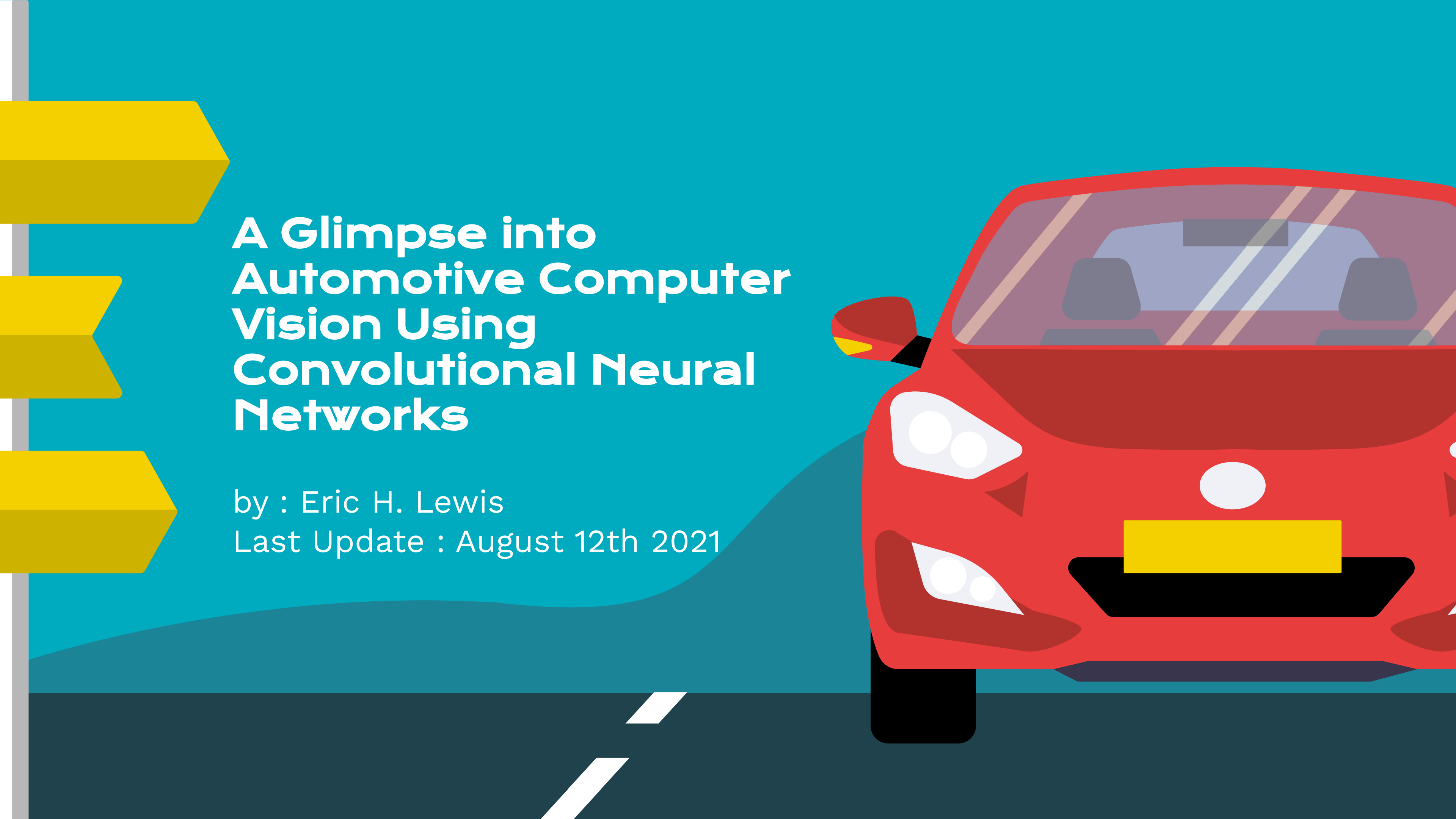
A Glimpse into Automotive Computer Vision Using Convolutional Neural Networks



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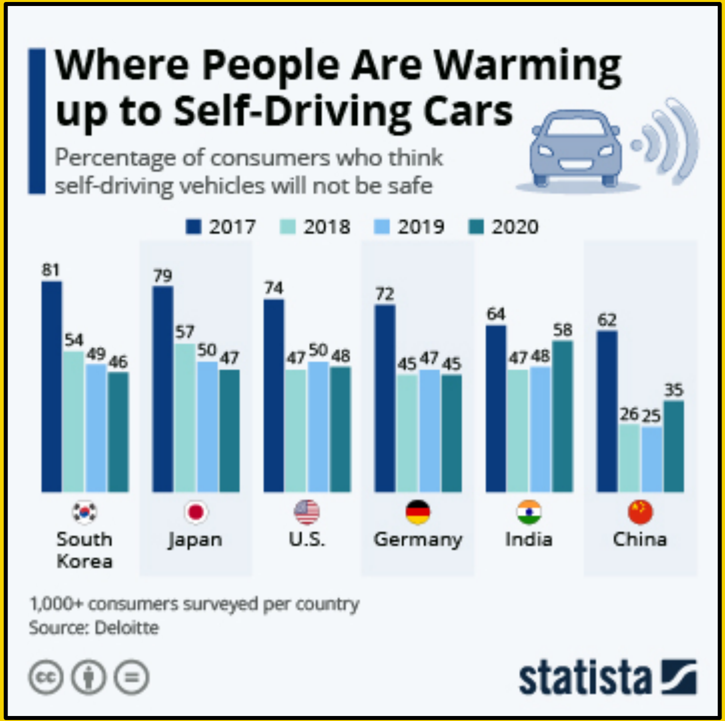
Understanding the Motivation

