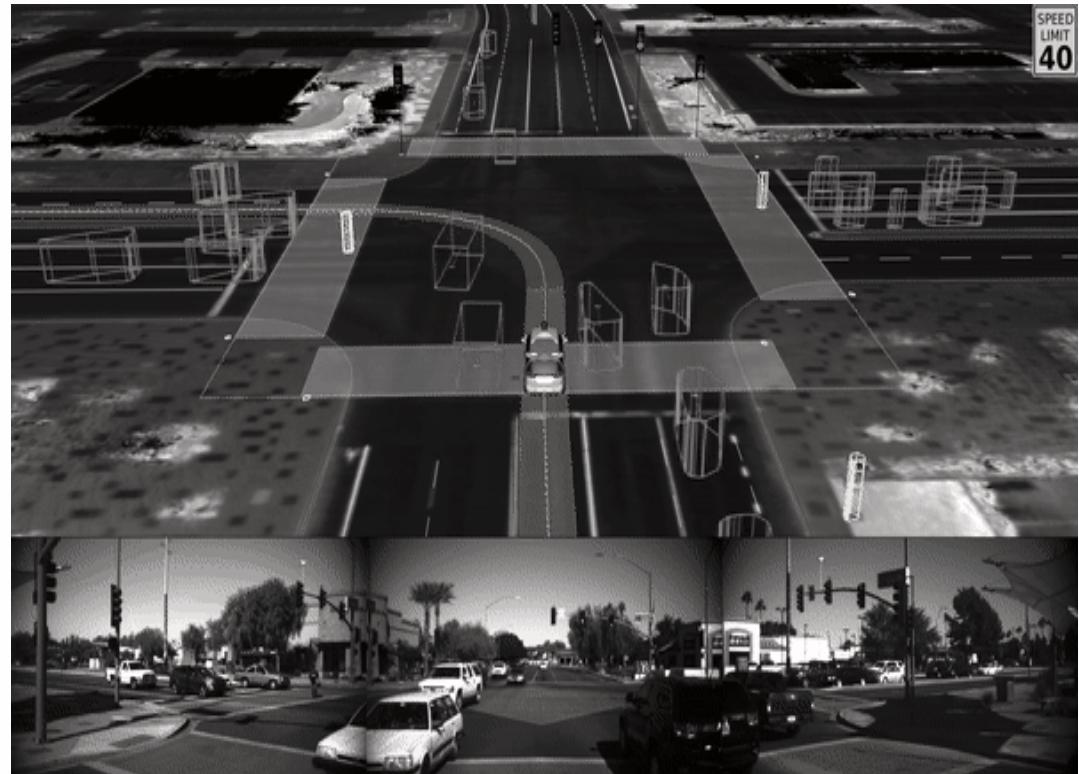
<https://www.youtube.com/watch?v=f1saaU6ovjY&feature=youtu.be>

