



THAI - ALPR

v.1.0

Thanapong Likhitparinya

Data Science Student

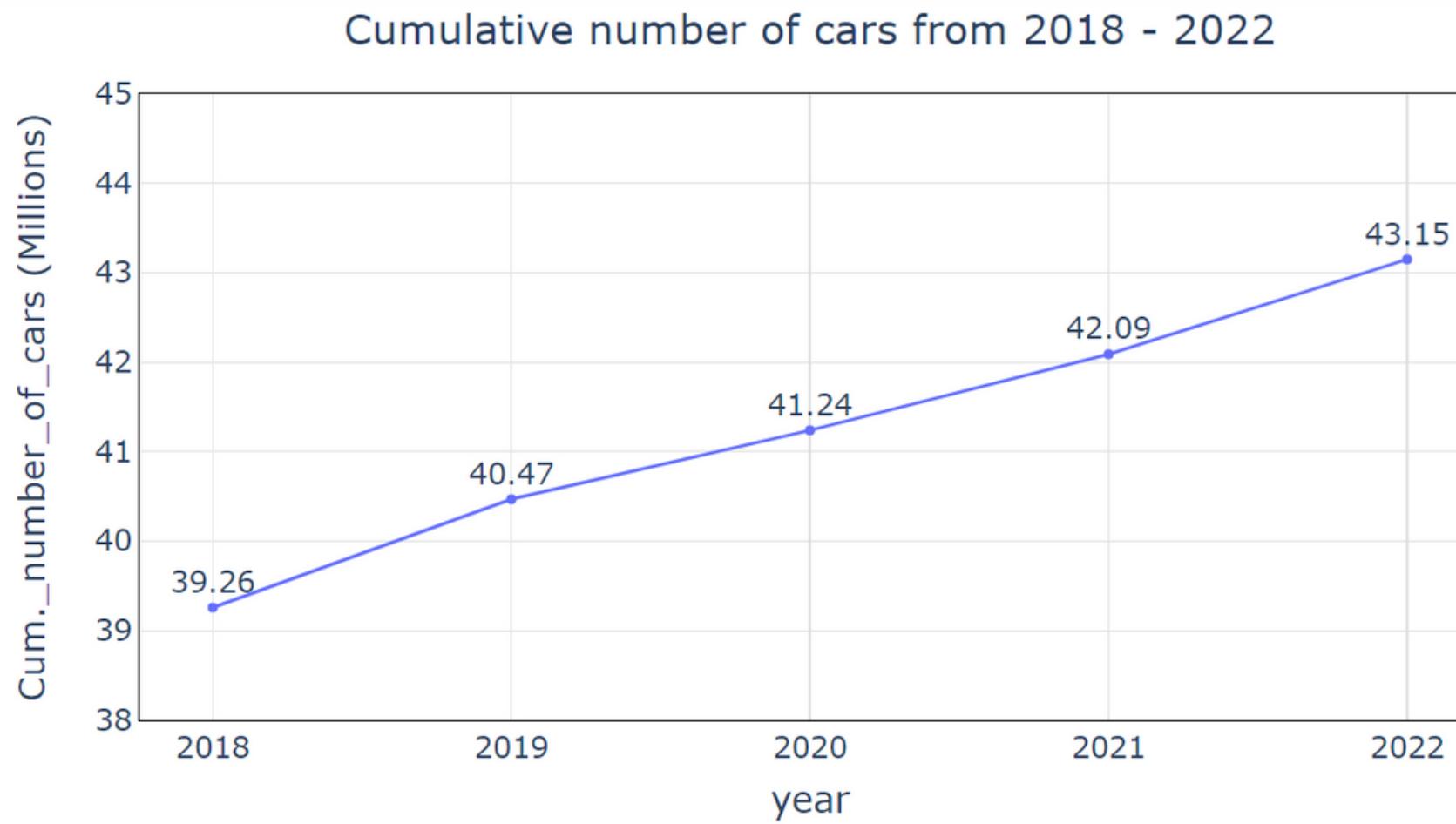
THANAPONG LIKHITPARINYA

Data Science Student - Road User



PROBLEM STATEMENT

03



The increase in the cumulative number of cars for the years 2018- 2022

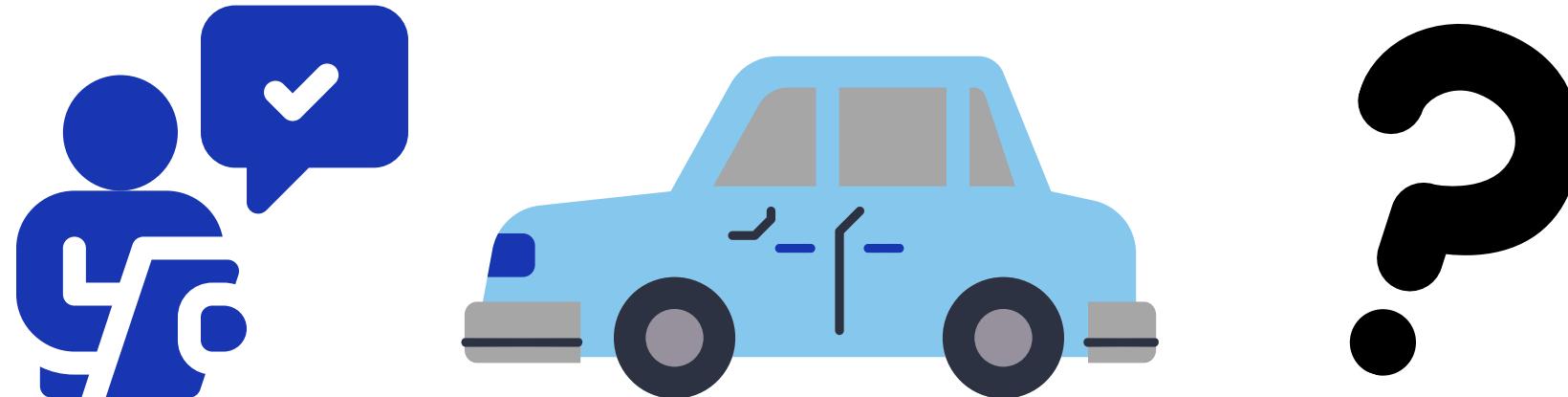


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DATA PREPARATION

VARIOUS SIZE OF IMAGES

Need to resize for some models

416 x 93 pixels

600 x 400 pixels

3600 x 2400 pixels

MISMATCHED FORMAT TYPE OF LABELS

XML / TXT

Kaggle : XML. Roboflow : TXT

DUPLICATE IMAGES

No effect to improvement of metric score, also may cause data leakage when shuffle split.