Computer vision



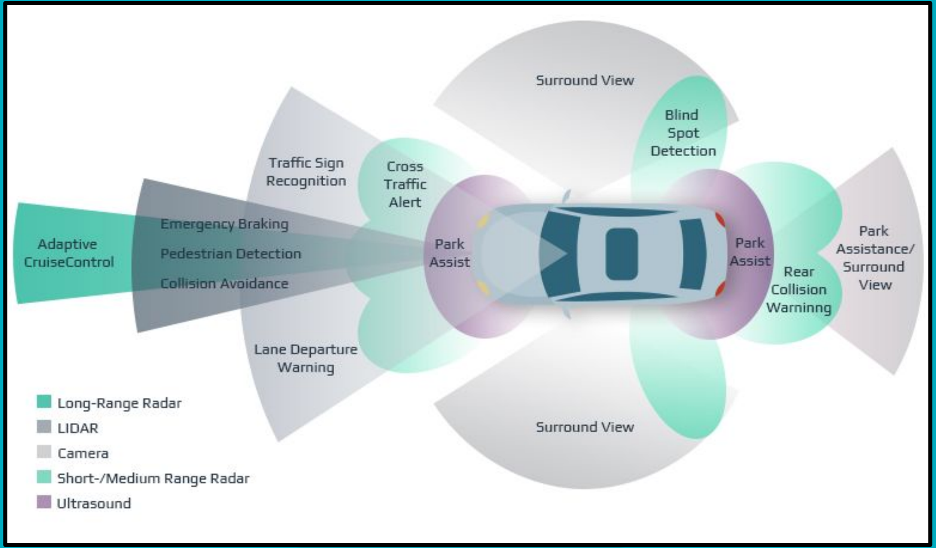
Where People Are Warming up to Self-Driving Cars

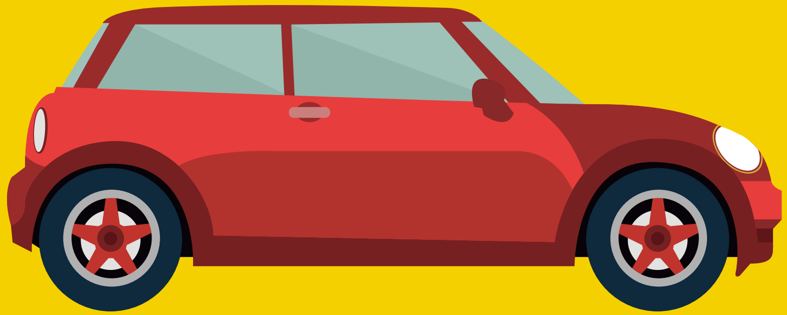
Percentage of consumers who think self-driving vehicles will not be safe

