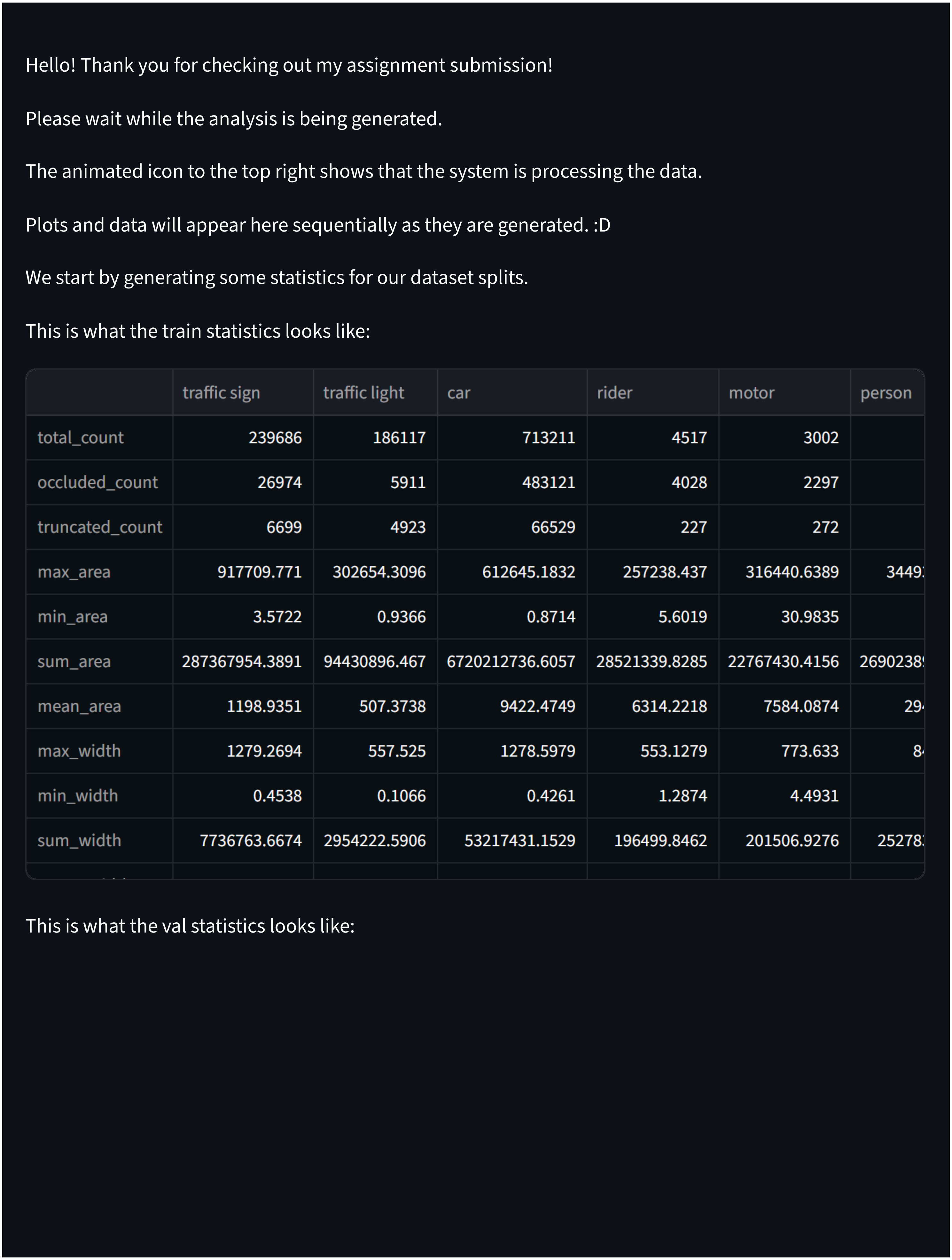


Hello! Thank you for checking out my assignment submission!

Please wait while the analysis is being generated.

The animated icon to the top right shows that the system is processing the data.

