

CS230: Deep Learning

Let's talk about:

I. Course logistics

II. Overview of CS230 programming assignments

III. Examples of student projects

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

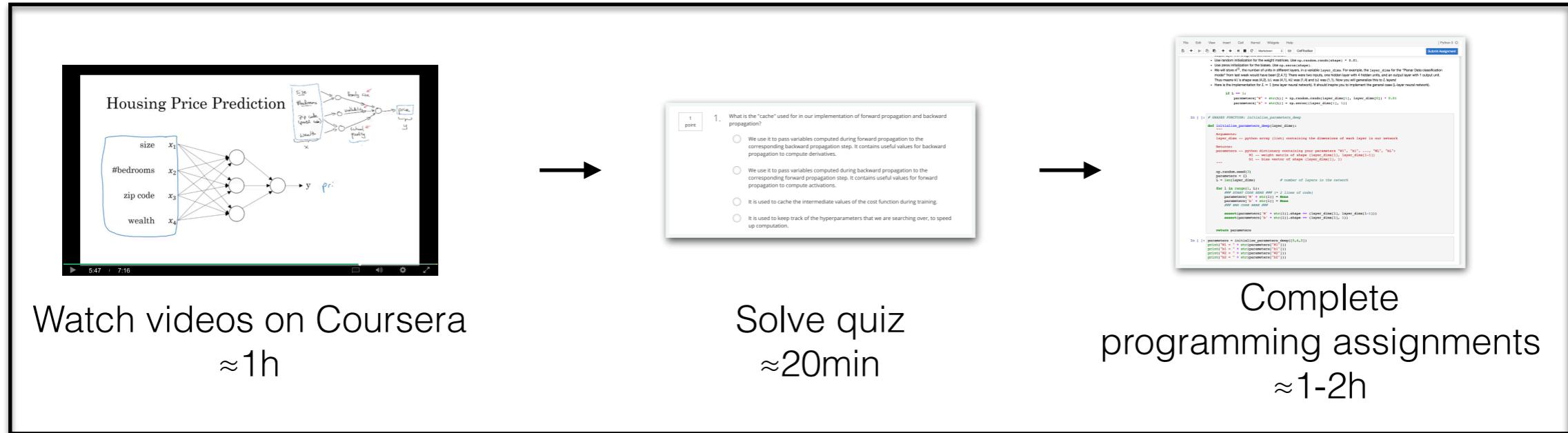
The schedule is on <http://cs230.stanford.edu/syllabus/>

We use Coursera: www.coursera.org

The class forum is on Ed discussion, which is accessible through Canvas under “Ed Discussion” tab.

One week in the life of a CS230 student

1 module



1 week of CS230 ≈ 2 modules + Zoom lecture (every Tuesday) ≈1h20 + TA sections (every Friday) ≈ 1 hour + 15min project mentorship w/ TA (every ≈2 weeks)

Assignments and Quizzes are due every week before lecture

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 Ed participation = 1% bonus

Late days

Example: For next Wednesday at 9.30am PDT 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 Wednesday: you submit 1 quiz and the 1 PA.

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

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

How many late days did you use?

3 late days

(Soft) Prerequisites

Students are expected to have the following background, and are invited to take the [Workera](#) technical assessments prior to the class to self-assess themselves prior to taking the class:

- Knowledge of **basic computer science principles and skills**, at a level sufficient to write a reasonably non-trivial computer program. This corresponds to a Developing level (or badge) in the “Algorithmic Coding” section on [Workera](#).
- **Familiarity with the probability theory** (CS 109 or STATS 116), which students can assess by taking the “Data Science” section on [Workera](#).
- **Familiarity with linear algebra** (MATH 51), which students can assess by taking the “Mathematics” section on [Workera](#).

(Recommended) Take the Workera assessment (www.workera.ai) prior to starting the class, you'll take it again at the end of the class to measure your progress!

The image shows three rectangular cards representing different Workera assessments:

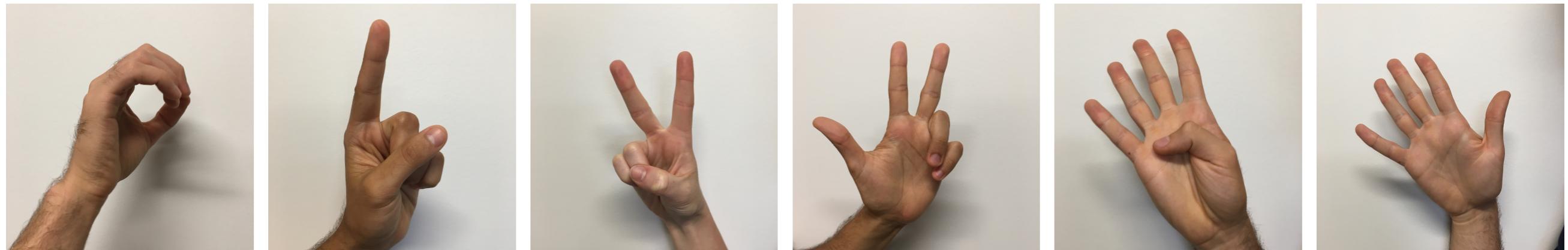
- Data Science**:
 - Description: ~ 20 mins, 7-19 Questions. This assessment covers using probabilities, using statistics, and analyzing data.
 - Level: Beginning (indicated by a person icon and a pink arrow).
 - Buttons: "Go to Learning" and "Retry".
 - Statistics: 14355 test takers | ★★★★☆
- Mathematics**:
 - Description: ~ 19 mins, 7-16 Questions. This assessment covers working with linear algebra, working with functions, and understanding calculus.
 - Level: Beginning (indicated by a person icon and a pink arrow).
 - Buttons: "Go to Learning" and "Retry".
 - Statistics: 11127 test takers | ★★★★☆
- Algorithmic Coding**:
 - Description: ~ 21 mins, 7-15 Questions. This assessment covers classic algorithms like sorting and searching, and classic data structures like dictionaries and arrays.
 - Level: Developing (indicated by a person icon and a blue arrow).
 - Buttons: "Go to Learning" and "Retry".
 - Statistics: 10628 test takers | ★★★★☆