1,000+ consumers surveyed per country

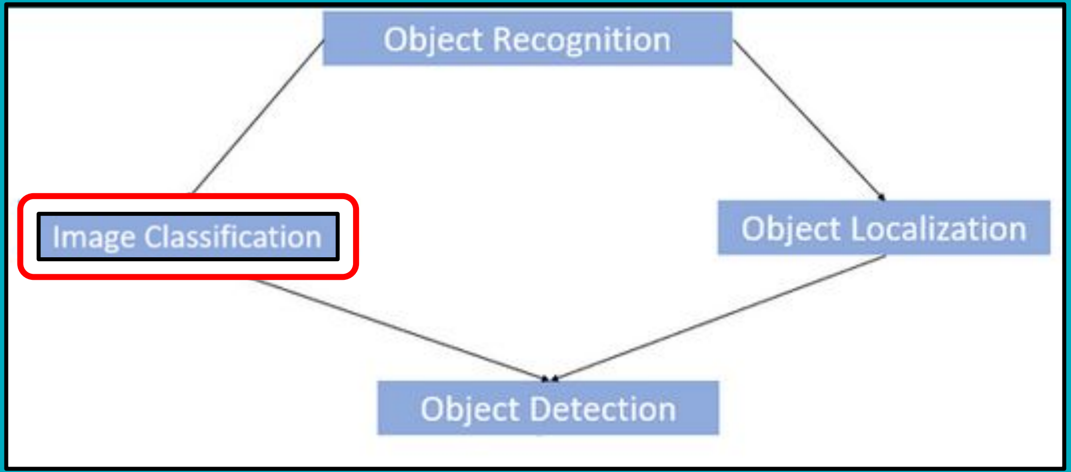
Source: Deloitte

Understanding the Motivation





Computer Vision Essentials

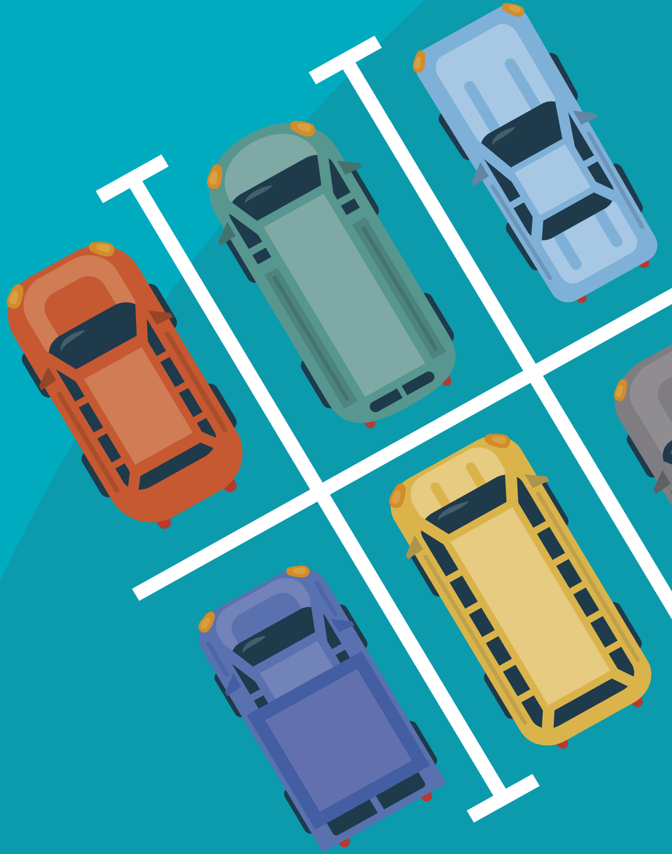


Object Recognition

Image Classification

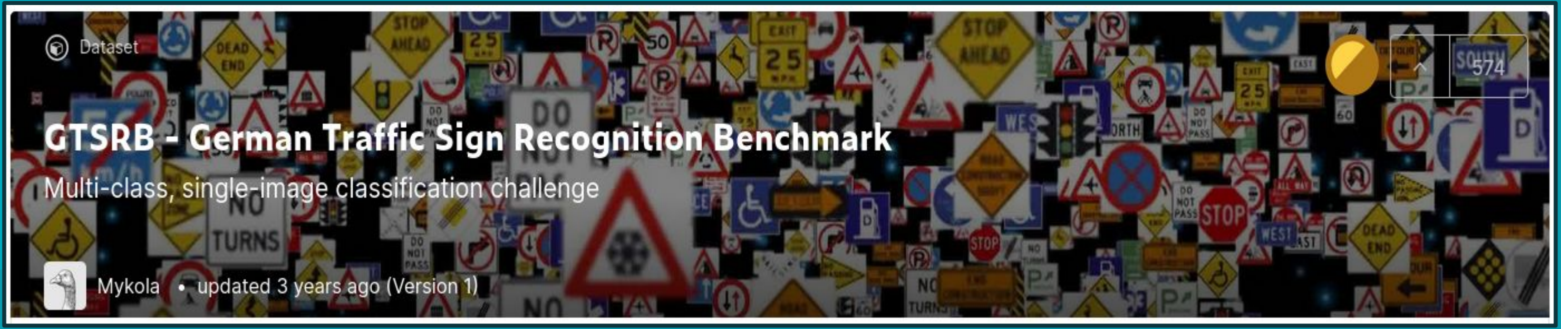
Object Localization

