

Object Detection

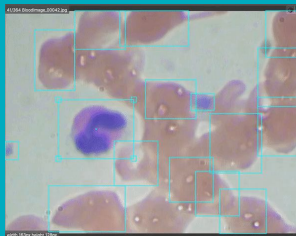
Aditya, Alex, Akhil,
Araav, Justin, Pranit



Applications

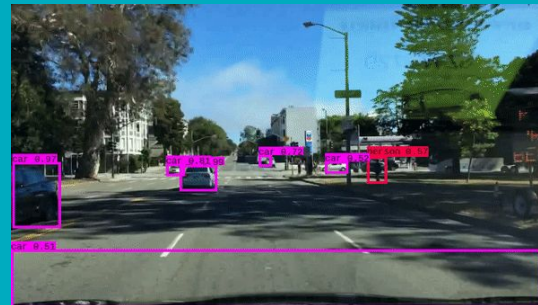
01

Self Driving Cars



02

Surveillance
cameras

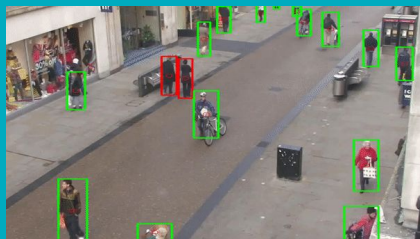


03

Medicine

04

Human aid



Object Detection

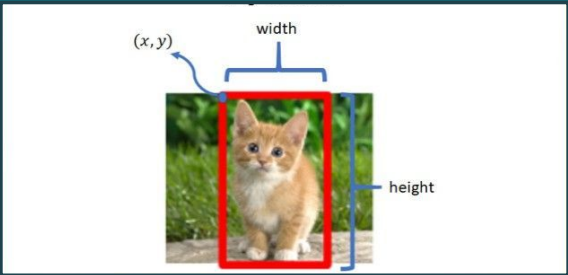
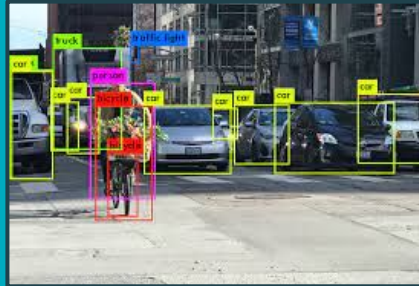
Computer Vision Technique