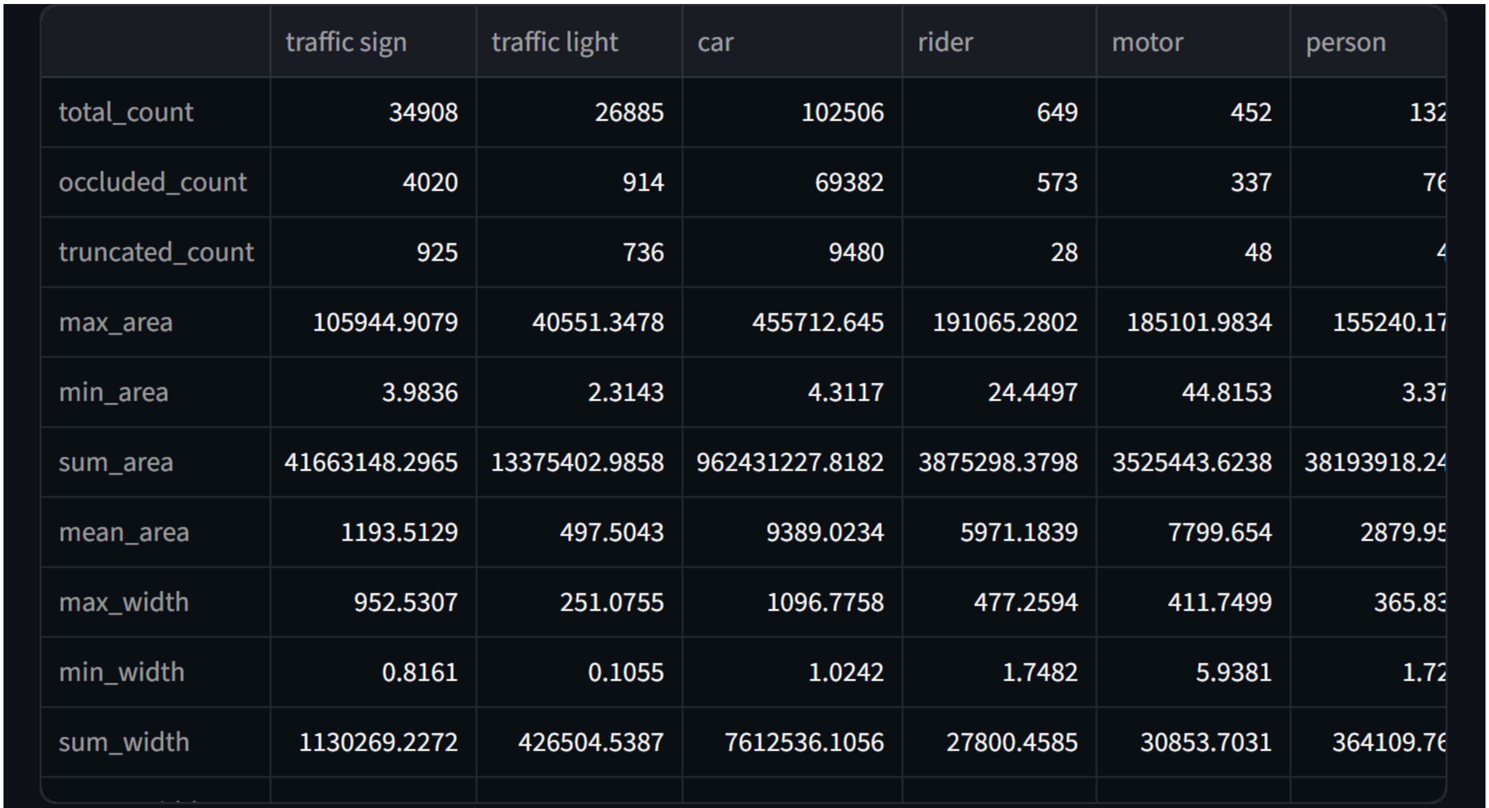
Plots and data will appear here sequentially as they are generated. :D

We start by generating some statistics for our dataset splits.

This is what the train statistics looks like:

	traffic sign	traffic light	car	rider	motor	person
total_count	239686	186117	713211	4517	3002	
occluded_count	26974	5911	483121	4028	2297	
truncated_count	6699	4923	66529	227	272	
max_area	917709.771	302654.3096	612645.1832	257238.437	316440.6389	3449
min_area	3.5722	0.9366	0.8714	5.6019	30.9835	
sum_area	287367954.3891	94430896.467	6720212736.6057	28521339.8285	22767430.4156	2690238
mean_area	1198.9351	507.3738	9422.4749	6314.2218	7584.0874	29
max_width	1279.2694	557.525	1278.5979	553.1279	773.633	8
min_width	0.4538	0.1066	0.4261	1.2874	4.4931	
sum_width	7736763.6674	2954222.5906	53217431.1529	196499.8462	201506.9276	25278

