



# *Distracted Driver Detection*

Deep Learning for Image  
Classification



- Problem Statement
- Project Objectives
- Data Set
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- Models used
- Evaluation of Models
- Conclusion

# Problem Statement

Road Traffic Accident Report by the  
World Health Organisation(WHO)



**1.35 million  
lives lost**



**Leading cause of  
death for ages 5-29**



**20 to 50 million  
suffer disability**





# **Economic costs incurred due to disabilities**

**Treatment costs**

**Loss in productivity at  
work**

**Cost most countries 3% of their  
Gross Domestic Product(GDP)**

# Distracted Driving

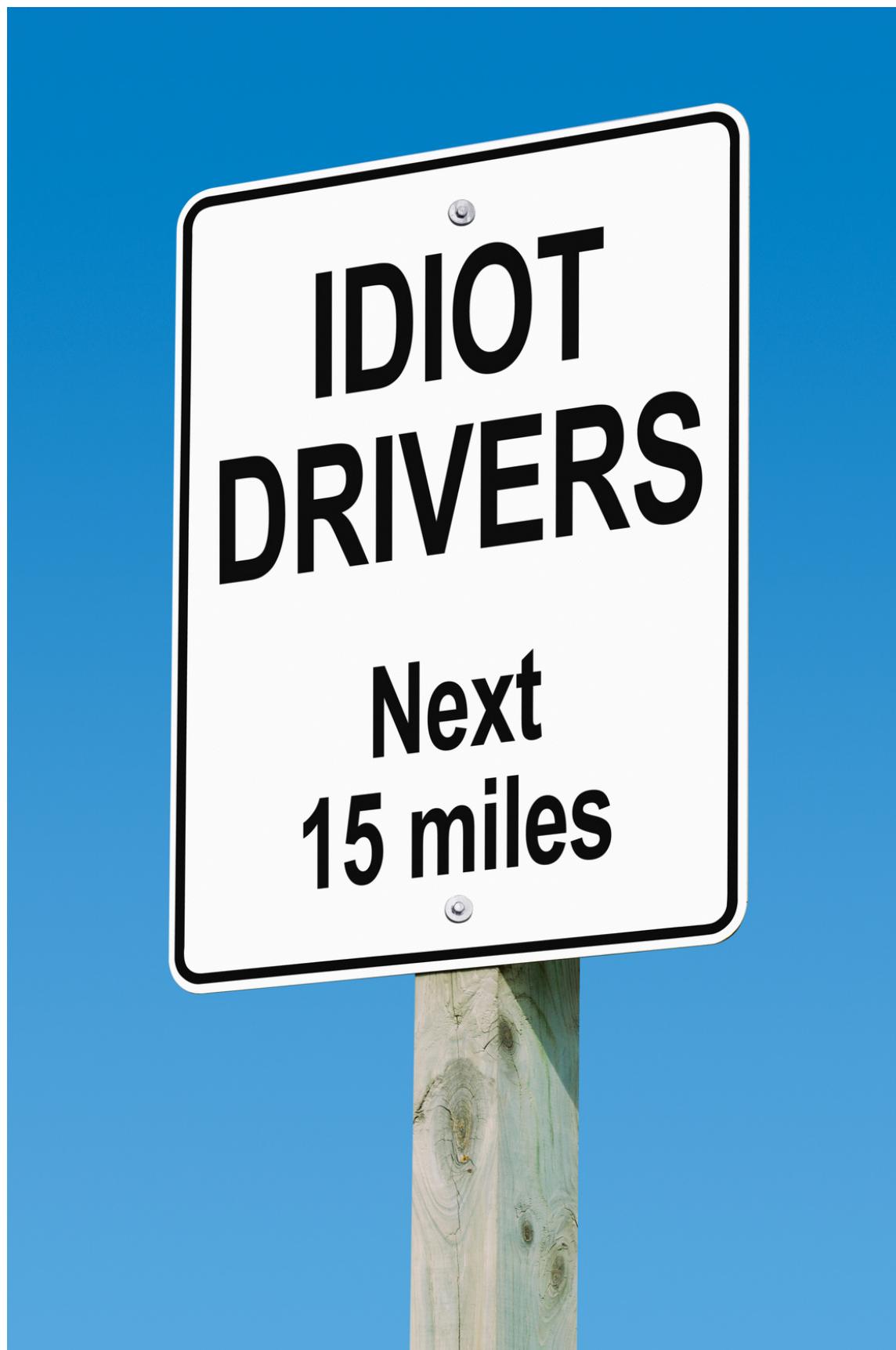


- NUMBER 1 CAUSE OF CAR ACCIDENTS
- THE ACT OF DRIVING WHILE ENGAGING IN OTHER ACTIVITIES WHICH DIVERTS ATTENTION AWAY FROM SAFE DRIVING
- IN THE UNITED STATES ALONE, 25-50% OF VEHICLE CRASHES ARE DIRECTLY RELATED TO DRIVER DISTRACTION
- DRIVING WHILE TALKING ON PHONE QUADRUPLES RISK OF CRASHING
- THE REACTION TIME OF A DRIVER IS SLOWED DOWN BY 38%



ARE WE STILL ABLE TO RELY ON THEM?

# Project Objectives



- **TRAIN A MACHINE LEARNING MODEL**

2D image or video of dashboard driver as input

- **IDENTIFY DISTRACTED DRIVERS**

Use deep learning and computer vision systems to accurately predict and classify each driver's behavior

- **APPLICATION**



Car sharing or taxi companies



Insurance companies



Car rental companies



Traffic Police

# Data Set



- **Approximately 20,000 Images**  
Divided into 10 different classes of driving behavior
- **Size of image: 480 x 640**