roboflow

: 660 images

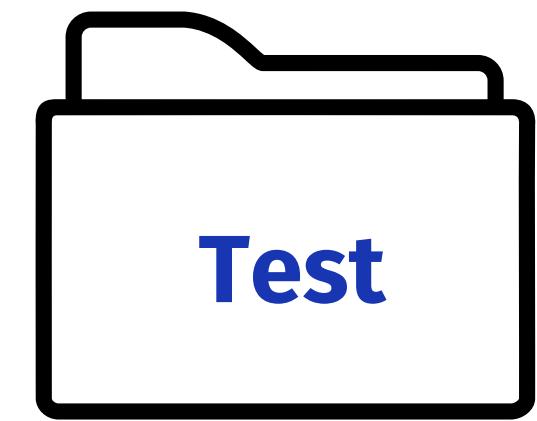
kaggle

: 510 images

90 : 10



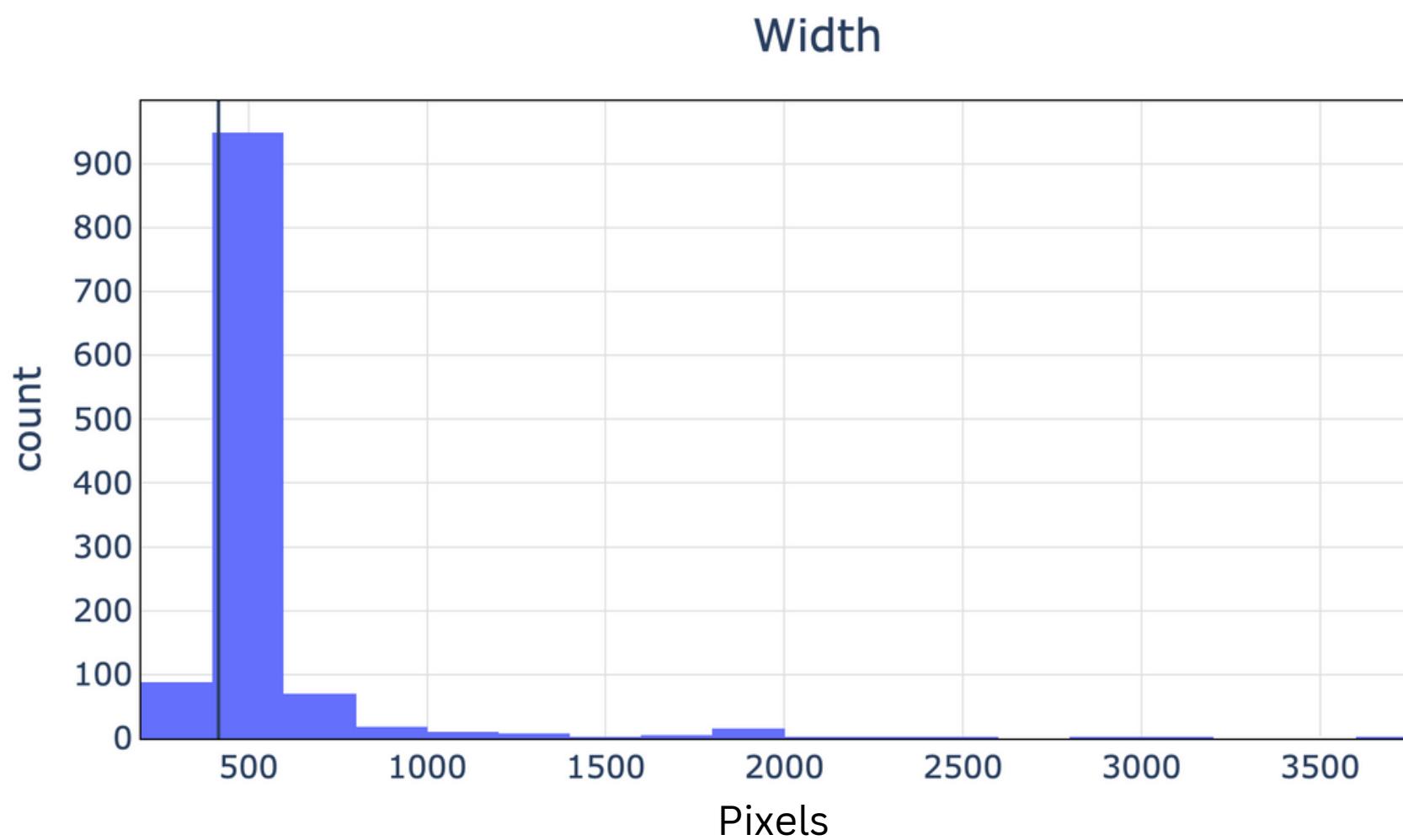
1070 images



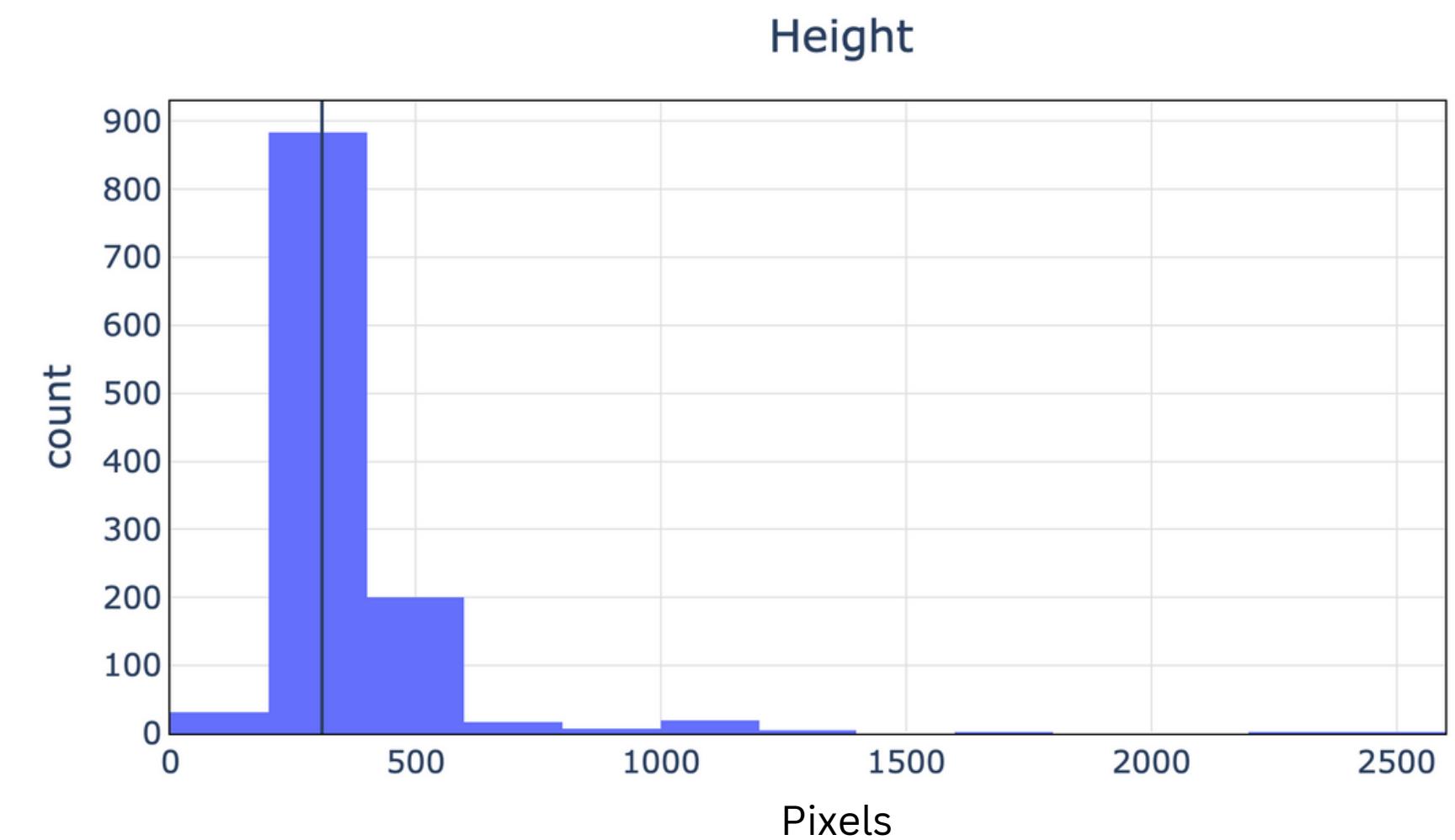
100 images

EDA (EXPLORATORY DATA ANALYSIS)

WIDTH



HEIGHT



The approximate mean pixel of both height and width falls around 350 - 400 pixels

HOW TO SELECT MODEL ?

3 areas of concern

- Power of the model (Highest metric score)
- Speed of the model
- Appropriate use case



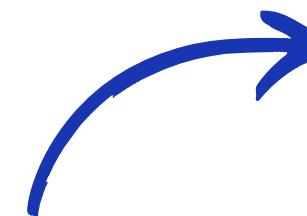
MODEL

YOLOv5

Object Detection model on
Region base algorithm

ADVANTAGES

- Pre-trained model
- Speed
- Easy to implement
- Appropriate for my use case



TRANSFER LEARNING



YOLOv5 trained on COCO data set, which contains many vehicle & road objects

VARIOUS OPTIONS

			
Small YOLOv5s	Medium YOLOv5m	Large YOLOv5l	XLarge YOLOv5x
15 MB _{FP16} 2.4 ms _{V100} 37.0 mAP _{coco}	42 MB _{FP16} 3.4 ms _{V100} 44.3 mAP _{coco}	92 MB _{FP16} 4.4 ms _{V100} 47.7 mAP _{coco}	170 MB _{FP16} 6.9 ms _{V100} 50.8 mAP _{coco}

