CS230: Deep Learning

Course Staff

Andrew Ng

Instructor

Kian Katanforoosh

Instructor

Amelie Byun

Coordinator

Swati Dube Batra

Course Advisor

Elaine Sui

Head TA

Course Assistants

Yanjun Chen

Tianhe Yu

Fenglu Hong

Grace Lam

Jack Lee

Allan Zhou

Vincent Li

Kian Katanforoosh

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

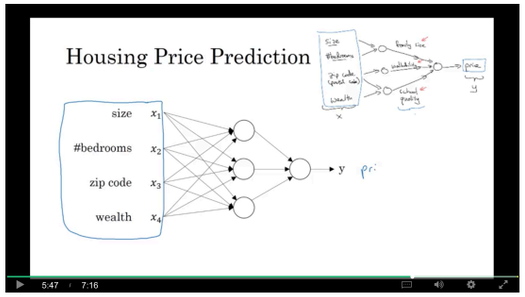
The schedule is on http://cs230.stanford.edu/syllabus/

We use Coursera: www.coursera.org

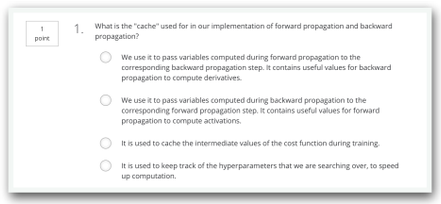
The class forum is on Ed discussion, which is accessible through Canvas under “Ed Discussion” tab.

One week in the life of a CS230 student

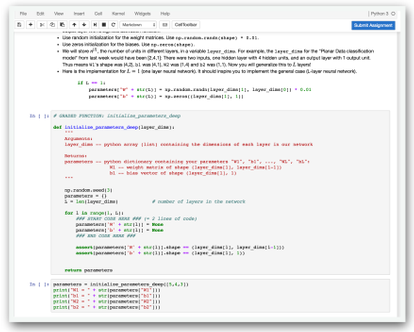
1 module



Watch videos on Coursera
≈1h



Solve quiz
≈20min



Complete
programming assignments
≈1-2h

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

Kian Katanforoosh

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 9.45am 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 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.

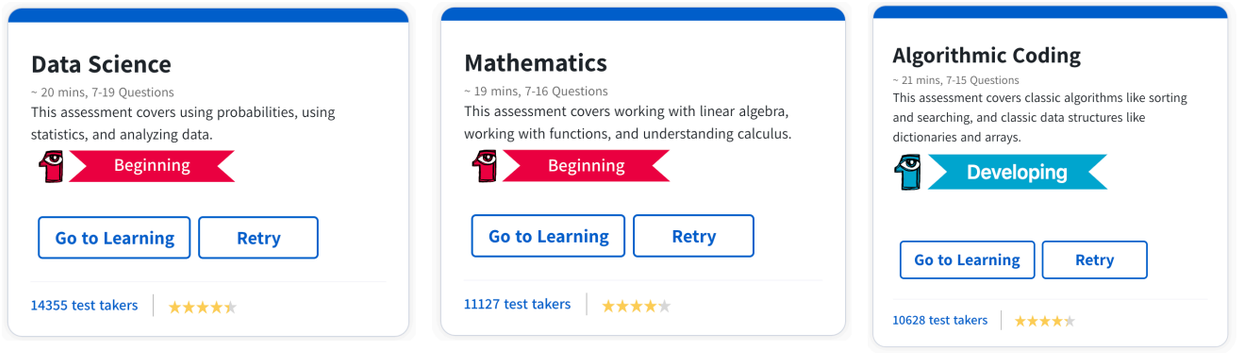
How many late days did you use? 3 late days

(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!



