PS - II FINAL PRESENTATION

By:

Devyash Parihar ID No: 2016A7PS0066P

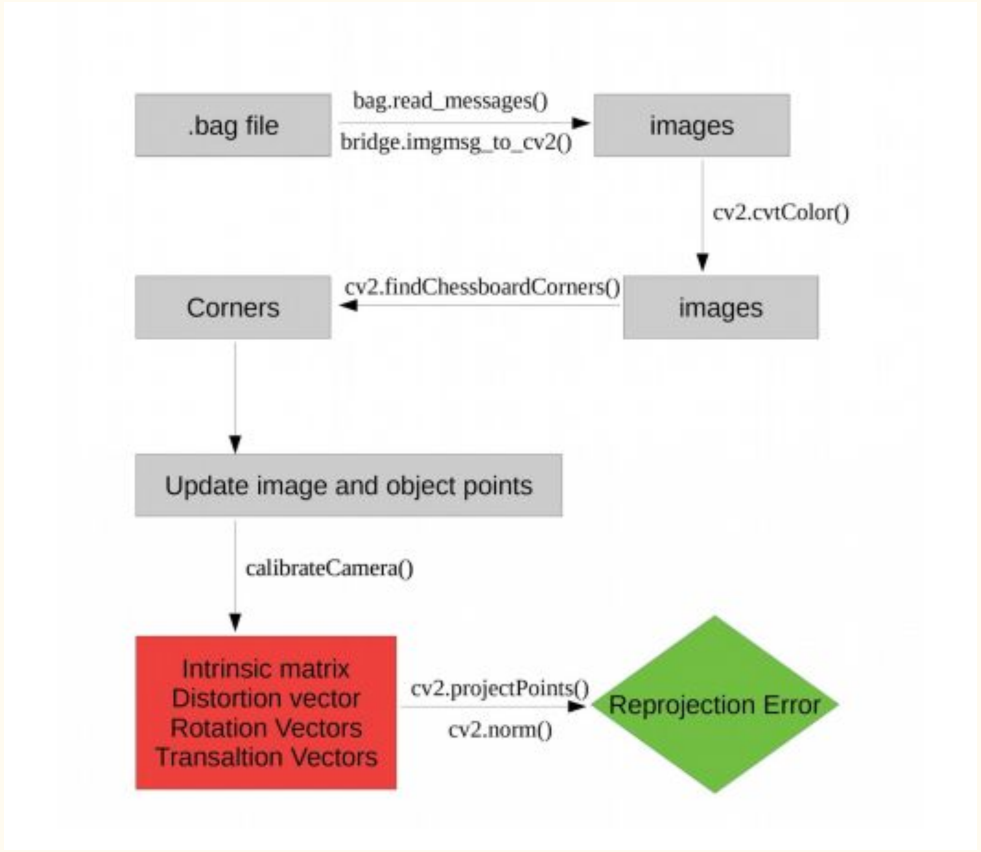
PS-II station: MapmyIndia, Bengaluru

Problem Definition/Objective

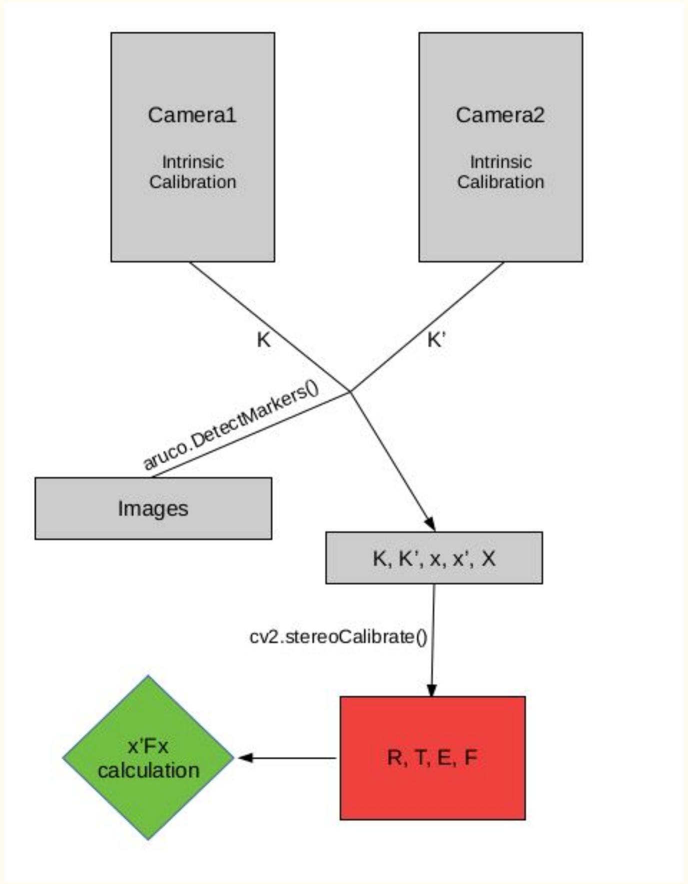
1. To get the intrinsic and extrinsic parameters of camera using techniques of computer vision and geometry.
2. To find an architecture for detection and segmentation of road objects(as mentioned in the AOD sheet) and train it on Apolloscape Lane Segmentation dataset.