Take Workera assessments (DLE) at the end of the class. We recommend (at least) the domains:

- Deep Learning on [Workera](#), try to reach the Accomplished level at the end of the class
- Tensorflow (or Pytorch) on [Workera](#), try to reach Developing level at the end of the class
- AWS on [Workera](#), try to reach Developing level at the end of the class

- I. Overview of CS230 programming assignments
- II. Examples of student projects

Projects: SIGN language image classification



$$y = 0$$



$$\begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$y = 1$$



$$\begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$y = 2$$



$$\begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$y = 3$$



$$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$y = 4$$



$$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$y = 5$$

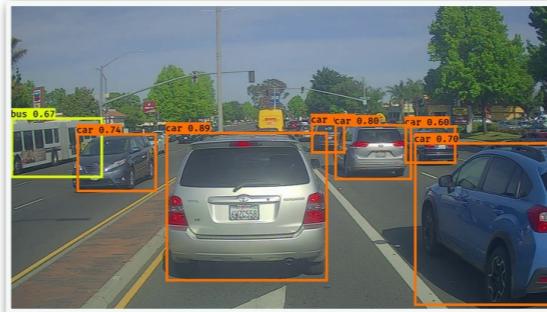


$$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

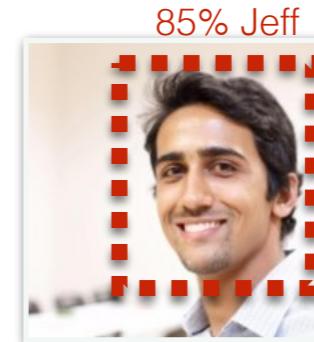
Projects: others



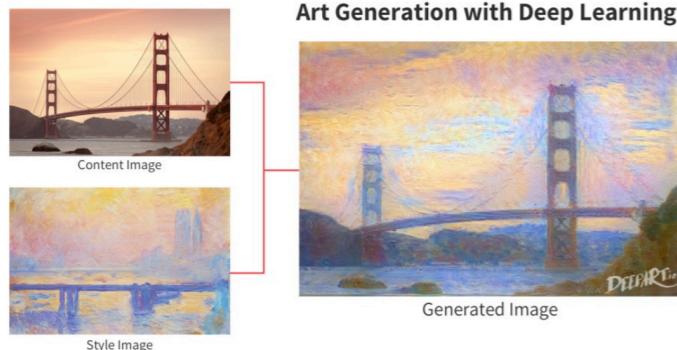
Optimal goalkeeper shoot prediction



Car detection



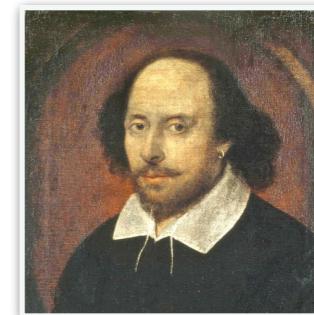
Face recognition



Art generation



Music generation



Text generation

“I love you”
↓

Emojifier



Machine translation



Trigger word detection

And many more...

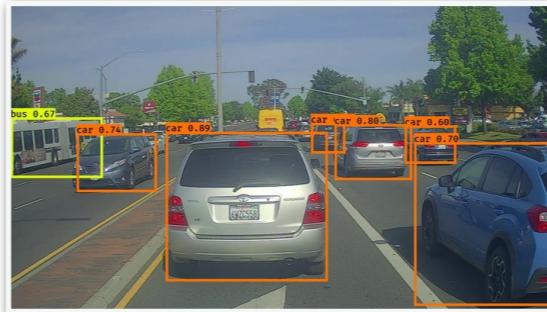
Assignment: Car detection for autonomous driving



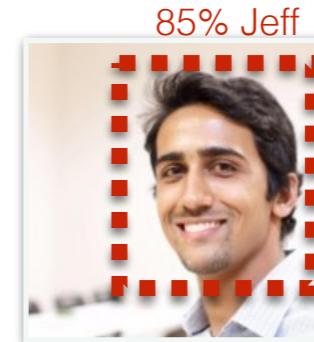
Projects: others



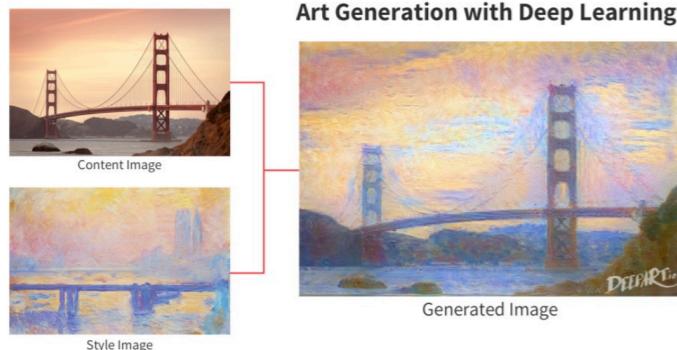
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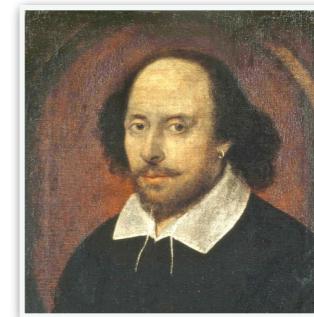
Face recognition



