

CS230

Spring 2019
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Teaching Team

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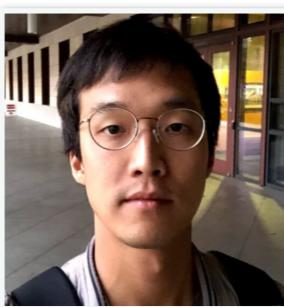
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Ahmad-reza Momeni



Patrick Cho



Jay Whang



Ashwin Sreenivas

Kian Katanforoosh

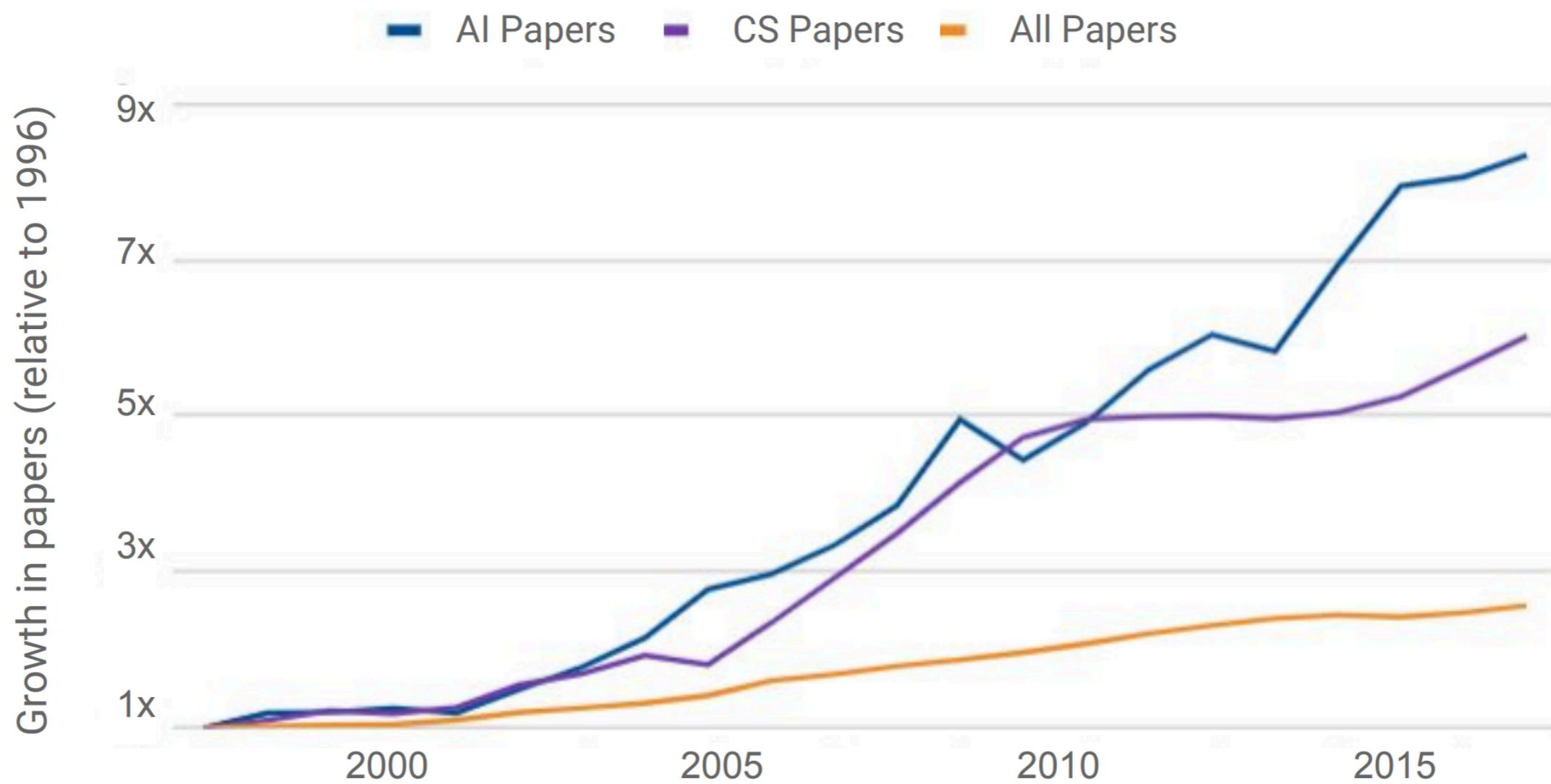
Today's outline

- I. What is deep learning? (25min)
- II. Course Logistics (15min)
- III. Introduction to Deep Learning Applications (20min)
- IV. Examples of student projects (10min)

What is deep learning?