# Target Labels

**C0: SAFE DRIVING**



**C1: TEXTING - RIGHT**



**C2: TALKING ON PHONE - RIGHT**



**C3: TEXTING - LEFT**



**C4: TALKING ON PHONE- LEFT**



**C5: OPERATING THE RADIO**



**C6: DRINKING**



**C7: REACHING BEHIND**



**C8: HAIR AND MAKEUP**



**C9: TALKING TO PASSENGER**



# Data Set - Experiment

## DRIVERS

Close to 80 volunteers



## VEHICLES

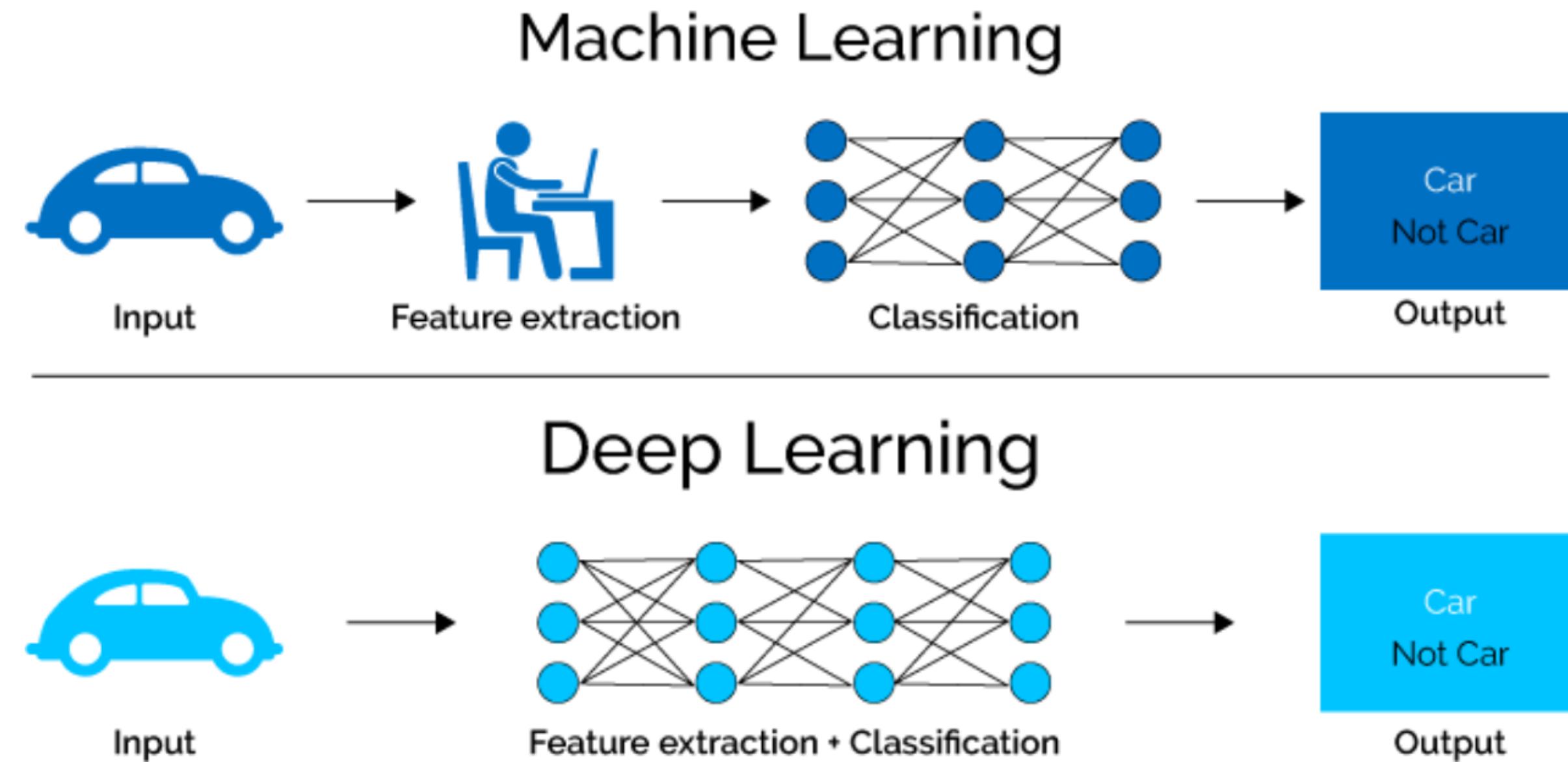
Truck dragging the car around  
on the streets - so these  
"drivers" weren't really driving.



