Computer Vision Detecting Hand Gestures

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Opportunity Statement

To create a more human interface to interact with a computer system.

- Stage 1 – to have a computer system interact with pre-defined gestures
- Stage 2 – to have a model intuit human needs through our gestures (as the family dog uses observation to reactively communicate)

Goal Of This Project

- To train a convolutional neural network to identify particular hand gestures

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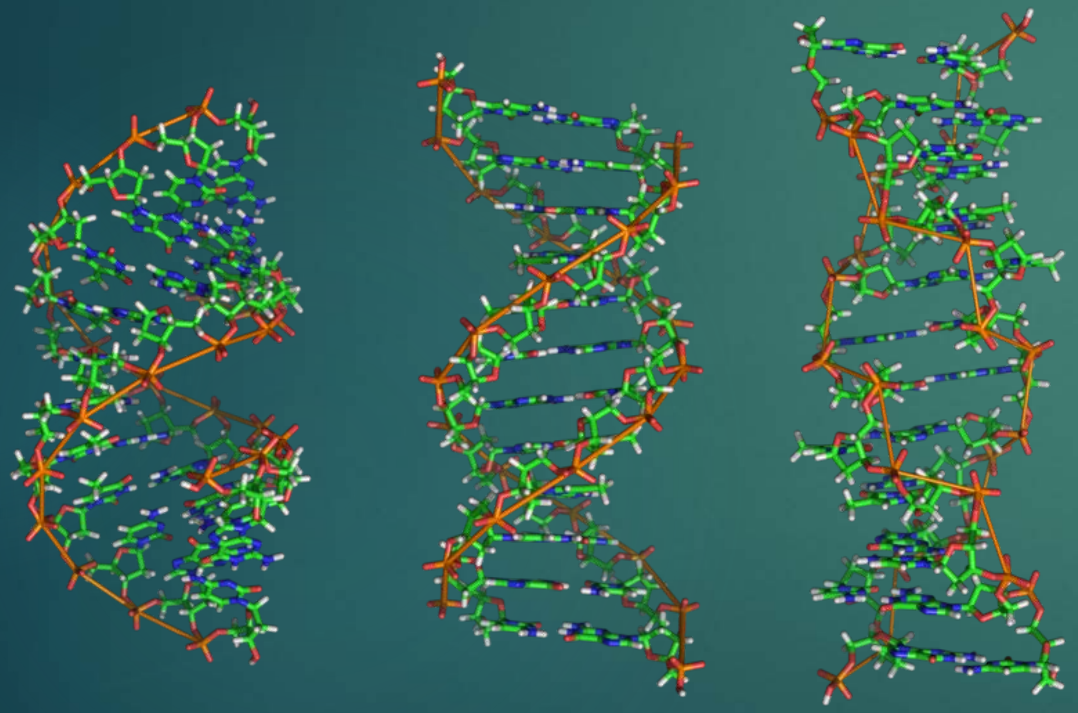
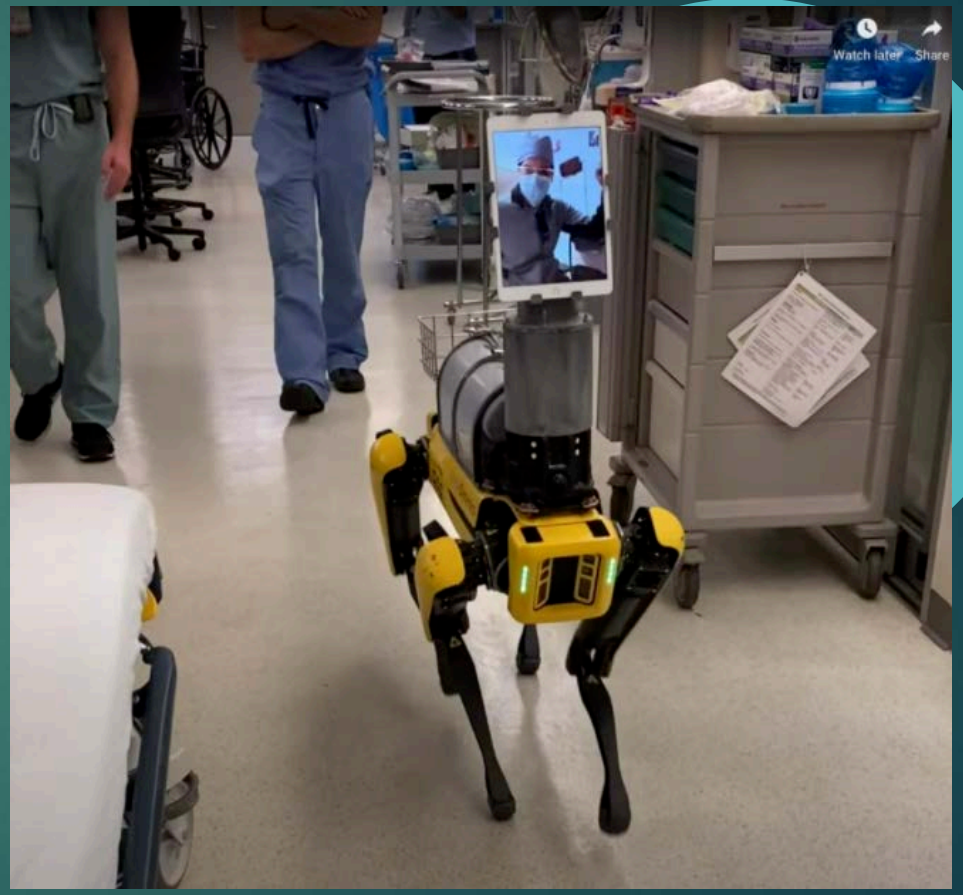