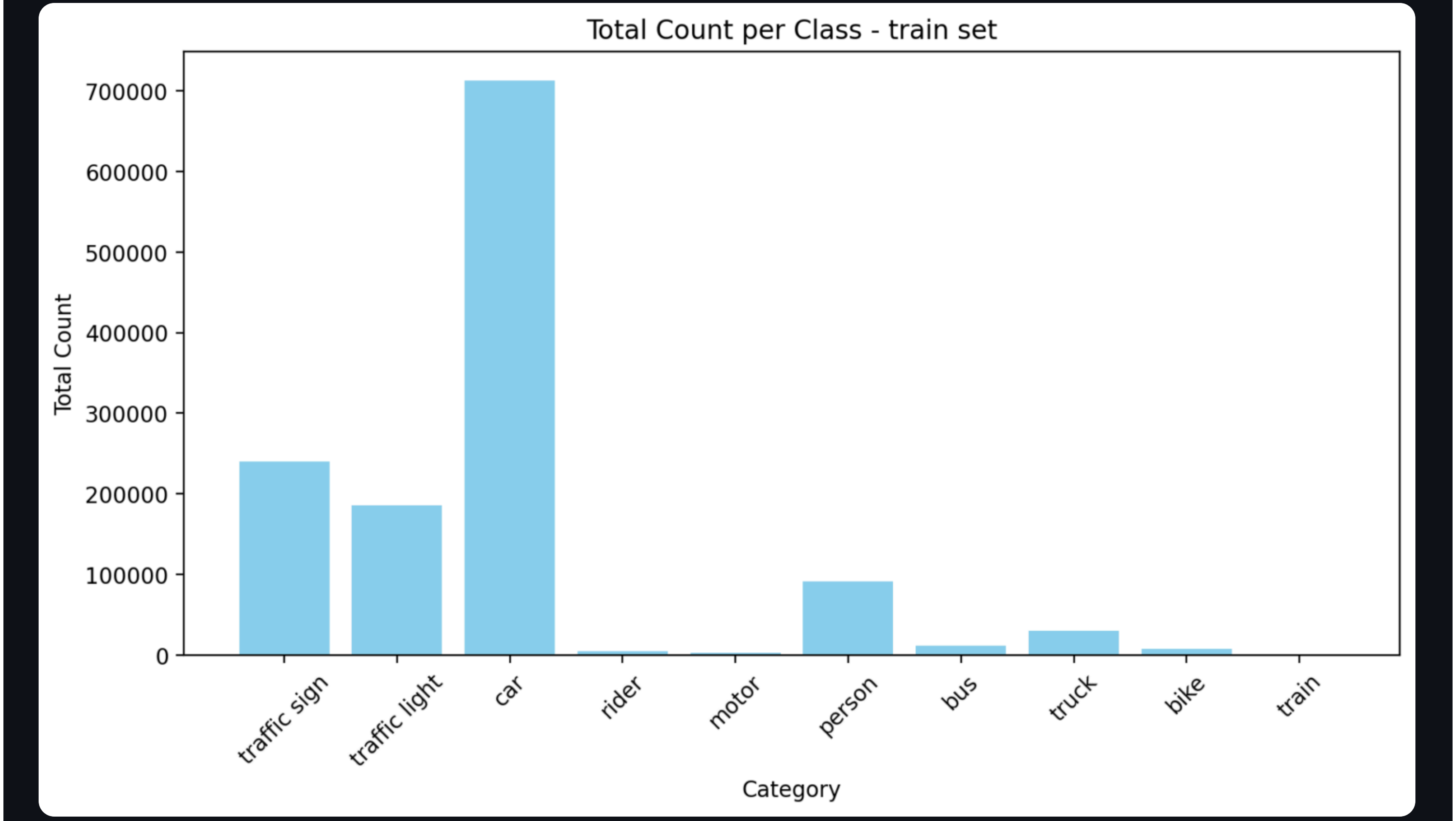
This is what the val statistics looks like:



	traffic sign	traffic light	car	rider	motor	person
total_count	34908	26885	102506	649	452	132
occluded_count	4020	914	69382	573	337	76
truncated_count	925	736	9480	28	48	4
max_area	105944.9079	40551.3478	455712.645	191065.2802	185101.9834	155240.17
min_area	3.9836	2.3143	4.3117	24.4497	44.8153	3.37
sum_area	41663148.2965	13375402.9858	962431227.8182	3875298.3798	3525443.6238	38193918.24
mean_area	1193.5129	497.5043	9389.0234	5971.1839	7799.654	2879.95
max_width	952.5307	251.0755	1096.7758	477.2594	411.7499	365.83
min_width	0.8161	0.1055	1.0242	1.7482	5.9381	1.72
sum_width	1130269.2272	426504.5387	7612536.1056	27800.4585	30853.7031	364109.76

Although these statistics are useful, they are hard to interpret in tabular form.

