# Introduction and Project Flow

from surveillance camera . It can be used at tolls for recording the license number and finding Vehicle Number Plate Detector can detect the license number of Car from the images obtained the stolen cars etc. Below is the flow of project which contain 3 major steps:

07	Detecting and Extracting Number Plate from overall Image	<ul> <li>We have done this with 2 different method</li> <li>First by Finding Contours that resembles the number plate</li> <li>Second by You Only Look Once(YOLO) algorithm.</li> </ul>
02	Separating the Individual Character .	<ul> <li>Individual Character needs to be separated and segregated.</li> <li>We will use character segmentation technique like Finding rectangular Contours.</li> </ul>
03	Recognizing the Separated Characters .	<ul> <li>Segmented Characters will be recognized using deep learning classifier.</li> <li>We will make use off 4 layer -Convolutional Neural Network to do this.</li> </ul>

# Object detection using finding contours(Preprocessing)

Input image

Gray scale image

Noise elimination

Canny edge detection



- Each contours are approximated to form a Polygon.
- Contours with favourable condition are detected using cv2 library

Canditions:

- 1. Area>30
- 2. Quadrilateral in shape









## Object Detection Using YOLOus



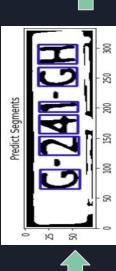
- We will use Pre-Trained Model with YOLOus weights for vehicle plate detection . We have got this from Kaggle.
  - Final Result :



### Character Segmentation

- Pre Processing Resizing, Grayscale conversion. Binarization, Eroding, Dilate
- Contour detection
- Finding bounding rectangle of each character by dimension comparison.







## Character Recognition using CNN

#### CNN Model Summary that we use for Character Recognition:

Working of CNN

	Layer (type) Output Shape Param #	Output Shape	Shape	Param #
	conv2d (Conv2D)	(None,	(None, 28, 28, 16)	23248
	conv2d_1 (Conv2D)	(None,	(None, 28, 28, 32)	131104
	conv2d_2 (Conv2D)	(None,	(None, 28, 28, 64)	131136
	conv2d_3 (Conv2D)	(None,	(None, 28, 28, 64)	65600
	max_pooling2d (MaxPooling2D) (None, 7, 7, 64)	(None,	7, 7, 64)	0
Is this	dropout (Dropout)	(None,	(None, 7, 7, 64)	0
Coala	flatten (Flatten)	(None, 3136)	3136)	0
	dense (Dense)	(None, 128)	128)	401536
	dense_1 (Dense)	(None, 36)	36)	4644
	Total params: 757,268 Trainable params: 757,268			

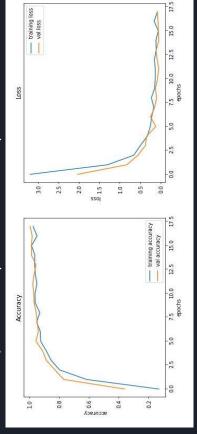
Non	Classification	Feature Extraction
fladen den den den den den den den den Tott	s this Koala?	fatten  Schwolution + ReLU  Convolution + ReLU  Pooling
con		Eye, nose, ears etc  Head, body

#### Hyper Parameter Tuning :

	adam	plis	rmsprop		adam	plis	rmsprop
IZ=0.001	0.8925	0.9743	0.9285	17=0.001	0.2944	0.9656	0.8888
-0.0005	0.9506	0.9754	0.9598	Ir=0.0005	0.9441	0.9479	0.9322
=0.0001	0.9726	0.8321	0.9794	Lr=0.000H	0.9812	0.6574	0.9618

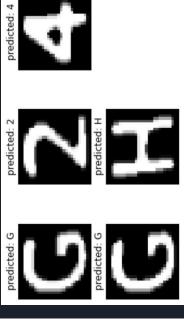
Loss function : sparse\_categorical\_crossentropy and optimal dropout rate = 0.4 , optimal learning rate = 0.0001 , and optimizer = adam

## Training Accuracy and Loss vs Epochs:



#### Predicting the Characters :-

predicted: 1



#### Conclusions:

- 1) Accuracy for Number Plate Detection using Finding Contour comes out to be around 63 %.
- Accuracy for Number Plate Detection using YOLOus comes out to be around 72 %. 2)
- Contour Method may return any rectangular objects found in an image, hence its accuracy is less compared to YOLO v3 3)
- It's important to do preprocessing before every step in order to get better results. *(b*
- 5) Hyper parameter tuning in CNN helps us to get the optimal parameter and thus increase model efficiency .