YOLOv5 has many model choices base on size, speed and average precision score of user preference

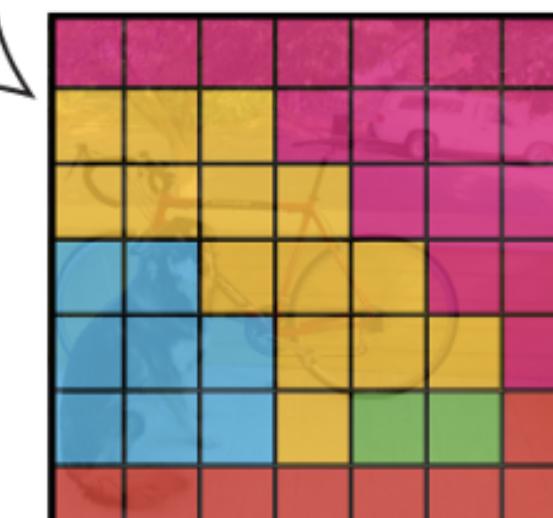
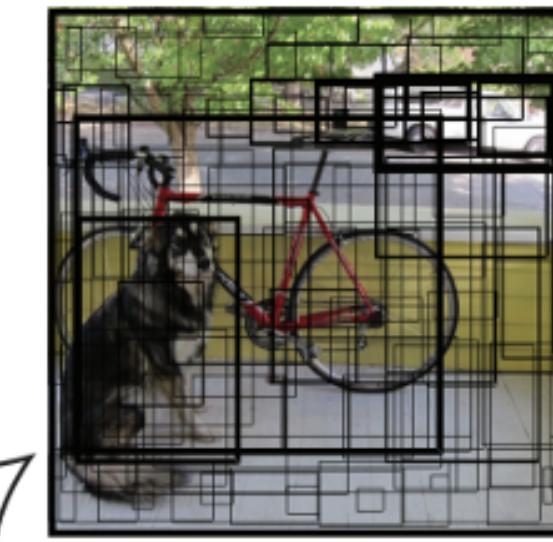
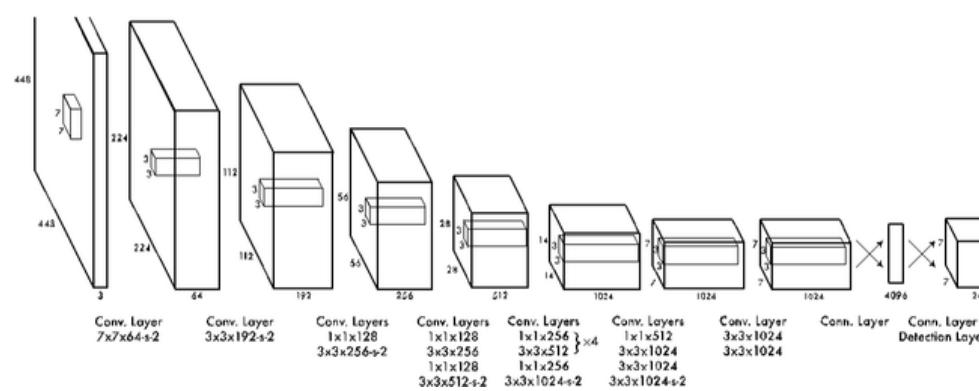
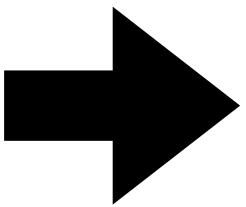
IMPLEMENTATION

```
# run
!python /content/yolov5/train.py --data /content/yolov5/custom.yaml --epoch 250 --weights yolov5s.pt --cache
```

Only few lines of code needed.