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

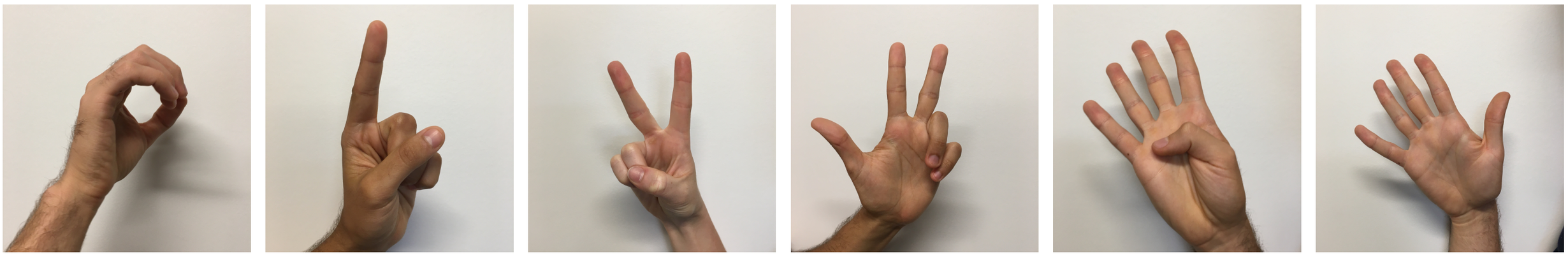
Today's outline

I. Course logistics

II. Overview of CS230 programming assignments

III. Examples of student projects

Projects: SIGN language image classification

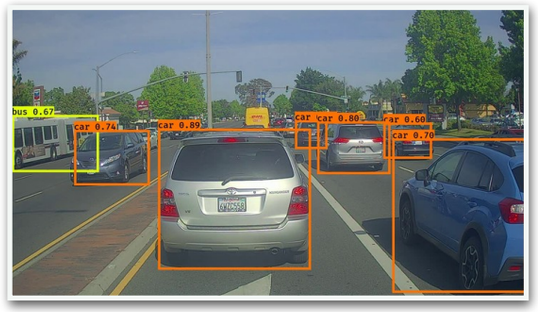


$y = 0$ $y = 1$ $y = 2$ $y = 3$ $y = 4$ $y = 5$

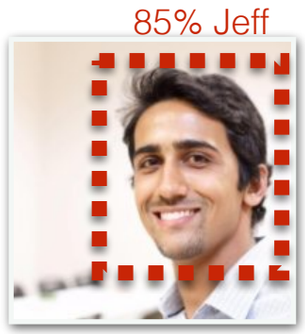
$$\begin{bmatrix}1\\0\\0\\0\\0\\0\end{bmatrix} \quad \begin{bmatrix}0\\1\\0\\0\\0\\0\end{bmatrix} \quad \begin{bmatrix}0\\0\\1\\0\\0\\0\end{bmatrix} \quad \begin{bmatrix}0\\0\\0\\1\\0\\0\end{bmatrix} \quad \begin{bmatrix}0\\0\\0\\0\\1\\0\end{bmatrix} \quad \begin{bmatrix}0\\0\\0\\0\\0\\1\end{bmatrix}$$

Projects: others

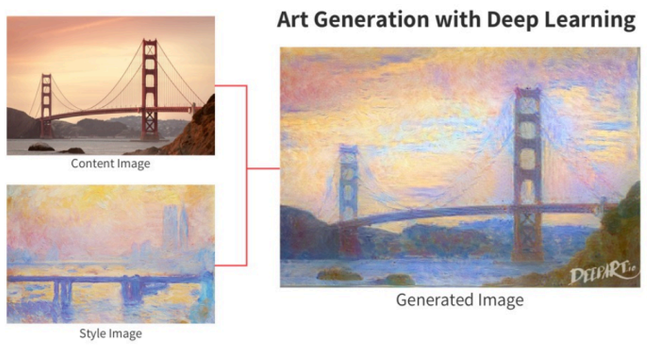
Optimal goalkeeper shoot prediction



Car detection



Face recognition



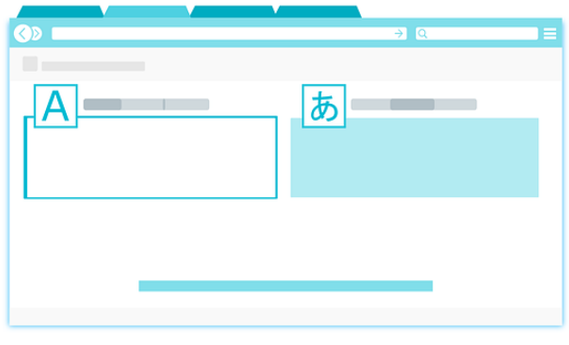
Art generation

Music generation

Text generation

"I love you"

Emojifier



Machine translation

Trigger word detection

And many more…

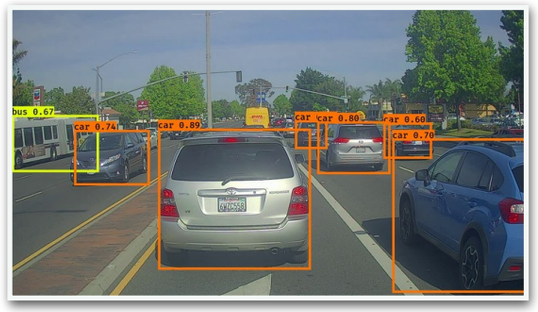
Assignment: Car detection for autonomous driving

[Deep Learning Specialization]

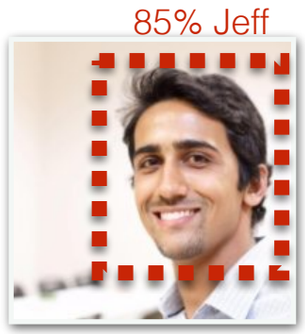
Kian Katanforoosh

Projects: others

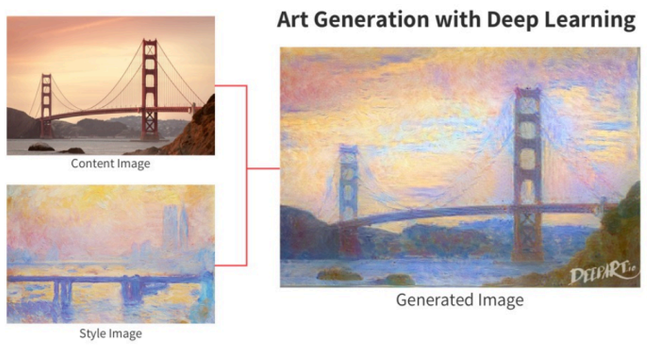
Optimal goalkeeper shoot prediction



Car detection



Face recognition



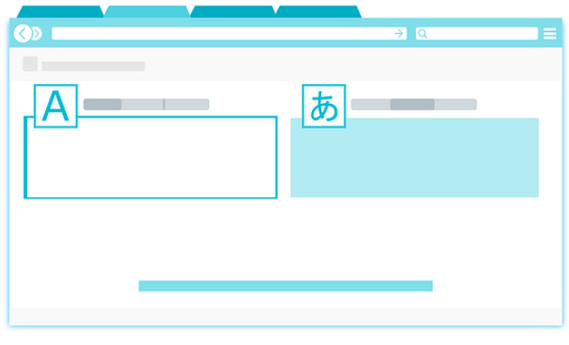
Art generation

Music generation

Text generation

"I love you"