Art generation

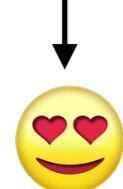


Music generation

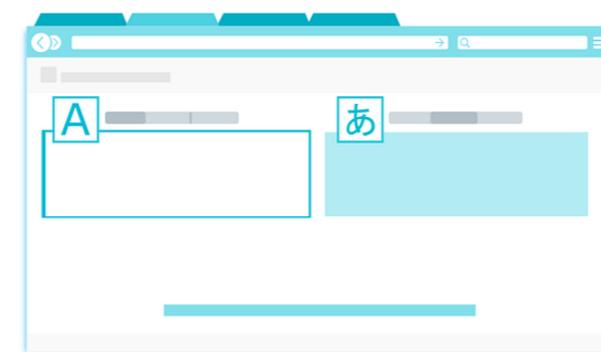


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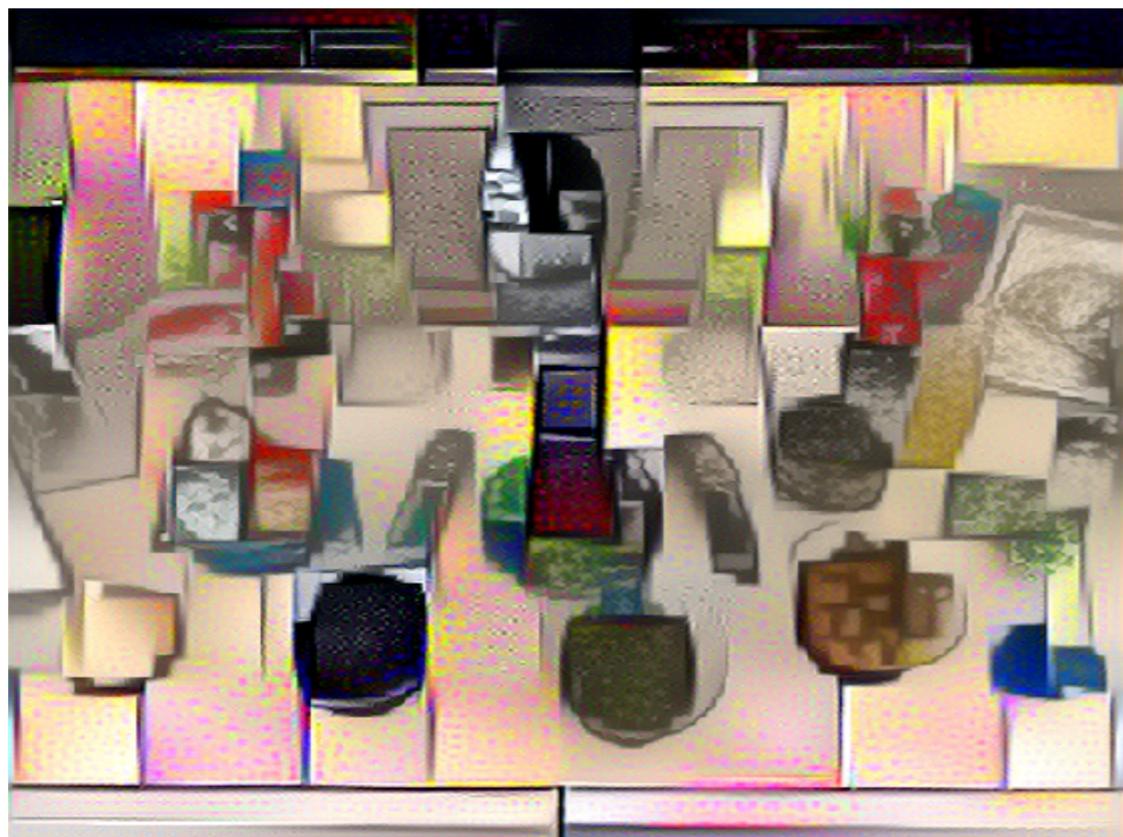