Localization

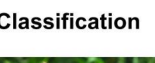
Identifying Location

Classification

Labeling Object




Classification



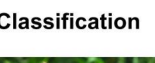
CAT

Object Detection




CAT, DOG, DUCK

Classification

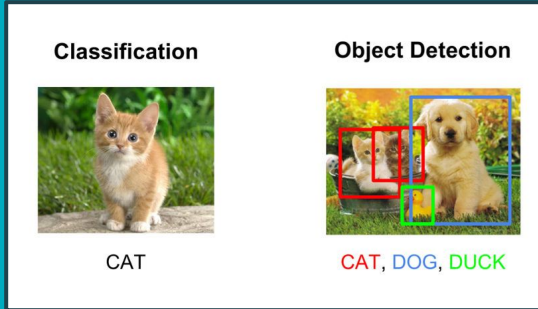


CAT

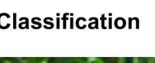
Object Detection



CAT, DOG, DUCK




Classification

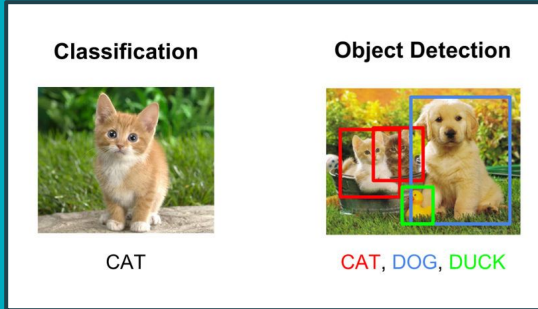


CAT

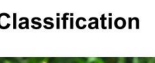
Object Detection



CAT, DOG, DUCK




Classification



CAT

Object Detection



CAT, DOG, DUCK

Input

Original
Picture



Split to
RGB



Pixel
Values:
0-255

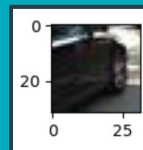
```
( 251, 181, 068, 041, 032, 071, 197, 041,
  ( 251, 181, 068, 041, 032, 071, 197, 41, 164,
    196, 014, 132, 213, 187, 043, 041, 64, 255,
    174, 011, 200, 254, 254, 232, 164, 55, 253,
    202, 014, 012, 128, 242, 255, 255, 53, 165,
    253, 212, 089, 005, 064, 196, 253, 65, 105,
    255, 255, 251, 196, 030, 009, 165, 35, 170,
    127, 162, 251, 254, 197, 009, 105, 70, 250,
    062, 005, 100, 144, 097, 006, 170, 50
  )
)
```

Output

Background



Car



Truck



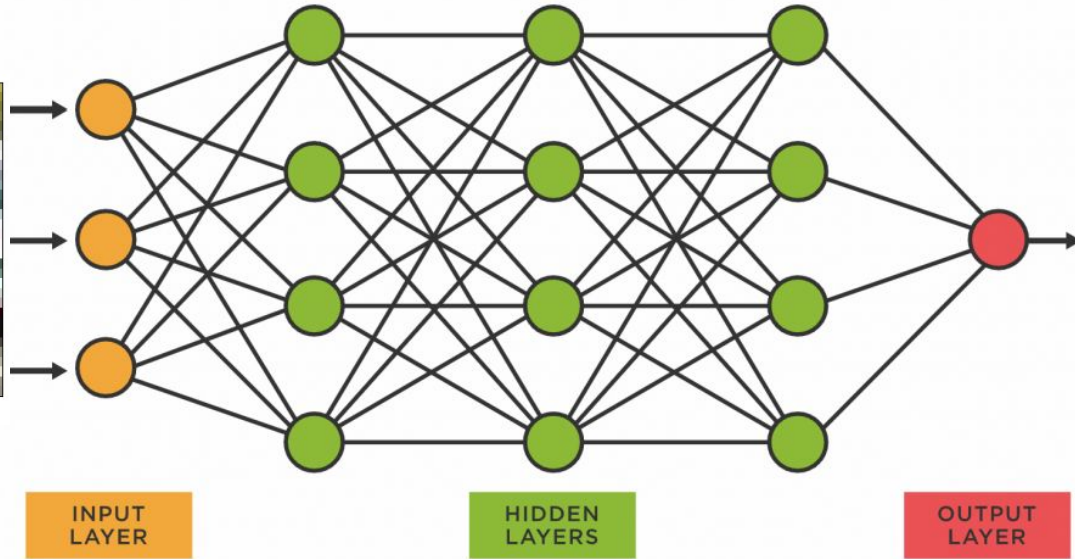
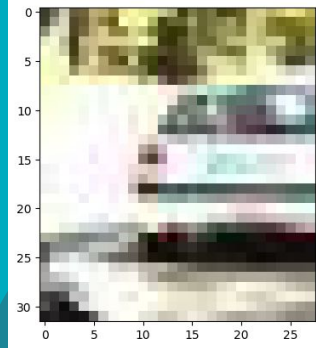
[0, 1, 2]

Neural Network Basics

What is a
neural
network?