Emojifier



Machine translation

Trigger word detection

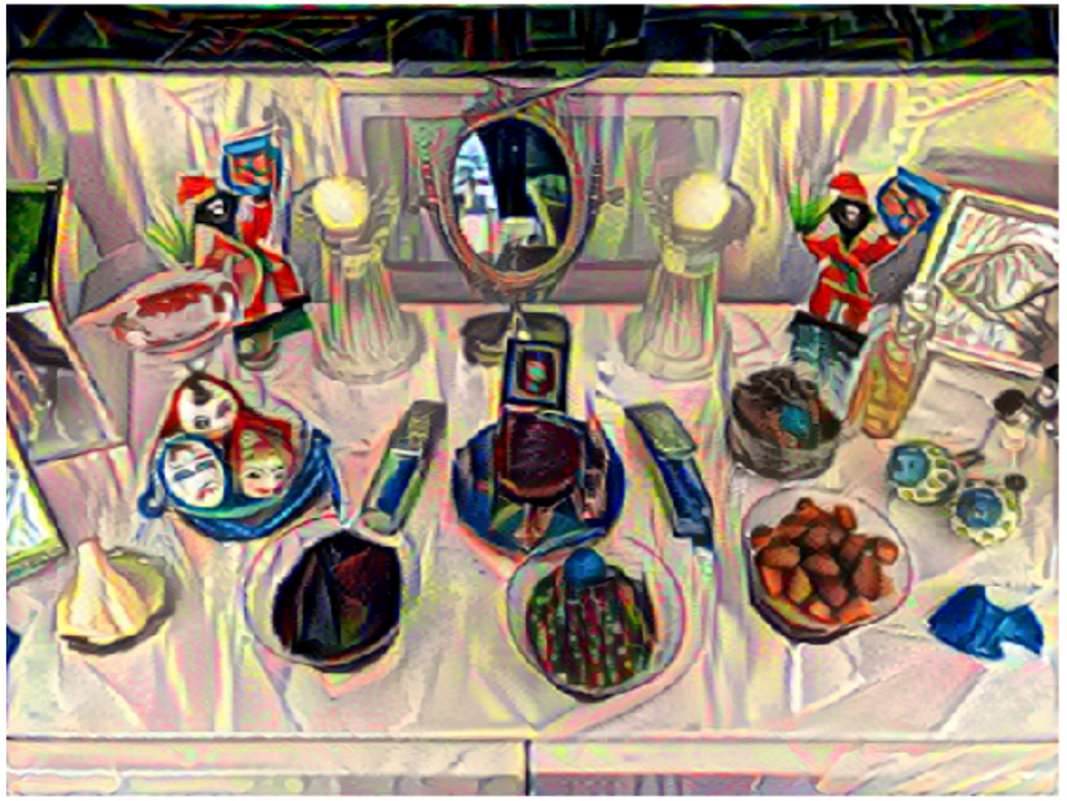
And many more…


SAMSUNG

In the style of Claude Monet

In the style of Yayoi Kusama

In the style of Piet Mondrian



In the style of Pablo Picasso

[L. Gatys et al.: Image Style Transfer Using Convolutional Neural Networks , 2015]

In the style of Hilma af Klint

In the style of Jamini Roy

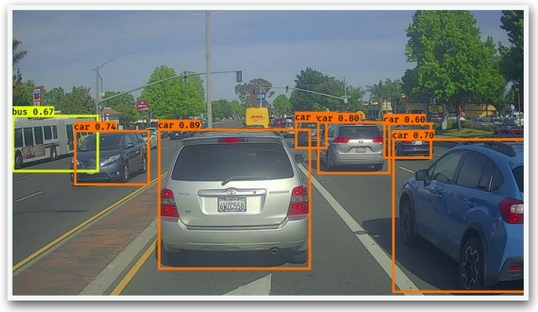
In the style of Eiichiro Oda

In the style of Salvador Dali

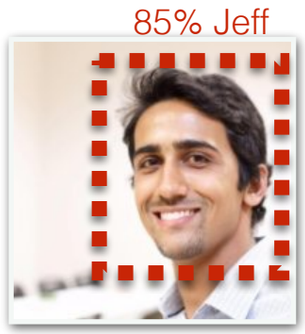
[L. Gatys et al.: Image Style Transfer Using Convolutional Neural Networks , 2015]

Projects: others

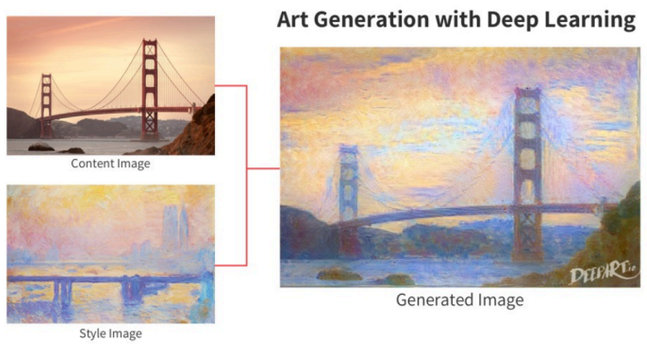
Optimal goalkeeper shoot prediction



Car detection



Face recognition



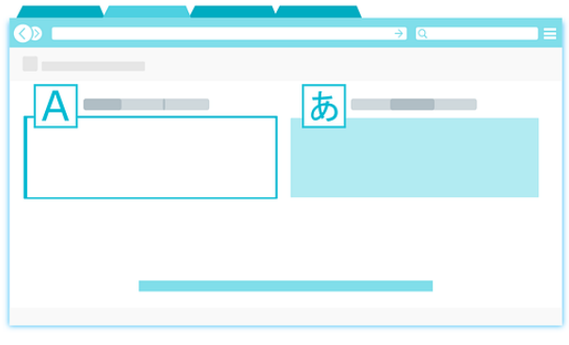
Art generation

Music generation

Text generation

"I love you"