Object Detection



Data

Image Classification



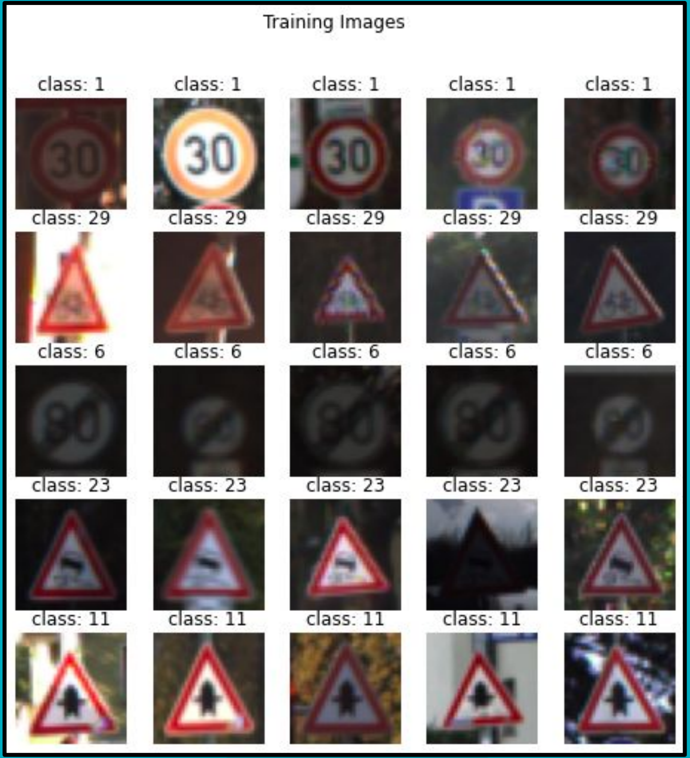
Dataset

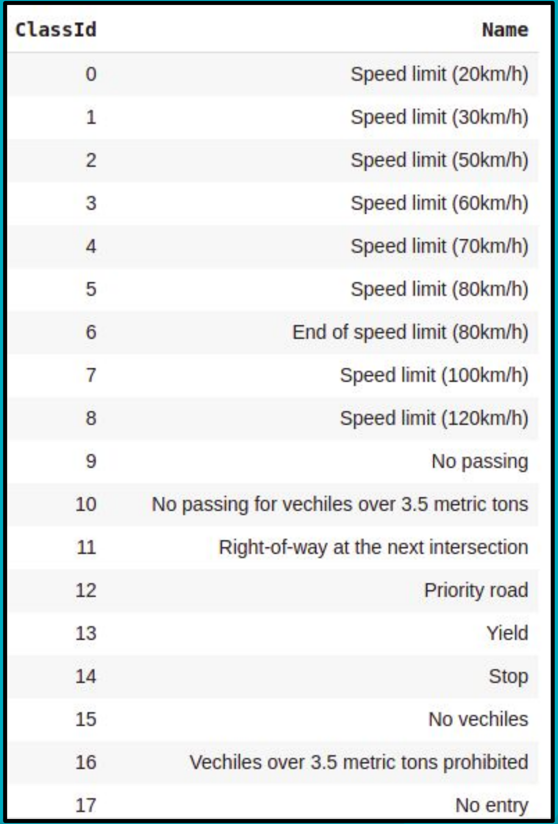
GTSRB - German Traffic Sign Recognition Benchmark

Multi-class, single-image classification challenge

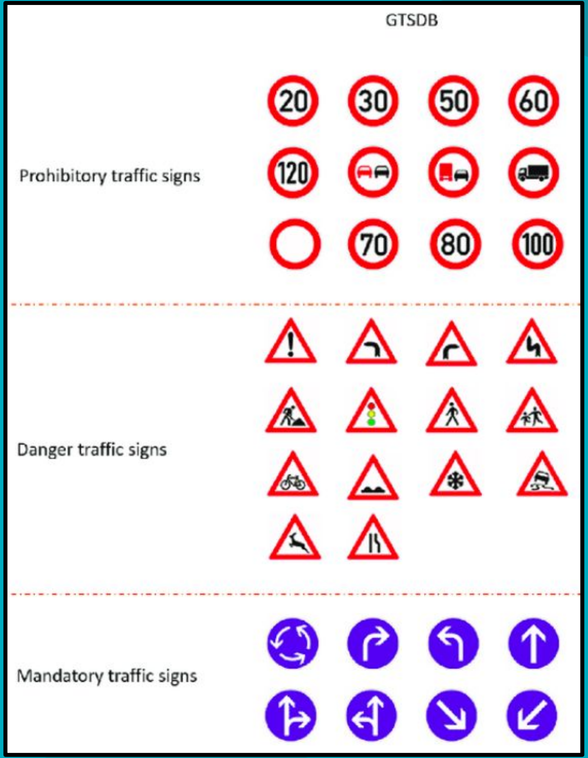
Mykola • updated 3 years ago (Version 1)