## DATA COLLECTION



# Machine Learning vs Deep Learning

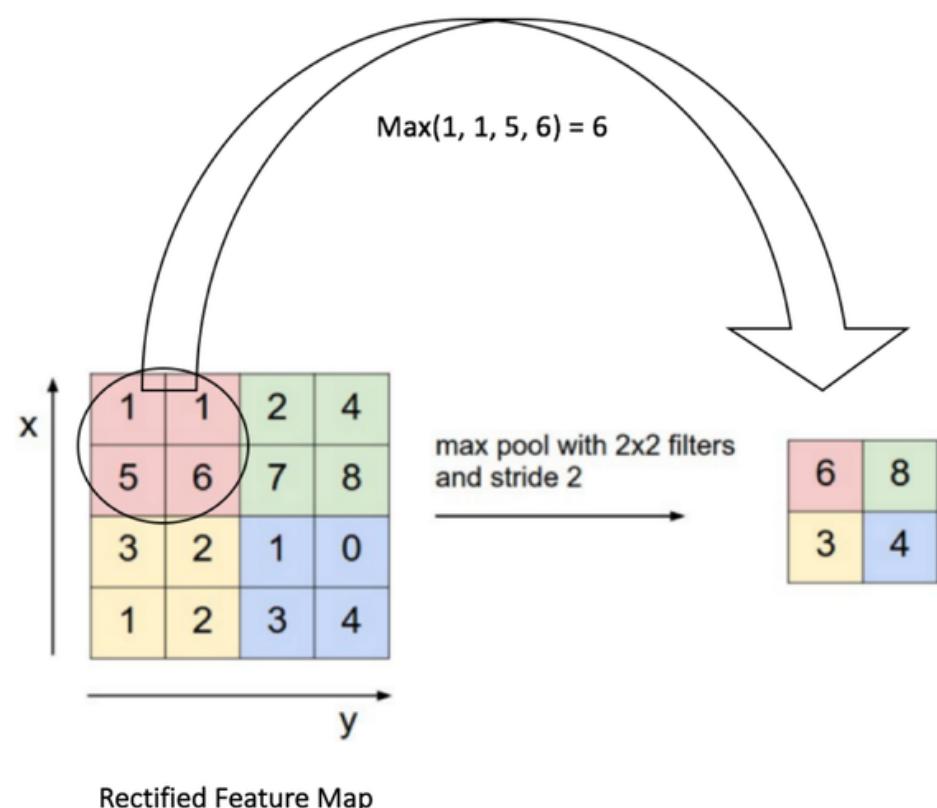


# Convolutionary Neural Network

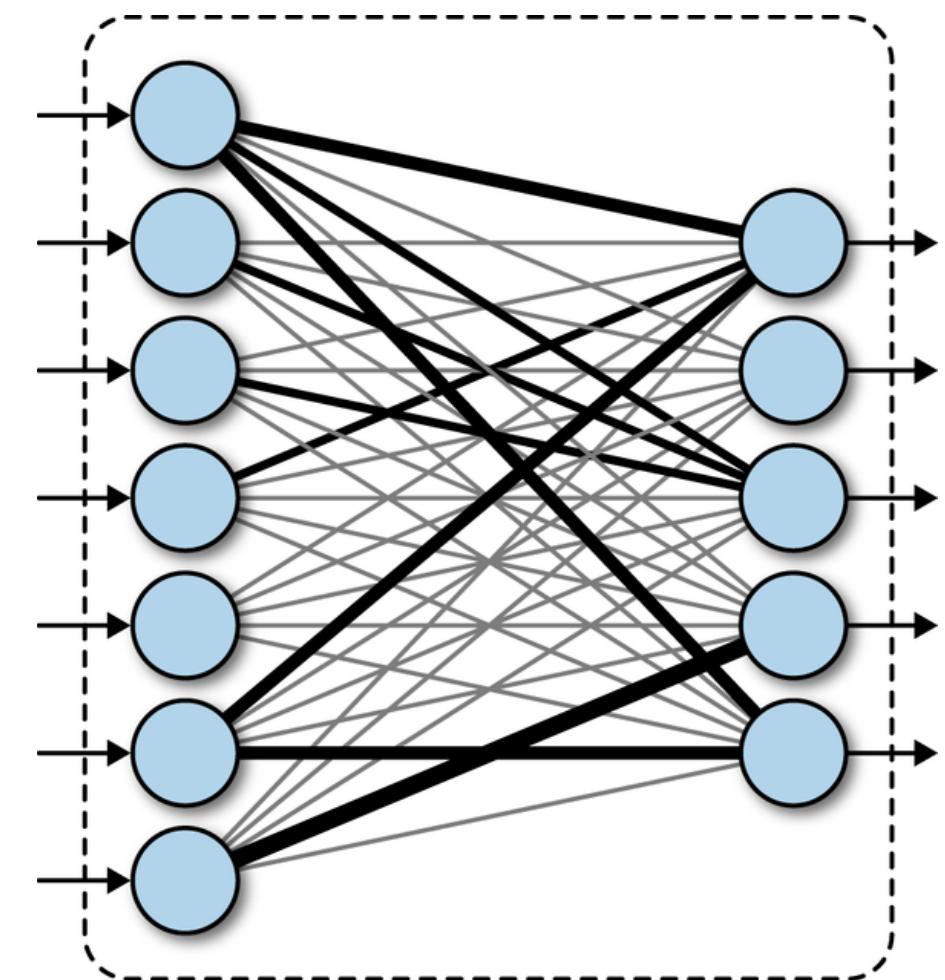
## Convolution Layer



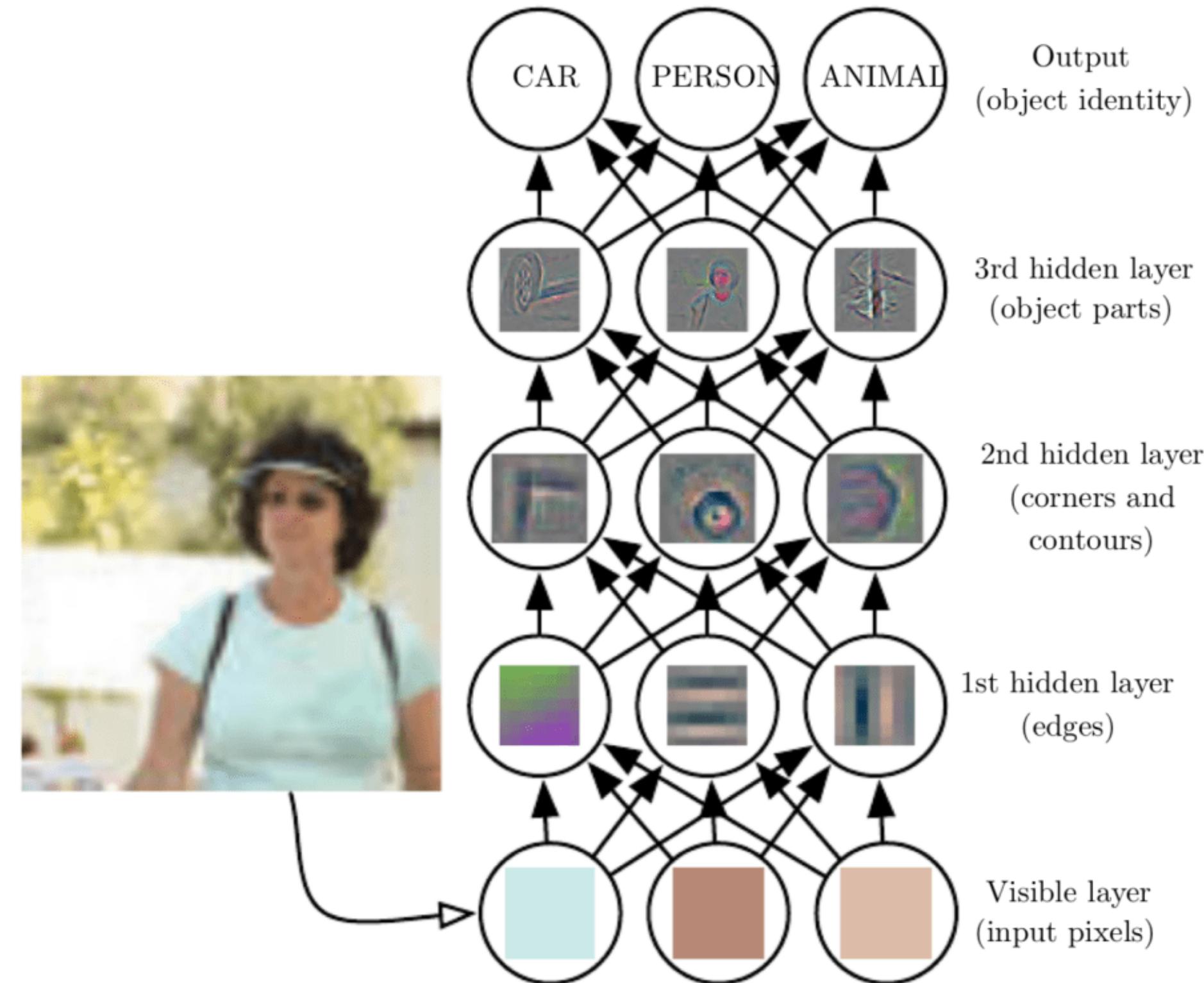
## Pooling



## Fully Connected Layer



# Convolutionary