Applications: Composition



<https://www.youtube.com/watch?v=JUCcbJtZr80&feature=youtu.be>

Applications: Robotics

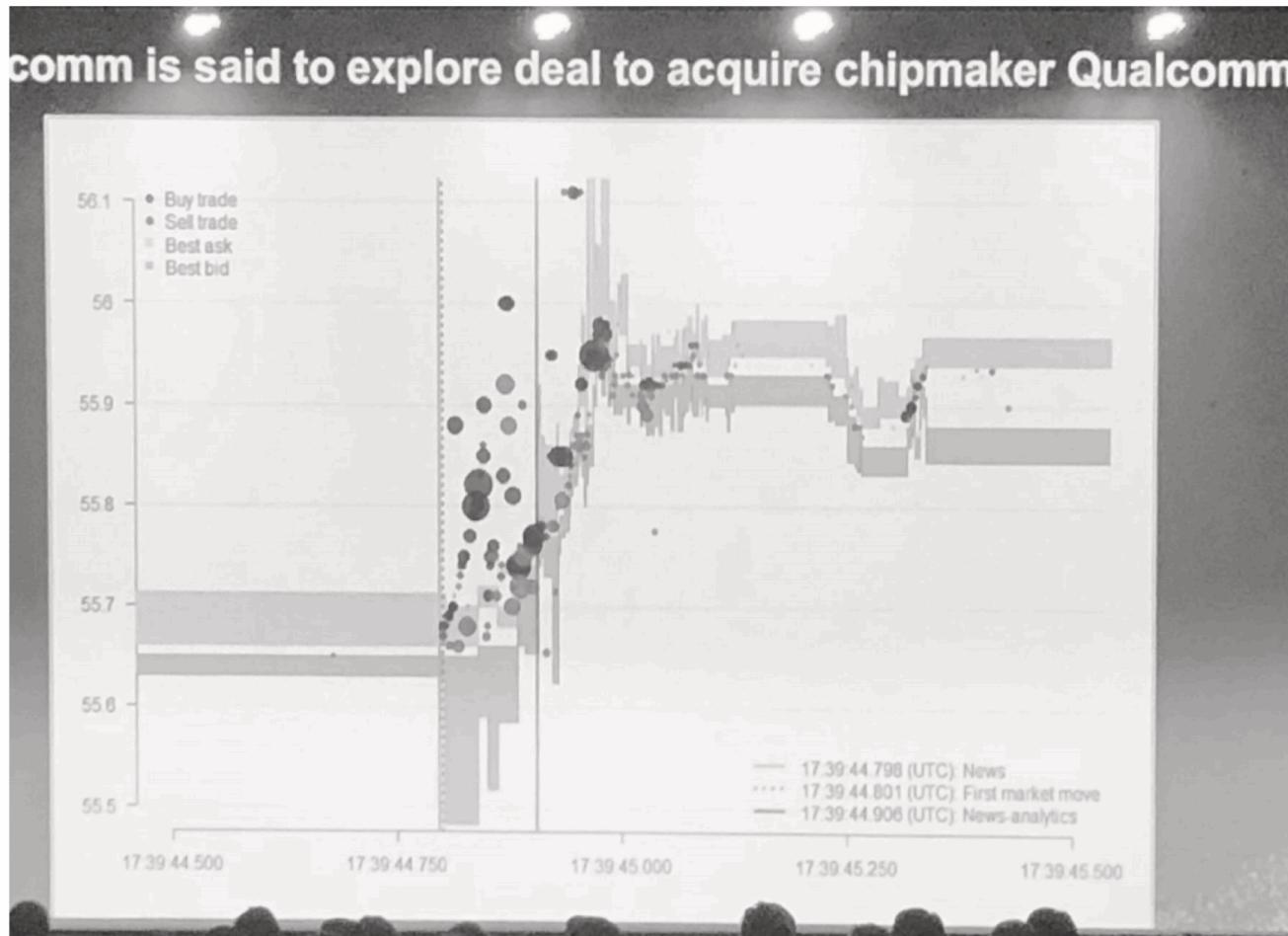


Applications: Robotics



<https://www.youtube.com/watch?v=gQpMDdJmbNs>

Applications : Finance



News Based Trading Algorithm

Applications : Finance



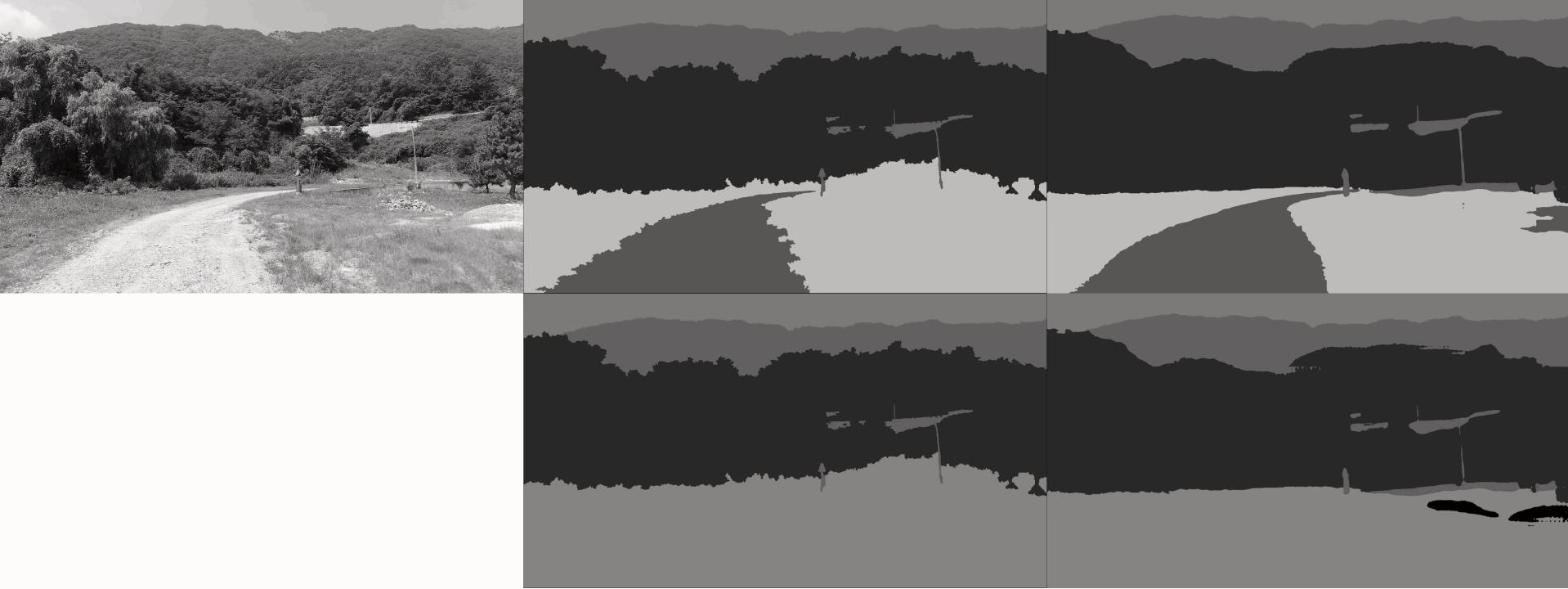
Applications : CCTV (How to rule the country using A.I.)



<https://www.youtube.com/watch?v=uReVvICTrCM>

Road segmentation (ADD)

IMG	GT(1)	Val(1)
	GT(2)	Val(2)