In the style of Claude Monet



In the style of Yayoi Kusama



In the style of Piet Mondrian



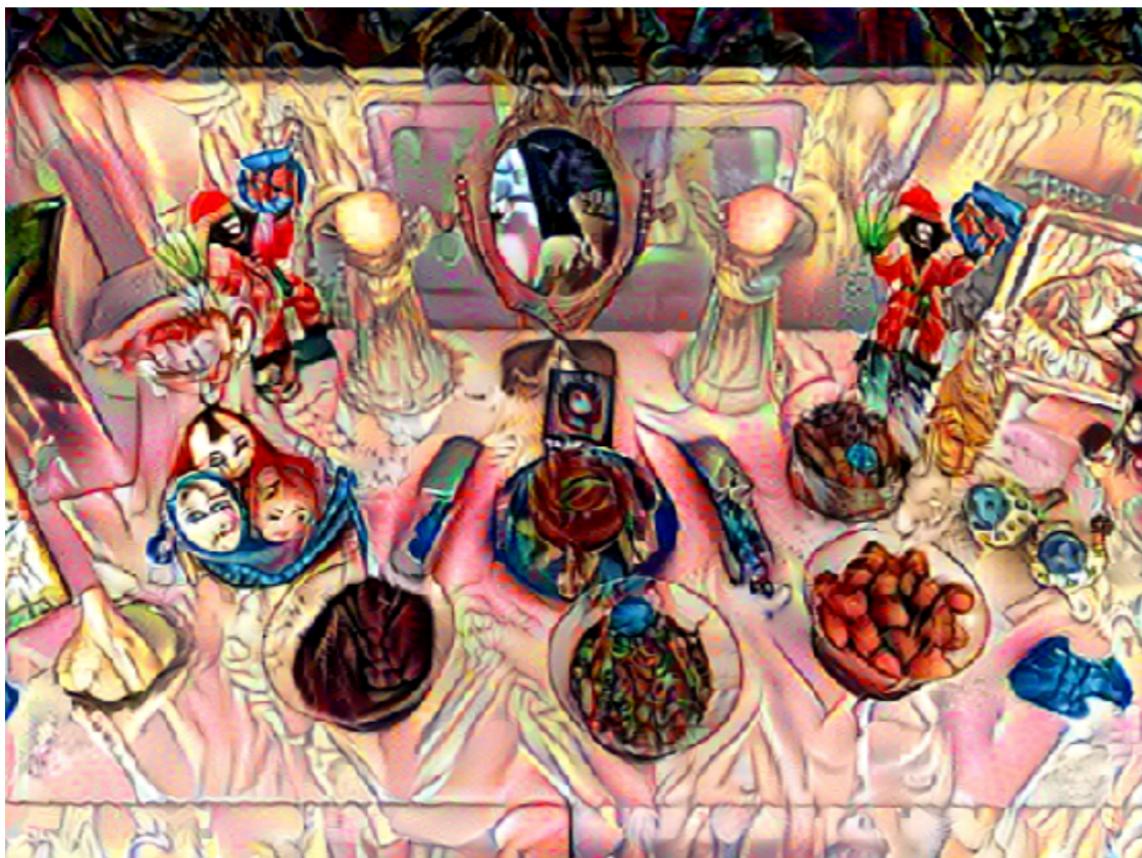
In the style of Pablo Picasso



In the style of Hilma af Klint



In the style of Jamini Roy



In the style of Eiichiro Oda

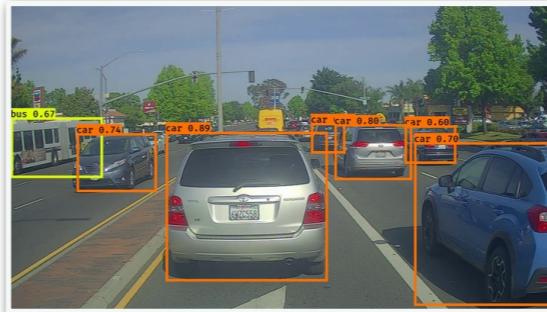


In the style of Salvador Dali

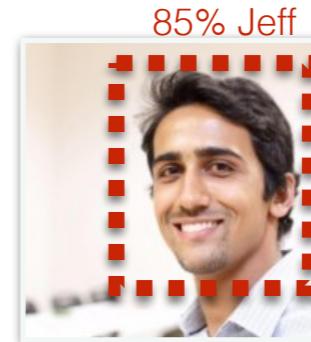
Projects: others



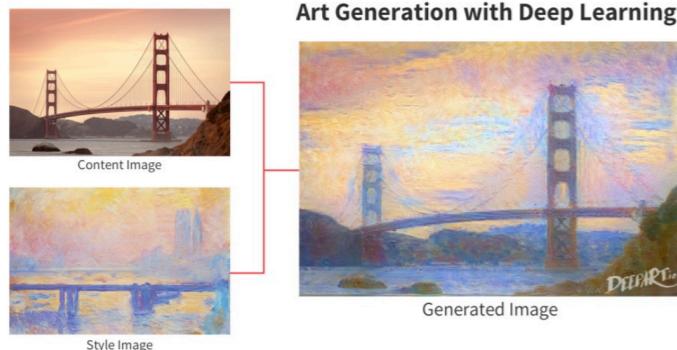
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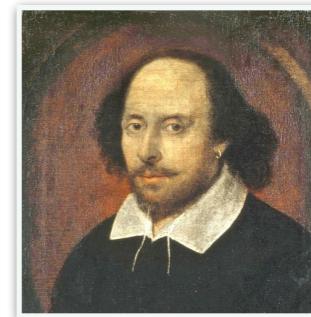