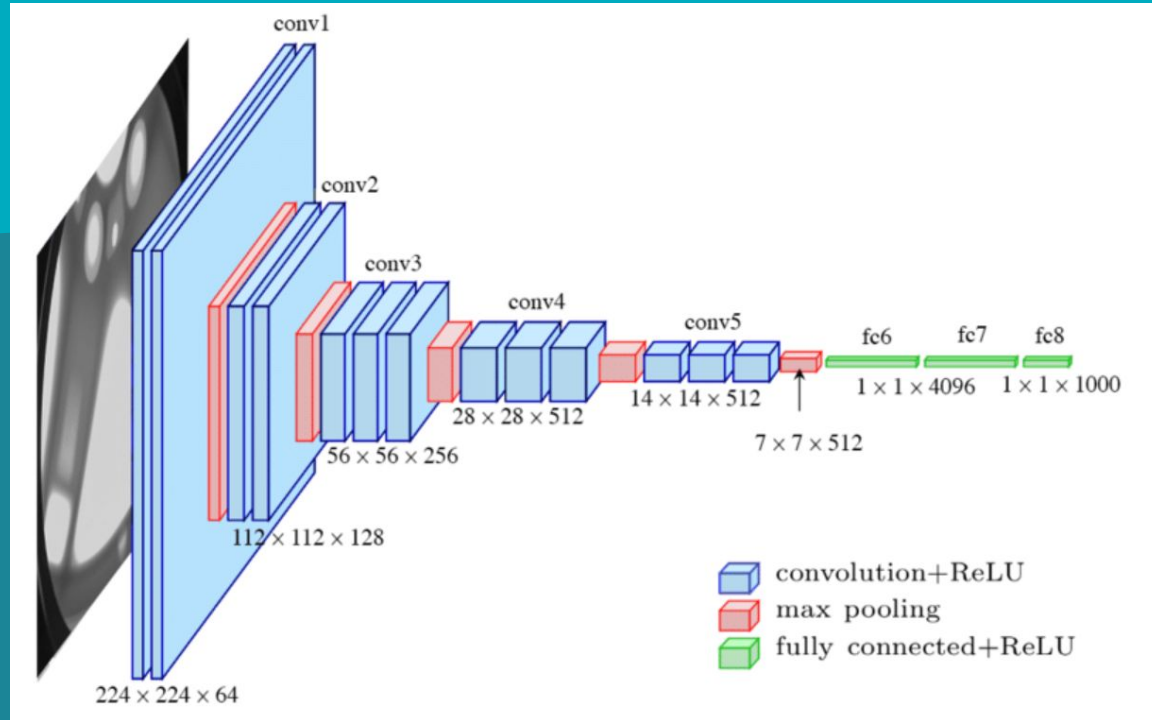
- Subset of machine learning.
- Inspired by the human brain.

Neural Network Architecture



Background/Car/Truck

Convolutional Neural Networks



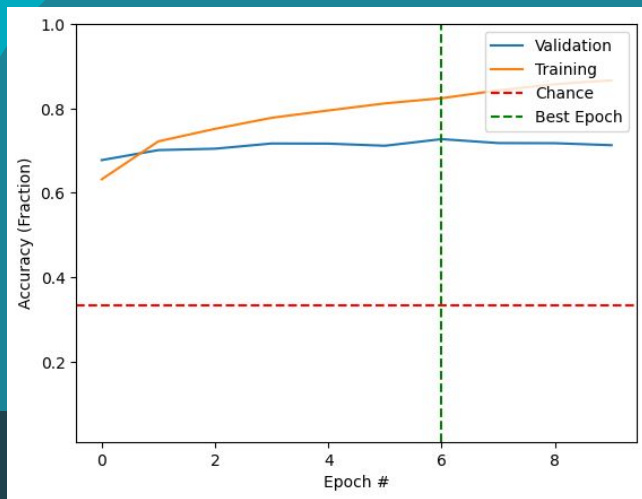
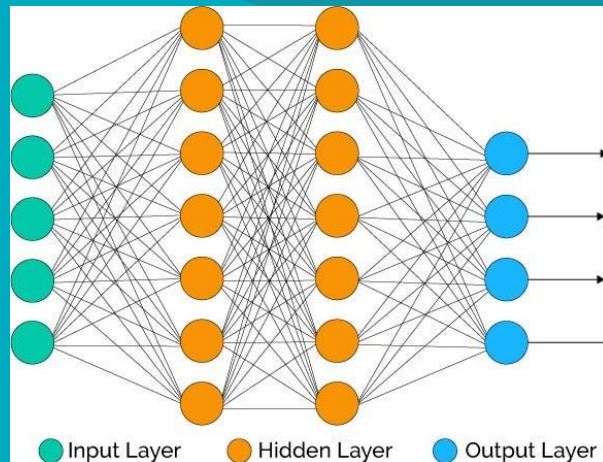
The background is a stylized illustration of a car's interior from the driver's perspective. It features a dark blue steering wheel on the left, a dashboard with two circular gauges and a central display, and a rearview mirror at the top center. The entire scene is set against a light blue background with abstract, darker blue curved shapes. The text "Model Types" is centered in the middle of the image.