ResNet50+UperNet
ResNet50+PPM

| ResNet50+UperNet(obj/part only)
| ResNet18+UperNet

Part segmentation result



Part segmentation result

ResNet50+UpperNet
ResNet50+PPM

| ResNet50+UpperNet(obj/part only)
| ResNet18+UpperNet



Part segmentation result

ResNet50+UperNet
ResNet50+PPM

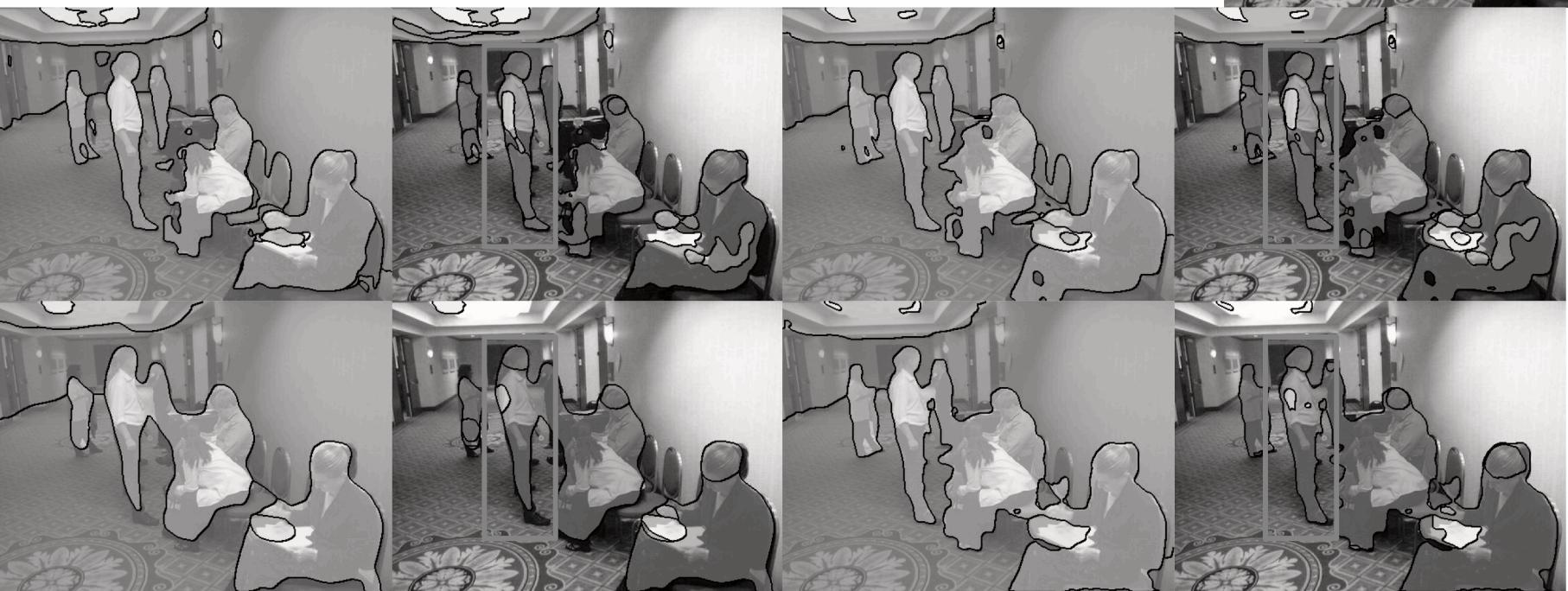
| ResNet50+UperNet(obj/part only)
| ResNet18+UperNet