PART-1

Methodology - Intrinsic



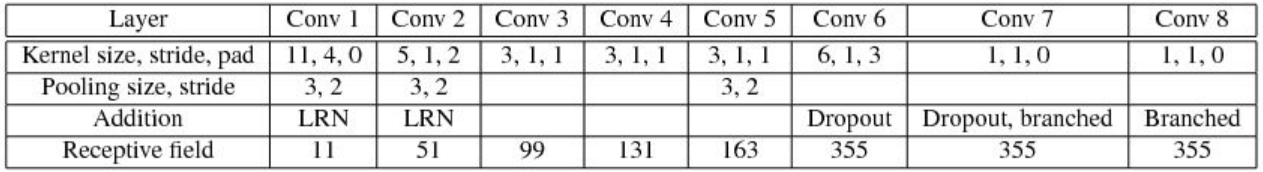
Methodology - Extrinsic



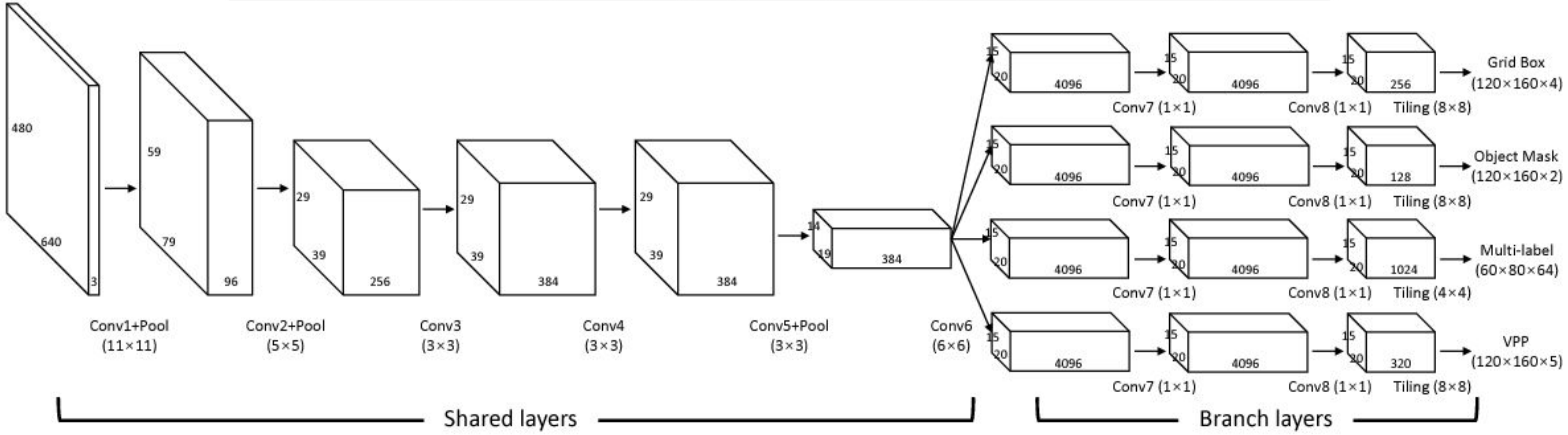
PART-2

Architecture 1 - VPGNet (Vanishing Point Guided Network for Lane and Road Marking Detection and Recognition)

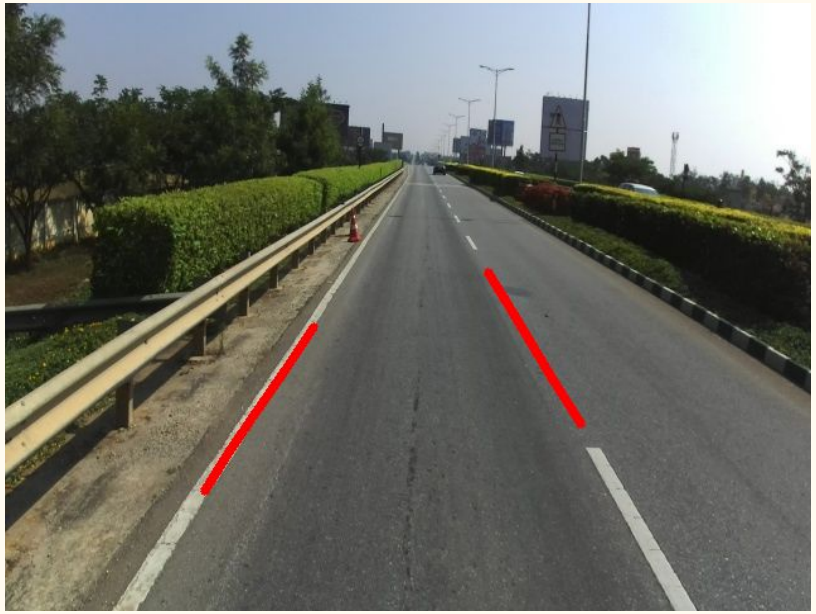
Table 3. Proposed network structure.

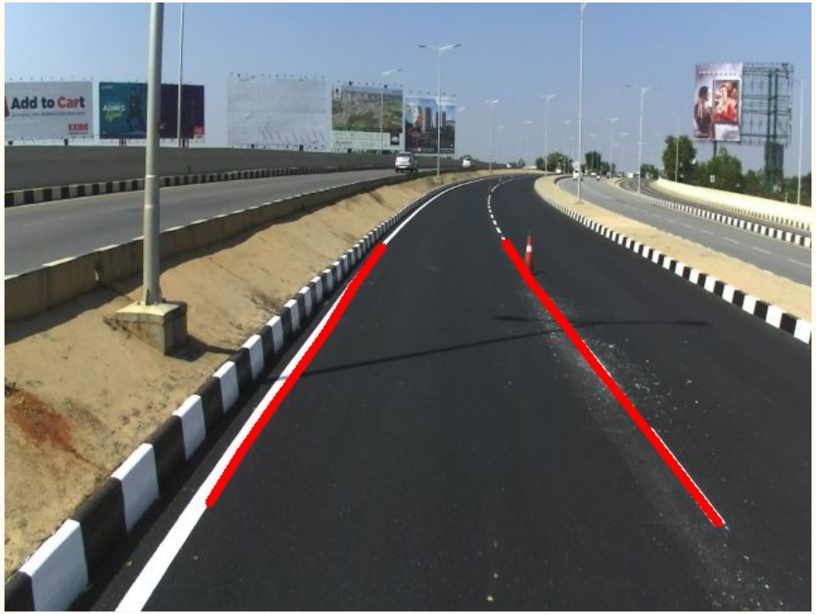


Layer	Conv 1	Conv 2	Conv 3	Conv 4	Conv 5	Conv 6	Conv 7	Conv 8
Kernel size, stride, pad	11, 4, 0	5, 1, 2	3, 1, 1	3, 1, 1	3, 1, 1	6, 1, 3	1, 1, 0	1, 1, 0
Pooling size, stride	3, 2	3, 2			3, 2			
Addition	LRN	LRN				Dropout	Dropout, branched	Branched
Receptive field	11	51	99	131	163	355	355	355