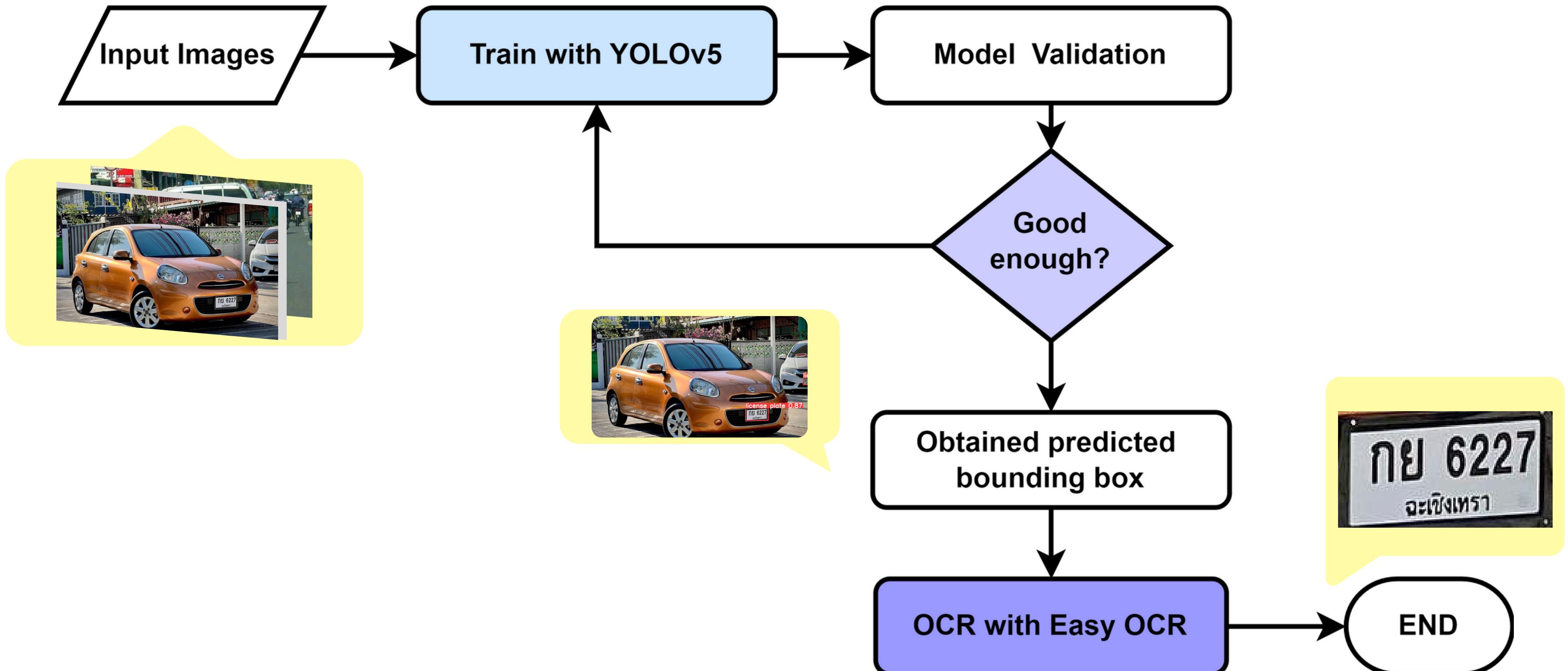
MODEL ARCHITECTURE

Single stage detection + Grid Base algorithm



Final detections

MODELLING PROCESS



MODEL SELECTION

IoU = 0.5

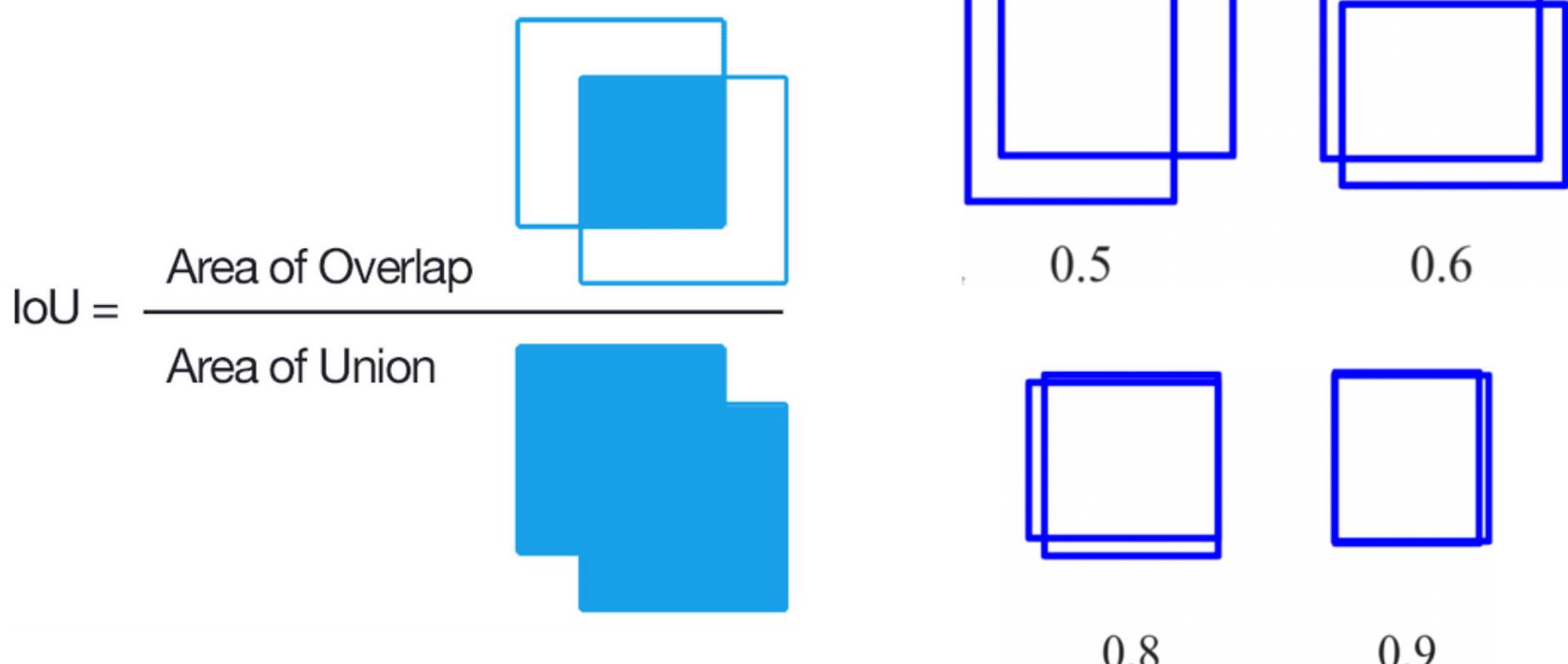


mAP (mean Average Precision)

based on these sub metrics:

- Confusion Matrix
- Intersection over Union (IoU)
- Recall
- Precision

IoU



MODEL SUMMARY

Model	Size (Mb)	mAP@0.5 (Test)	Speed (ms) (Test)
Default (Image size 640)	14.4	0.993	0.68
Image size 384	14.3	0.995	0.659
Image size 384 + Hyp. Tuning	14.3	0.993	0.668