Model Types

Model Types: Perceptron

Perceptron

- A simple neural network
- Contains input layer, hidden layers, and output layers
- Low accuracy



← the model's accuracy on test data (blue line) is quite low (around 70%)

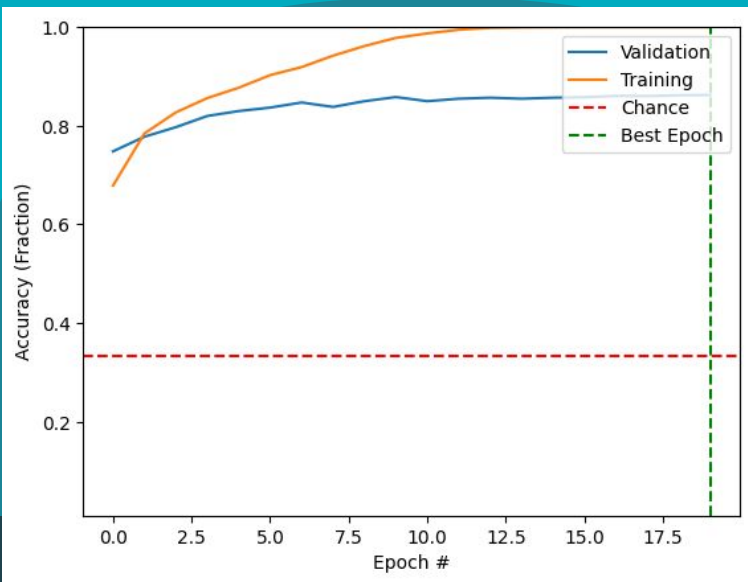
the model's accuracy on training data is shown by the orange line

Overfitting: when the orange line continues to increase but the blue line stays constant → means the model is memorizing the training data rather than learning patterns from it

Model Types: Convolutional Neural Network (CNN)

Convolutional Neural Network (CNN)

- Performs better on images (especially compared to perceptron)

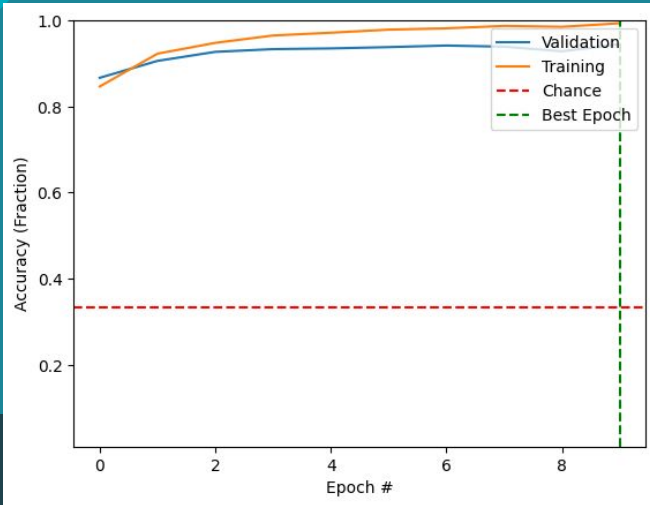


← This graph shows that the model's accuracy (blue line) is around 80%

Model Types: Transfer Learning (VGG16)

Transfer Learning

- The technique of using models that are already trained, and training it even more
- Performs better than CNN
- Compare this to CNN, in which we made models from scratch
- (VGG16 is one of the transfer learning networks)

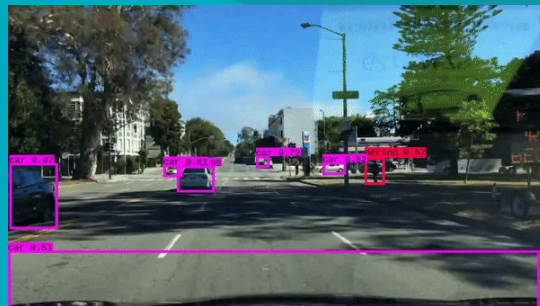


← This graph shows that the model's accuracy (blue line) is very high (around 95%)