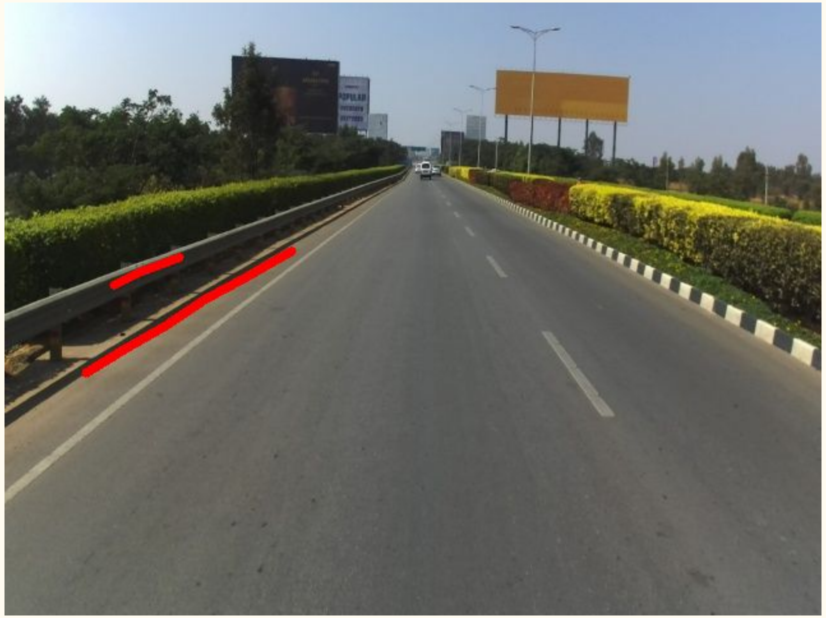


Results





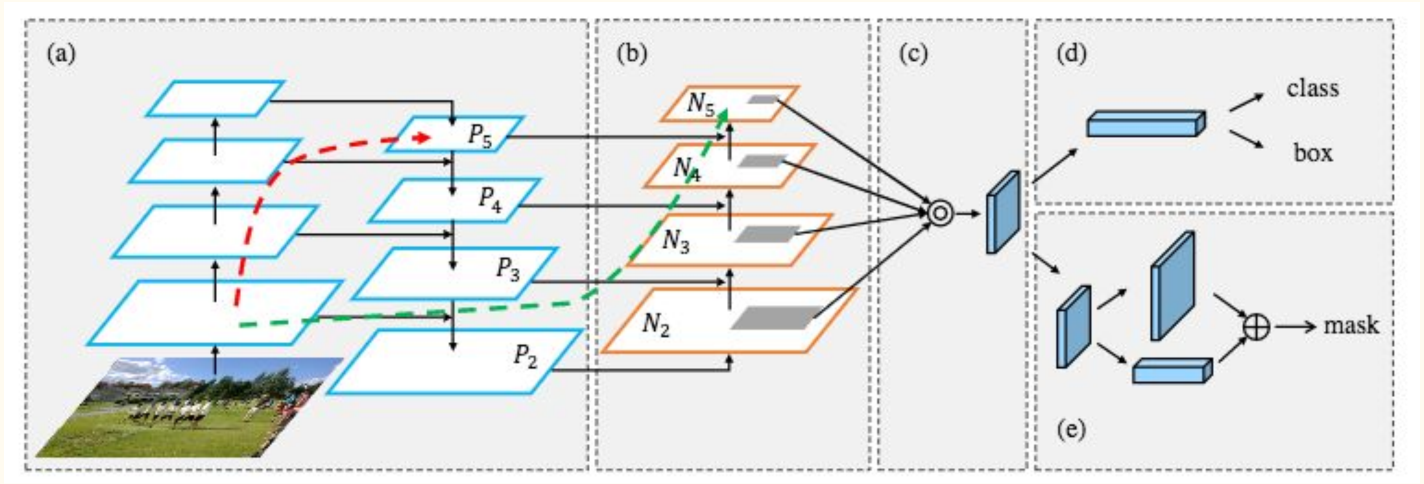
Results



Conclusion

- One of the key points of VPGNet was its dataset that contained annotations for several road markings but due to some reasons it hasn’t been published yet.
- Training on Caltech Lanes Dataset didn’t give satisfying results.
- A better architecture was needed.
- ApolloScape Lane Segmentation dataset and MAZE dataset had to be used for training.

Architecture 2 - PANet(Path Aggregation Network for Instance Segmentation)

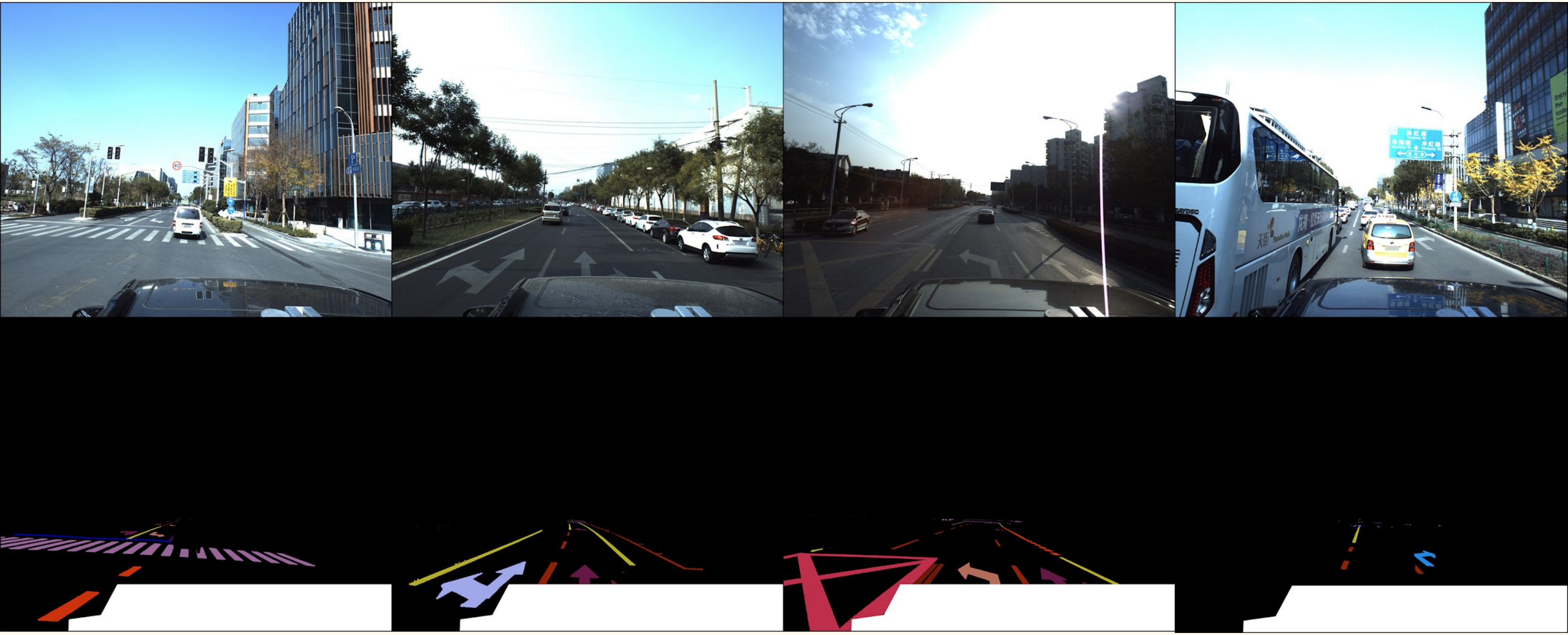


(a) Feature extractor using the FPN architecture (b) the new augmented bottom-up pathway added to the FPN
(c) the adaptive feature pooling layer (d) bounding box and class prediction
(e) the branch predicting the binary mask of the object.

(a). ApolloScape Lane Segmentation Dataset

- The lane mark detection challenge of ApolloScape aims to assign a semantic label to every image pixel to accurately localize the lane marks in traffic scenes.
- Its ultimate goal is to provide a comprehensive understanding of the semantics and functionalities of the lane marks in the context of autonomous driving.
- ApolloScape includes 35 common lane mark classes in everyday traffic scenes. Each class is uniquely defined by its type, color and use attributes jointly.

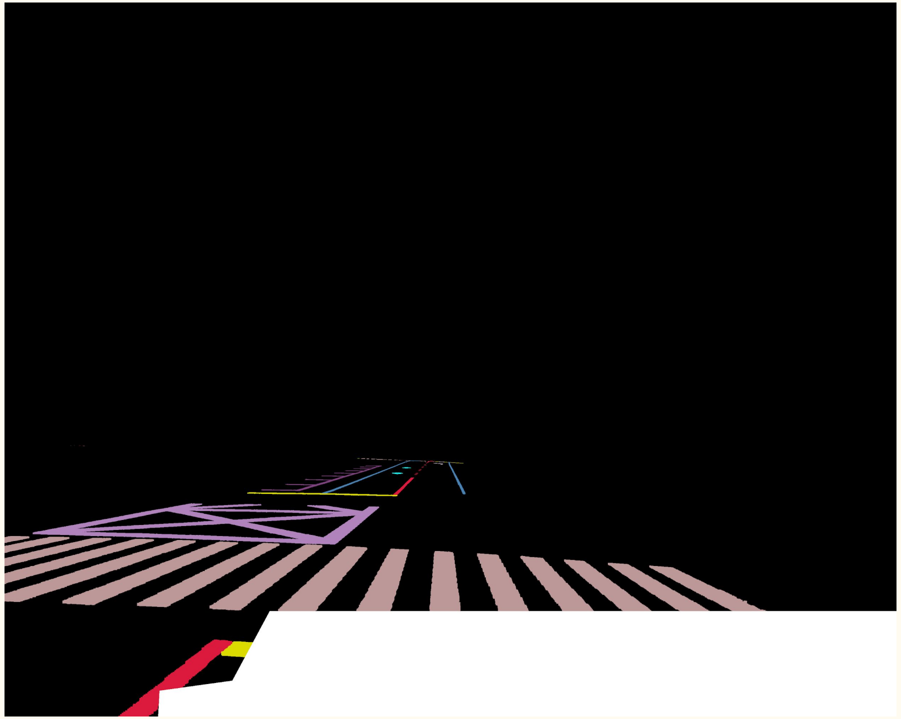
ApolloScape Lane Segmentation official pdf