Scientific Research



Medical

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Manufacturing

First Responders

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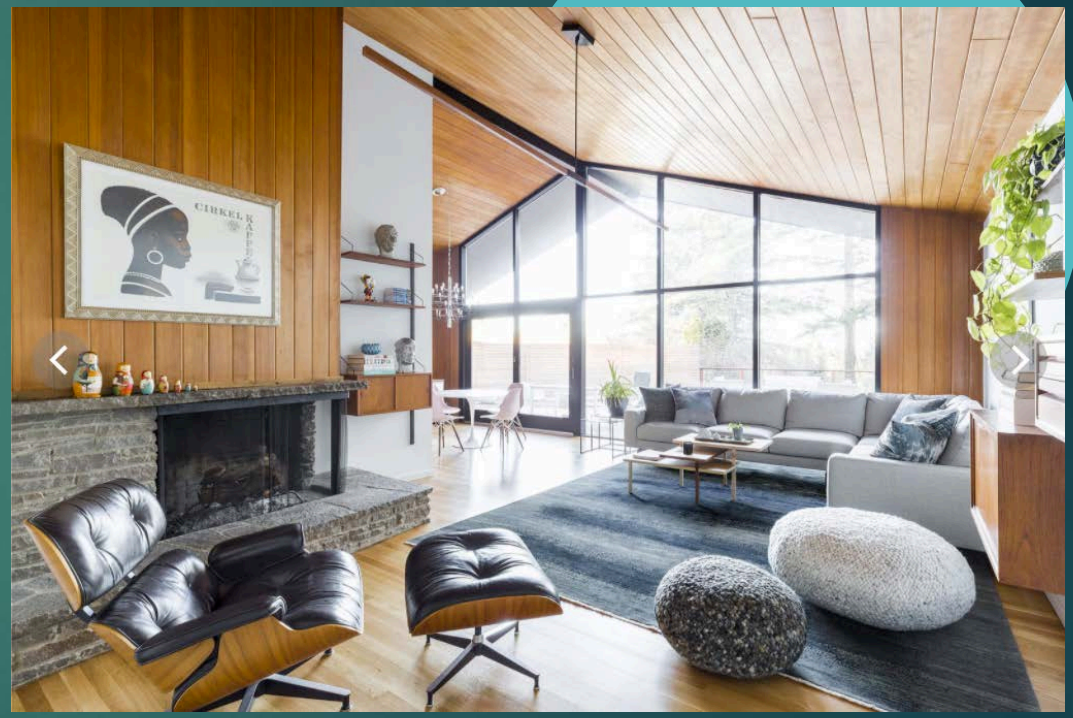


Homes

Process

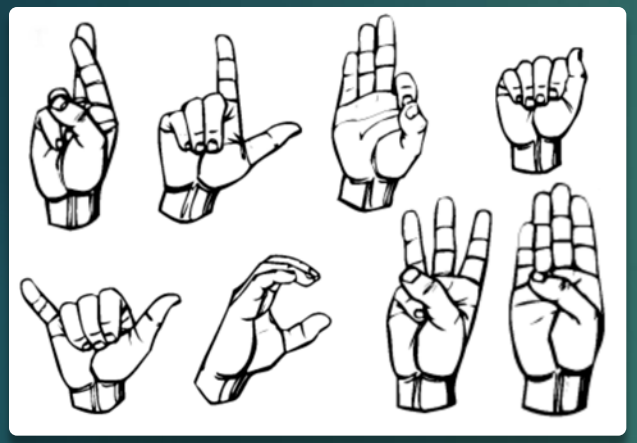
- Data
- Modeling
- Results
- What is next