Model Types

YOLO (v3)

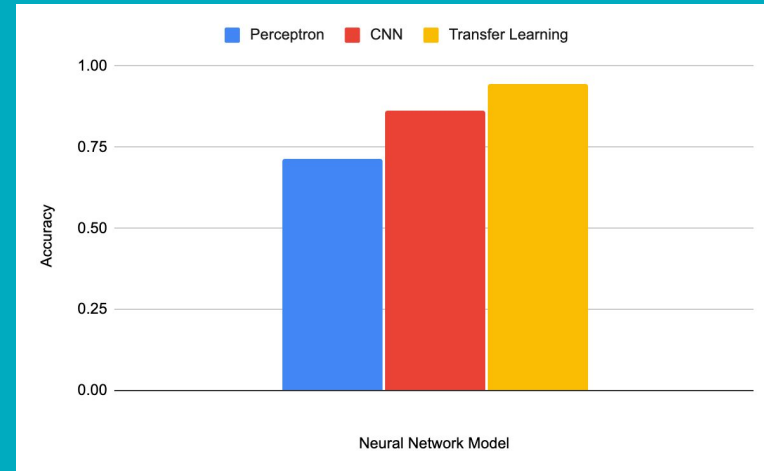
- “You Only Look Once”
- Designed for fast object detection
- Uses bounding boxes and class (category) probabilities from images in one evaluation
- Combines the two steps of image classification (localization and classification) into one evaluation, making it faster



Comparing the Models

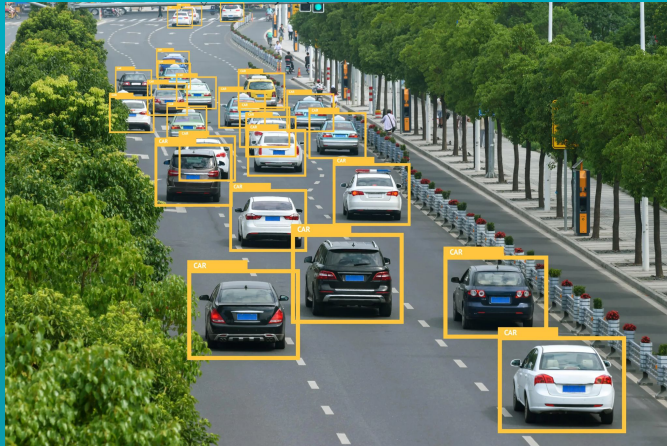
	Perceptron	CNN	Transfer Learning	YOLO v3
Image Classification Accuracy	0.7130	0.8623	0.9447	X

(YOLO doesn't have an accuracy because since it did not use predetermined models, it did not have a reference to calculate its accuracy with)



Pros/Cons

- Automation and efficiency
- Advancements in deep learning
- Wide range of applications
- Improved safety



- Reliance on external factors
 - Weather can affect sensors
- Accuracy
- Dependency on training data
- False Positives



Ethical Dilemmas



A



B

A stylized, flat-design illustration of a car's interior from the driver's perspective. The background is a solid light blue. At the top center, there is a black rectangular rearview mirror with a small red dot in the middle. In the lower-left corner, a black steering wheel is partially visible. At the bottom center, the dashboard is depicted with a large central circular gauge, two smaller circular gauges on either side (each with a red needle and blue dots), and two rectangular air vents below the side gauges. The overall aesthetic is modern and minimalist.

When can AI
break the law?