Growth of annually published papers by topic (1996–2017)

Source: Scopus

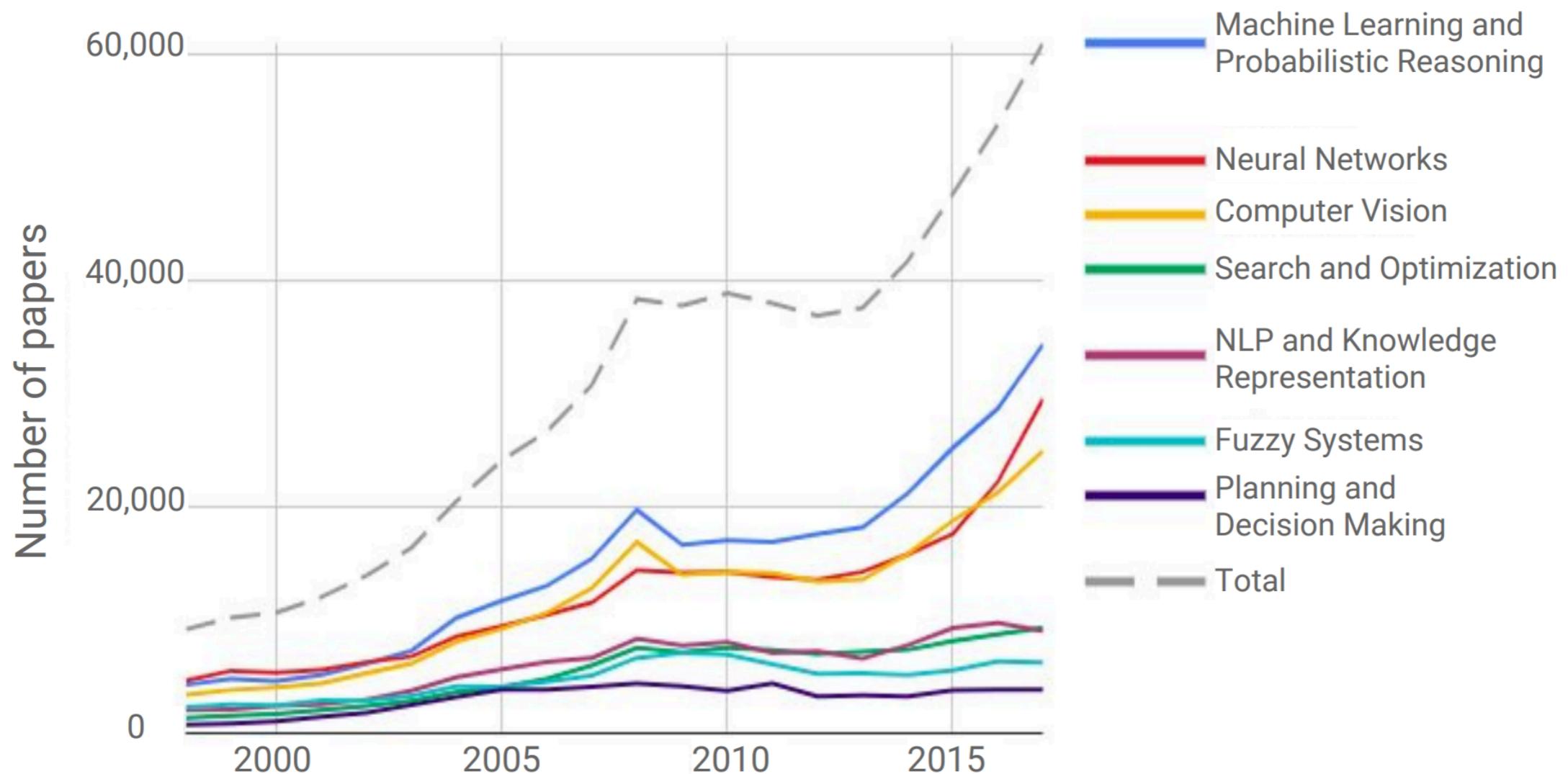


- The growth in annually published papers in AI has outpaced that of CS.
- A growing number of AI publications by researchers from other scientific fields (Physics, Chemistry, Astronomy, Material Science, etc.)

What is deep learning?

Number of AI papers on Scopus by subcategory (1998–2017)

Source: Elsevier



- The number of Scopus papers on Neural Networks had a compound annual growth rate of 37% from 2014 to 2017.
- It has notably driven the growth of #papers published in ML and CV.

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Course Logistics

5 “courses”:

