Image Tagging and Road Object Detection

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Agenda

- Project Workflow
- Execution Details
- Metrics
- Sample Images and Videos
- Deployment
- Challenges
- Work Ahead

Operable dataset

100K
Clips

50K
Rides

720p
Resolution

30 FPS
High frame-rate

GPU/IMU
Trajectories

The Berkeley Deep Drive (BDD) dataset is one of the largest and most diverse video datasets for autonomous vehicles

New York, San Fran Bay Area, etc.

City streets, residential areas, highways

Diverse weather conditions

Different times of the day

Project Workflow

Data Exploration and YOLO	Object Detection	MOT (DeepSORT)	App Deployment (Streamlit)	++
BDD100K	100K Data	DeepSORT	Deployment	IDD Dataset
YOLO v5	Training	Training	Live URL	YOLO v8
Label formation	Validation	Testing		
10K Test set	Testing	Metrics		
Data Split	MLOPS + Metrics			

Execution

- **YOLO Label format**

  Custom code written in Python to convert labels to YOLO format.

  Offline - Run in laptop to create Train, Val and Test directory with labels as per YOLO requirements and the directory uploaded in Google drive

- **YOLO v5 Training**

  Google Colab Pro to train Yolo on 70K Training set, 10 K Val set and 20 K Test set

  - 200 Epochs

  Integrated to **ClearML** which stores relevant artifacts after training is complete and shows training status

Execution contd...