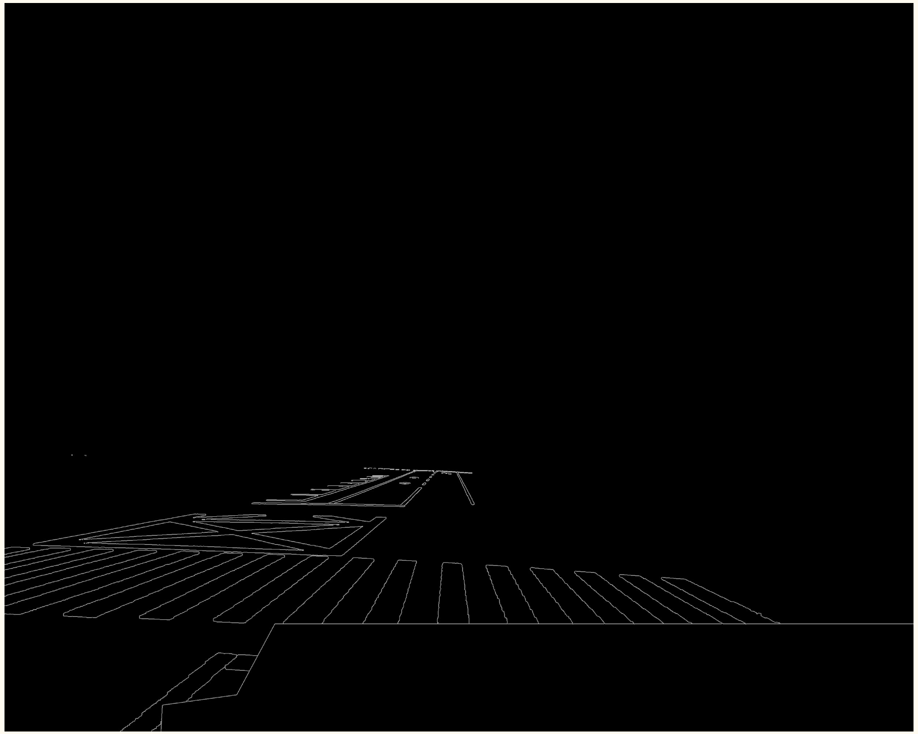
Sample annotated images

Extracting polygons from ApolloScape Lane Segmentation Dataset

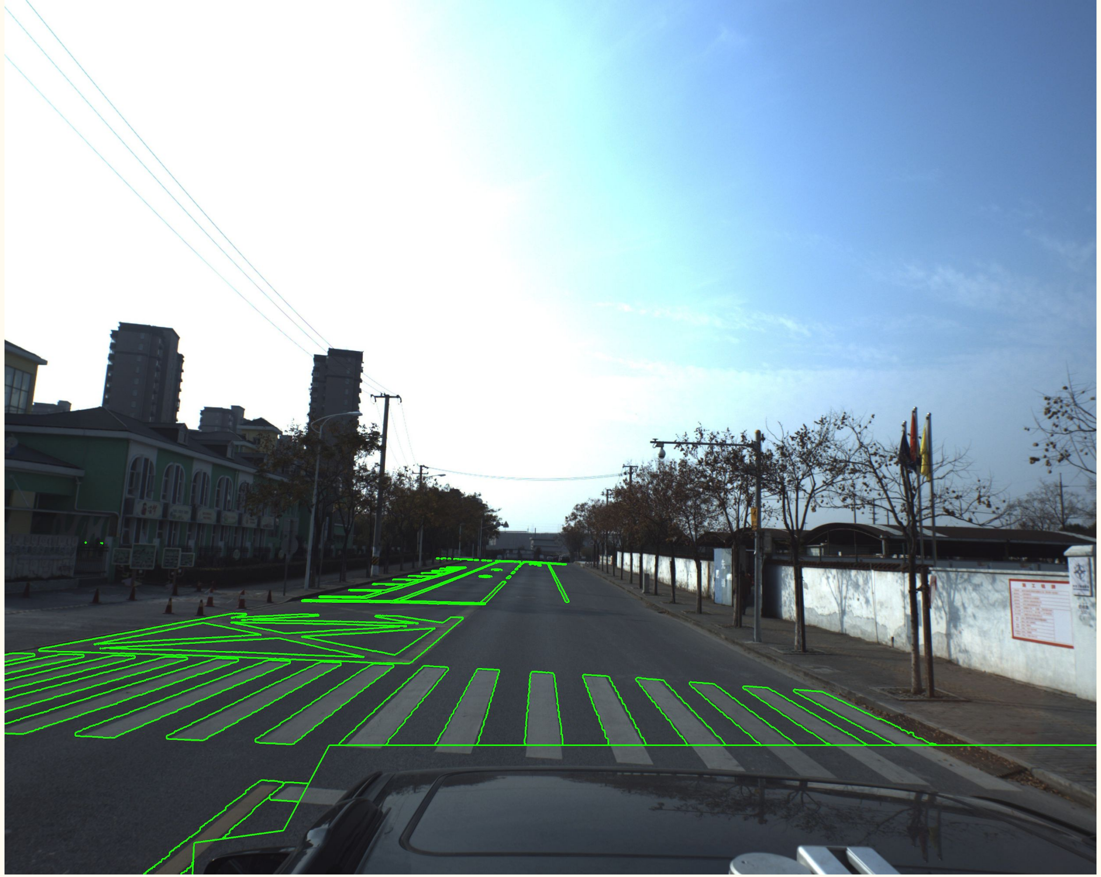
1. Convert masked image to gray.
2. Perform edge detection using Canny Edge Detection.
3. Find contours using findContour() function in opencv.
4. Filter the contours on the basis of the color that the contour has at its centroid in the masked image.