C1: Neural Networks and Deep Learning

C2: Improving Deep Neural Networks

C3: Strategy for Machine Learning Projects

C4: Convolutional Neural Networks

C5: Sequence Models

Example: C2M3: Course 2 Module 3

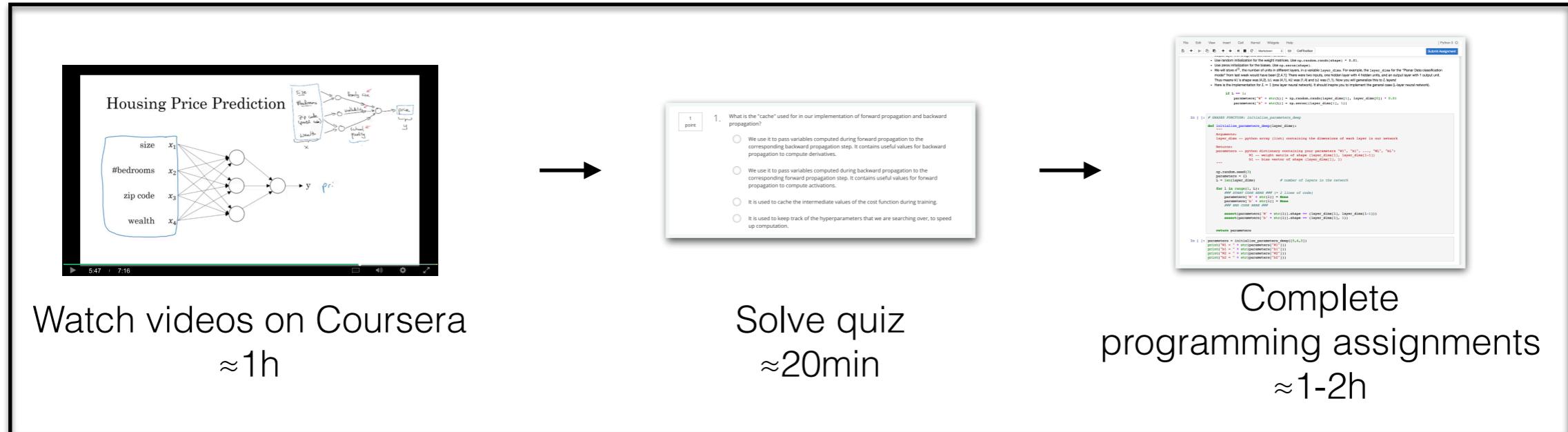
Schedule is on <http://cs230.stanford.edu/syllabus/>

We are going to use the Coursera Platform: www.coursera.org

The class forum is on Piazza: piazza.com/stanford/spring2019/cs230

One week in the life of a CS230 student

1 module



1 week of class \approx 2 modules + Go to in-class lecture $\approx 1\text{h}20$ + TA sections on Fridays $\approx 1\text{ hour}$ + 15min project mentorship with TA

Assignments and Quizzes are due every Tuesday at 8am
Do not follow the deadlines displayed on Coursera!!!

Grading Formula

$$Grade = 0.02A + 0.08Q + 0.25Pa + 0.25M + 0.40Pr$$

A = Attendance

Q = Quizzes

Pa = (Programming) assignments

M = Midterm

Pr = Final-project

Active Piazza participation = 1% bonus

Late days

Example: For next Tuesday at 8am you have to complete the following assignments:

- 2 Quizzes:
 - ★ Introduction to deep learning
 - ★ Neural Network Basics
- 2 Programming assignments:
 - ★ Python Basics with Numpy
 - ★ Logistic Regression with a neural network mindset

At 7am on Tuesday: you submit 1 quiz and the 1 PA.

At 3pm on Tuesday: you submit the second quiz.

At 2pm on Wednesday: you submit the second PA.

How many late days did you use?

3 late days

Today's outline

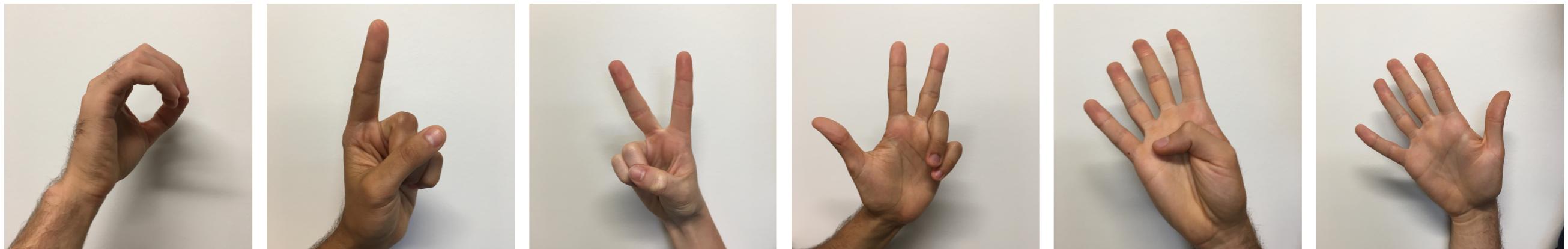
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Projects: SIGN language detection



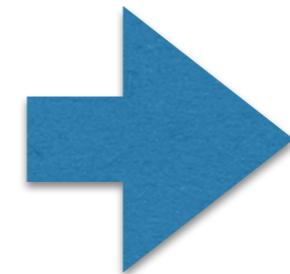
$$\begin{array}{llllll} y = 0 & y = 1 & y = 2 & y = 3 & y = 4 & y = 5 \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} & \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} & \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} & \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} & \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} & \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \\ 0 \end{bmatrix} \end{array}$$