- **Deepsort integration with Yolo v5**

  Code written in Python to integrate YOLO v5 to Deepsort

- **Github**

  Added code to Github to facilitate Streamlit Cloud deployment

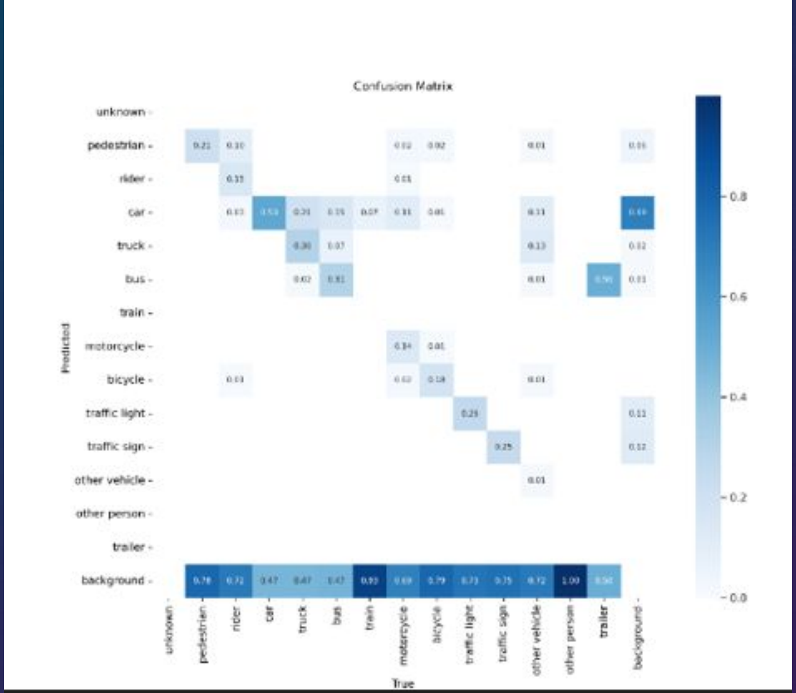
- **Streamlit Integration**

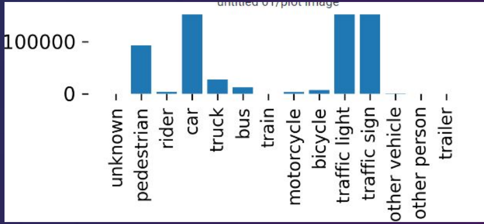
  Run in localhost

  Run in Streamlit Cloud

- **Project Report and Presentation**

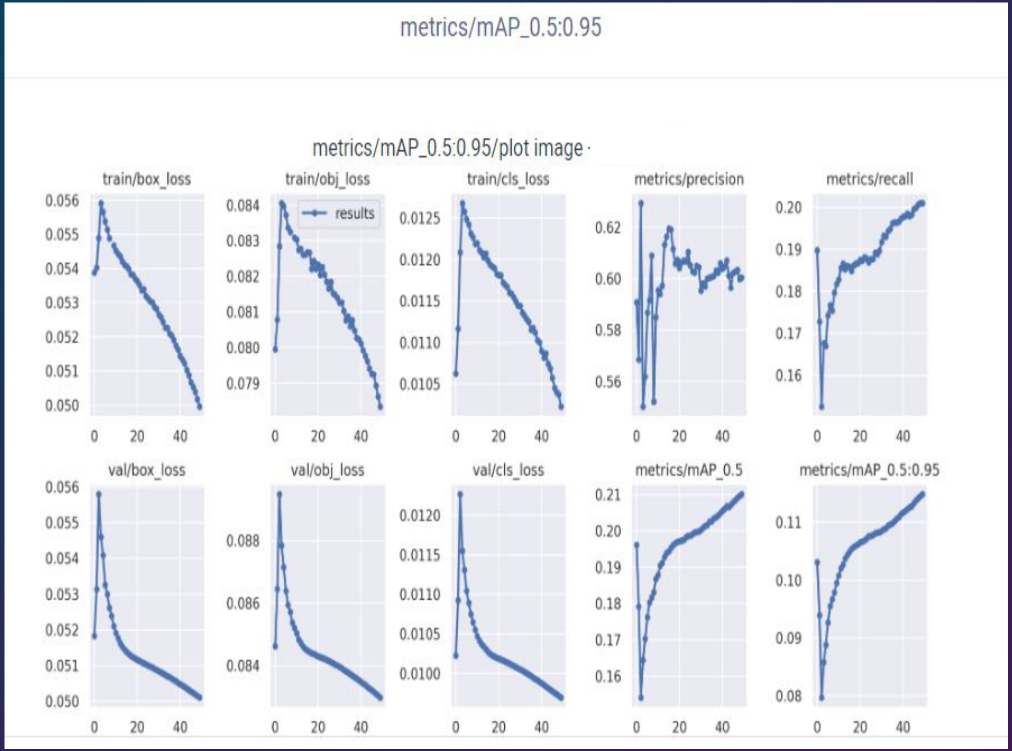
Object Detection - Metrics





- Cars are predicted well but there are certain instances where other vehicles are predicted as cars
- Bus is predicted as bus.
- Motorcycles, traffic lights and signs are correctly predicted, when predicted

Object Detection - Metrics



- Precision is about 0.60
- Recall is about 0.20

Tracking Metrics

SORT

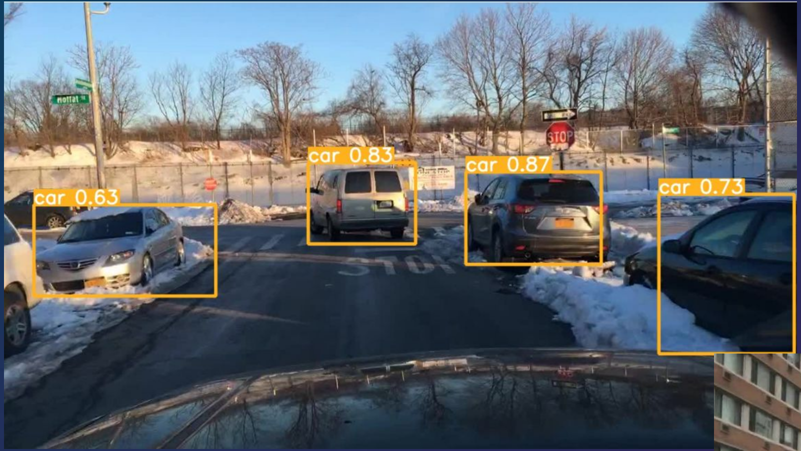
```
Notebook

Evaluating 1 tracker(s) on 1 sequence(s) for 8 class(es) on BDD100K dataset using the following

Evaluating qdtrack

1 eval_sequence(0000f77c-6257be58, qdtrack)                    0.5079 sec

All sequences for qdtrack finished in 0.51 seconds

HOTA: qdtrack-cls_comb_cls_av    HOTA     DetA     AssA     DetRe    DetPr    AssRe    A
COMBINED                         1.1888   1.0197   1.4673   1.2369   3.2848   4.1644   1

CLEAR: qdtrack-cls_comb_cls_av   MOTA     MOTP     MODA     CLR_Re   CLR_Pr   MTR      P
COMBINED                         -65.209  8.4561   -65.187  1.0102   2.6828   0        0

Identity: qdtrack-cls_comb_cls_av IDF1    IDR      IDP      IDTP     IDFN     IDFP
COMBINED                         0.93548  0.64387  1.7099   58       1068     371

Count: qdtrack-cls_comb_cls_av   Dets     GT_Dets  IDs      GT_IDs
COMBINED                         429      1126     12       47
```