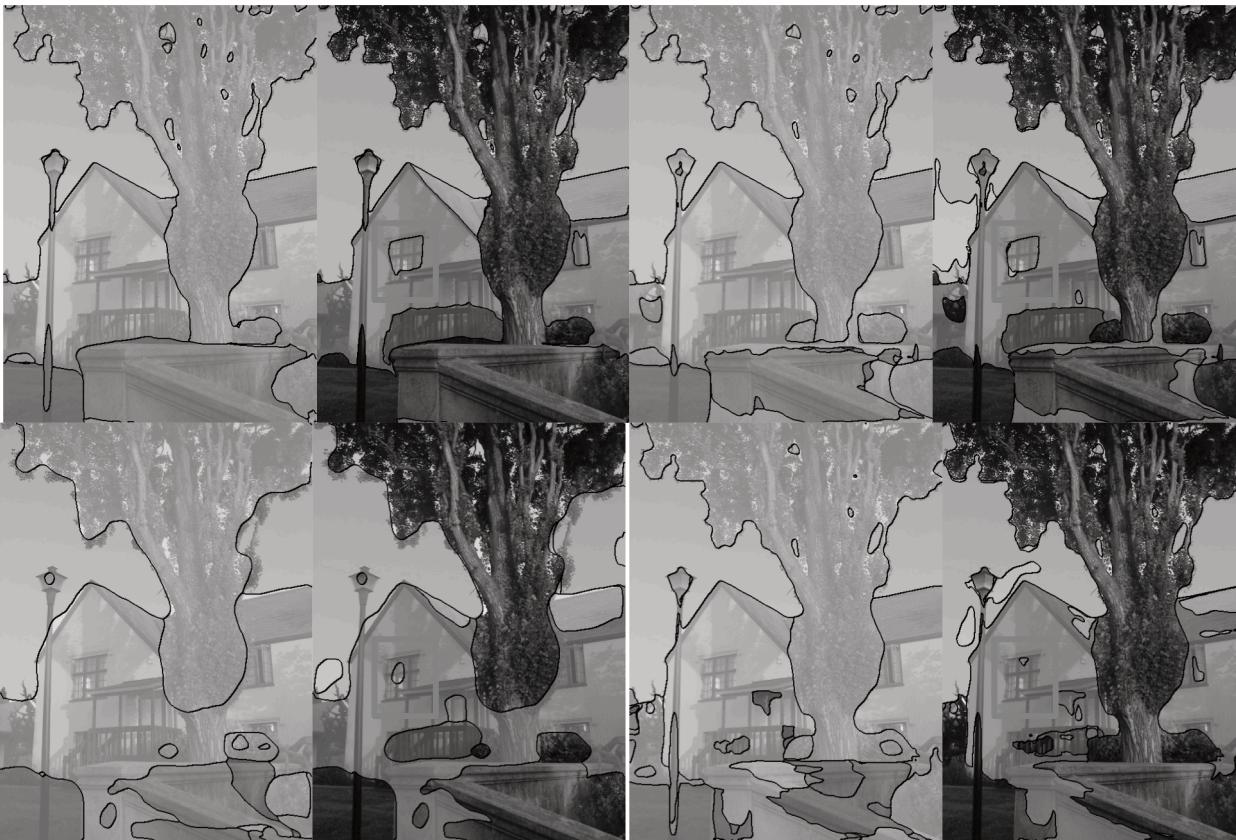
Part segmentation result

ResNet50+UpperNet
ResNet50+PPM

| ResNet50+UpperNet(obj/part only)
| ResNet18+UpperNet



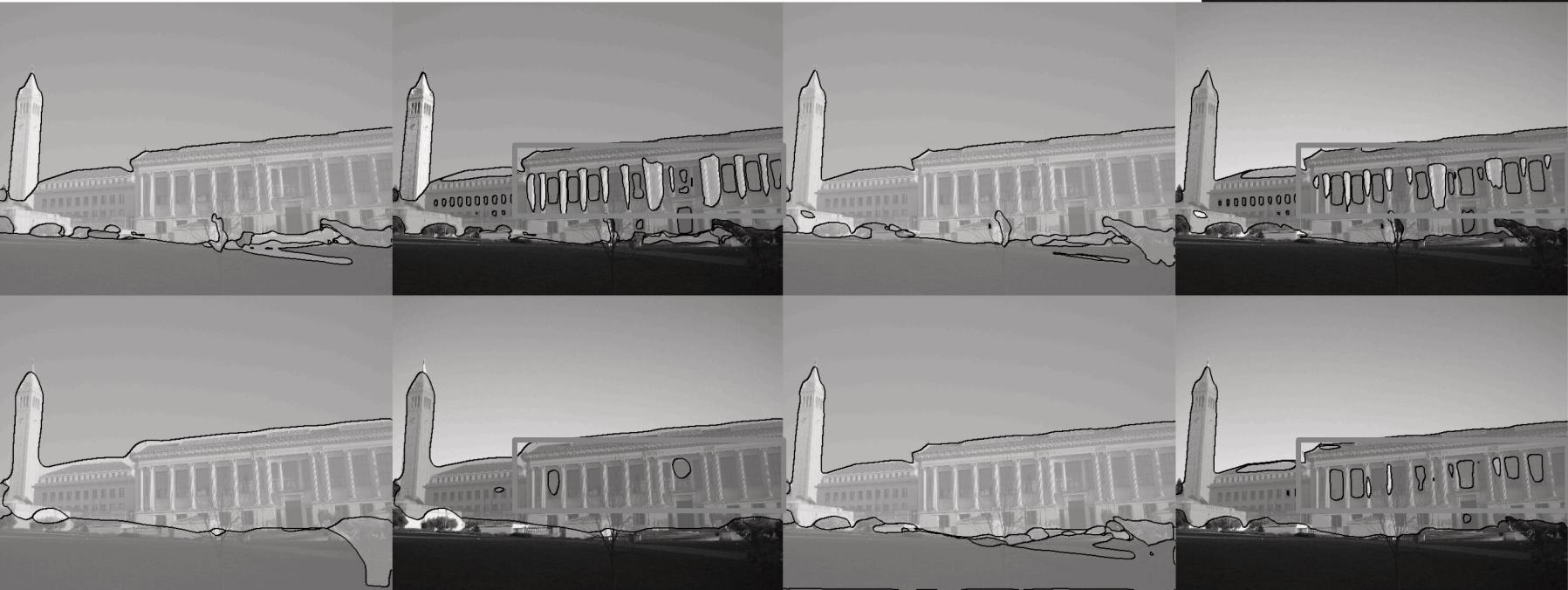
Part segmentation result



Part segmentation result

ResNet50+UpperNet
ResNet50+PPM

| ResNet50+UpperNet(obj/part only)
| ResNet18+UpperNet



Part segmentation result

ResNet50+UpperNet
ResNet50+PPM

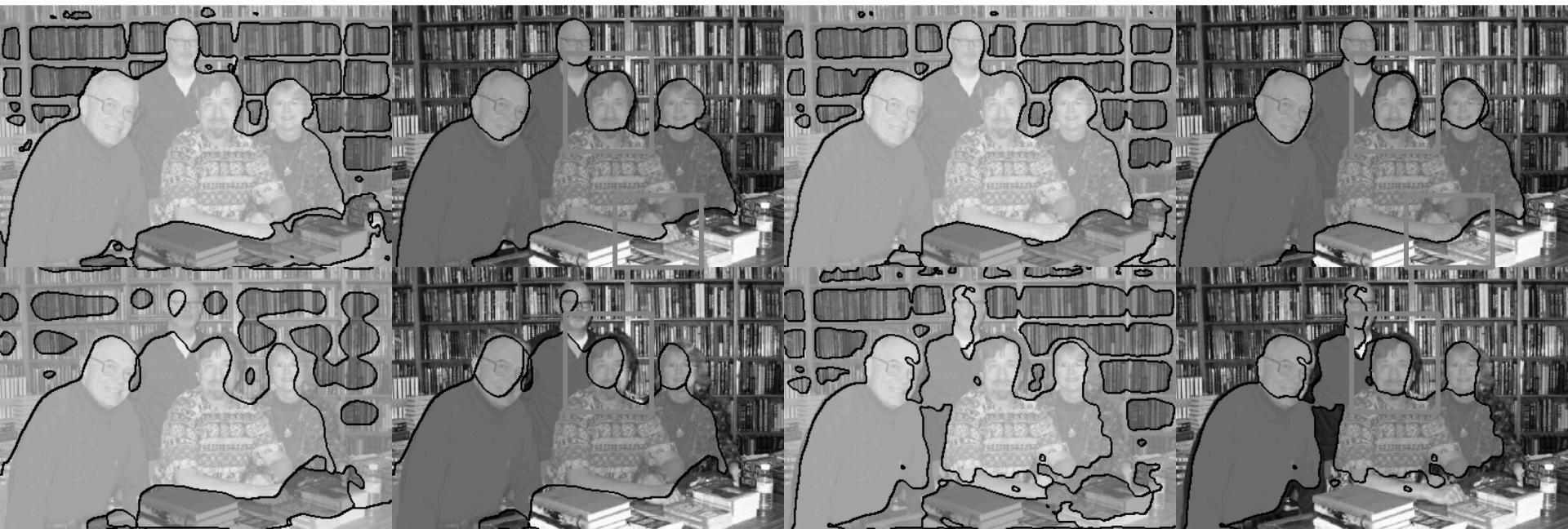
| ResNet50+UpperNet(obj/part only)
| ResNet18+UpperNet