1. Masked image



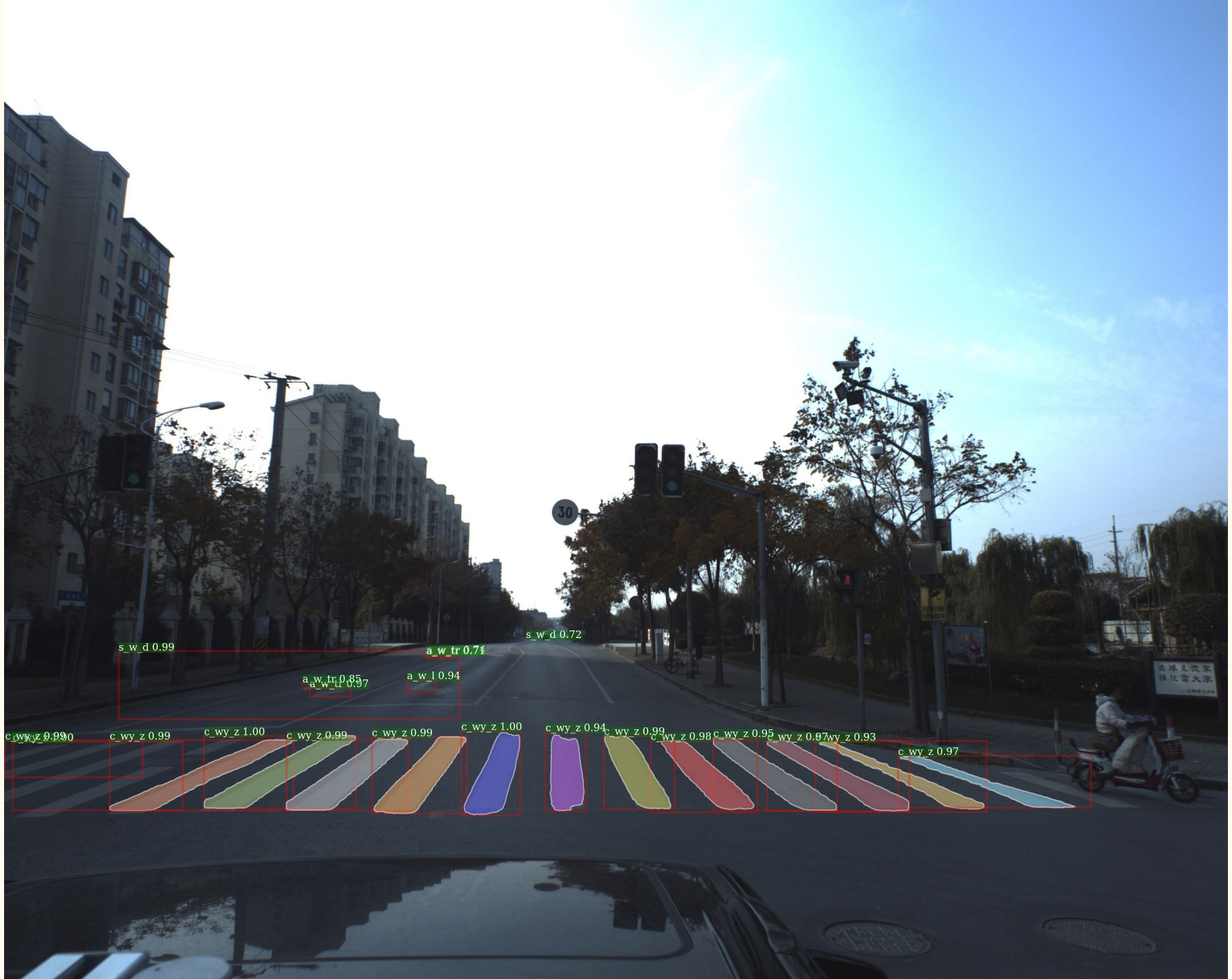
2. Edge Detection

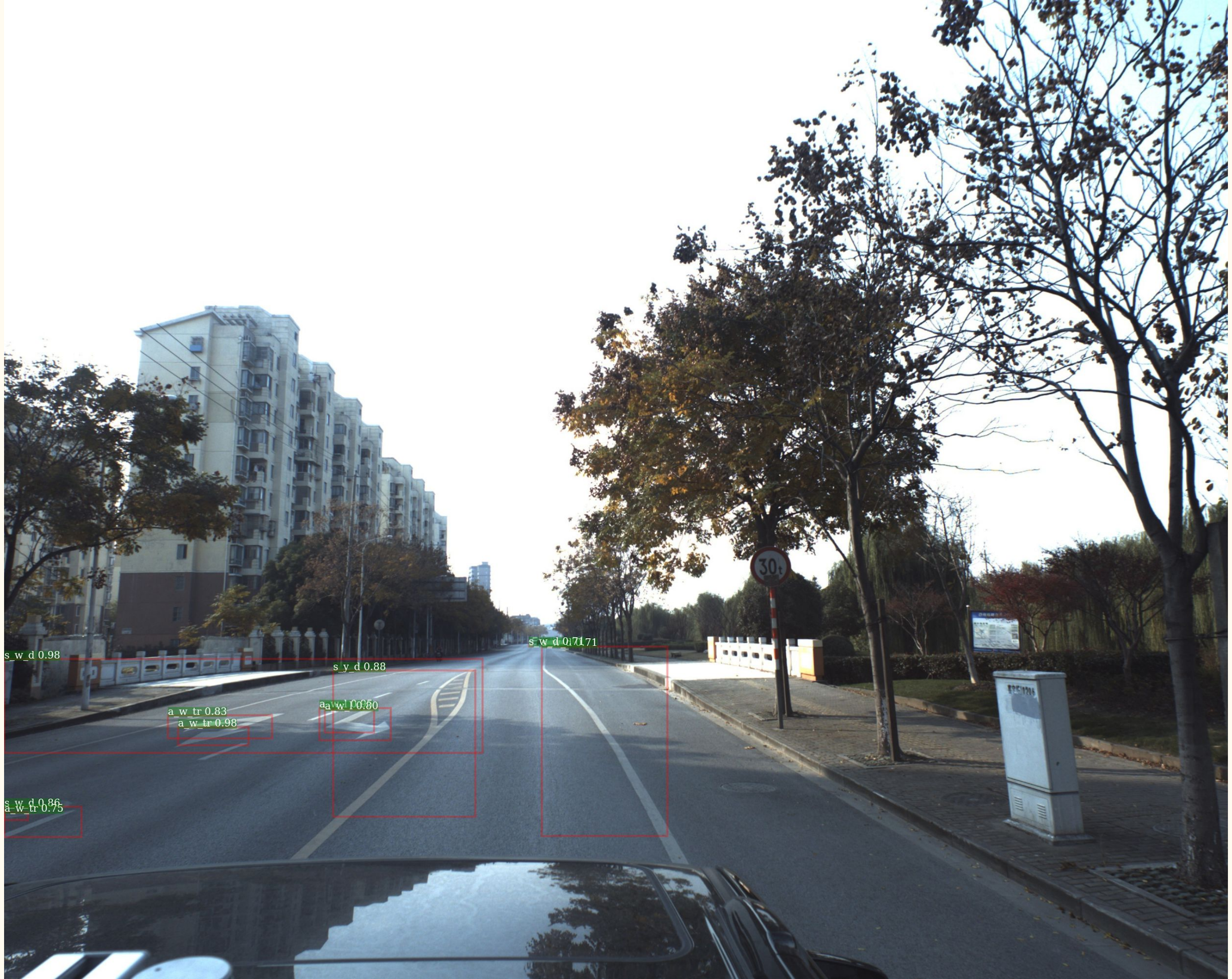


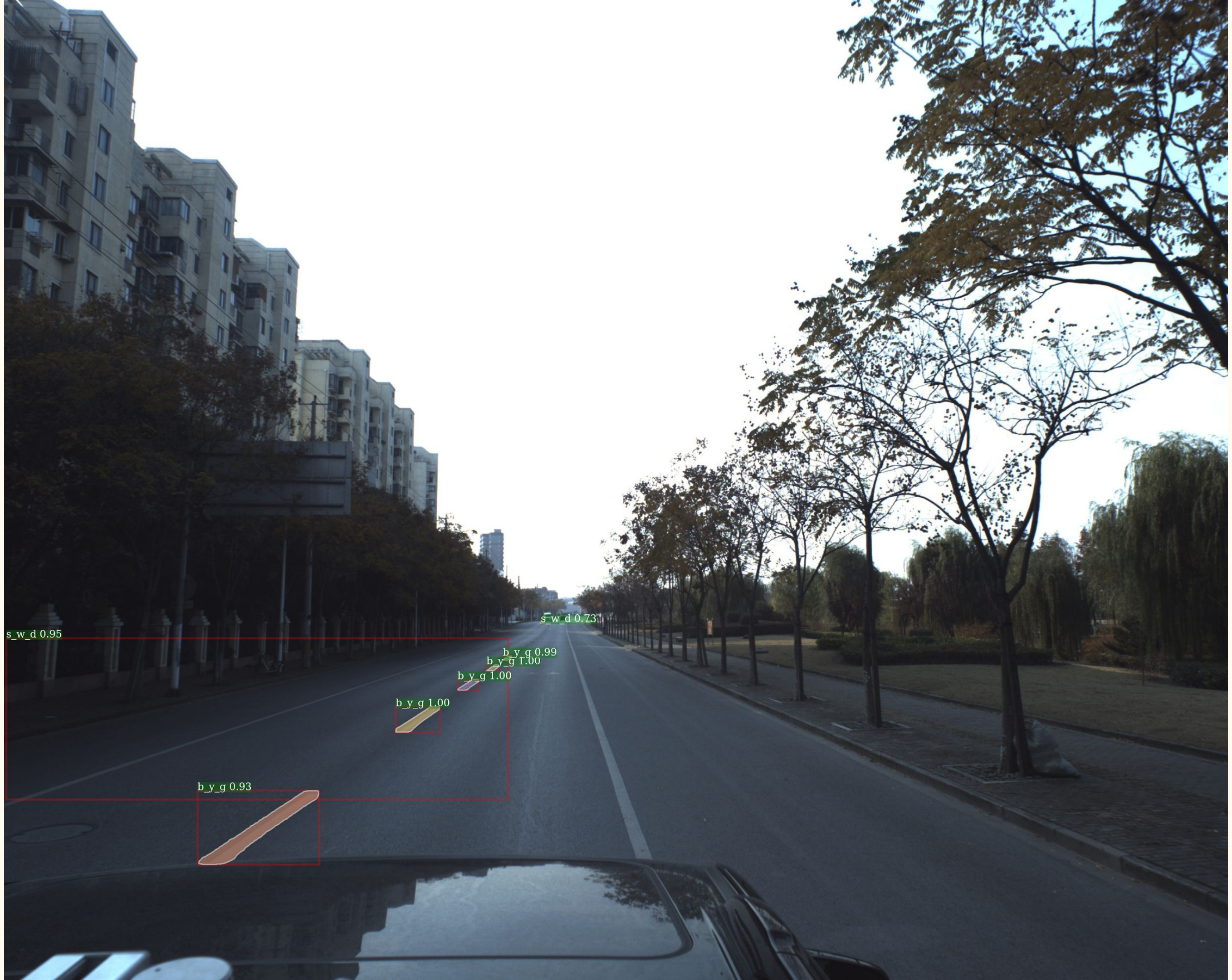
3. Overlaying contours onto the original