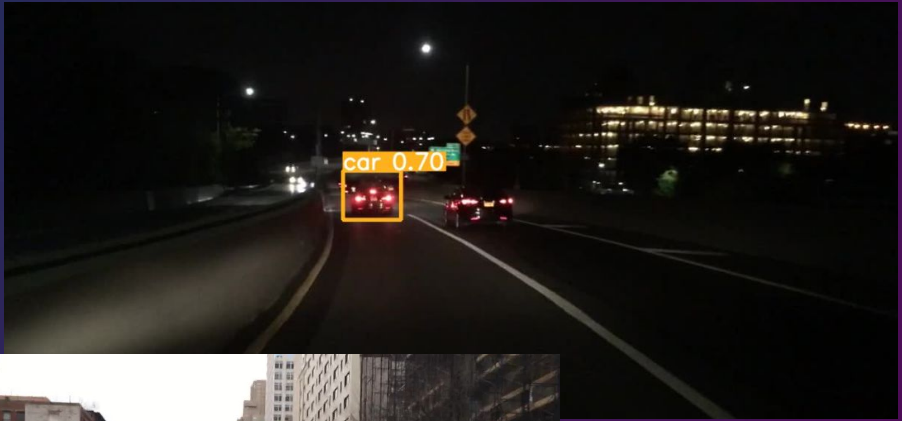
- MOTP - 0(Good) - 1(Poor)
- MOTA - -inf(Poor) - 1(Good)

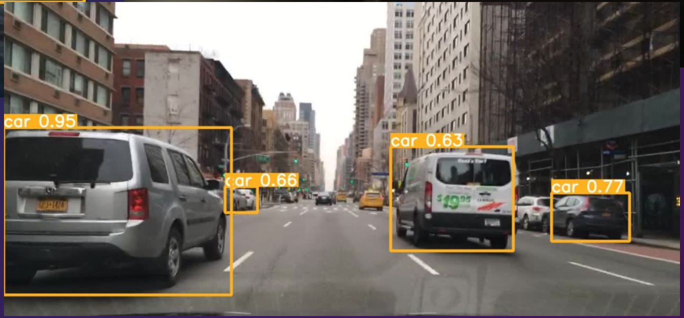
DEEPSORT

```
Notebook

Evaluating qdtrack

1 eval_sequence(0000f77c-6257be58, qdtrack)                    0.4664 sec

All sequences for qdtrack finished in 0.47 seconds

HOTA: qdtrack-cls_comb_cls_av     HOTA     DetA     AssA     DetRe    DetPr    AssRe
COMBINED                          1.1288   0.97768  1.3959   1.1909   3.093    4.0158

CLEAR: qdtrack-cls_comb_cls_av    MOTA     MOTP     MODA     CLR_Re   CLR_Pr   MTR
COMBINED                          -3.1417  8.3876   -3.1194  0.8467   2.1991   0

Identity: qdtrack-cls_comb_cls_av IDF1     IDR      IDP      IDTP     IDFN     IDFP
COMBINED                          0.74003  0.51248  1.331    46       1076     386

Count: qdtrack-cls_comb_cls_av    Dets     GT_Dets  IDs      GT_IDs
COMBINED                          432      1122     5        47
```

