

A Glimpse into Automotive Computer Vision Using Convolutional Neural Networks

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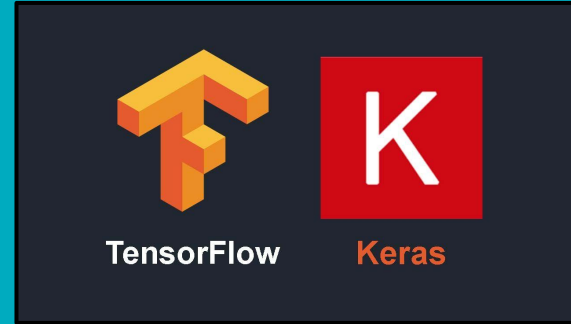
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Understanding the Motivation



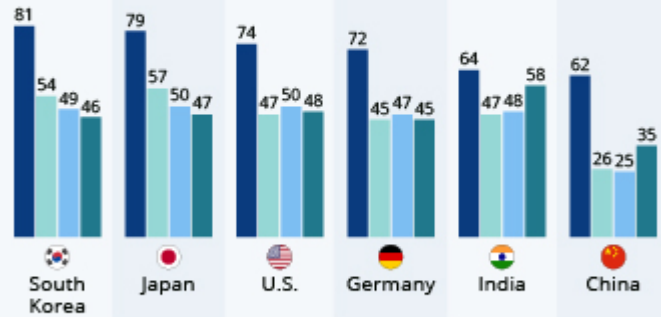
Understanding the Motivation

Where People Are Warming up to Self-Driving Cars

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



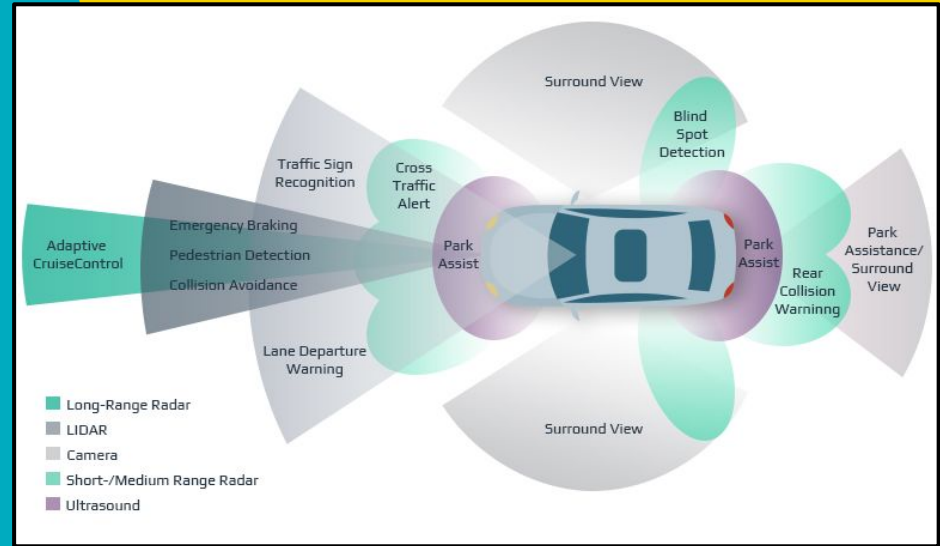
■ 2017 ■ 2018 ■ 2019 ■ 2020



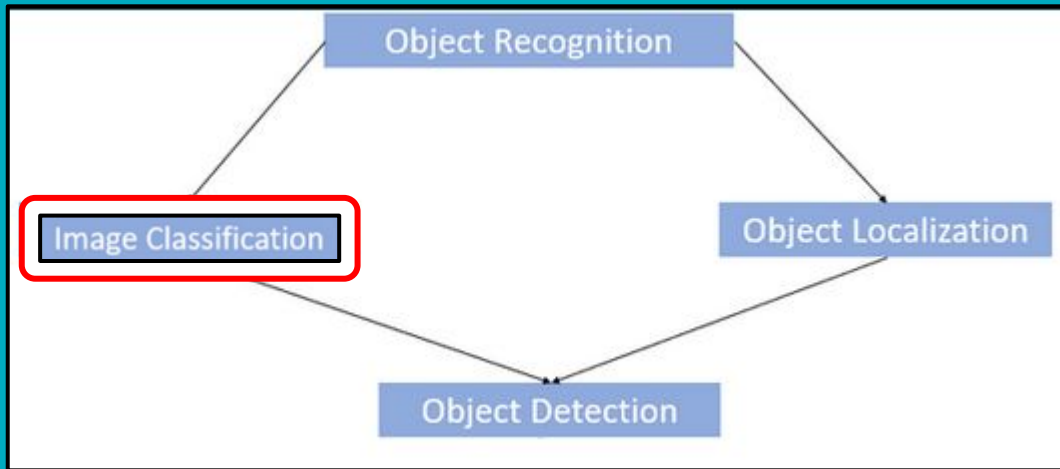
1,000+ consumers surveyed per country
Source: Deloitte