Emojifier



Machine translation

Trigger word detection

And many more…

Today's outline

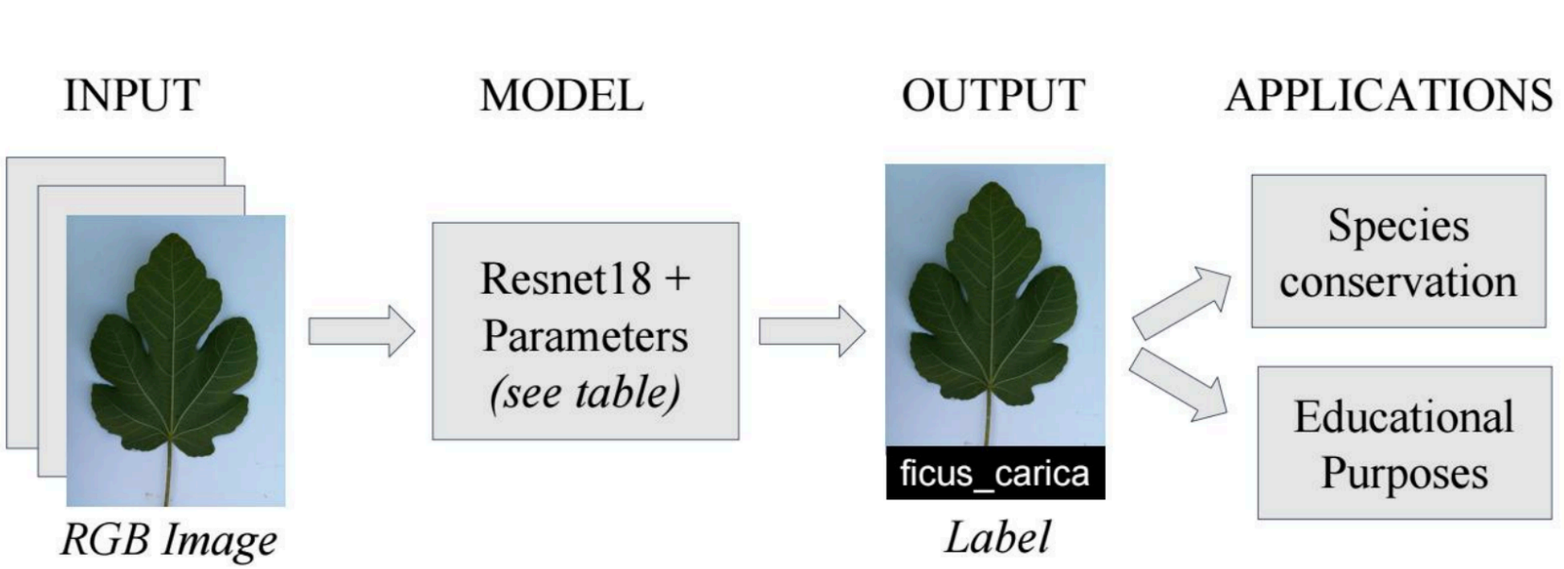
I. Course logistics

II. Overview of CS230 programming assignments

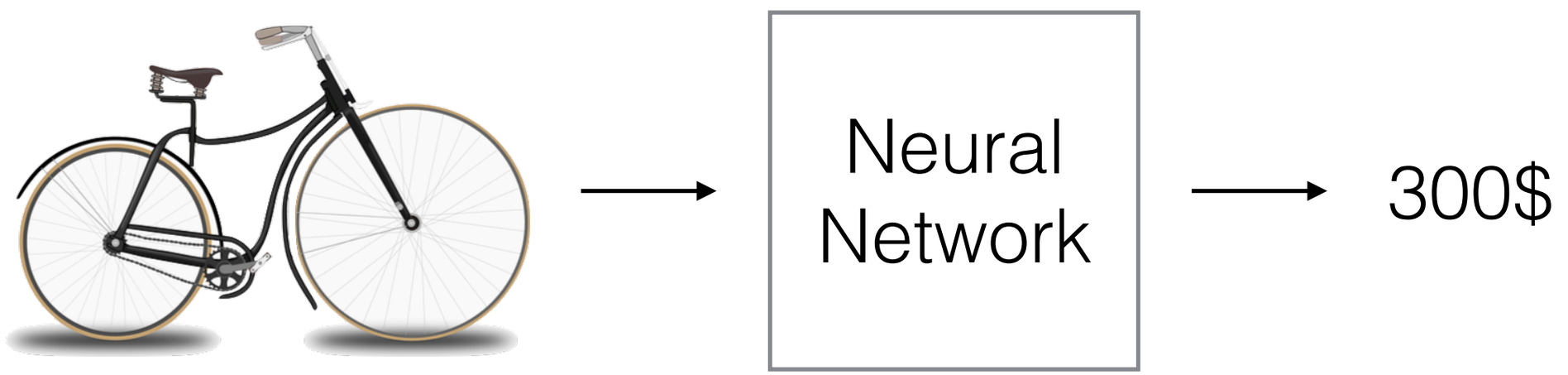
III. Examples of student projects

Projects: others

LeafNet: A Deep Learning Solution to Tree Species Identification



Predicting price of an object from a picture



[Galbally, Rao & Pacalin: Spring 2018, http://cs230.stanford.edu/projects_spring_2018/posters/8285741.pdf]