Data

Camera phone, webcam, opensource archive, and DSLR 35mm camera

Data

data teaches your network – be a good teacher



9 Classes

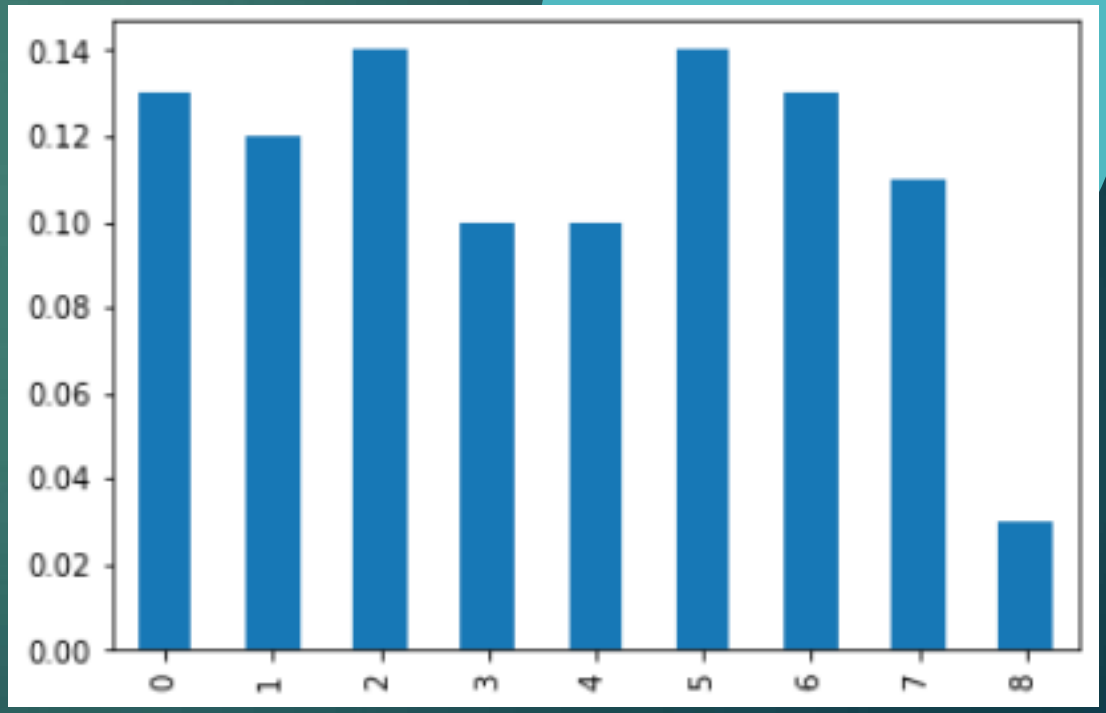
800 units of data

Diversity of subjects, positions, lighting situations, on different backgrounds

2,000 augmented

Brightness, warping, rotation, color saturation,

Balancing Classes

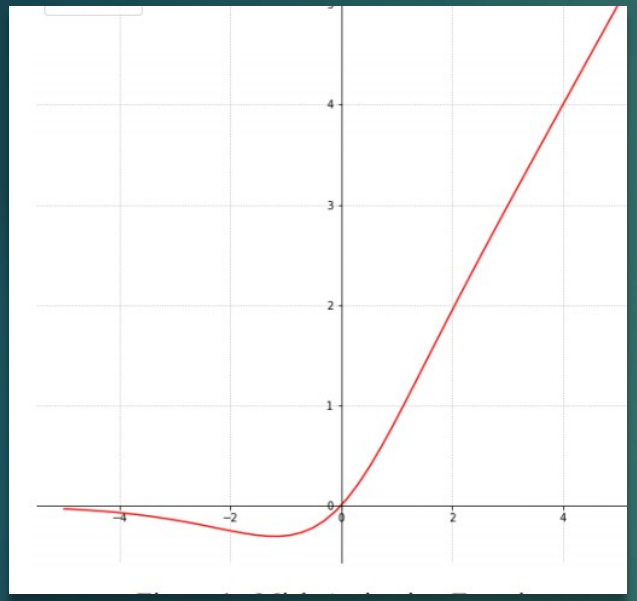


Model

YoloV4 tiny on Darknet

- Fast SSD model
- High accuracy score
- Pre-trained weights (transfer learning)
- Built for democratization of computer vision