Assignment: The Happy House

$y = 0$



$y = 0$

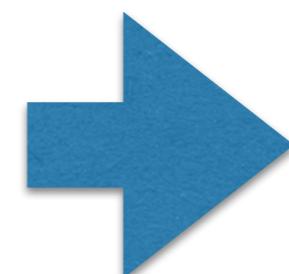


can't enter
the Happy House

$y = 1$

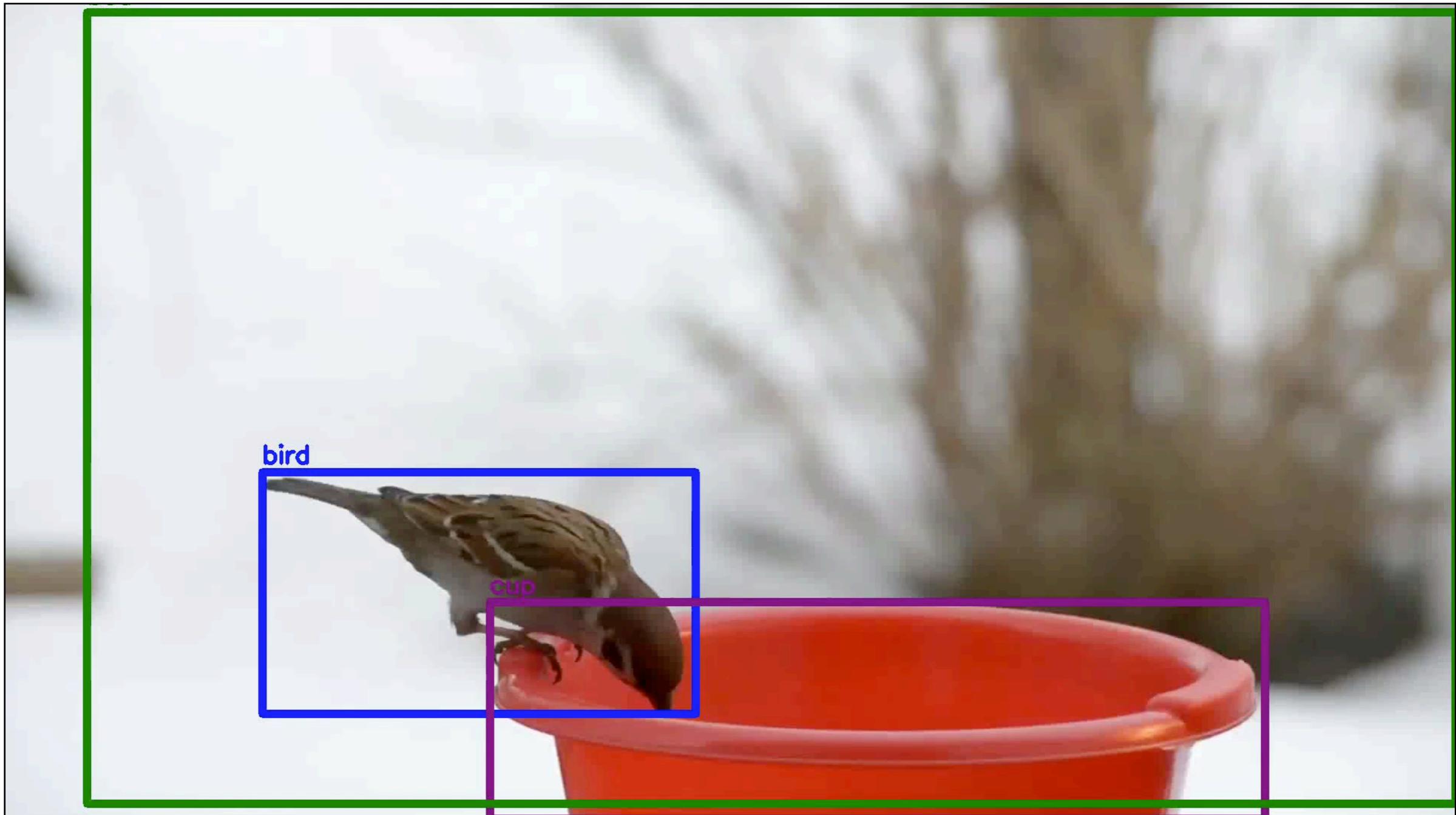


$y = 1$



can enter
the Happy House!

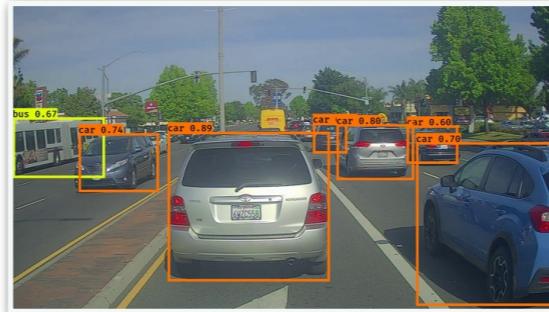
Assignment: Object detection



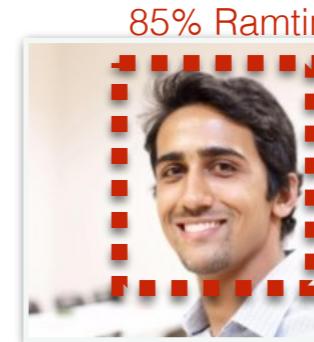
Projects: others



Optimal goalkeeper shoot prediction



Car detection



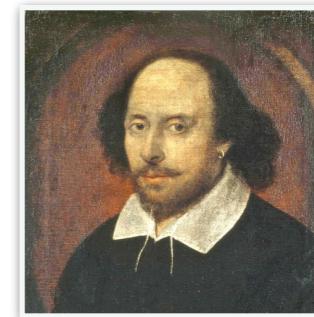
Face recognition



Art generation



Music generation



Text generation

“I love you”
↓

Emojifier



Machine translation



Trigger word detection

And many more...