statista



Computer Vision Essentials

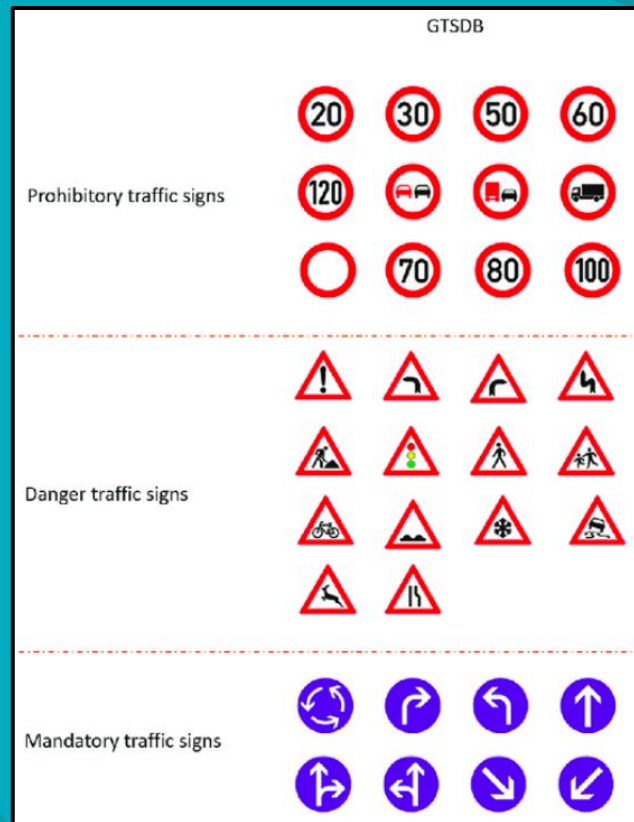


Data

Image Classification

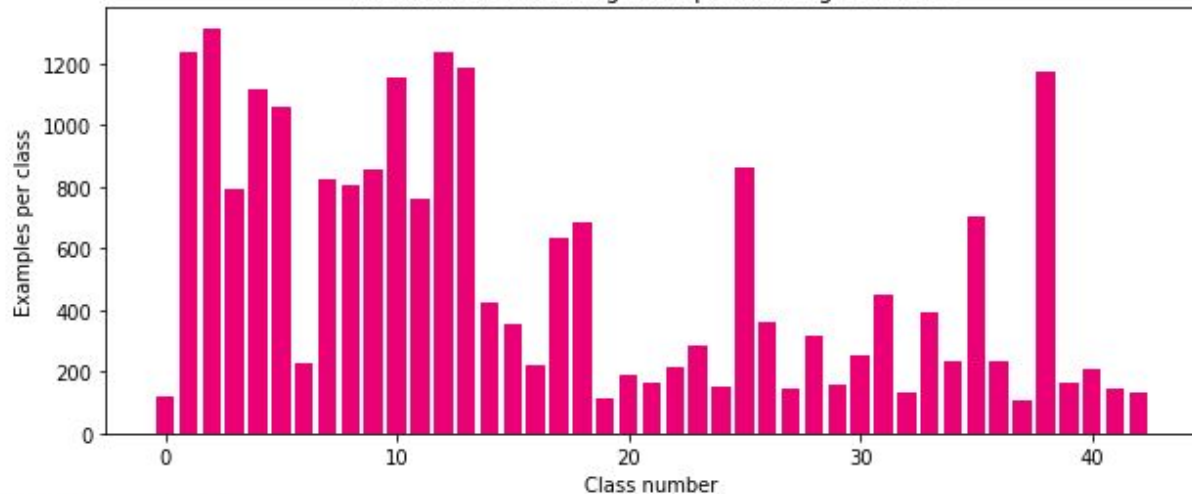


Image Classification



Distribution of Data

Distribution of Training Examples Amongst Classes

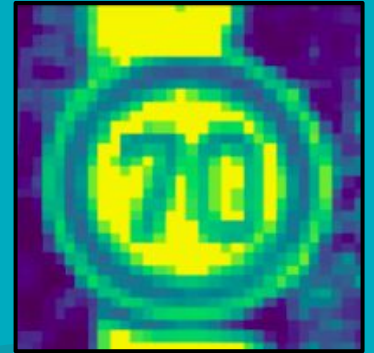


(22271, 32, 32, 3)