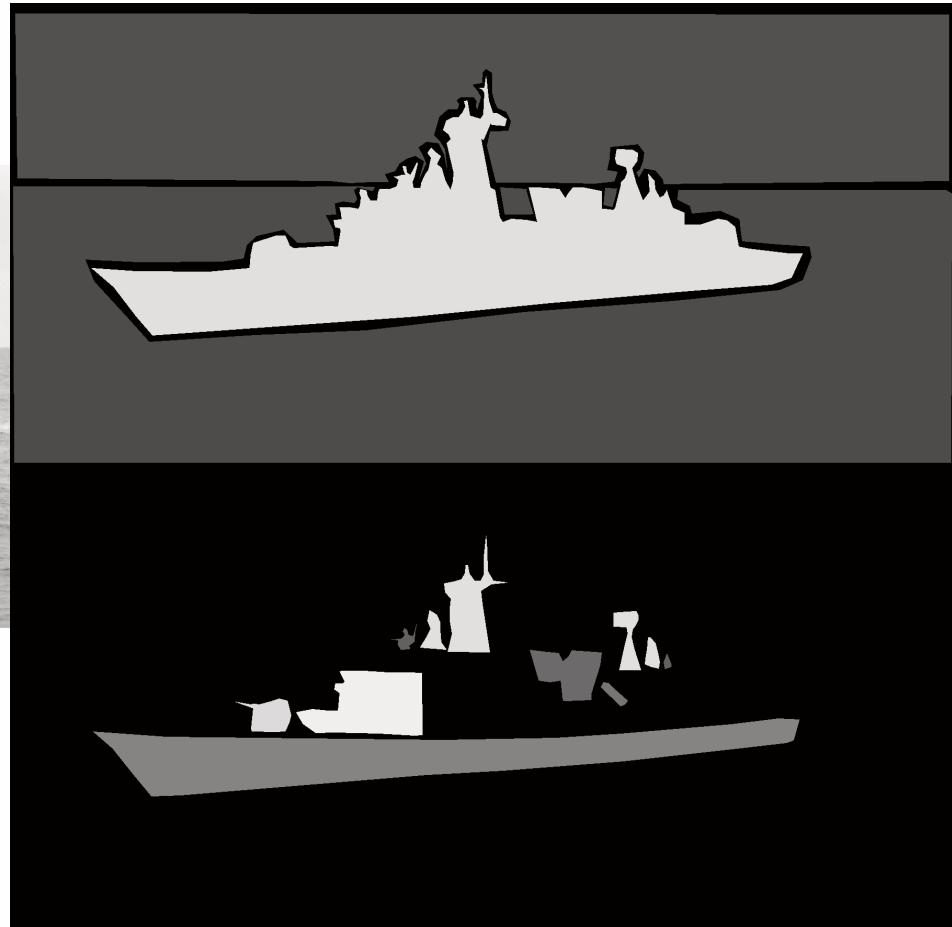
Part segmentation result

ResNet50+UperNet
ResNet50+PPM

| ResNet50+UperNet(obj/part only)
| ResNet18+UperNet



Application of part segmentation



RGB v.s. Two-stream (RGB+Flow)

- RGB ***incorrect*** and RGB+Flow ***correct***
- RGB: clap (X)
- RGB+Flow: brush hair (O)
- RGB model catches that the two hands are close
- Flow model catches the hand movement in details



RGB v.s. Two-stream (RGB+Flow)

- RGB ***incorrect*** and RGB+Flow ***correct***
- RGB: shoot ball (X)
- RGB+Flow: catch (O)
- RGB model found the soccer field and ball
- Flow model focus on the keeper's movement



RGB v.s. Two-stream (RGB+Flow)

- RGB ***incorrect*** and RGB+Flow ***correct***
- RGB: climb stairs (**X**)
- RGB+Flow: run (**O**)
- RGB model focus on the ladder (looks like stairs)
- Flow model focus on the large running movement instead

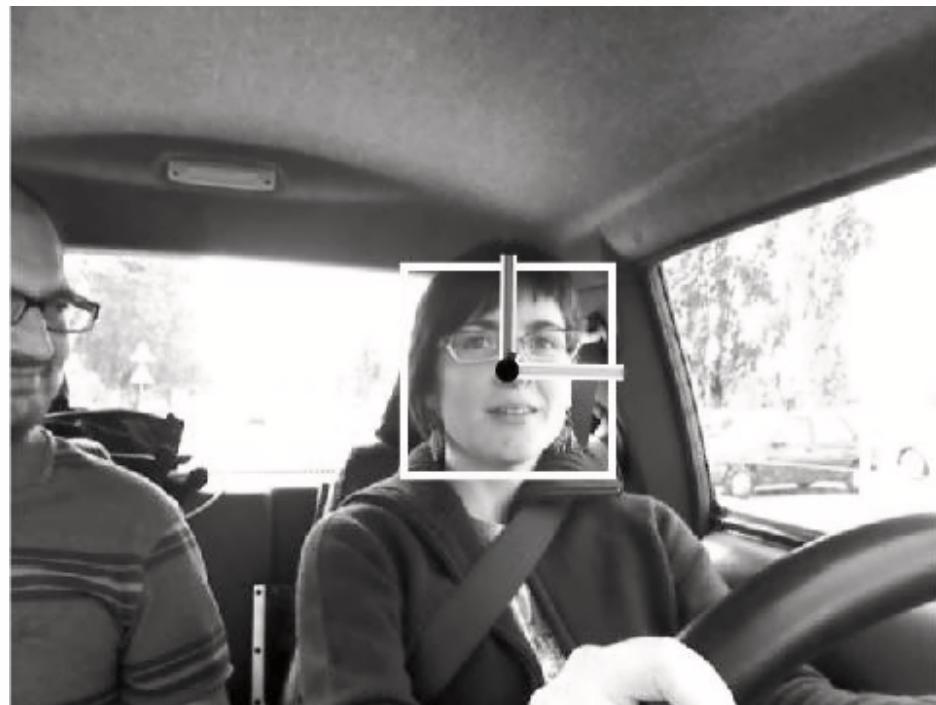


RGB v.s. Two-stream (RGB+Flow)

- RGB ***incorrect*** and RGB+Flow ***correct***
- RGB: talk (X)
- RGB+Flow: shake hands (O)
- RGB model focus on the two people facing each other
- Flow model focus on the small shaking movements



Autonomous Driving using A.I.