[Steven Chen: Fall 2017]

Kian Katanforoosh

Projects: others

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

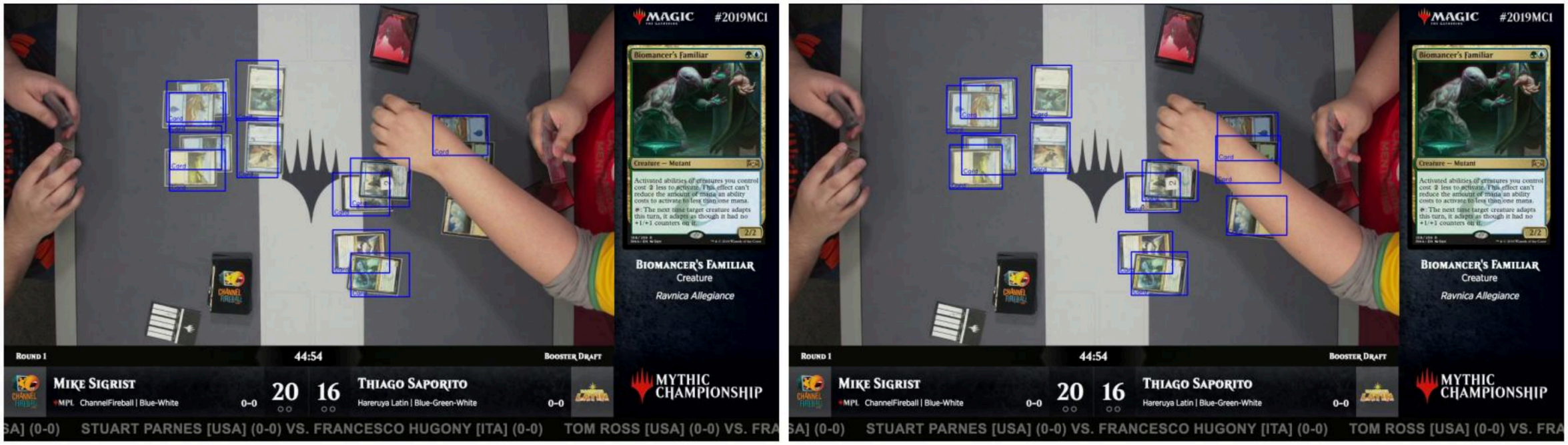
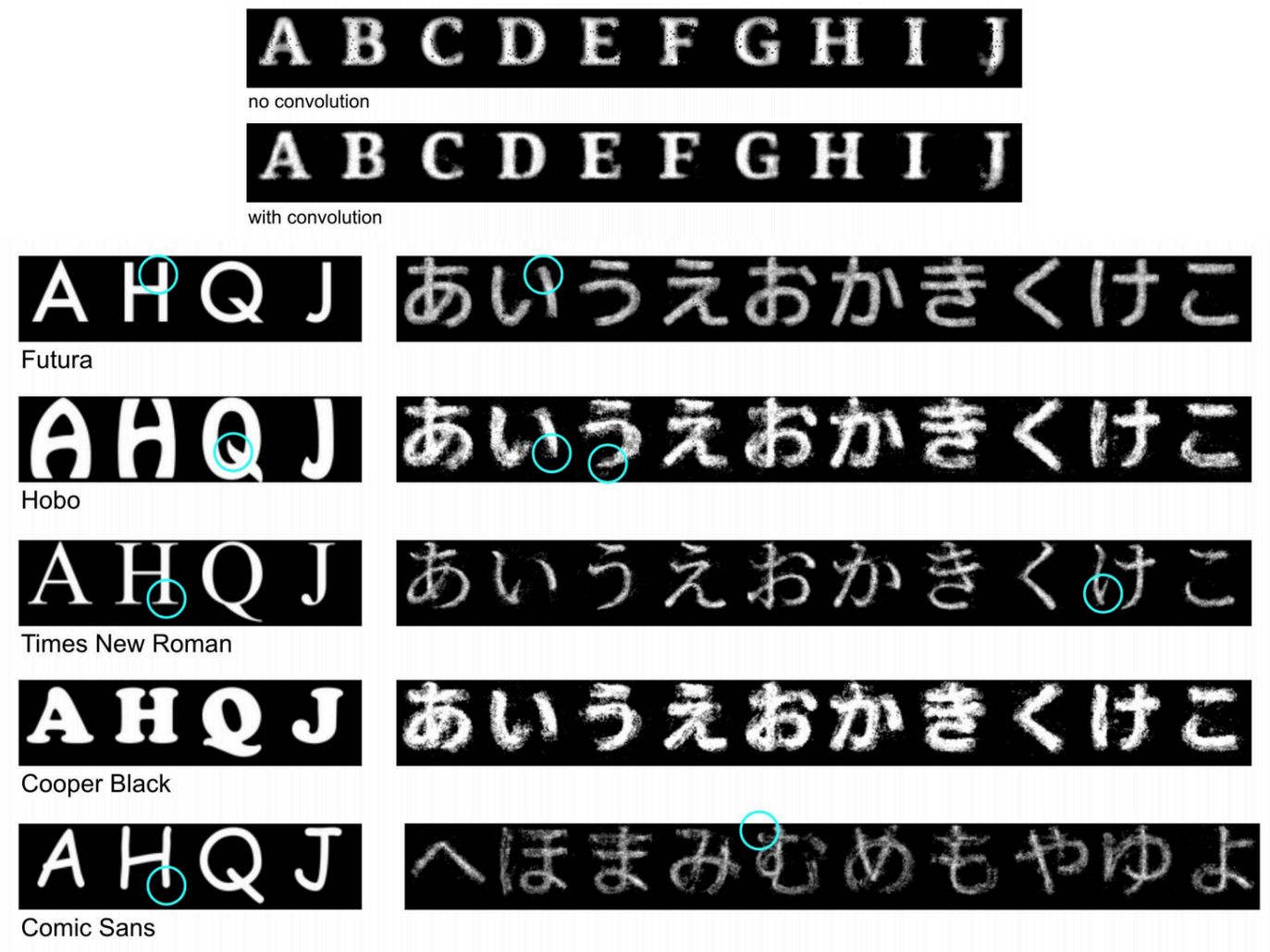