Neural Network

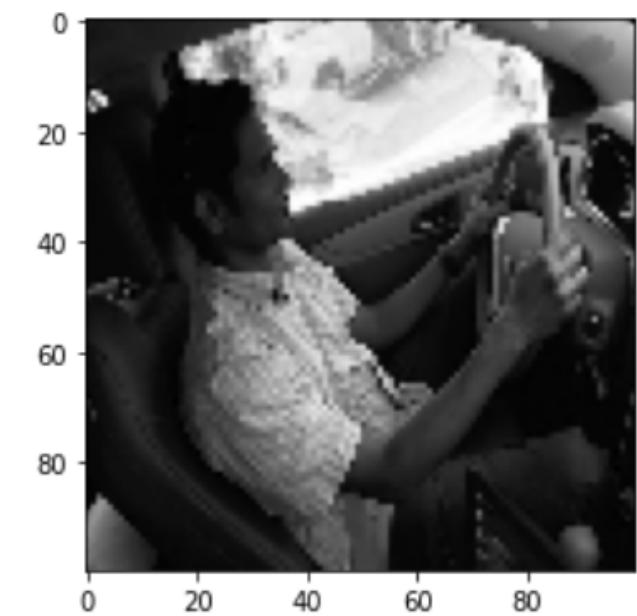
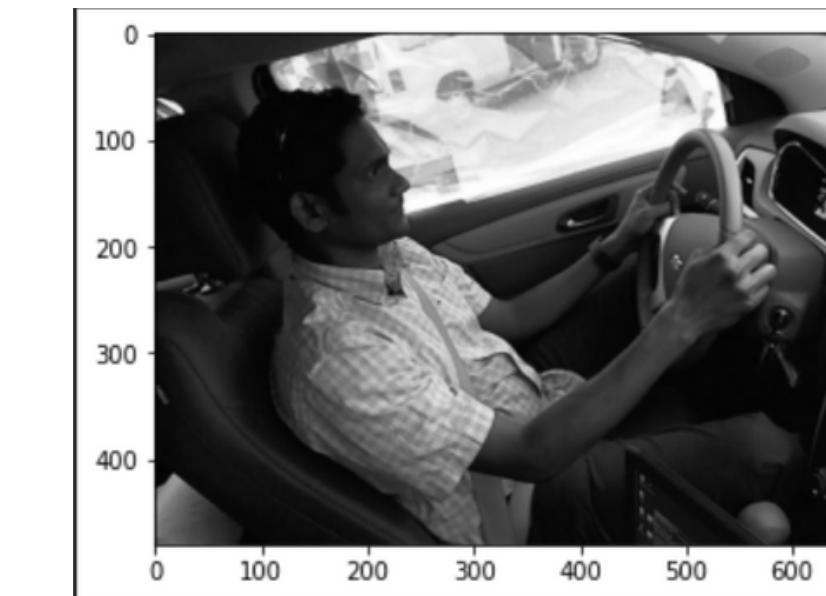


# Normalize Data

- GRayscale



- RESIZE



# Initial Model: CNN

	precision	recall	f1-score	support
0	0.99	0.99	0.99	498
1	0.99	0.99	0.99	453
2	1.00	0.99	0.99	464
3	0.99	1.00	0.99	469
4	0.99	0.99	0.99	465
5	1.00	0.99	0.99	463
6	0.99	1.00	1.00	465
7	0.99	0.99	0.99	400
8	0.99	0.99	0.99	382
9	0.99	1.00	0.99	426
accuracy			0.99	4485
macro avg	0.99	0.99	0.99	4485
weighted avg	0.99	0.99	0.99	4485

# Data Leakage

- Training data has multiple images of the same driver
- Leaked into validation data