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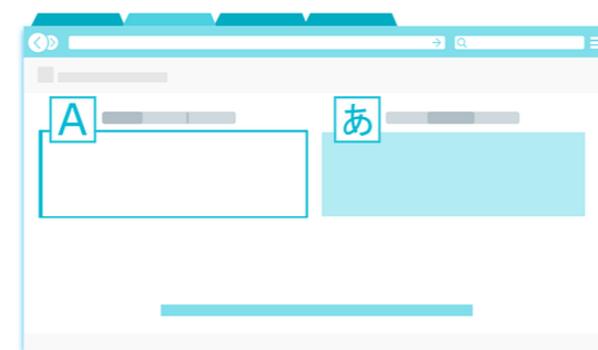
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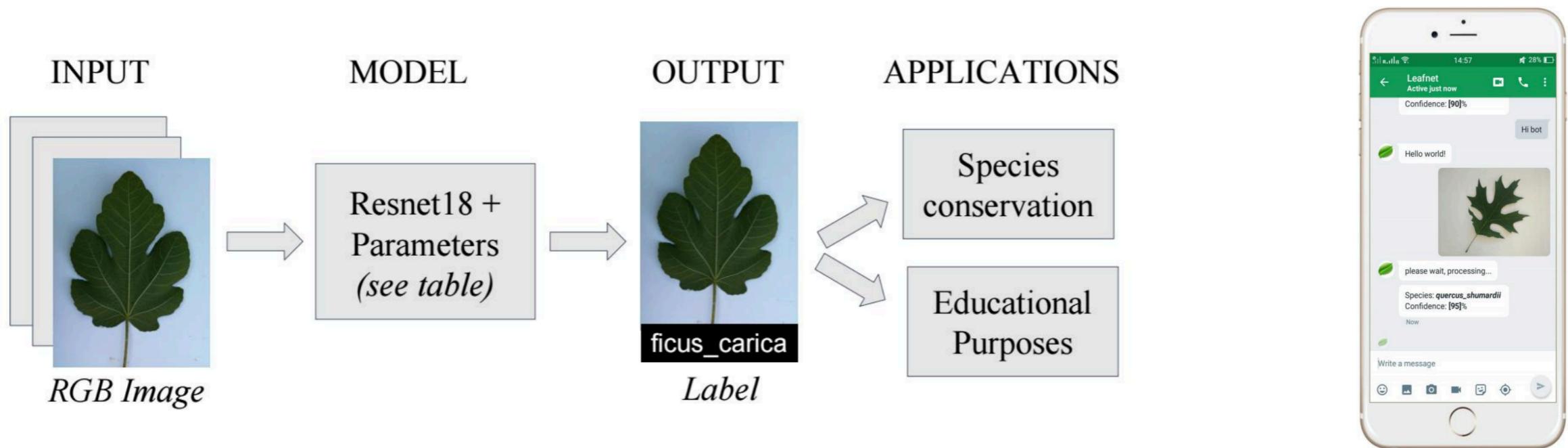
And many more...

I. Overview of CS230 programming assignments

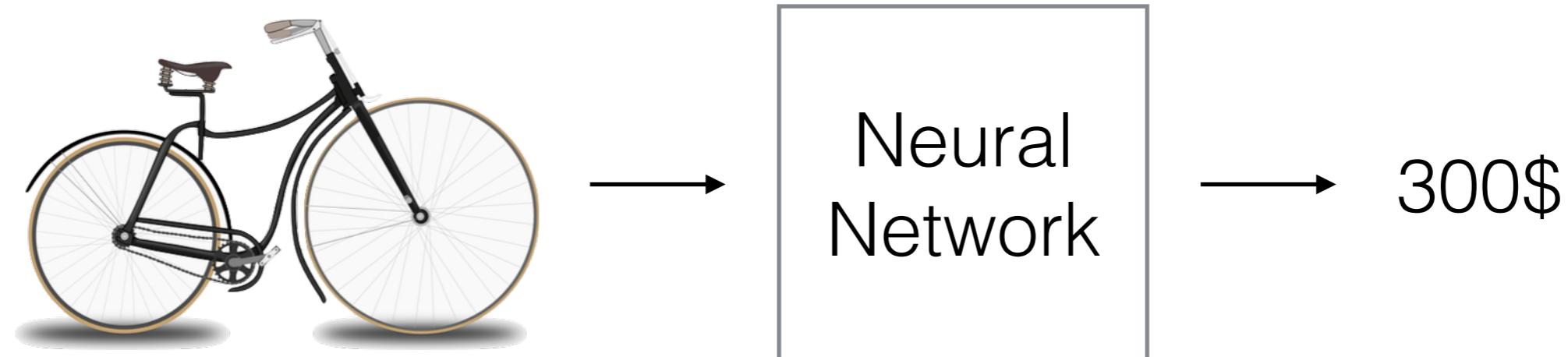
II. Examples of student projects

Projects: others

LeafNet: A Deep Learning Solution to Tree Species Identification



Predicting price of an object from a picture



Projects: others

Detect cards from real-time video of tournaments to improve viewer understanding and accessibility