Figure 2: Predicted objects on a single frame from Dataset 1 produced by my model (left) and the YOLOv3 baseline (right).

[Culberg: Winter 2019, http://cs230.stanford.edu/projects_winter_2019/reports/15811409.pdf]

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

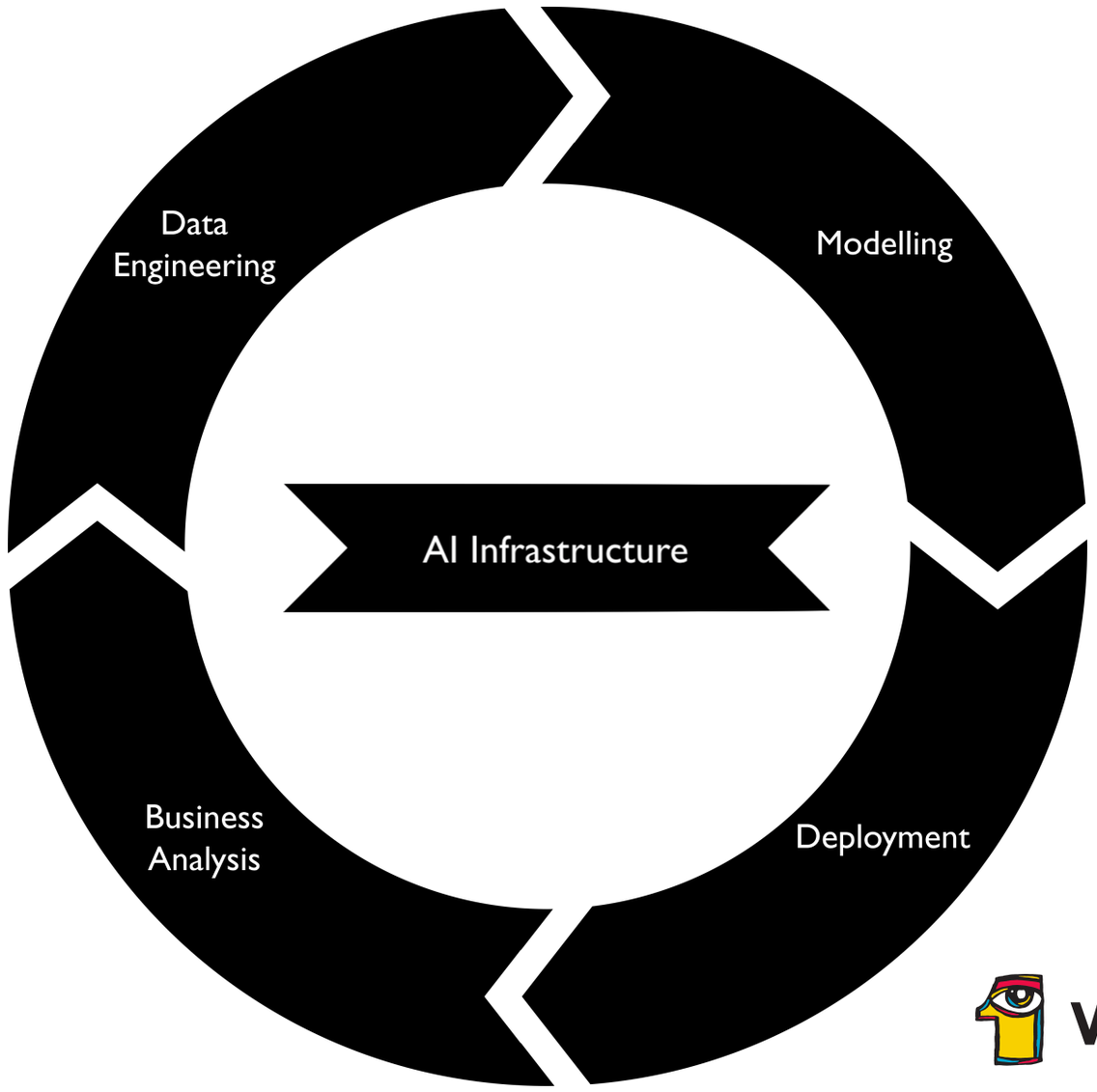


Figures 5-6: *Convolution; predicting Japanese sets.*

[Fernandez: Fall 2019, http://cs230.stanford.edu/projects_fall_2019/posters/26260232.pdf]