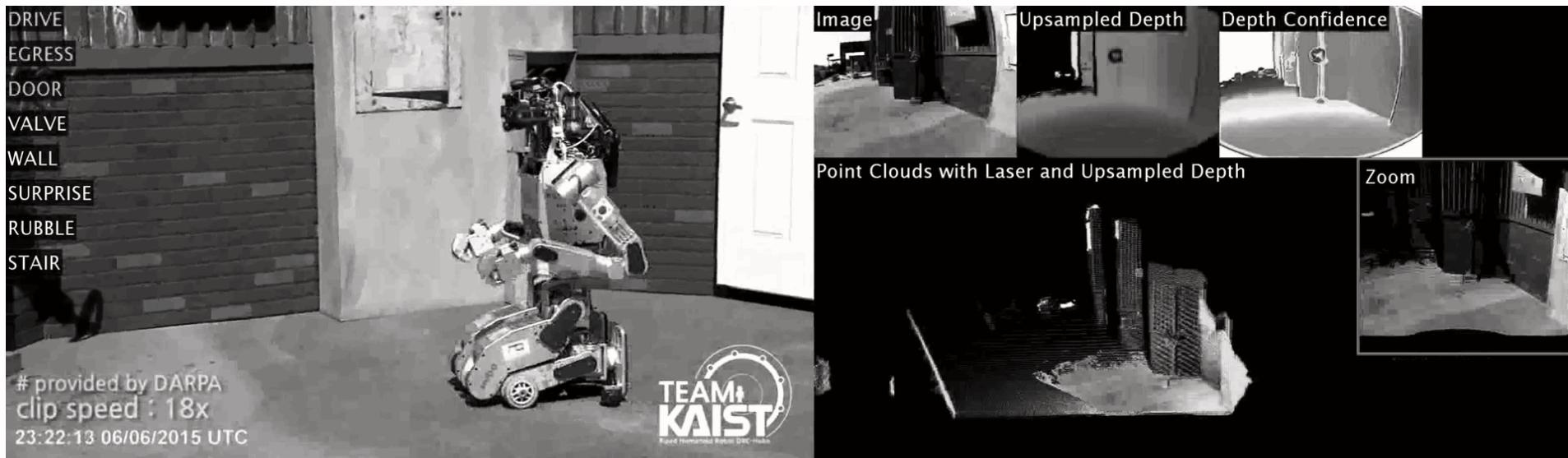


Head Pose estimation



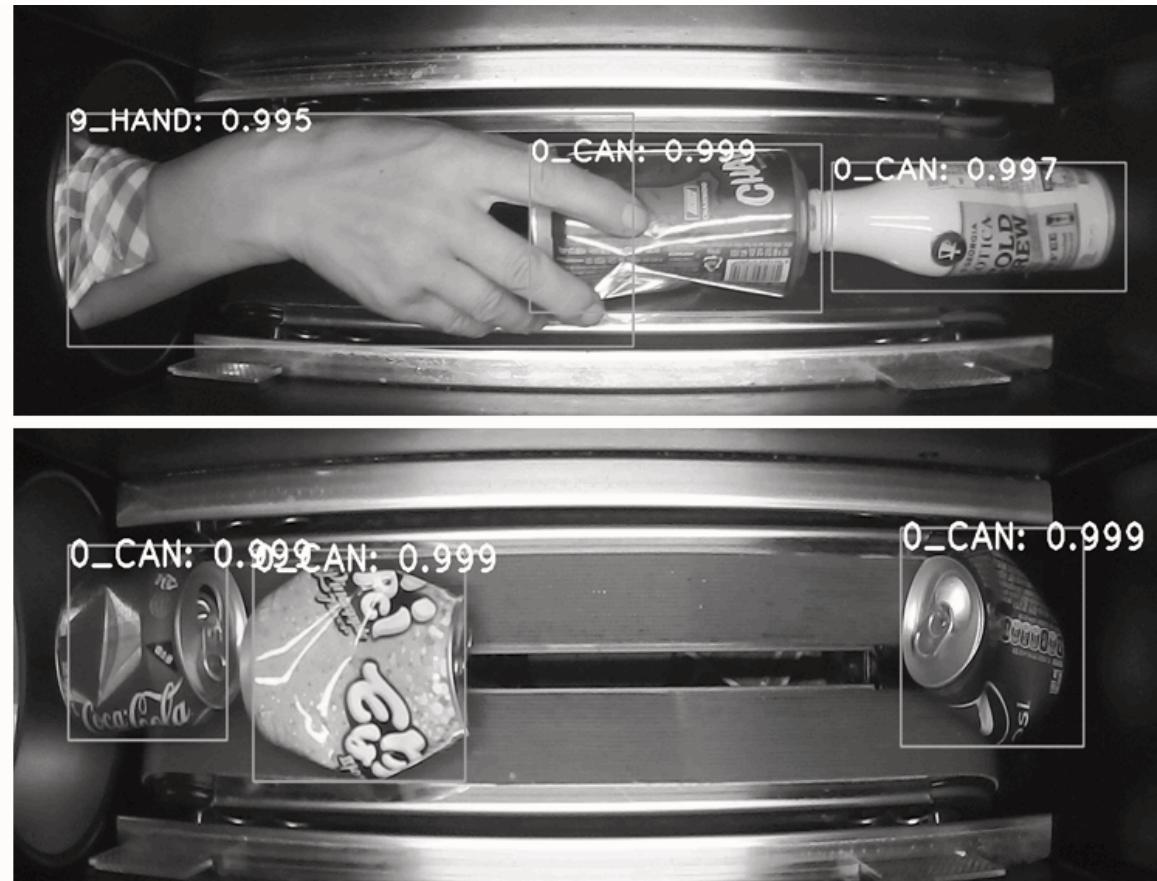
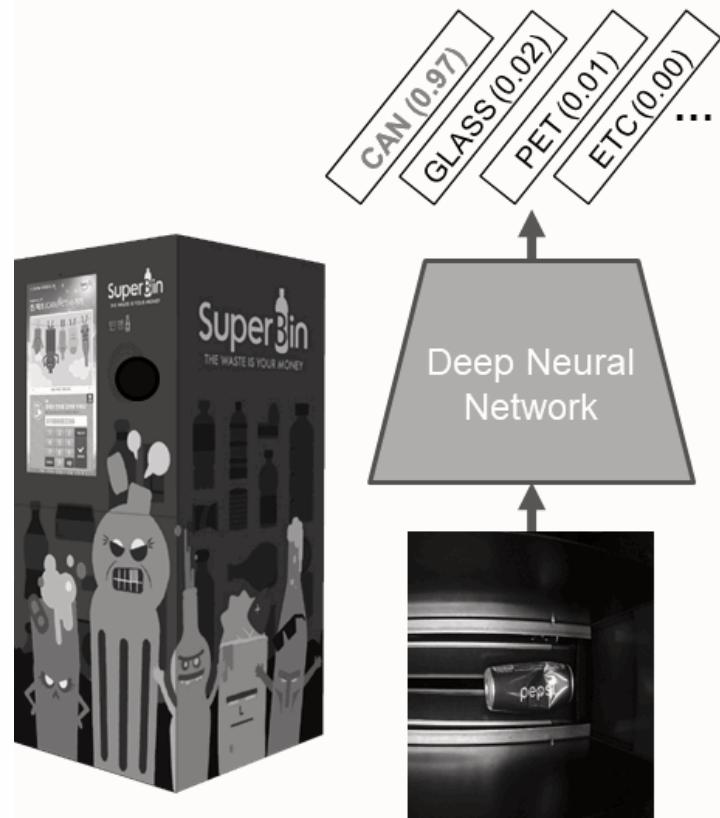
Lane Detection