Hyperparameters



Activation Layers

Leaky & Mish

Momentum

0.08, 0.9 0.929

Learning Rates

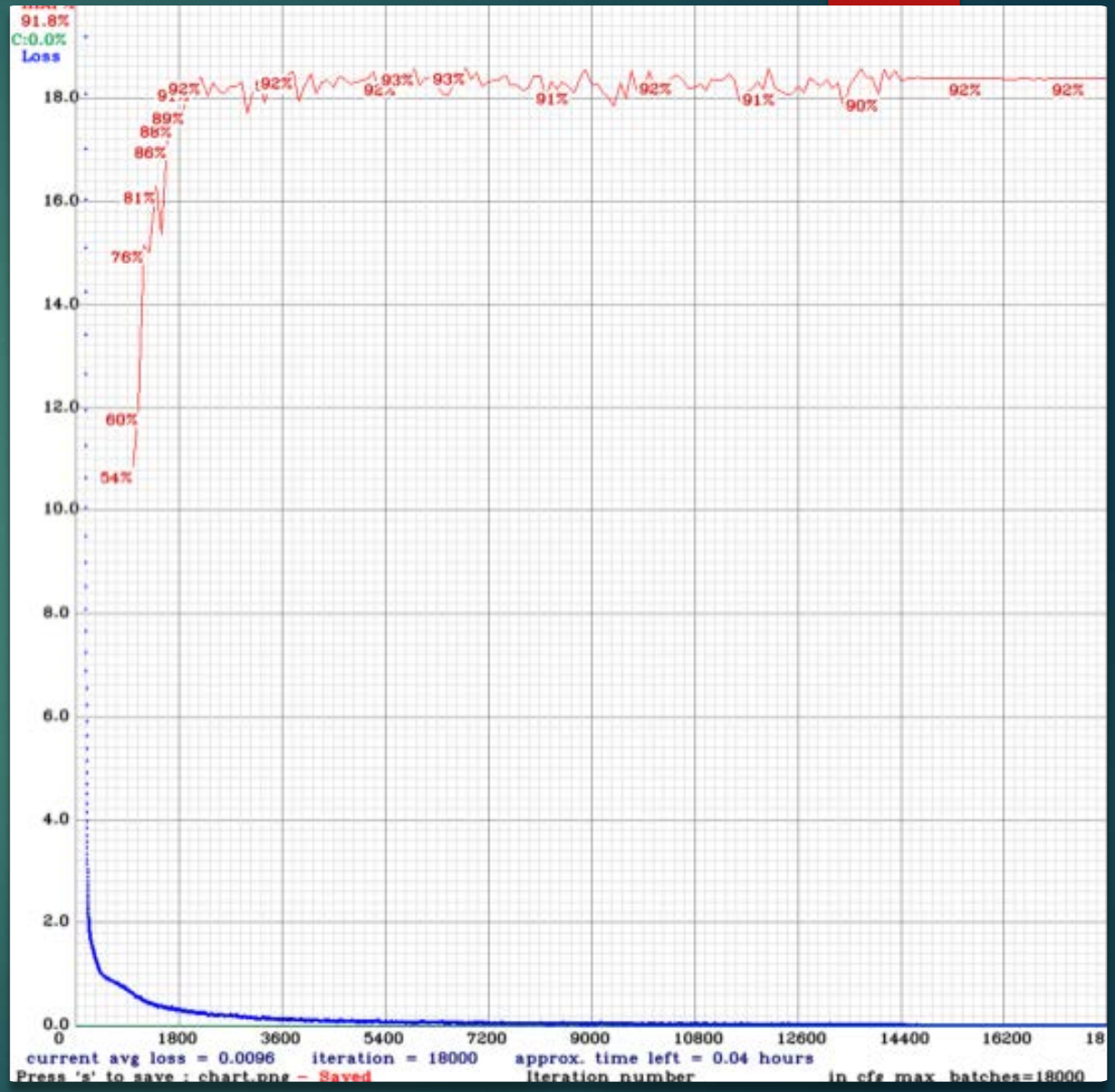
.01, 001, 0001

Decay

0.0005, 0.0003

Model Performance

mAP = 92.96 %



Accuracy Scores

recall = 0.91
precision = 0.87
F1-score = 0.89

Class	Average Precision	TP	FP
Forward	90.00	9	2
Back	100	10	0
Left	83.33	5	0
Right	91.82	10	2
Input	90	5	1
Plus	81.48	8	1
Three	100	5	2
Seven	100	7	1
Five	100	2	0

Results

- Good performance
- speed - 1 sec detection time
- Need more and more data

What is Next

- Test different elemets of the data in small batches and compare mAP. Isolating: angle of view & rotation,
- Look into other models such as Mediapipe (trained on 30K hands)
- Look into passively collecting data, ‘clustering’ for body movements.

What is Next, Next

To examine the implications and uses of computers intuiting full body gestures.

Gesture types

- Public / shared dictionary of gestures, ex: hand wave, a smile, head node.
- Private / personal gestures. This vocabulary of gestures would give deep insight into who you are and how you act.

Thank you

How fast, fast…