Projects: others

The AI project development lifecycle

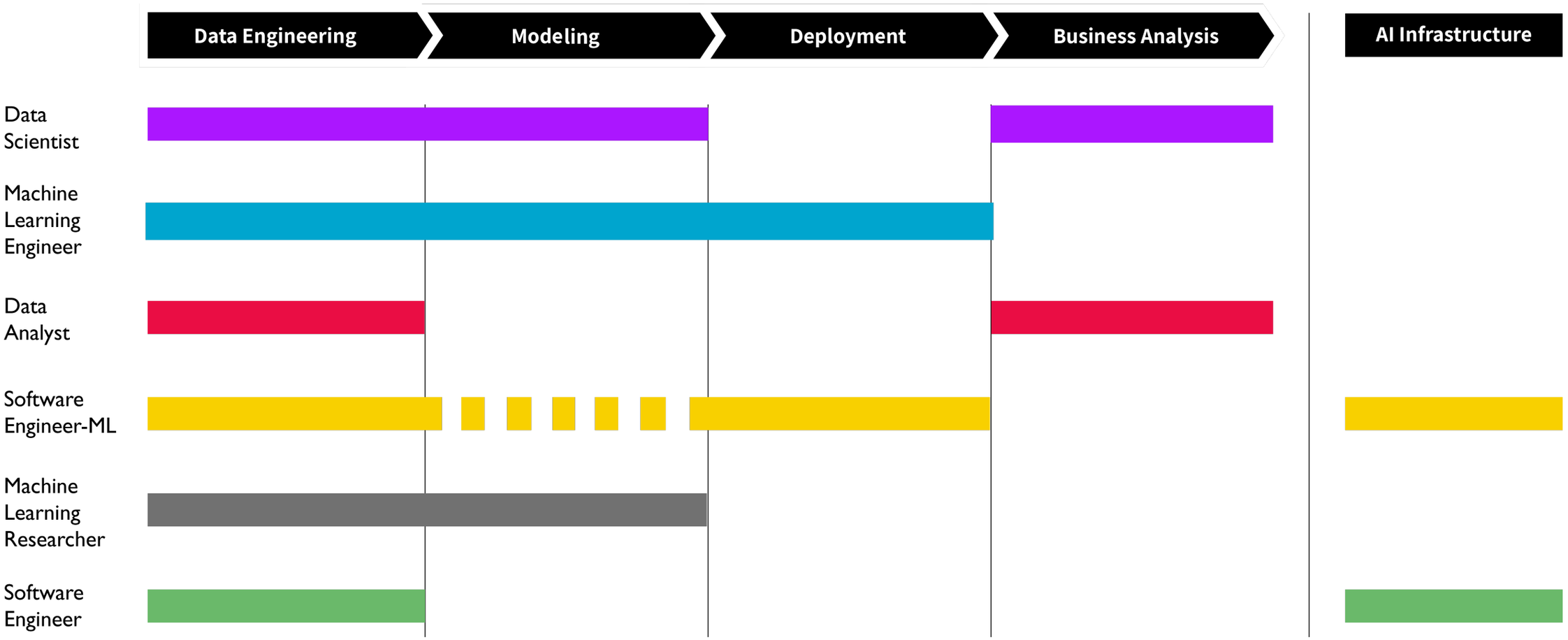


WORKERA
a deeplearning.ai company

[The AI project development lifecycle, Workera (2020): www.workera.ai]