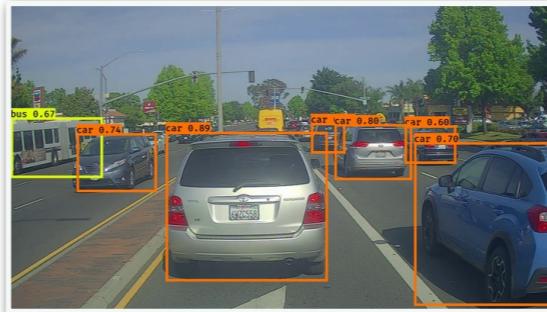
Assignment: Car detection for autonomous driving



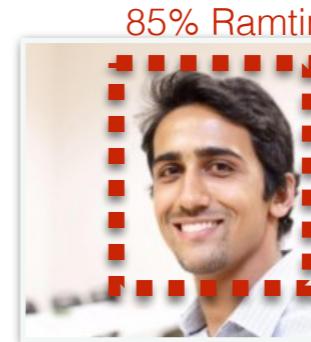
Projects: others



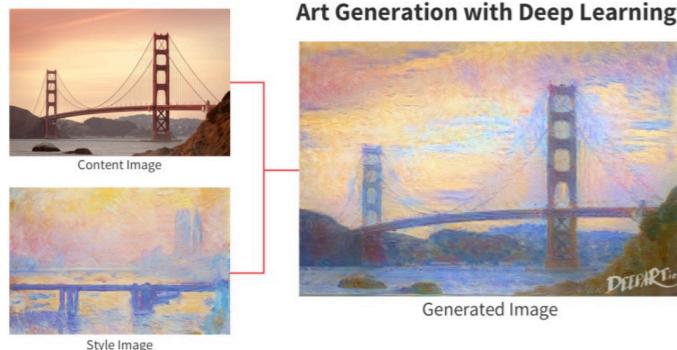
Optimal goalkeeper shoot prediction



Car detection



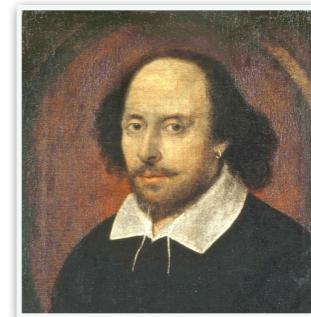
Face recognition



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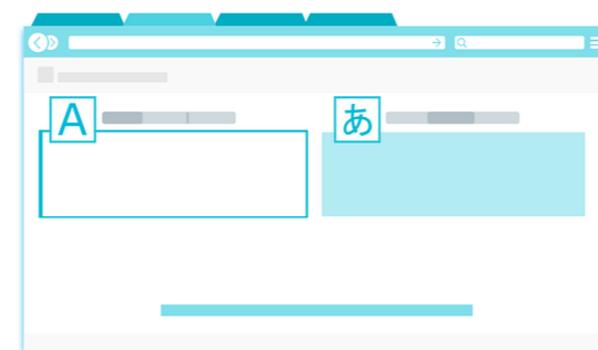
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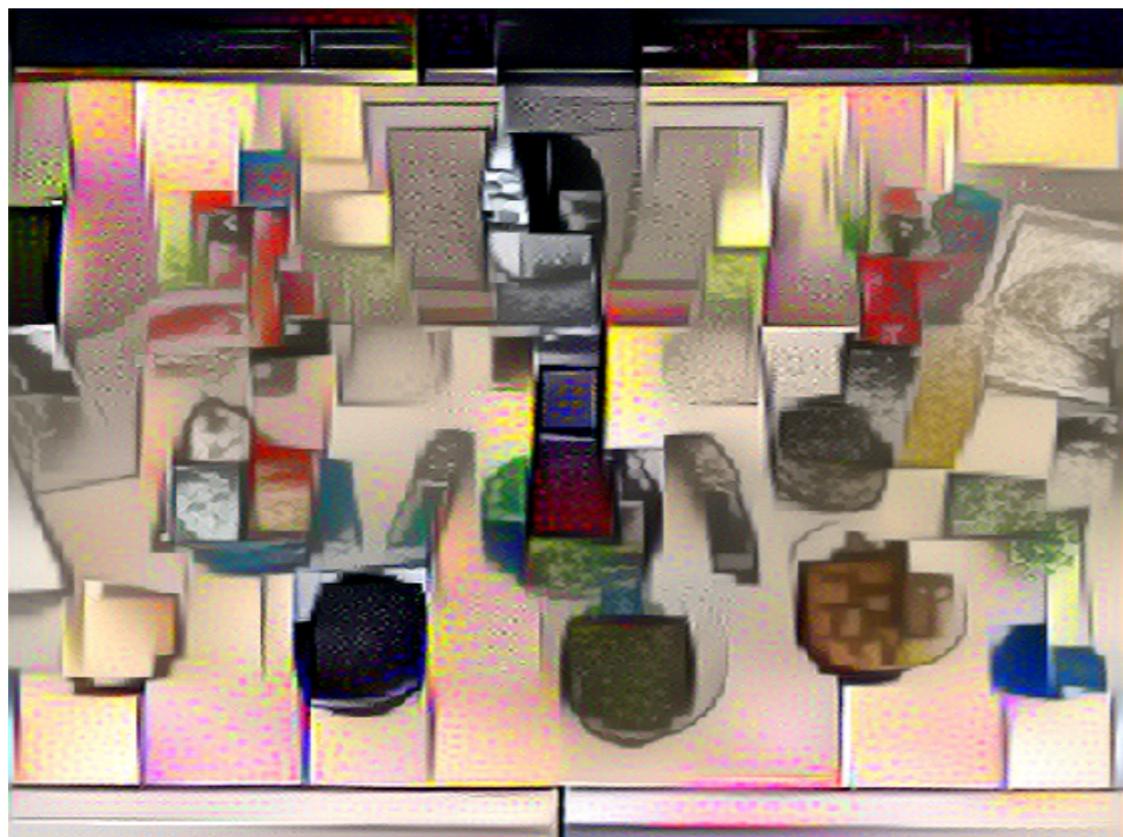