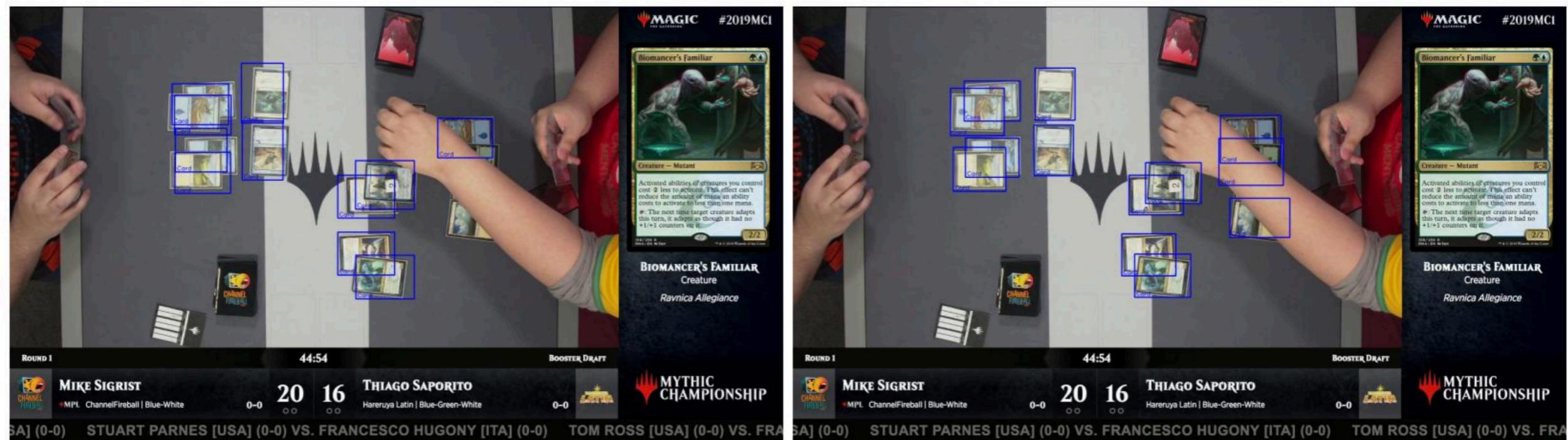
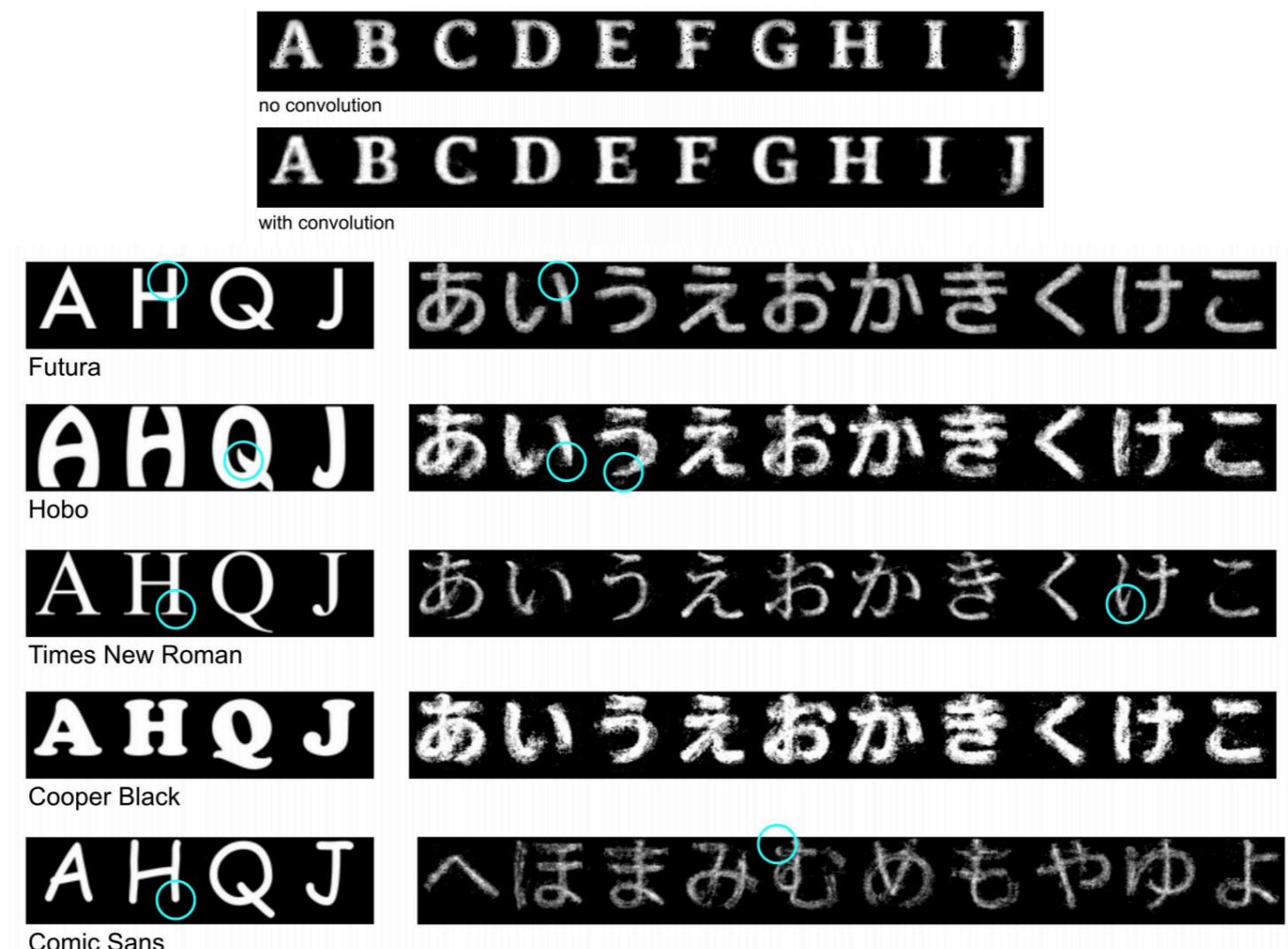


Figure 2: Predicted objects on a single frame from Dataset 1 produced by my model (left) and the YOLOv3 baseline (right).

Projects: others

font-gen: Deep Models for Inferring Alternate Language Sets from Fonts



Figures 5-6: Convolution; predicting Japanese sets.