Projects: others

What technical roles make up an AI team

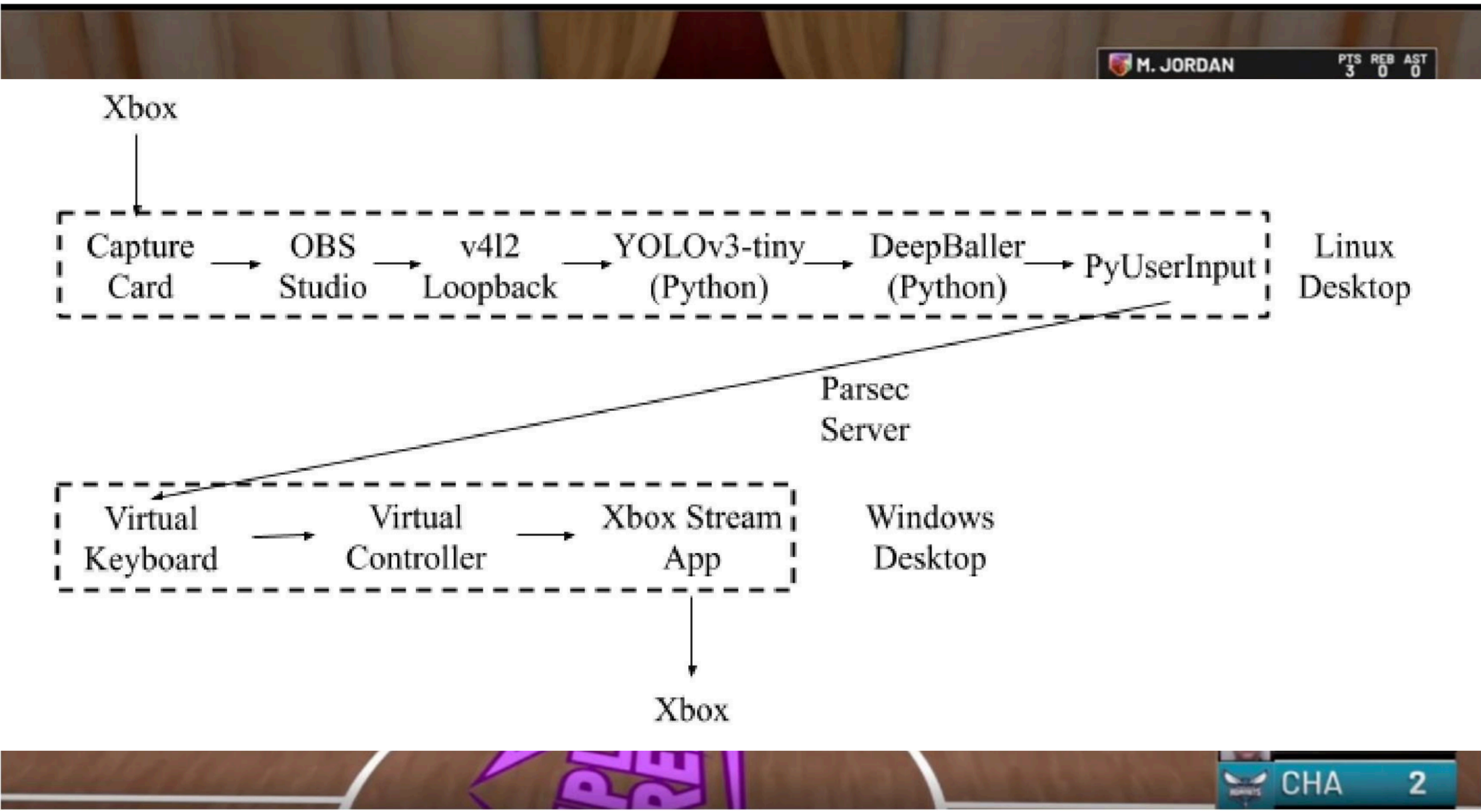


WORKERA
a deeplearning.ai company

[The AI project development lifecycle, Workera (2020): www.workera.ai]

Projects: others

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



[Pontius, Sakata and Santos: Spring 2019, http://cs230.stanford.edu/projects_spring_2019/reports/18676218.pdf]

Kian Katanforoosh

Projects: others

Image-to-Image translation with Conditional-GAN

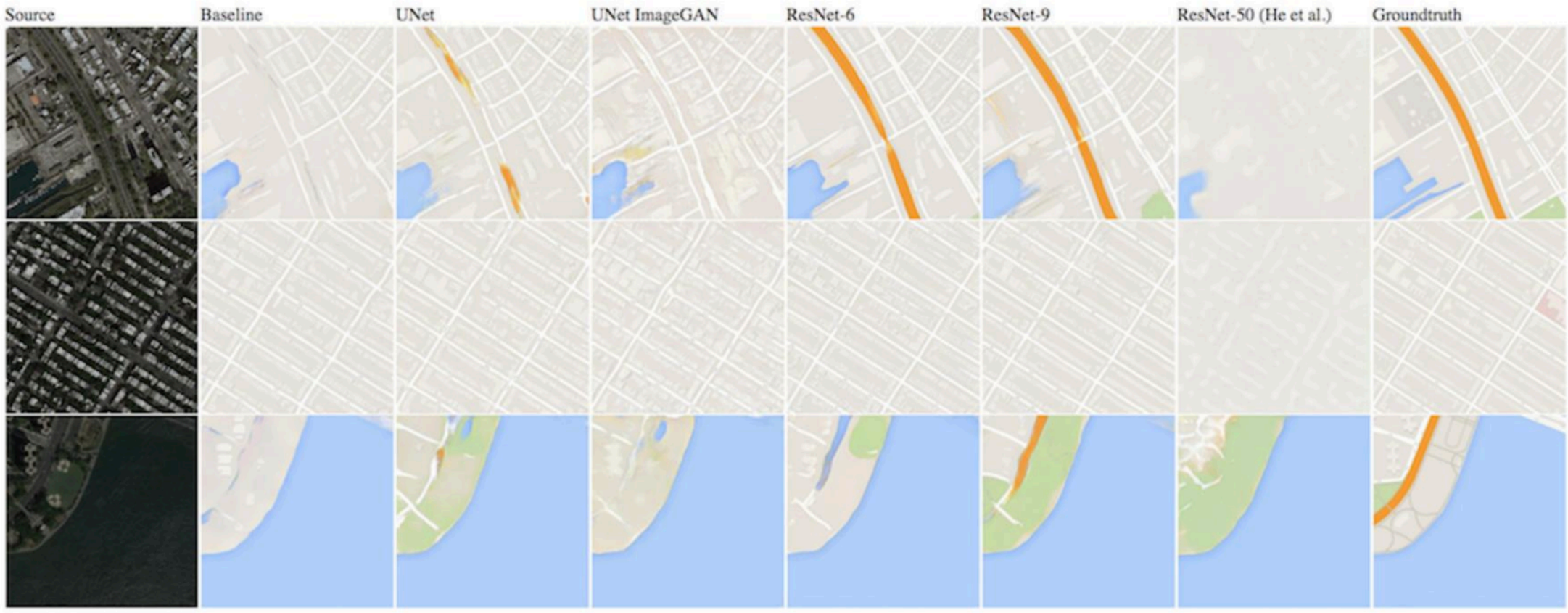


Figure 3: Generated map images of different architecture and hyperparameters. From left to right are source aerial images, baseline, U-Net, U-Net with ImageGAN, ResNet-6, ResNet-9, ResNet-50, and ground truth map images

[Hu, Yu & Yu, Spring 2018: http://cs230.stanford.edu/projects_spring_2018/reports/8289557.pdf]

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

[Albrecht, Wang & Zhu: Spring 2019, http://cs230.stanford.edu/projects_spring_2019/reports/18681694.pdf]

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