Dataset for Image Classification

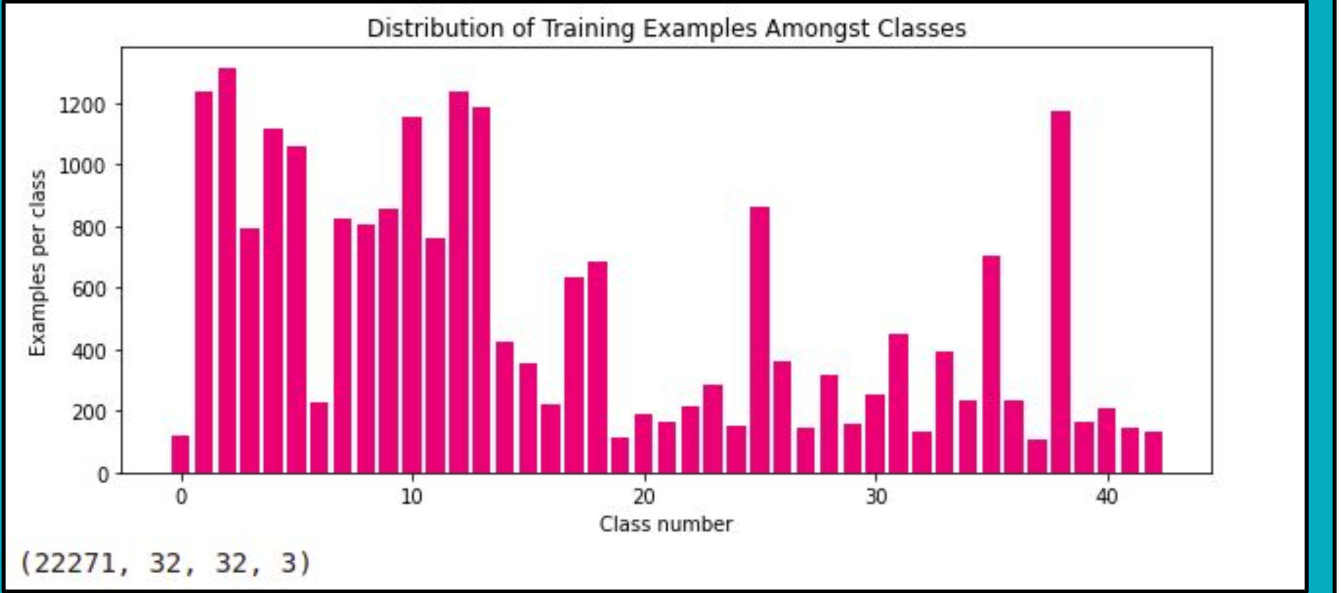




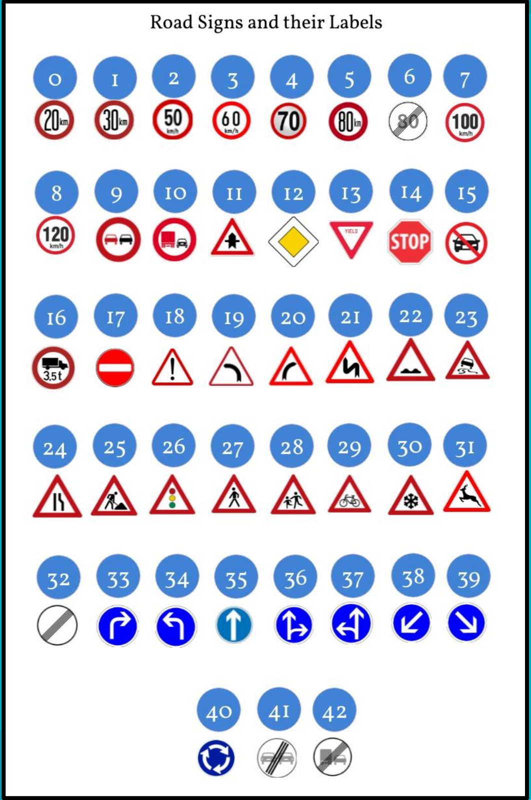
ClassId	Name
0	Speed limit (20km/h)
1	Speed limit (30km/h)
2	Speed limit (50km/h)
3	Speed limit (60km/h)
4	Speed limit (70km/h)
5	Speed limit (80km/h)
6	End of speed limit (80km/h)
7	Speed limit (100km/h)
8	Speed limit (120km/h)
9	No passing
10	No passing for vechiles over 3.5 metric tons
11	Right-of-way at the next intersection
12	Priority road
13	Yield
14	Stop
15	No vechiles
16	Vechiles over 3.5 metric tons prohibited
17	No entry