Projects: others

NBA 2k19 DeepBaller: A NN-Controlled Real-Time video game AI

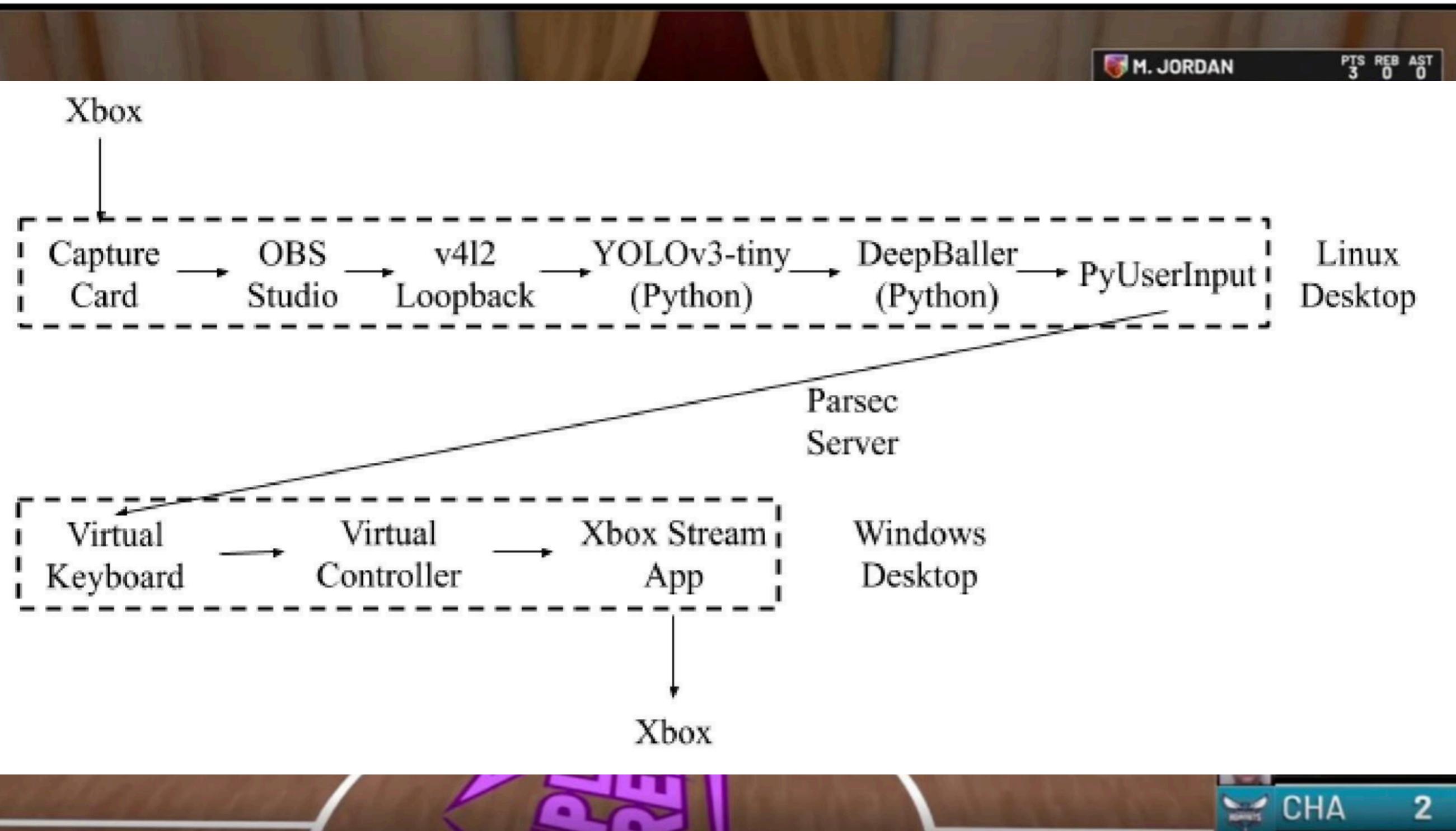


Image-to-Image translation with Conditional-GAN

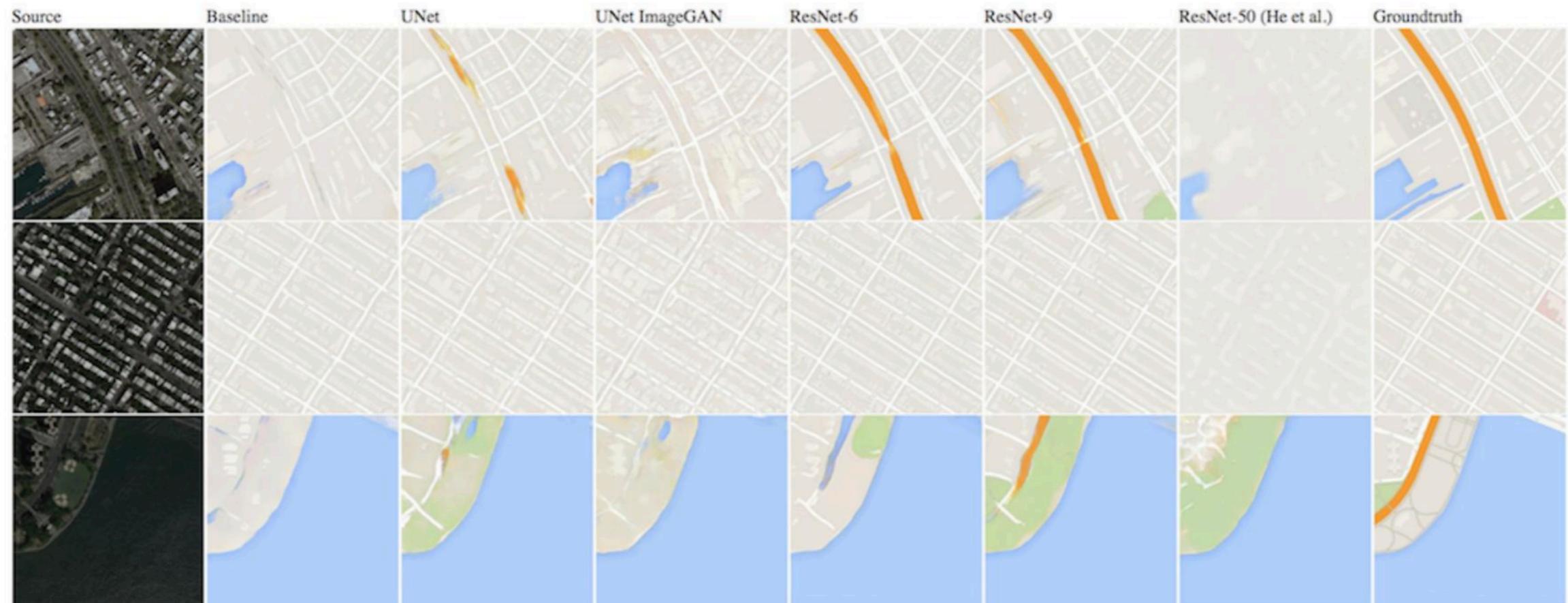


Figure 3: Generated map images of different architecture and hyperparameters. From left to right are source aerial images, baseline, U-Net, U-Net with ImageGAN, ResNet-6, ResNet-9, ResNet-50, and ground truth map images

Projects: others

Discrete reasoning in natural language processing

Reasoning	Passage (some parts shortened)	Question	Answer	BiDAF
Subtraction (28.8%)	That year, his Untitled (1981) , a painting of a haloed, black-headed man with a bright red skeletal body, depicted amid the artists signature scrawls, was sold by Robert Lehrman for \$16.3 million, well above its \$12 million high estimate.	How many more dollars was the Untitled (1981) painting sold for than the 12 million dollar estimation?	4300000	\$16.3 million
Comparison (18.2%)	In 1517, the seventeen-year-old King sailed to Castile . There, his Flemish court In May 1518, Charles traveled to Barcelona in Aragon.	Where did Charles travel to first, Castile or Barcelona?	Castile	Aragon
Selection (19.4%)	In 1970, to commemorate the 100th anniversary of the founding of Baldwin City, Baker University professor and playwright Don Mueller and Phyllis E. Braun, Business Manager, produced a musical play entitled The Ballad Of Black Jack to tell the story of the events that led up to the battle.	Who was the University professor that helped produce The Ballad Of Black Jack, Ivan Boyd or Don Mueller?	Don Mueller	Baker
Addition (11.7%)	Before the UNPROFOR fully deployed, the HV clashed with an armed force of the RSK in the village of Nos Kalik, located in a pink zone near Šibenik, and captured the village at 4:45 p.m. on 2 March 1992 . The JNA formed a battlegroup to counterattack the next day .	What date did the JNA form a battlegroup to counterattack after the village of Nos Kalik was captured?	3 March 1992	2 March 1992