# Data Leakage : Solved

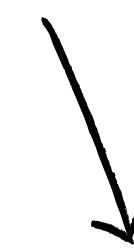
**Split data by driver id**

p012

p002

p024

p021



Train

Test

# Realistic Results

	precision	recall	f1-score	support
0	0.49	0.58	0.53	616
1	0.61	0.52	0.56	448
2	0.42	0.62	0.51	493
3	0.39	0.08	0.13	527
4	0.51	0.17	0.25	502
5	1.00	0.45	0.62	525
6	0.59	0.18	0.27	525
7	0.19	0.49	0.27	455
8	0.47	0.65	0.54	425
9	0.27	0.38	0.31	504
accuracy			0.41	5020
macro avg	0.49	0.41	0.40	5020
weighted avg	0.50	0.41	0.40	5020

# Transfer Learning - Pretrained Models

VGG16

RESNET 50

MOBILENET

XCEPTION

Image Augmentation

Pretrained weights from Imagenet Dataset

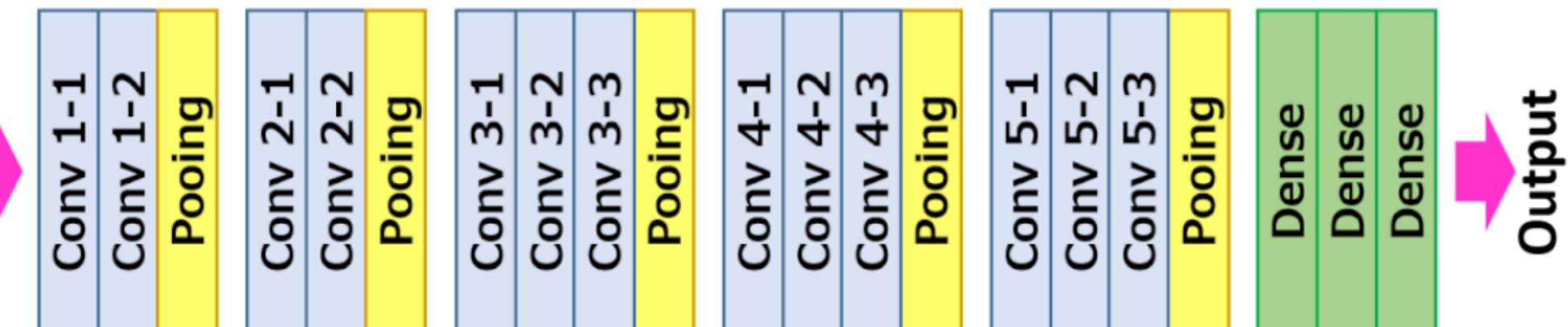
SGD Optimisation for loss(Categorical crossentropy)

Batch normalization

Fully connected dense layers(Softmax)