Yolov5s model
Batch size = 16
Epochs = 250

MODEL SUMMARY

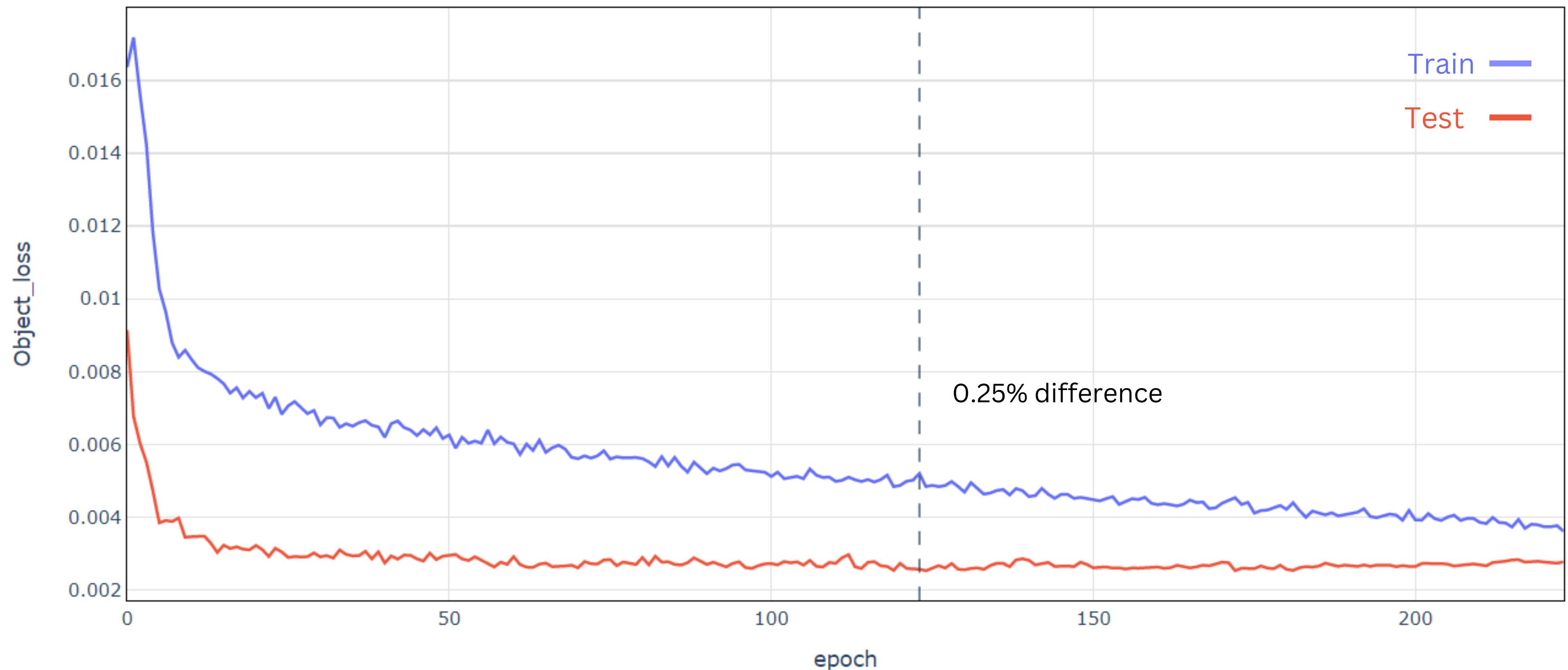
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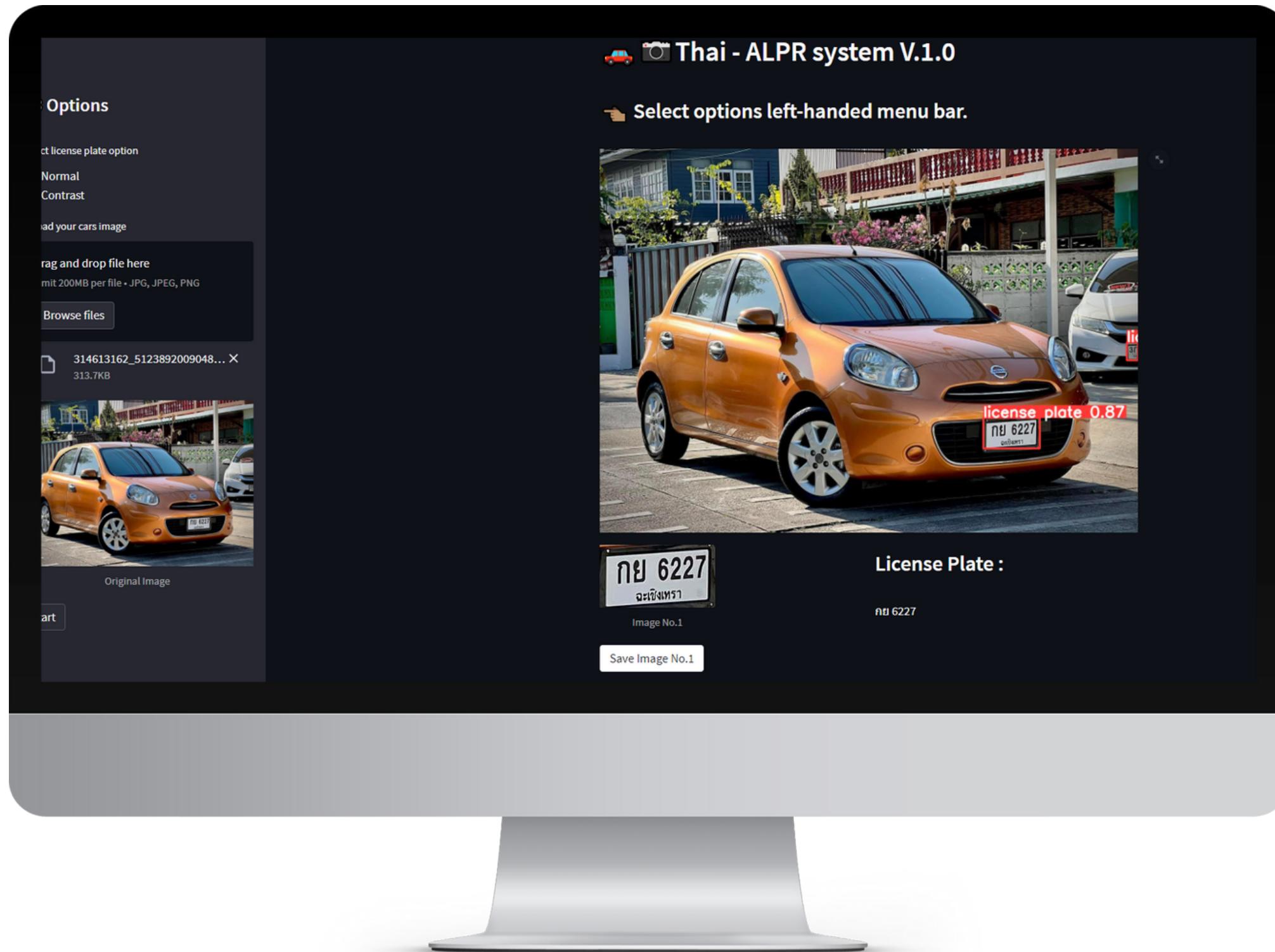
Evaluation Model