colored image(just for visualization)

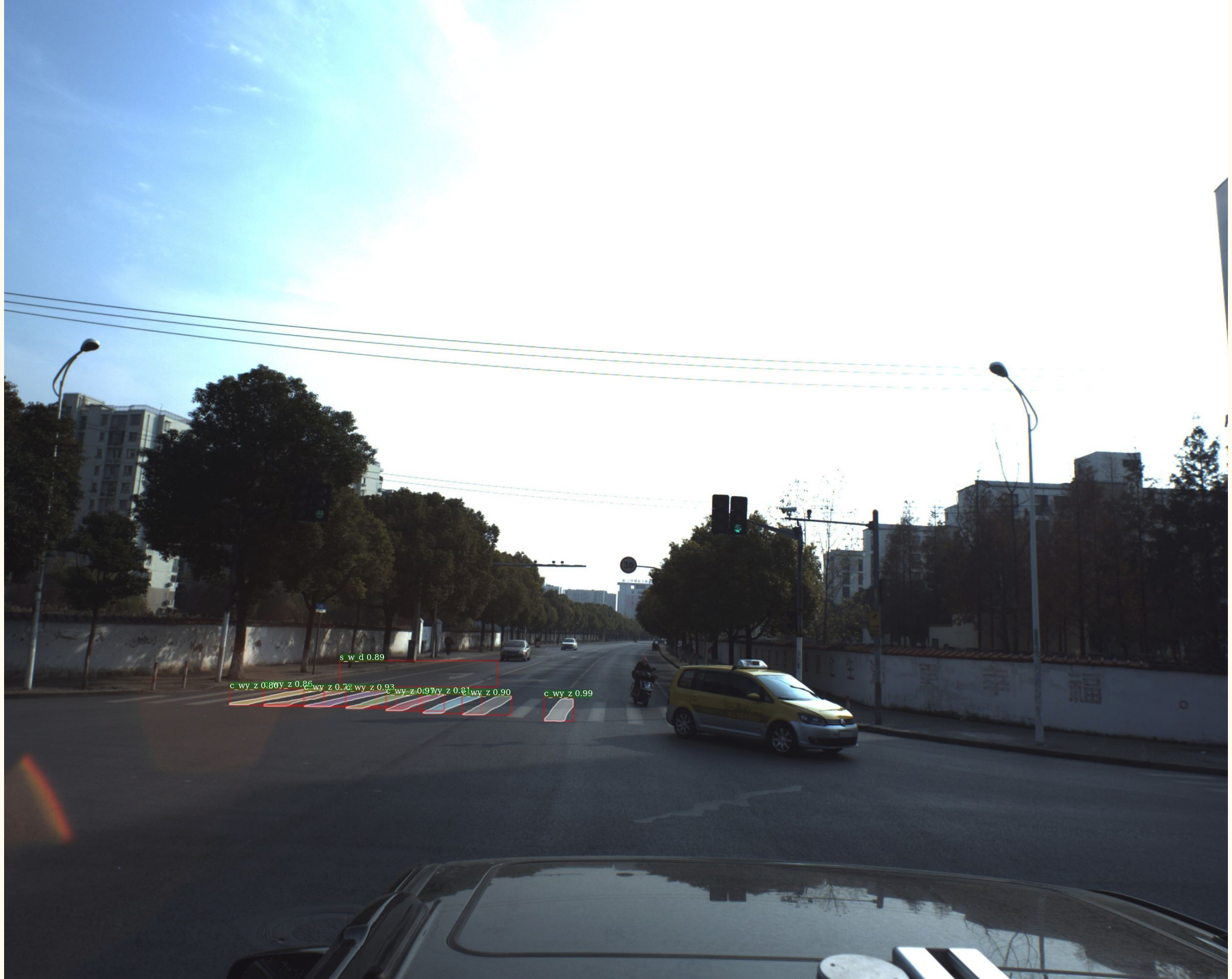
- Training details
    - 1,058 images
    - 55,798 annotations
    - Batch size = 1
    - 96,233 iterations
    - Epochs ~ 90