Distribution of Data

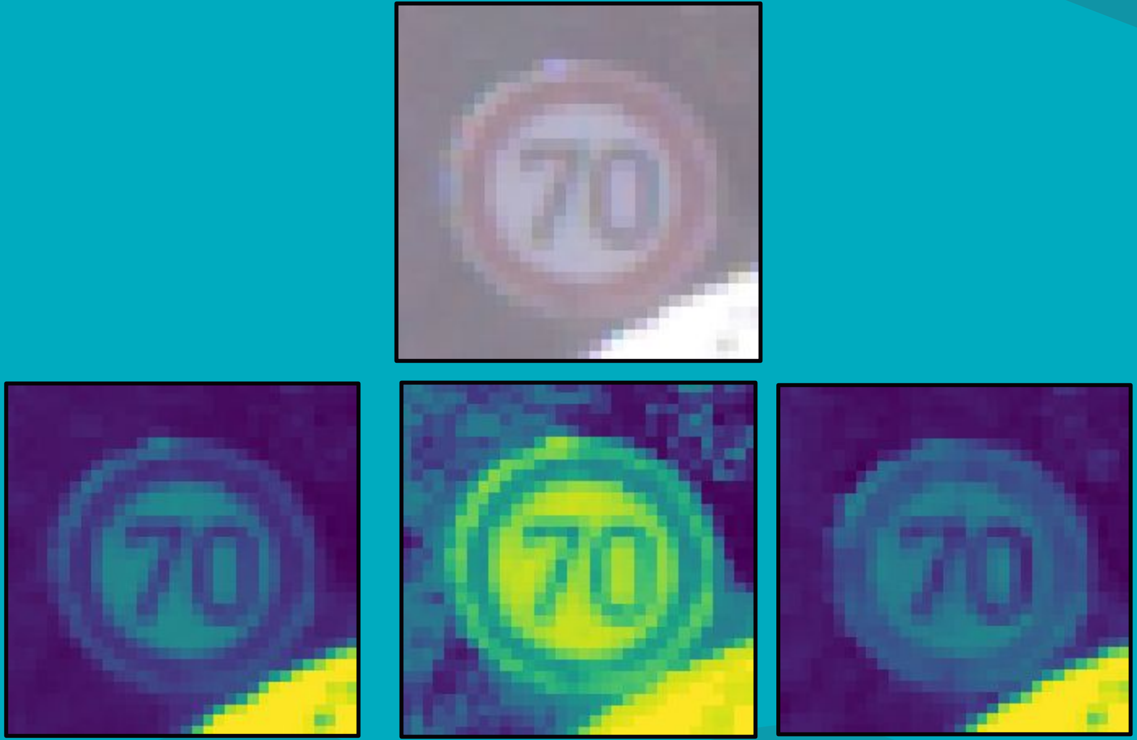


```
(22271, 32, 32, 3)
```

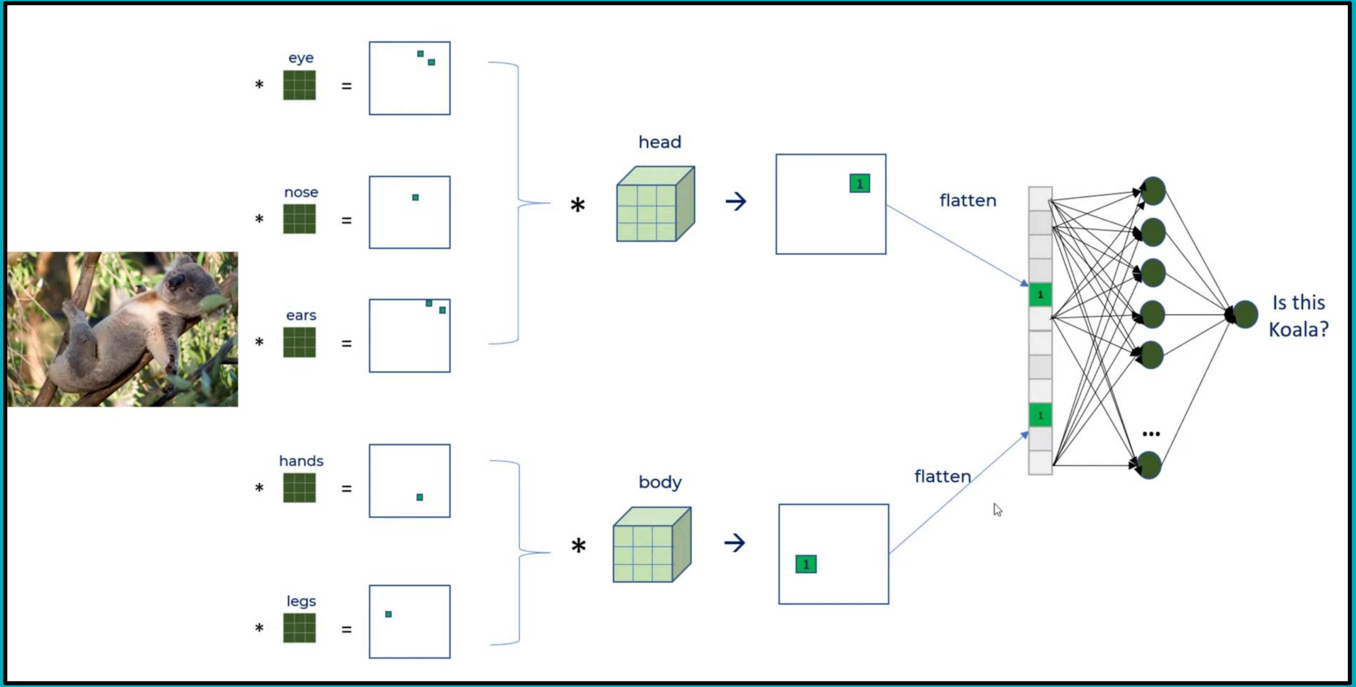

Road Signs and their Labels

Data Augmentation

- Resize (32, 32, 3)
- Grayscale
- Equalization
- Normalization



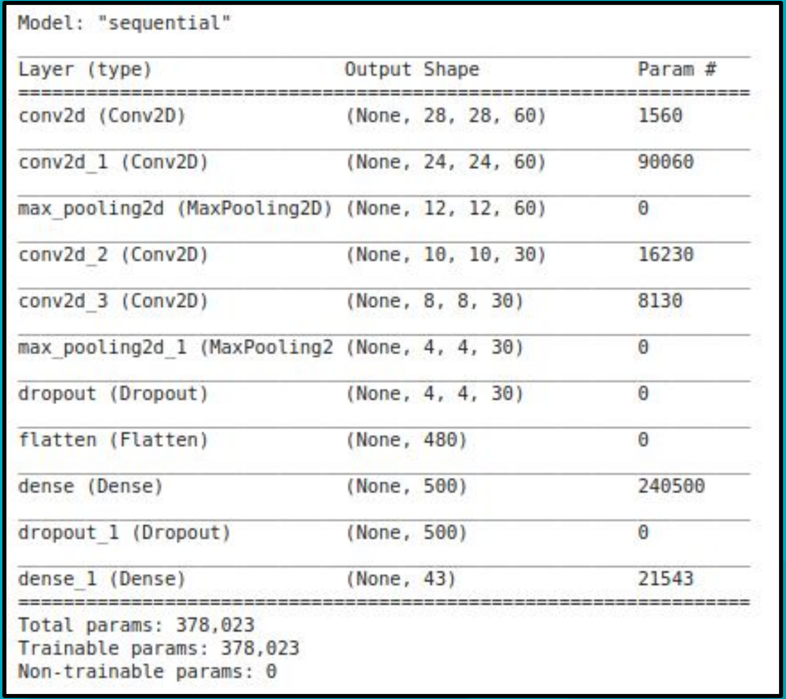
Convolutional Neural Network



Youtube Credit :
CodeBasics - Simple Explanation of Convolutional Neural Network

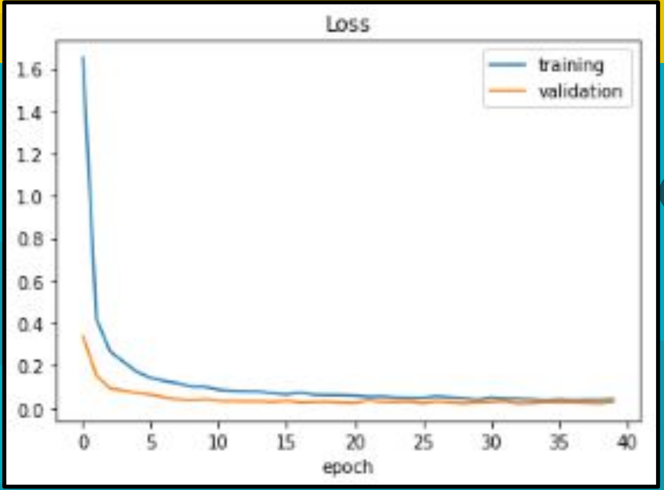
Convolutional Neural Network

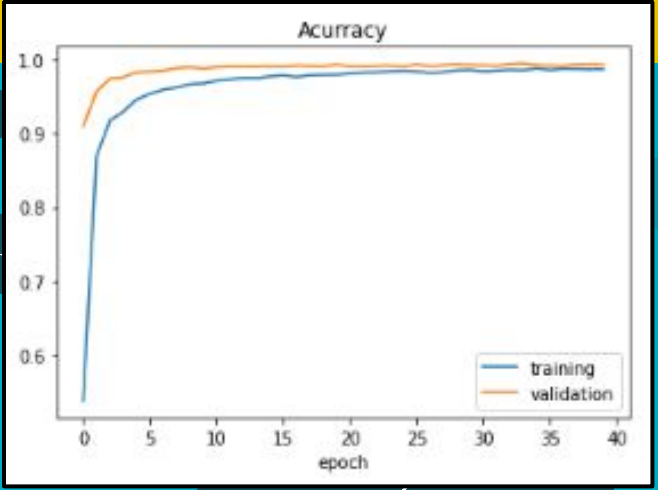
Input Image Dimensions
(32, 32, 3)



```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 28, 28, 60)        1560
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 24, 24, 60)        90060
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 12, 12, 60)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 10, 10, 30)        16230
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 8, 8, 30)          8130
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 4, 4, 30)          0
_________________________________________________________________
dropout (Dropout)            (None, 4, 4, 30)          0
_________________________________________________________________
flatten (Flatten)            (None, 480)               0
_________________________________________________________________
dense (Dense)                (None, 500)               240500
_________________________________________________________________
dropout_1 (Dropout)          (None, 500)               0
_________________________________________________________________
dense_1 (Dense)              (None, 43)                21543
=================================================================
Total params: 378,023
Trainable params: 378,023
Non-trainable params: 0
```