Train-Test Loss of best model

Object loss during training



APPLICATION PROTOTYPE



Thai License Plate Detectable

96% Precision testing on over 90 Thai License Plates



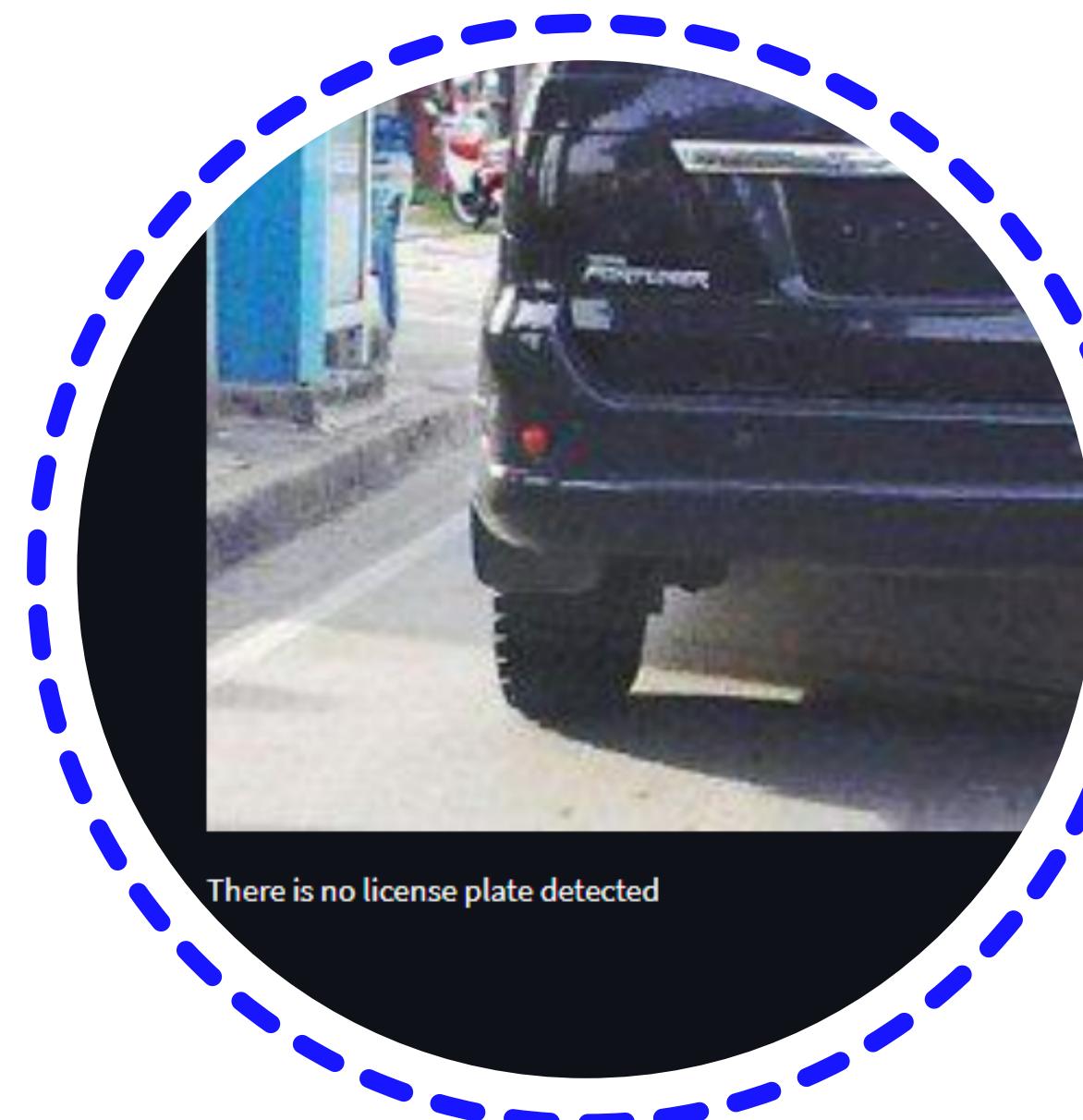
Able to extract Thai characters (V.1.0)