Results


30
s_w_d 0.99
s_w_d 0.72
a_w_tr 0.71
a_w_tr 0.85
a_w_u 0.97
a_w_l 0.94
c_wy_z 0.99
c_wy_z 1.00
c_wy_z 0.99
c_wy_z 1.00
c_wy_z 0.99
c_wy_z 0.99
c_wy_z 1.00
c_wy_z 0.94
c_wy_z 0.99
c_wy_z 0.98
c_wy_z 0.95
c_wy_z 0.97
c_wy_z 0.93
c_wy_z 0.97


s_w_d 0.98
s_w_d 0.71
s_y_d 0.88
a_w_tr 0.83
a_w_tr 0.98
a_w_l 0.80
s_w_d 0.86
a_w_tr 0.75
30t


s_w_d 0.95
s_w_d 0.73
b_y_g 0.99
b_y_g 1.00
b_y_g 1.00
b_y_g 1.00
b_y_g 0.93


s_w_d 0.89
c_wy_z 0.80
y_z 0.86
c_wy_z 0.7
c_wy_z 0.93
c_wy_z 0.97
wy_z 0.81
c_wy_z 0.90
c_wy_z 0.99

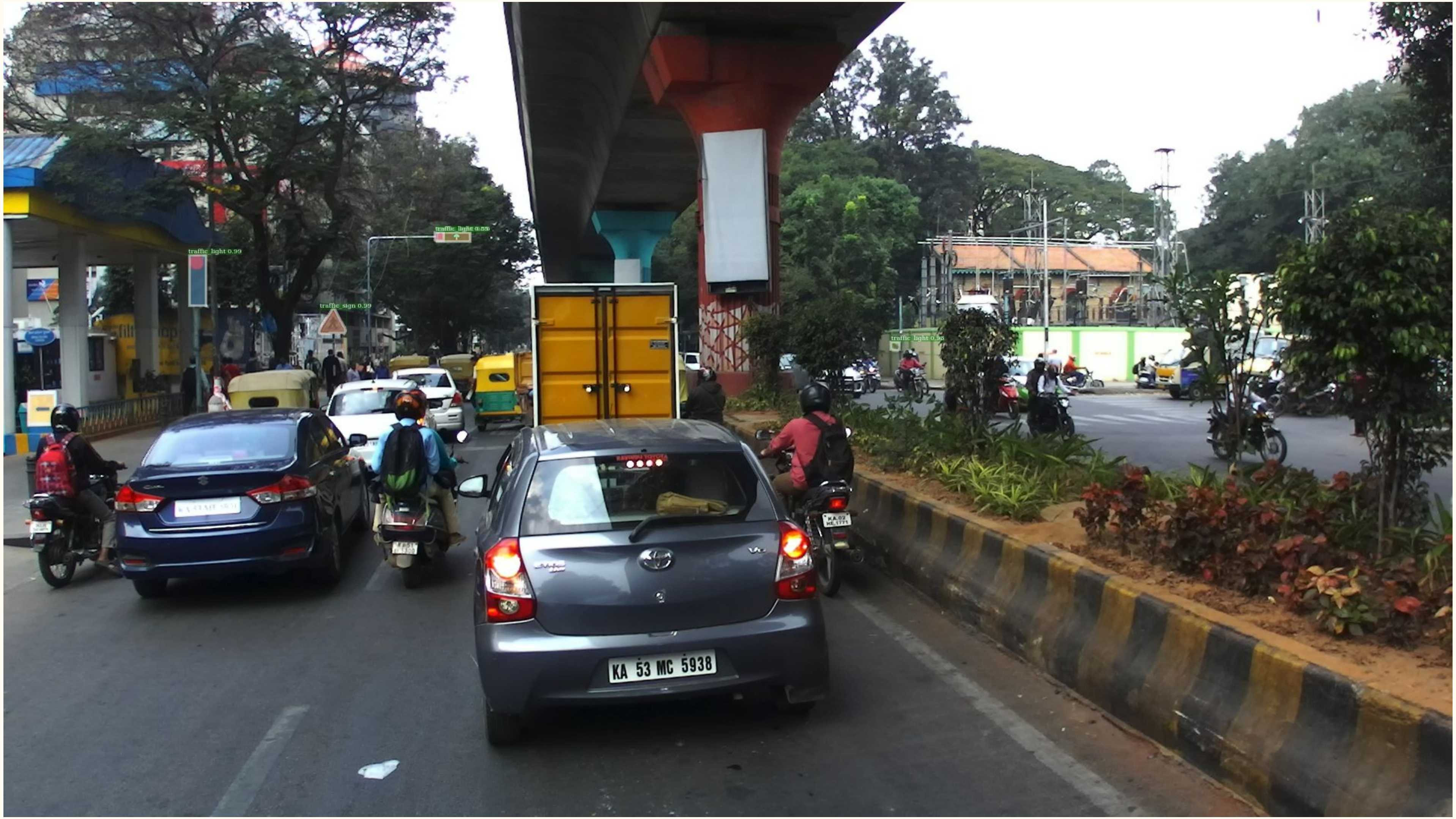
Conclusion

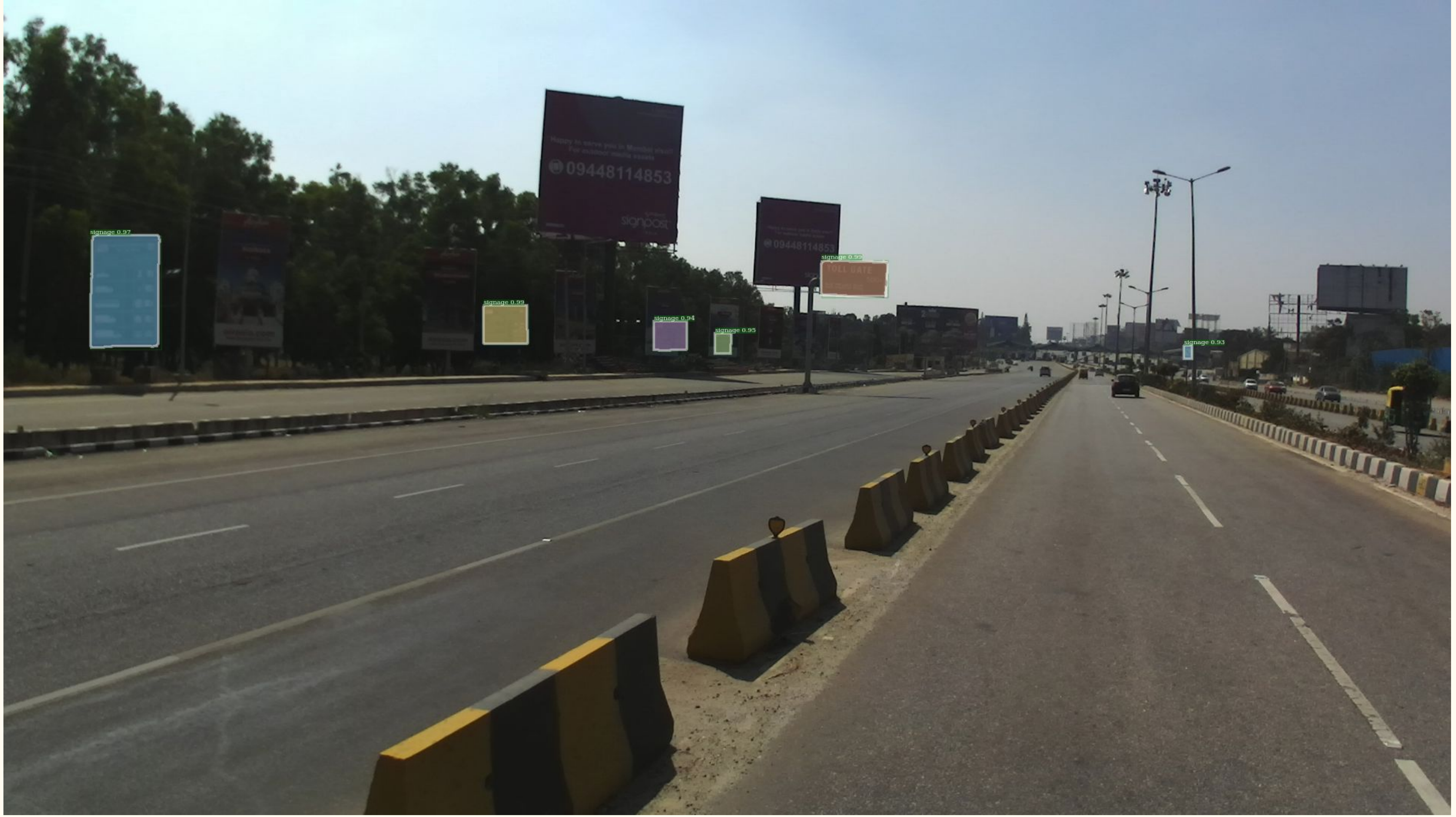
- Detection of sleeping road objects like road boundaries, etc. does not make sense as the orientation of predicted bbox doesn't align with that of the original object.
- Finding contours and then filtering on the basis of the color of the centroid causes some of the masks missing as centroid might lie outside of the polygon in some cases.