In the style of Claude Monet



In the style of Yayoi Kusama



In the style of Piet Mondrian



In the style of Pablo Picasso



In the style of Hilma af Klint



In the style of Jamini Roy



In the style of Eiichiro Oda

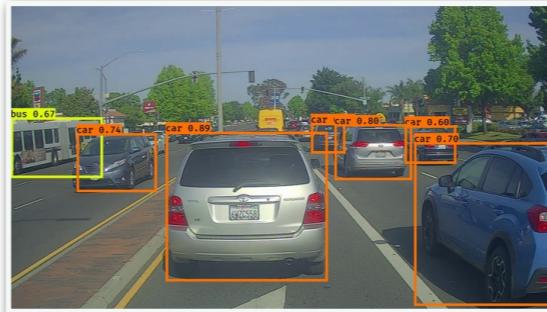


In the style of Salvador Dali

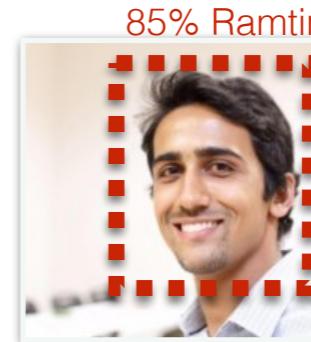
Projects: others



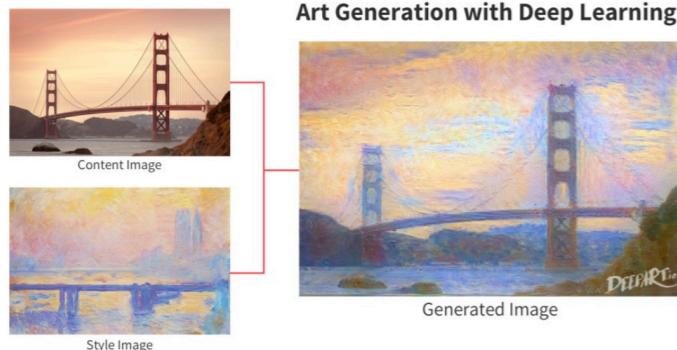
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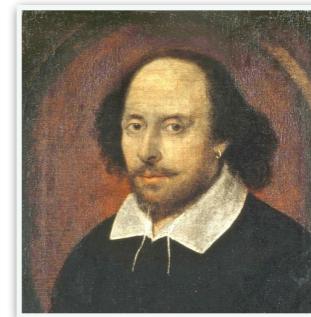
Face recognition



Art generation



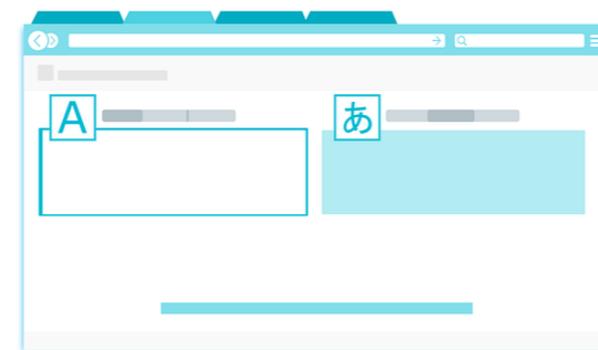
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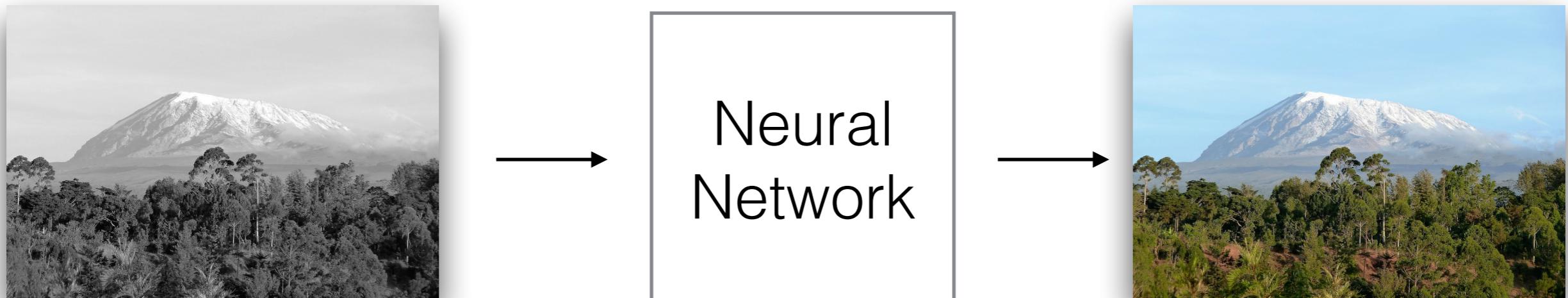
Trigger word detection

And many more...