Traffic Laws

Accountability

Accountable to humans

Laws are the metric

Not fully accepted in
the industry

Naturalistic Driving

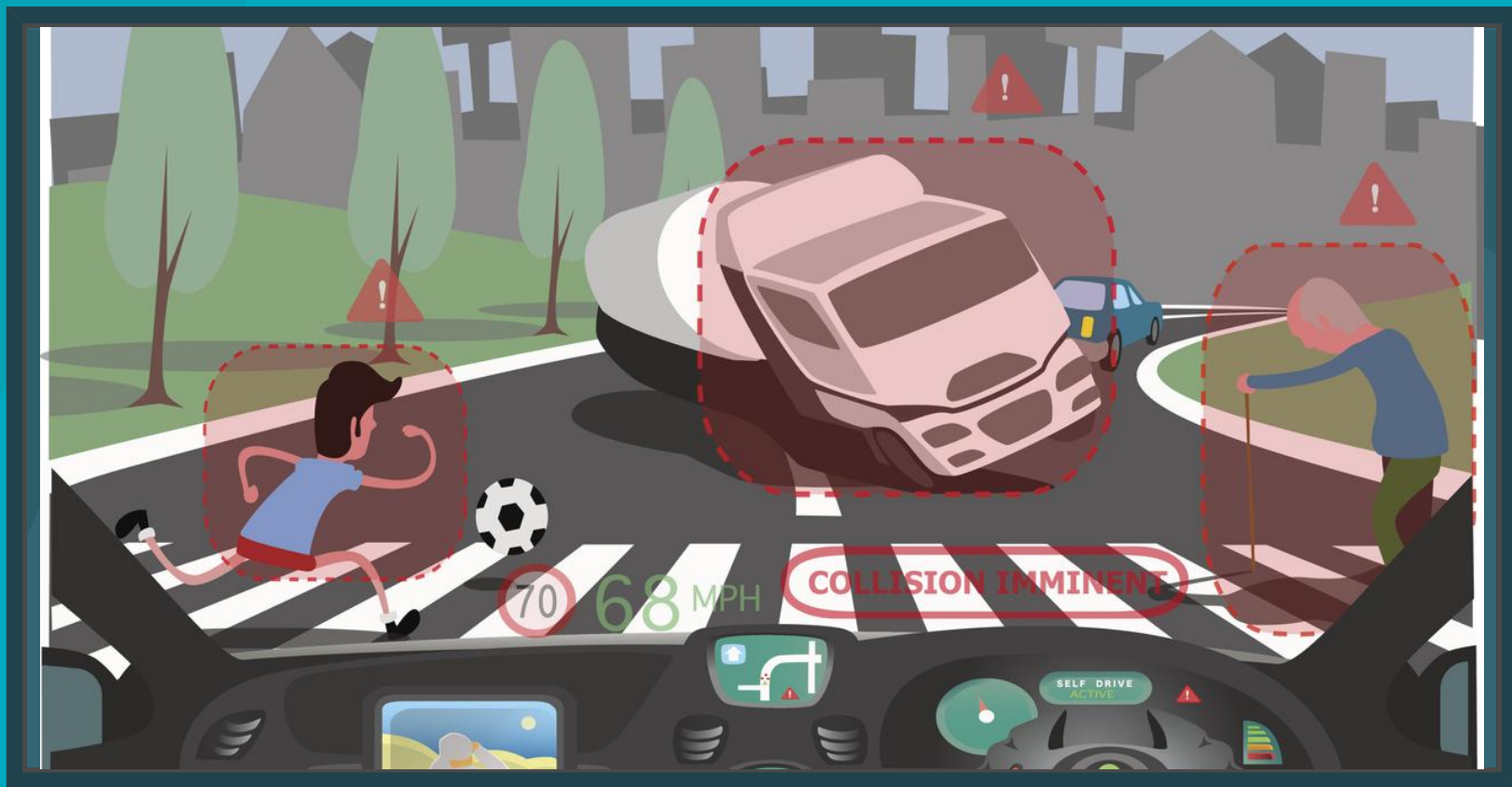
If other people are
speeding, can the av
speed too?

Saving Lives

What if breaking the
law is necessary to
avoid a collision?

What if a car need to
cross over double
yellow lines to avoid
hitting a biker?

What would you do?



Who gets to decide?

Politicians?

Manufacturers?

Ethicists?

Drop your thoughts in the chat





Conclusion

THANK YOU

Questions?