- mAP couldn't be produced as there are no annotations present to compare my predictions with.

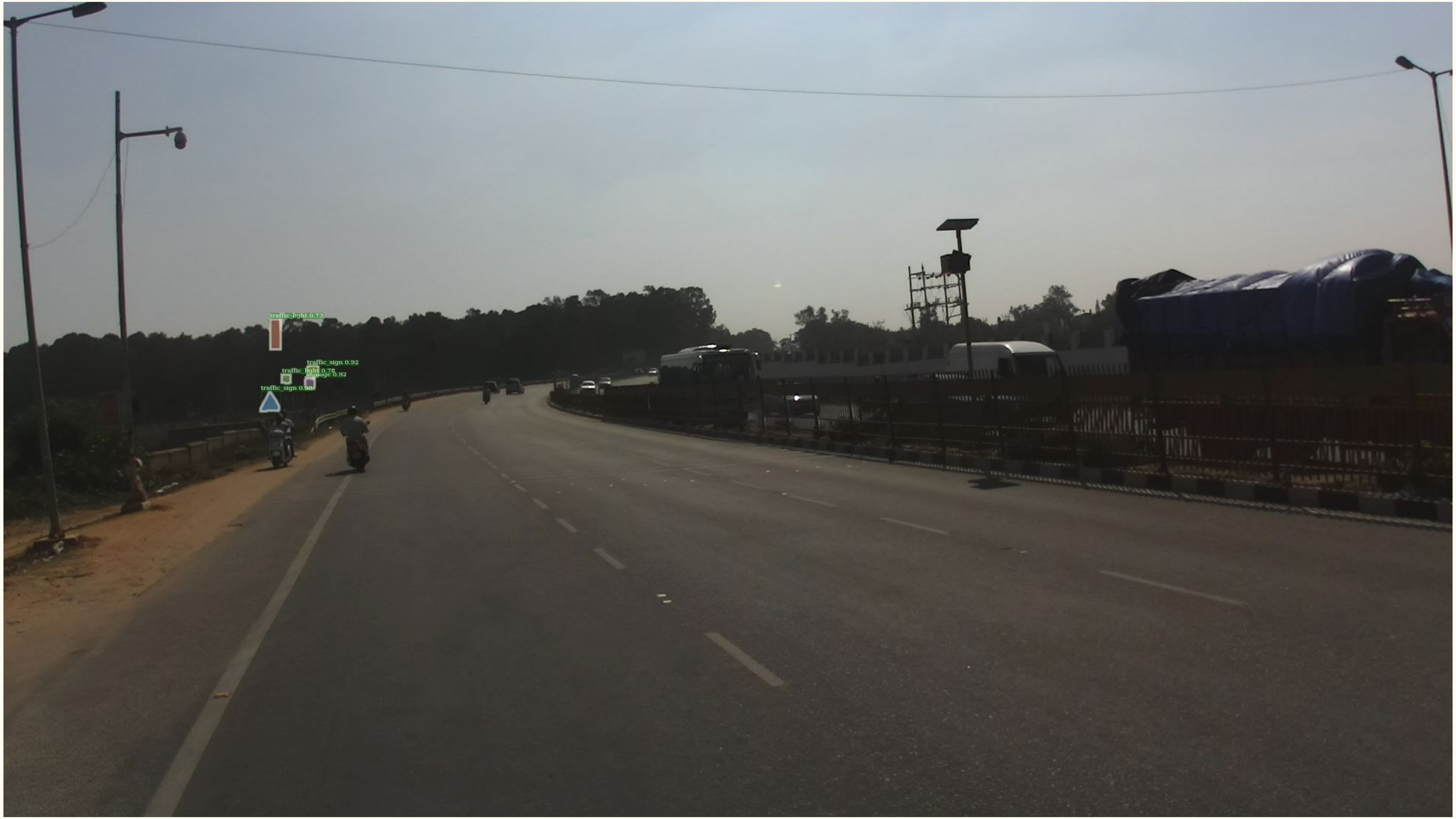
(b). MAZE dataset

- 3 labels are used for training
  - Traffic_sign
  - Traffic_light
  - Signage
- Training details
  - 9,546 images
  - 30,154 annotations
    - Traffic_sign : 10245
    - Traffic_light : 8552
    - Signage : 11357
  - Batch size = 1

Results


traffic light 0.56
traffic light 0.99
traffic sign 0.99
traffic light 0.98
KA 53 MC 5938


signage 0.97
09448114853
signpost
signage 0.99
signage 0.94
signage 0.95
09448114853
signage 0.99
TOLL GATE
signage 0.93


traffic_light 0.73
traffic_sign 0.92
traffic_light 0.78
signage 0.92
traffic_sign 0.98

Tasks for coming week:

- Calculate mAP (both for box and mask separately)
- See if dataset conversion script for Apolloscape Lane Seg to COCO can be improved.
- Update the GitHub repository.

THANK YOU!