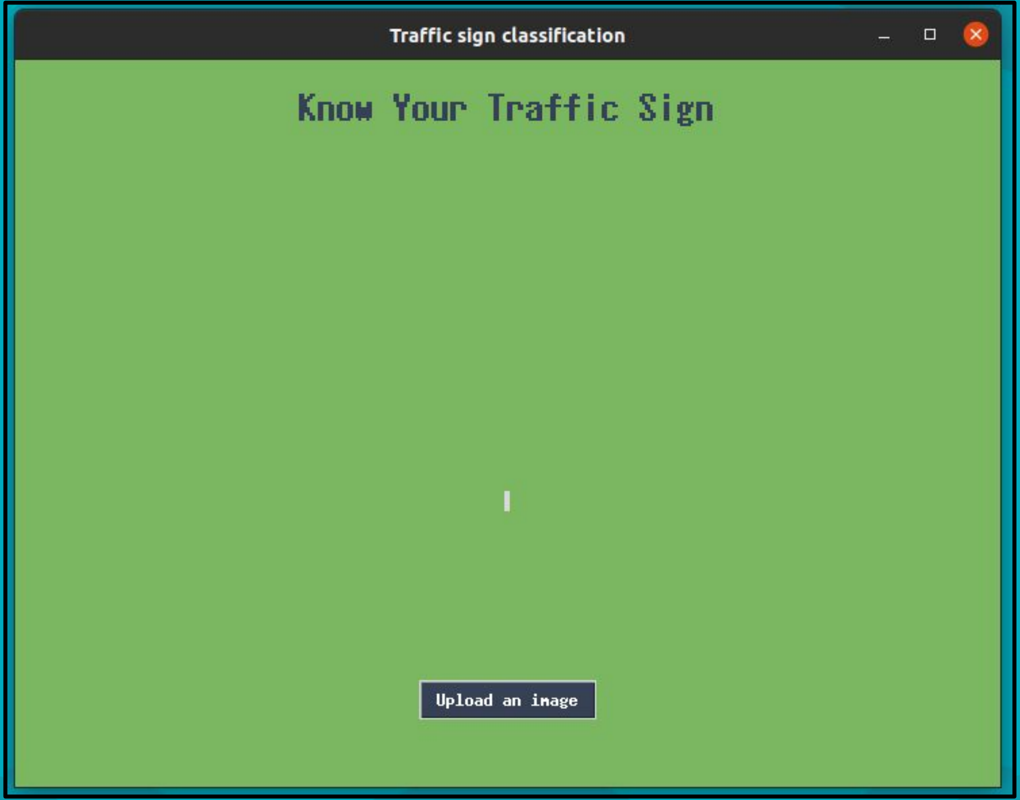
Results





	Loss	Accuracy
CNN	0.0514	0.9842

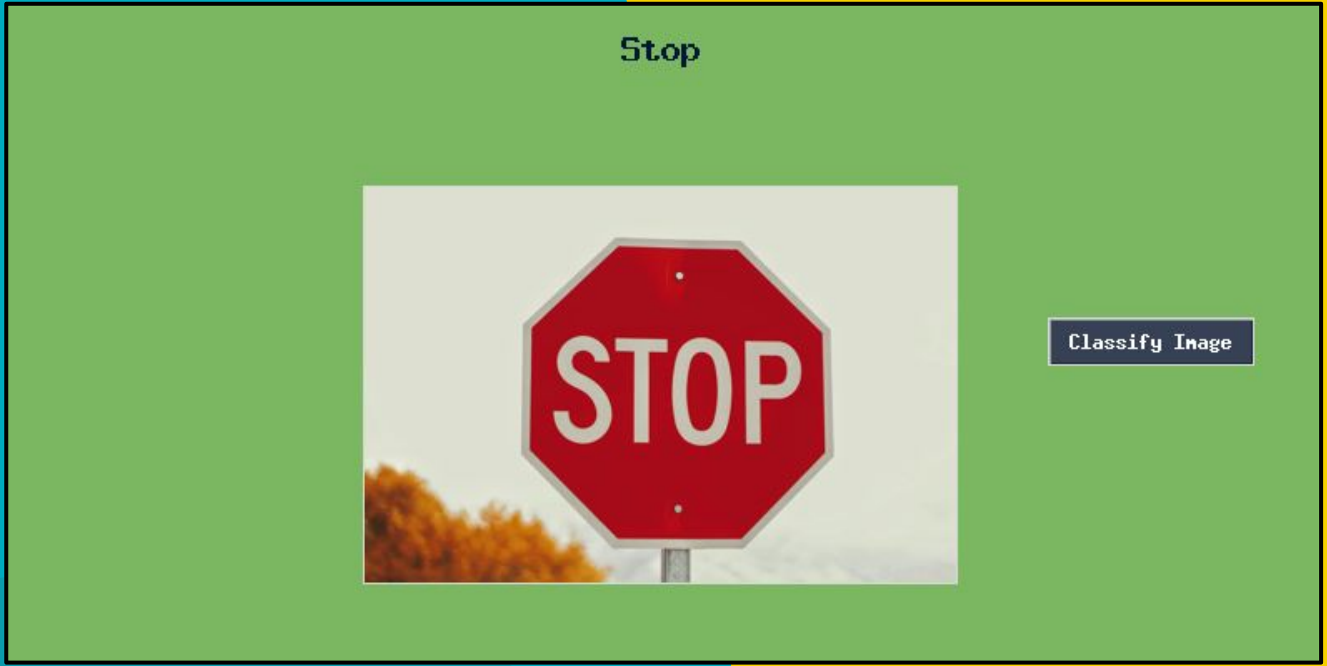
TKinter GUI



Traffic sign classification

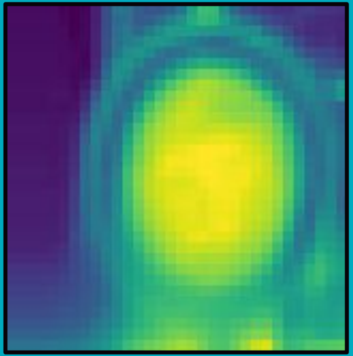
Know Your Traffic Sign

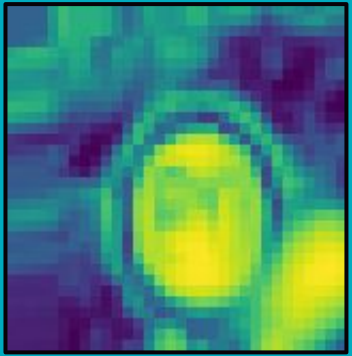
Image Classification of Traffic Signs

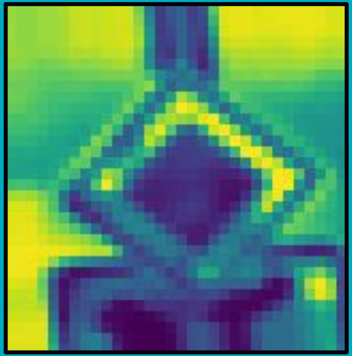


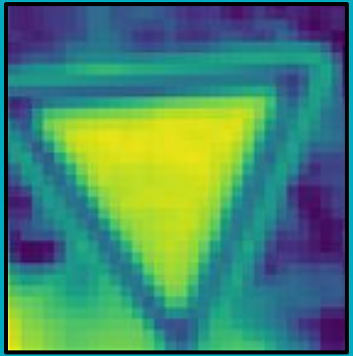
Stop

Pitfalls



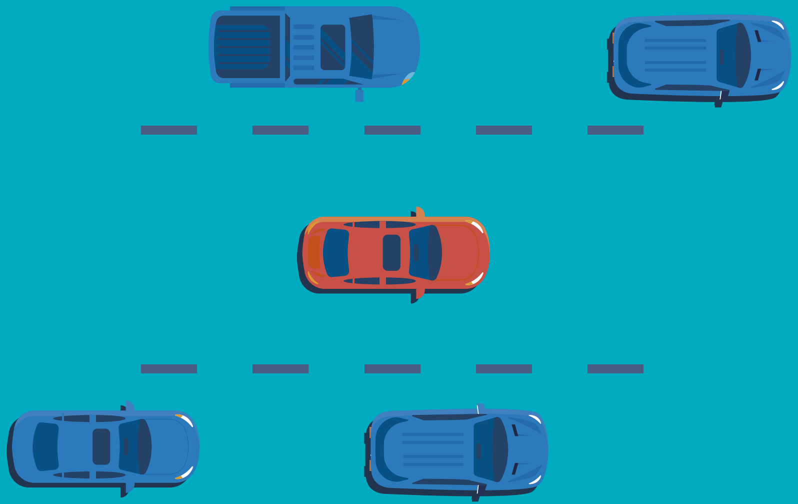






Solutions

- Rolling Training Sets
- Gather more data.



Thanks!

Do you have any questions?