Intelligent system



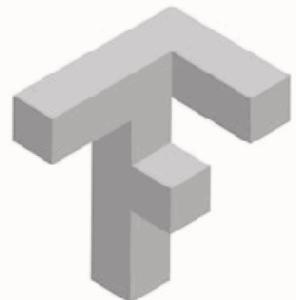
Object recognition, 3D reconstruction, Motion estimation

Classification



Classification using CNN : can, pet, glass, hand, etc..

Deep Learning Frameworks



julia

mxnet

K



DEEP
LEARNING

theano

Microsoft
CNTK

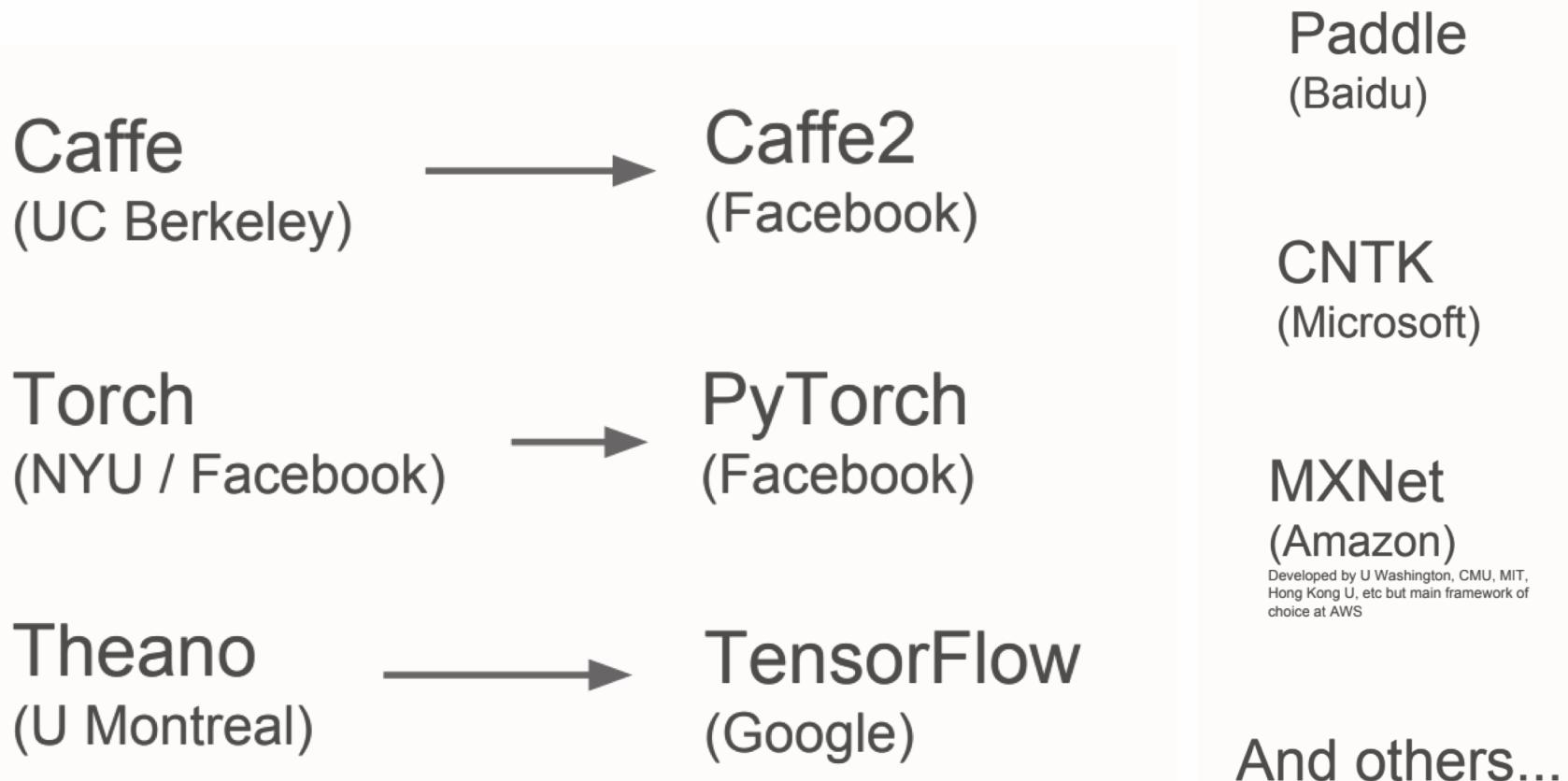


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Caffe2



Chainer

Deep Learning Frameworks

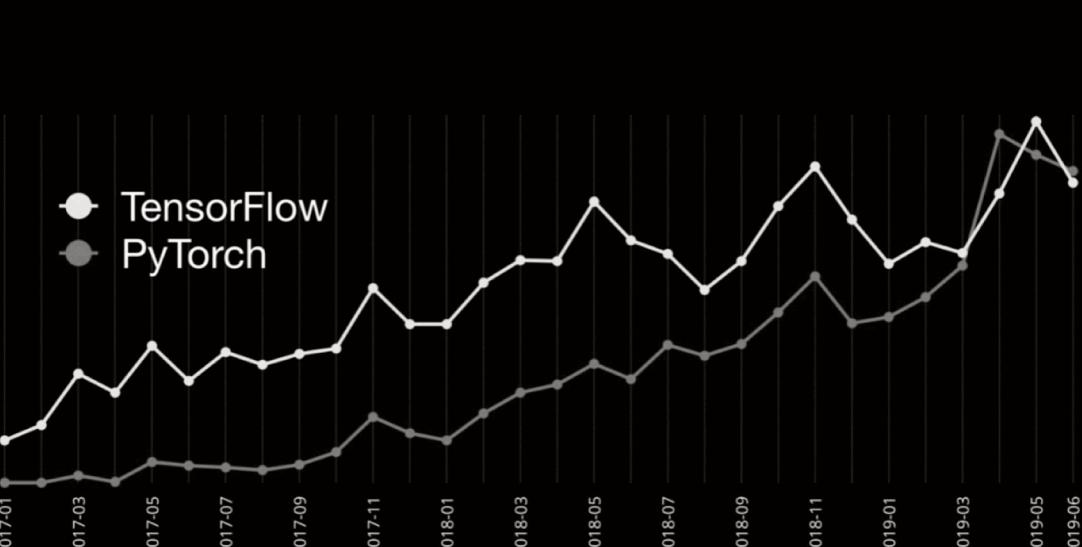


Why use Framework

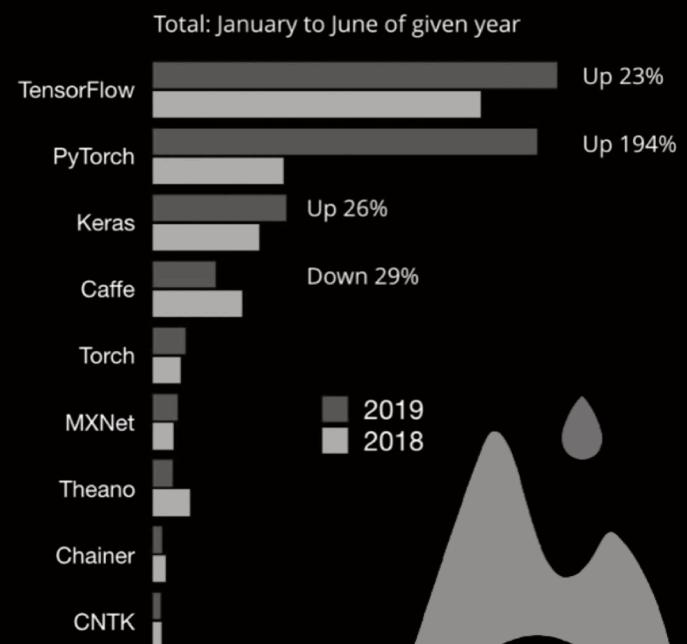
1. Easily build big computational graphs
2. Easily compute gradients in computational graphs
3. Run it all efficiently on GPU (wrap cuDNN, cuBLAS, etc)

Pytorch