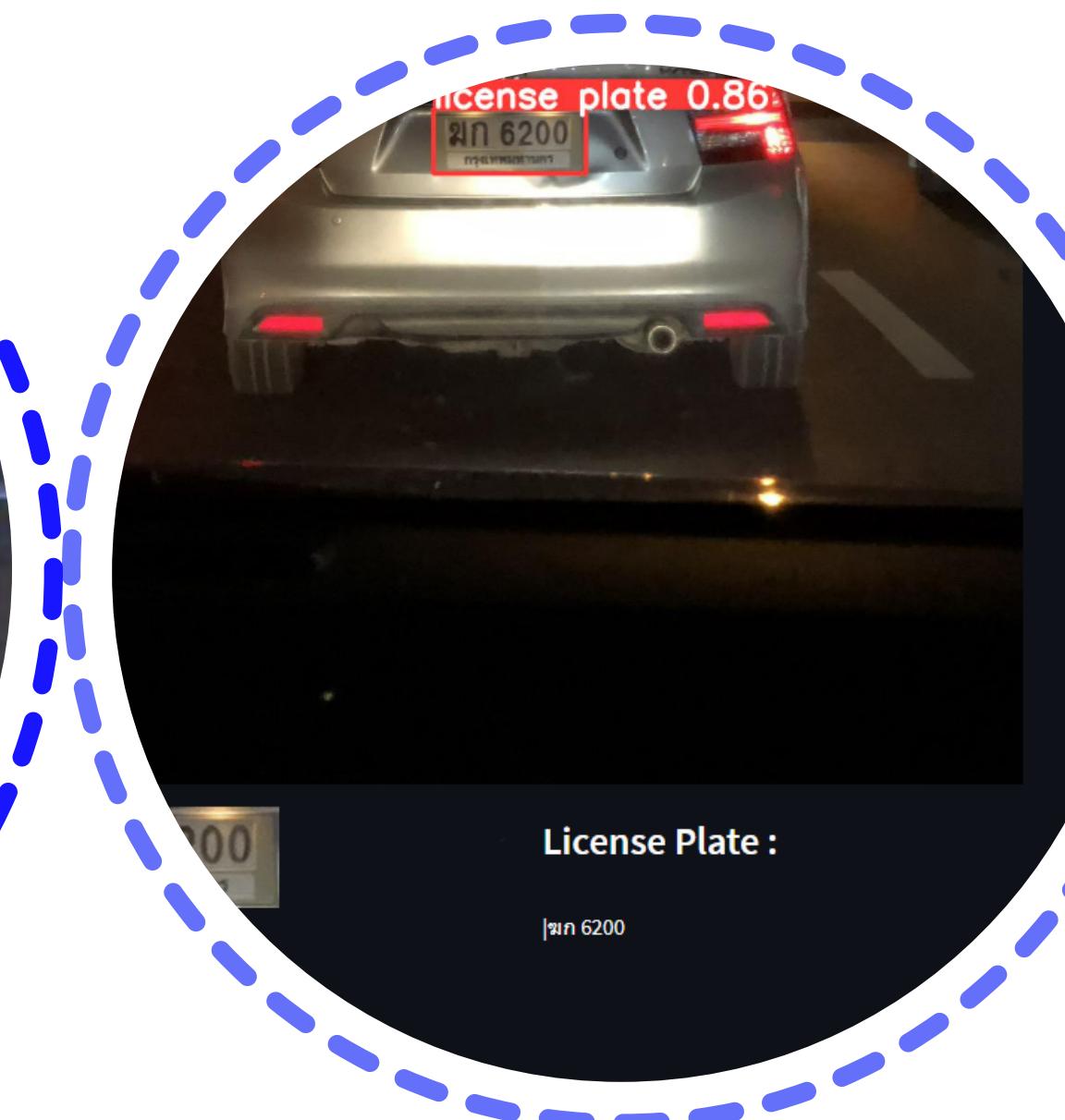
Color shade options

Normal / Contrast

APPLICATION USAGE



No license detectable



License Plate Readable



Multiple Licenses in one image

SUMMARY

- Model Selected
 - Yolov5s, epochs = 250, batch = 16, image size = 384 pixels
 - Parameters : 7.01 M, Speed (ms) = 0.5, Size = 14.3 Mb
- Detect license plates from **International** test set :
 - Precision = 0.988, Recall = 0.98
- Detect license plates from **Thai** test set :
 - Precision = 0.96, Recall = 0.90

RECOMMENDATION

- To maximize the efficiency of the system best to use high resolution images.
- For deployment into system, the car image capture should be at perpendicular angle for maximum efficiency.
- Areas of potential improvement:
 - Speed of the web app
 - Find Thai data set with various conditions to train the model
 - Improve the OCR (Optical Character Recognition) system

**THANK YOU
FOR YOUR ATTENTION**