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

Data Augmentation

- Grayscale
- Equalization
- Normalization



Convolutional Neural Network

Input Image Dimensions

(32, 32, 3)

Model: "sequential"

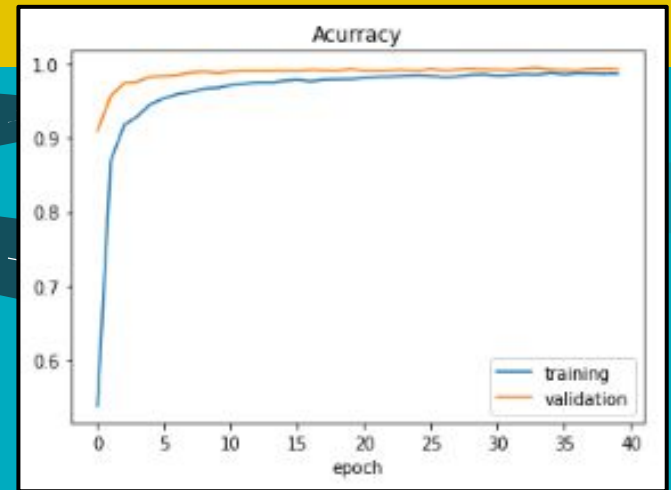
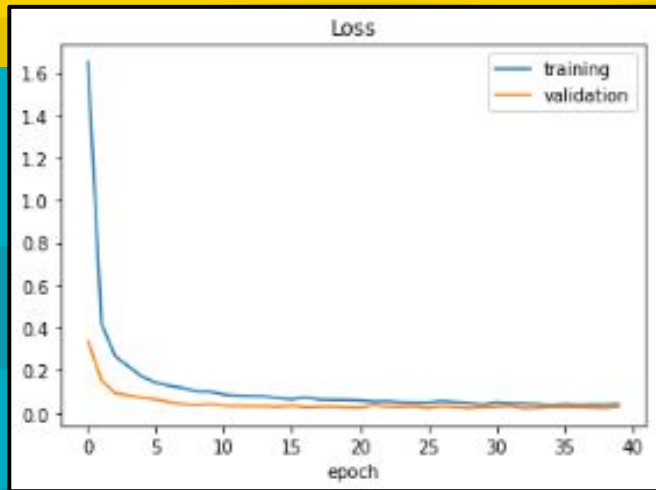
Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 28, 28, 60)	1560
conv2d_1 (Conv2D)	(None, 24, 24, 60)	90060
max_pooling2d (MaxPooling2D)	(None, 12, 12, 60)	0
conv2d_2 (Conv2D)	(None, 10, 10, 30)	16230
conv2d_3 (Conv2D)	(None, 8, 8, 30)	8130
max_pooling2d_1 (MaxPooling2D)	(None, 4, 4, 30)	0
dropout (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