Number of papers on arxiv.org that mention a given framework



Source: Data from RISELab ; graphic from gradientflow.com



Next Lecture

1. Linear Regression
2. Logistic Regression

H/W

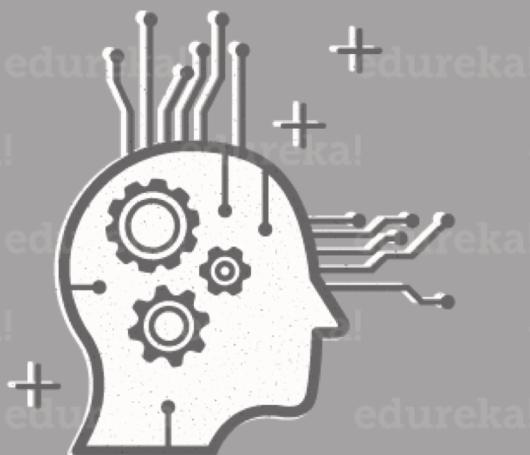
1. Python Study:

- Jump to Python(<https://wikidocs.net/11>) Ch2 ~ Ch5

AI Technologies Timeline

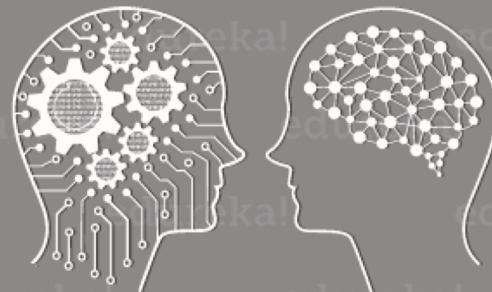
ARTIFICIAL INTELLIGENCE

Engineering of making Intelligent
Machines and Programs



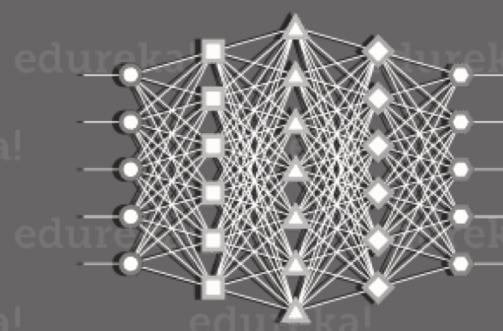
MACHINE LEARNING

Ability to learn without being
explicitly programmed



DEEP LEARNING

Learning based on Deep
Neural Network



1950's > 1960's > 1970's > 1980's > 1990's > 2000's > 2006's > 2010's > 2012's > 2017's