Object Detection Samples







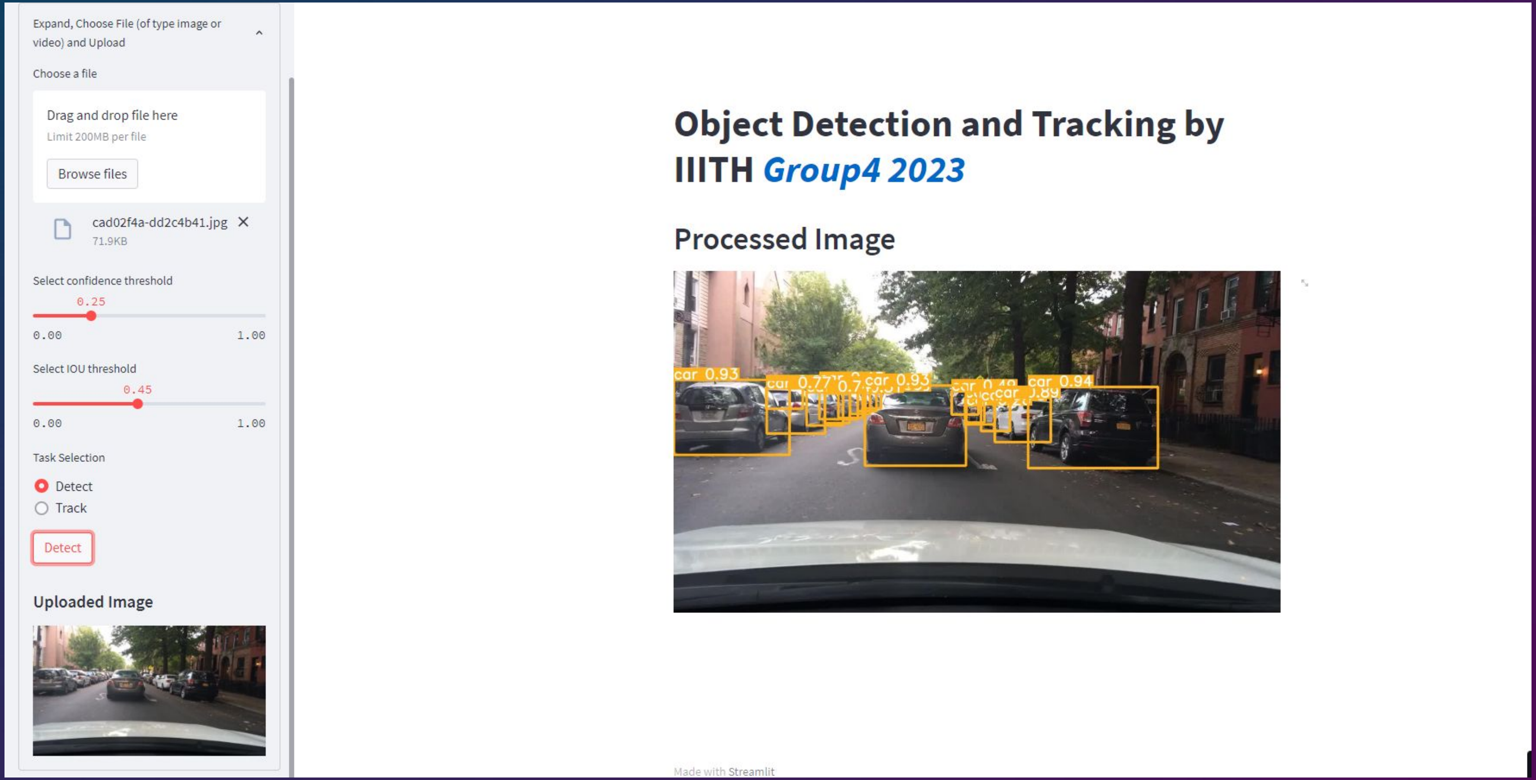
Object Tracking Samples

- For comparison

Tracking on Coco Model

Tracking on our Yolov5 Model

App Deployment



Challenges

- Storing model file for download. Github LFS has limitation in free tier. Used OneDrive Personal with downloadable link
- Codec issue while running app in Streamlit. Used ffmpeg to convert video from avi to mp4 so that streamlit HTML5 player can play the video. ‘avi’ video is created from frames as the codec is pre installed in Streamlit Cloud.
- Training of Yolo v5 model was slow. 50 Iterations in about 9 hours. The problem is still not solved
- Creating video detections in Streamlit Cloud is slower than some teams. The problem is still not solved.

Work Ahead

- Train the model another 100 Epochs with a slower learning rate and test. Better model metrics
- IDD
- Yolo v8
- Deploy in Azure Cloud or AWS

Thank you