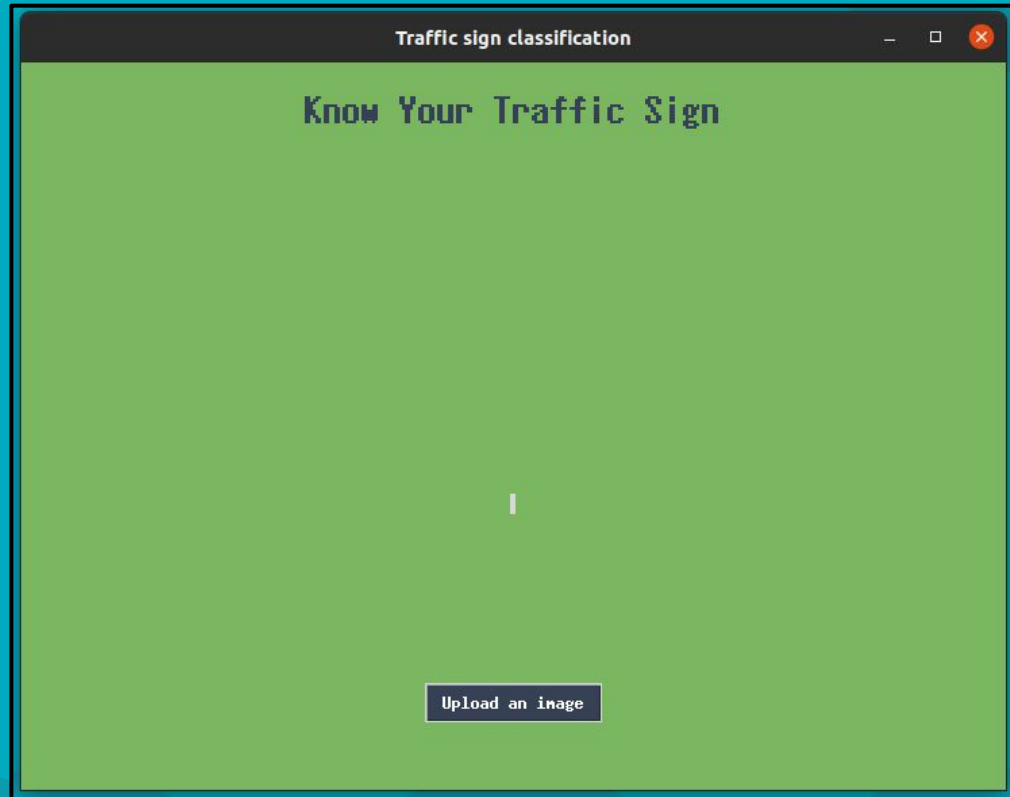
Results



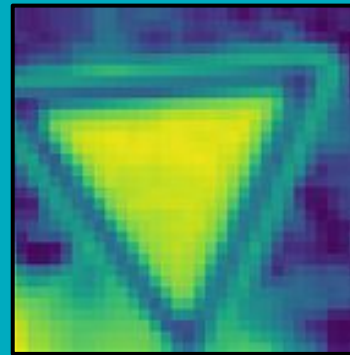
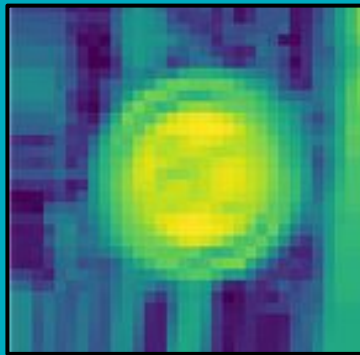
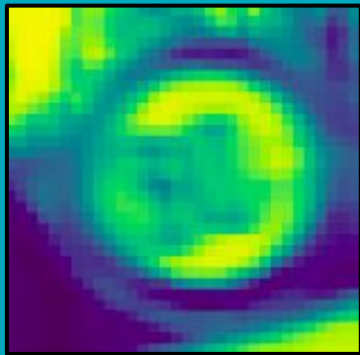
	Loss	Accuracy
CNN	0.0514	0.9842



TKinter GUI

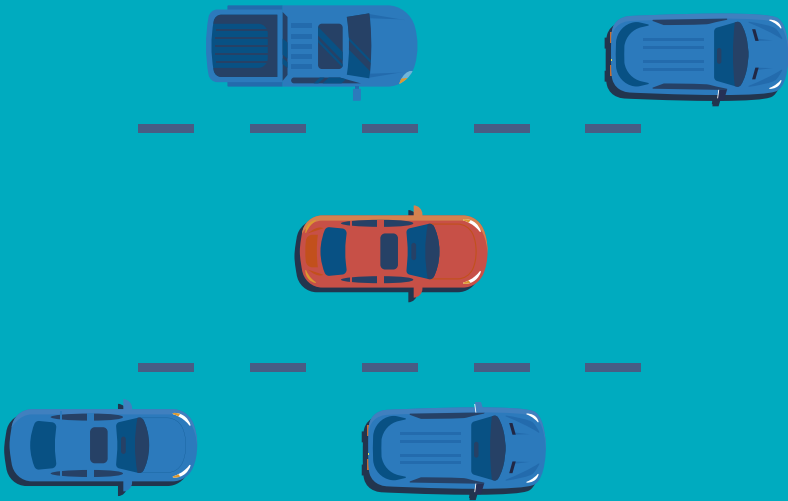


Pitfalls



Solutions

- Rolling Training Sets
- Gather more data.



Thanks!

Do you have any questions?