Count (16.5%) and Sort (11.7%)	Denver would retake the lead with kicker Matt Prater nailing a 43-yard field goal , yet Carolina answered as kicker John Kasay ties the game with a 39-yard field goal Carolina closed out the half with Kasay nailing a 44-yard field goal In the fourth quarter, Carolina sealed the win with Kasay's 42-yard field goal .	Which kicker kicked the most field goals?	John Kasay	Matt Prater

AI+X: Leveraging your subject-matter expertise

- Roy, Quill, and Tuchman **from Material Science & Engineering** predicted the melting point and viscosity of ionic liquids based on the component anion and cation chemical structures ([report poster](#)).
- Buechler **from Mechanical Engineering** developed a deep learning framework to approximate the outputs from a power flow simulation, and evaluate performance for a variety of power network characteristics ([report poster](#)).
- Sokol and Aguirre **from the Biomedical Informatics Training Program** leveraged deep learning to estimate the ancestral composition of a genomic sequence at high resolution ([report poster](#)).
- Peng, Zhao, Yu **from Computer Science, Civil Engineering, and Biomedical Engineering** used deep learning to classify gestures from divers communicating with an autonomous robot companion in dangerous underwater environments ([report poster](#)).
- O'Day, Seagers, and Lee **from Bioengineering and Mechanical Engineering** studied neural signals of patients with Parkinson's disease while walking to predict freezing behaviors ([report poster](#)).

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

...

Check out past projects: <http://cs230.stanford.edu/past-projects/>

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 week:

- 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 Ed soon.
- The GPU credit registration form will be posted with instructions on Ed soon. Upon forming a team, students should sign up for GPU credits.
- The teaching staff will create an open thread on Ed so that students can use it to find project teammates as we are all remote and this can prove cumbersome as compared to normal times.

This Friday: TA section “Getting Started with Your Project”

Download your iPython notebooks after you finished them!

You can find all deadlines on the website Syllabus

Kian Katanforoosh