Earlystopping and Callbacks

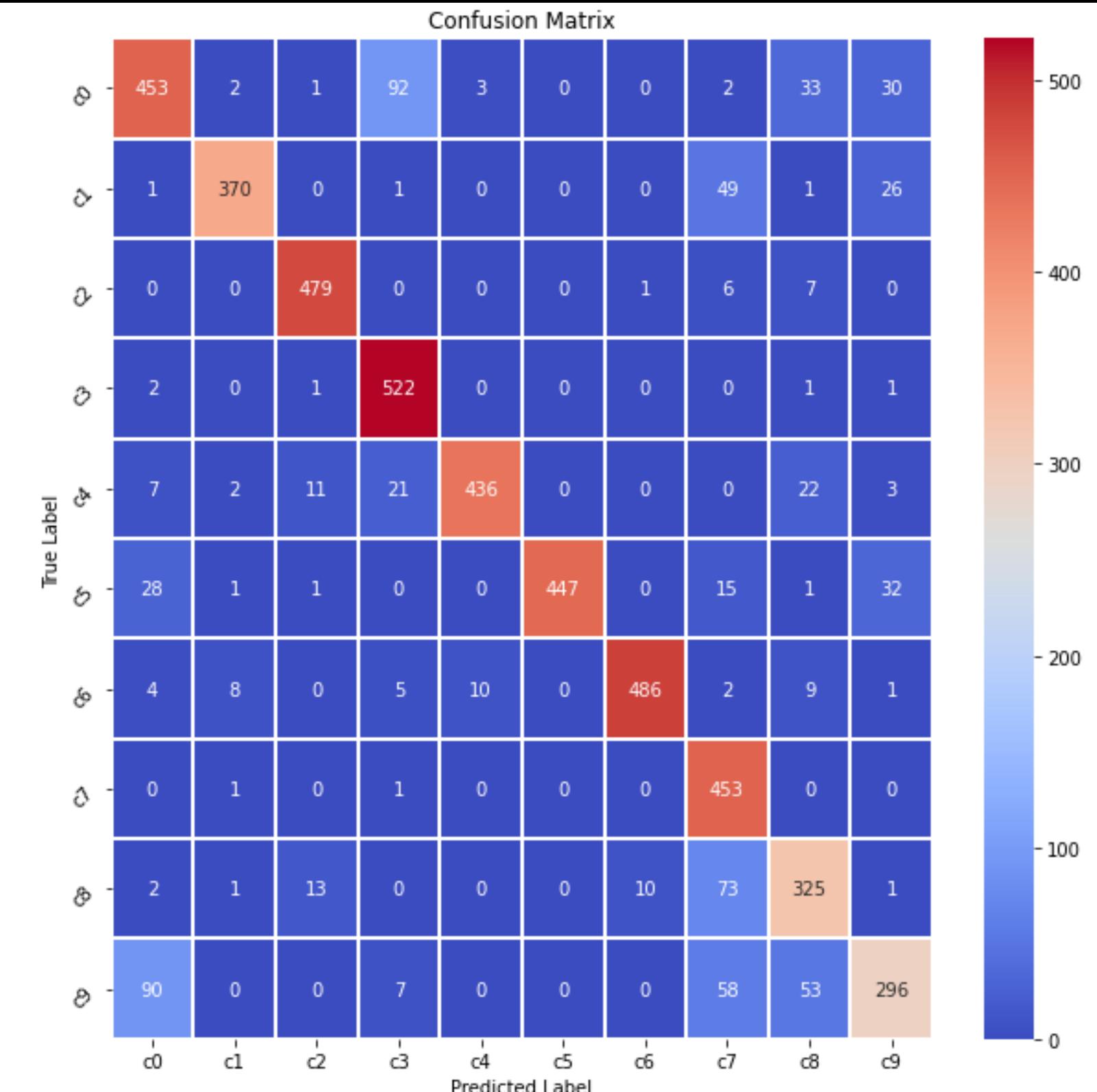
Input



# Model Results - VGG16

85% Accuracy and F1 score

	precision	recall	f1-score	support
0	0.77	0.74	0.75	616
1	0.96	0.83	0.89	448
2	0.95	0.97	0.96	493
3	0.80	0.99	0.89	527
4	0.97	0.87	0.92	502
5	1.00	0.85	0.92	525
6	0.98	0.93	0.95	525
7	0.69	1.00	0.81	455
8	0.72	0.76	0.74	425
9	0.76	0.59	0.66	504
accuracy			0.85	5020
macro avg	0.86	0.85	0.85	5020
weighted avg	0.86	0.85	0.85	5020



# Review Results

**C9: TALKING TO  
PASSENGER**



**C0: SAFE DRIVING**



**C3: TEXTING - LEFT**



# Moving Forward

DEPLOY MODEL



# **Moving Forward**

**STUDY OF DISTRACTED DRIVER BEHAVIOUR**

**CAR MANUFACTURERS DESIGN ANTI-DISTRACTION  
FEATURES**

**GOVERNMENTS**



**END**