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Coloring Black&White pictures with Deep Learning



Predicting price of an object from a picture

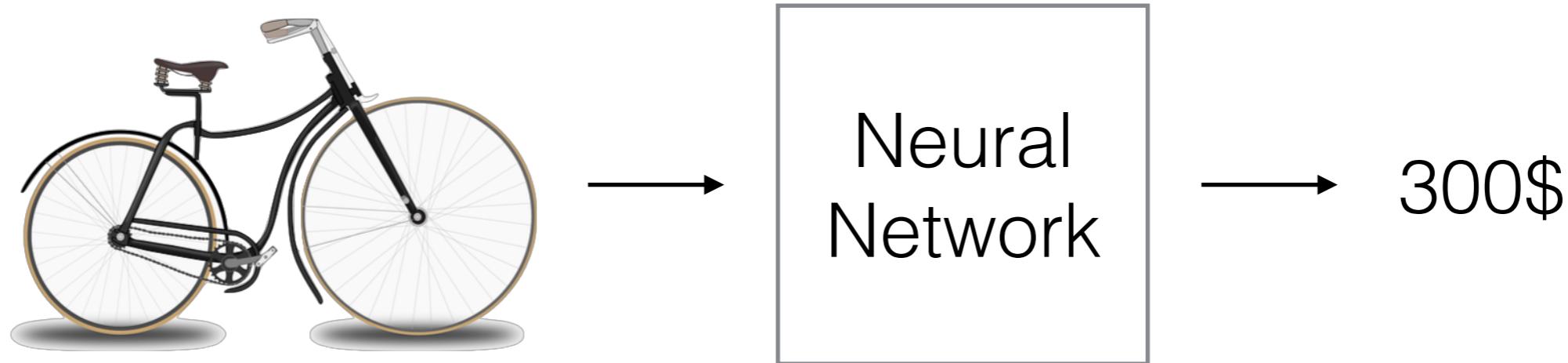


Image-to-Image translation with Conditional-GAN

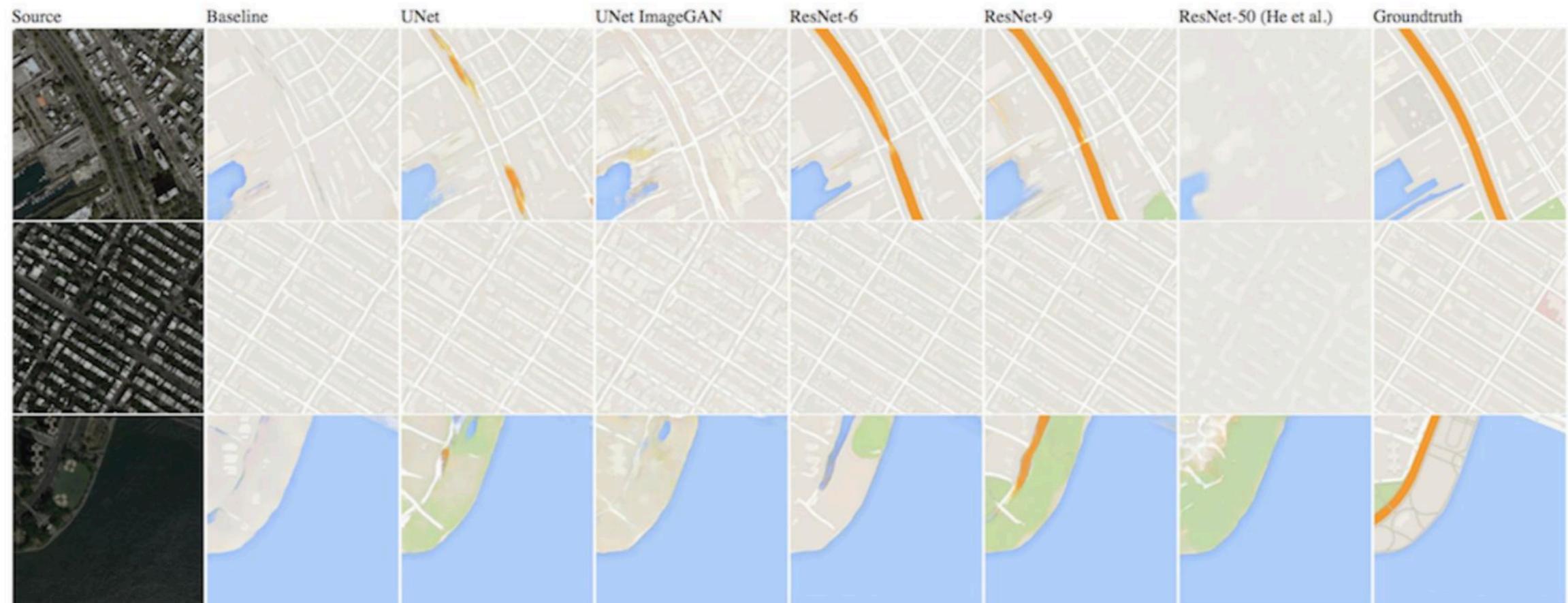
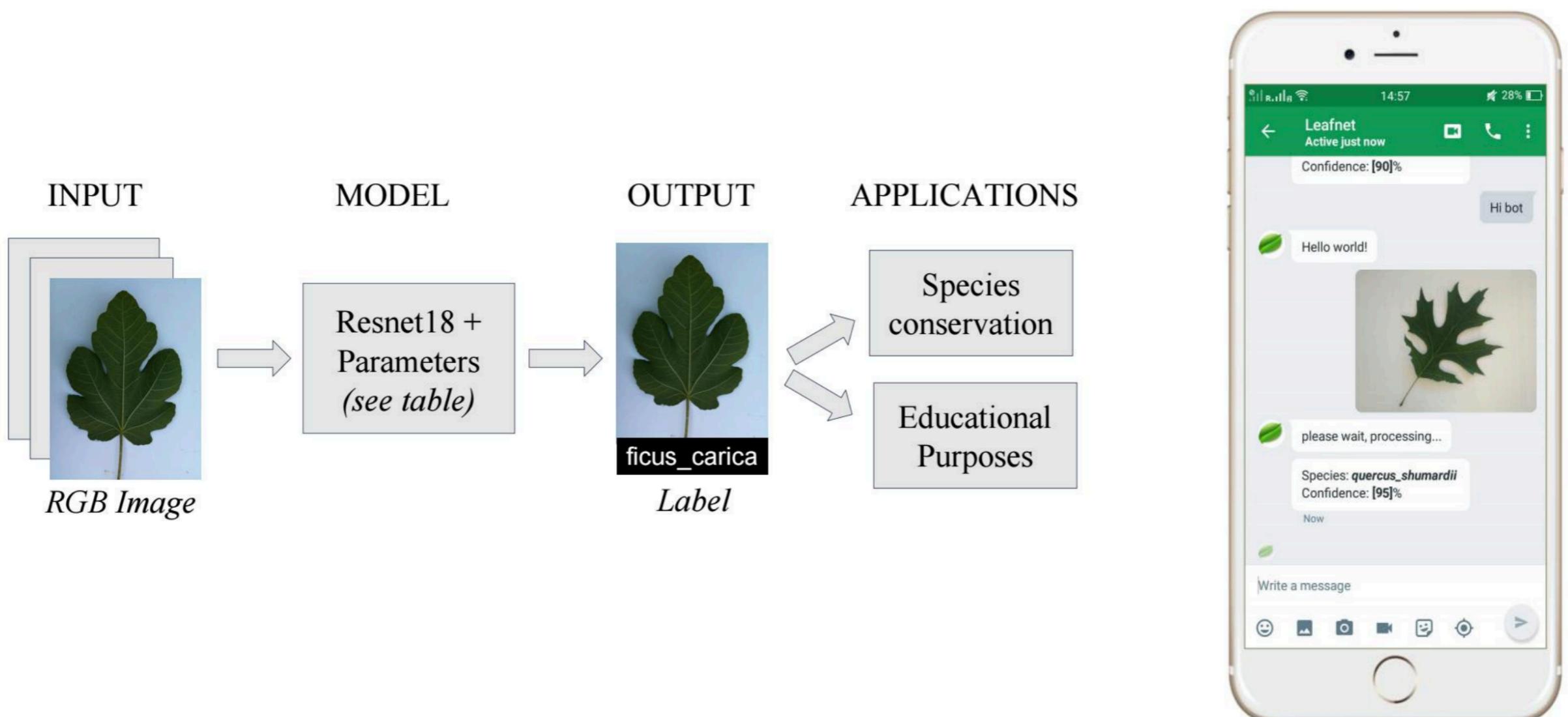


Figure 3: Generated map images of different architecture and hyperparameters. From left to right are source aerial images, baseline, U-Net, U-Net with ImageGAN, ResNet-6, ResNet-9, ResNet-50, and ground truth map images

Projects: others

LeafNet: A Deep Learning Solution to Tree Species Identification



And many more...

Predicting atom energy based on atomic-structure

Visual Question Answering

Cancer/Parkinson/Alzheimer detection

Activity recognition in video

Music genre classification / Music Compression

Accent transfer in a speech

Generating images based on a given legend

Detecting earthquake precursor signals

...

To sum up

1. You will learn about wide range of deep learning topics
2. The course is very applied, you will code these applications
3. You have access to mentorship to build an outstanding project in 10 weeks

For next Tuesday (04/09) 8am:

- Create Coursera account and join the private session using the invitation
- Finish **C1M1 & C1M2**
- 2 Quizzes:
 - ★ Introduction to deep learning
 - ★ Neural Network Basics
- 2 Programming assignments:
 - ★ Python Basics with Numpy
 - ★ Logistic Regression with a neural network mindset
- Find project team-mates and fill-in the Google form that will be posted on Piazza.

This Friday (04/05):

- TA section “Deep Learning Applications”

Download your notebooks after you finished them!
Follow only the website deadlines!