Let's generate some plots to visualize the data!

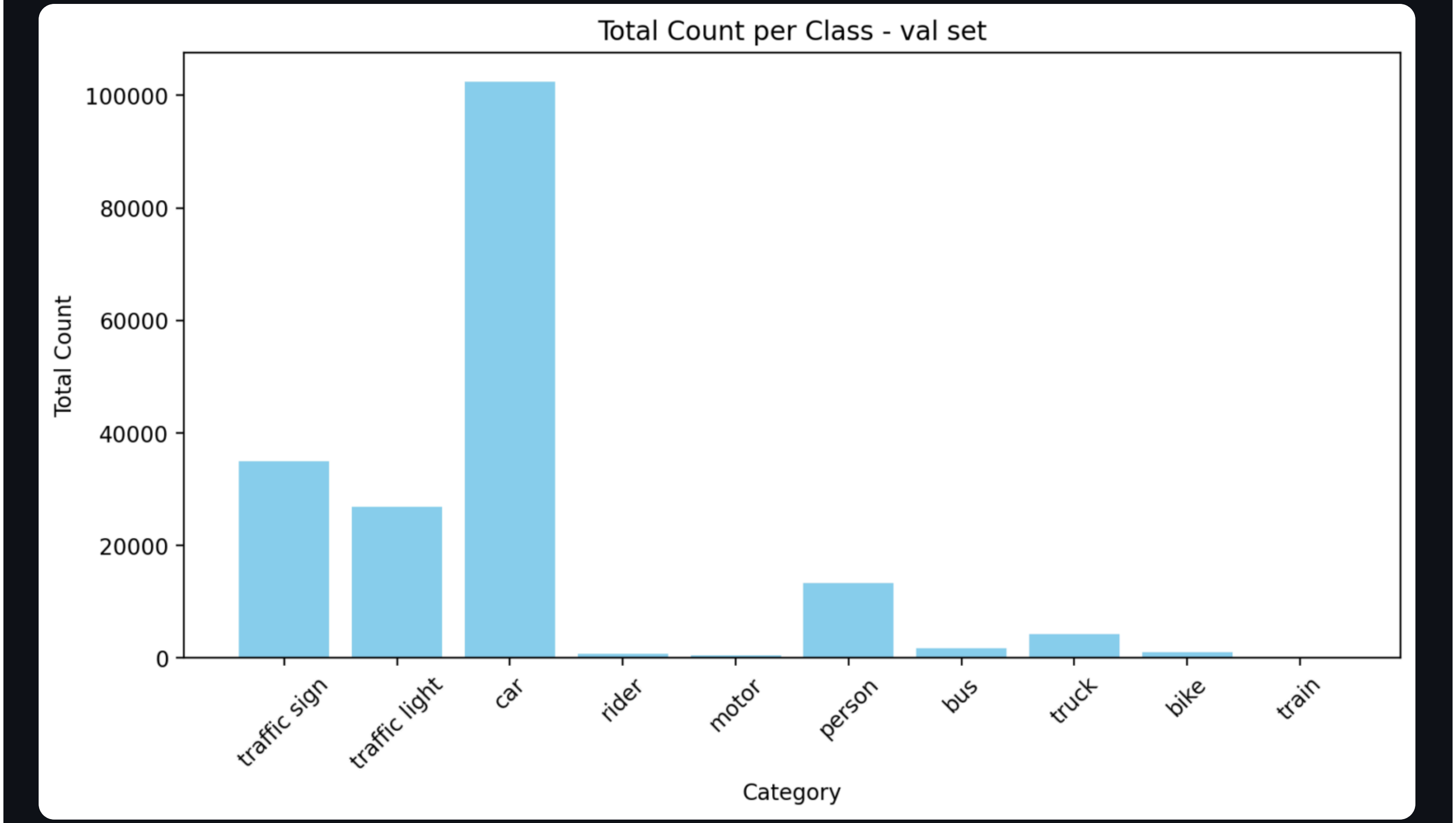


It looks like car is the category with the most number of occurences, followed by traffic sign, and then by traffic light.

person class also has a significant presence in the dataset.

train, motor, and rider are have the three lowest counts.

I hypothesize from this information, that the model (if trained on this dataset) will perform well if tasked with detecting cars, but will not perform so well when tasked with detecting the three classes with the lowest counts



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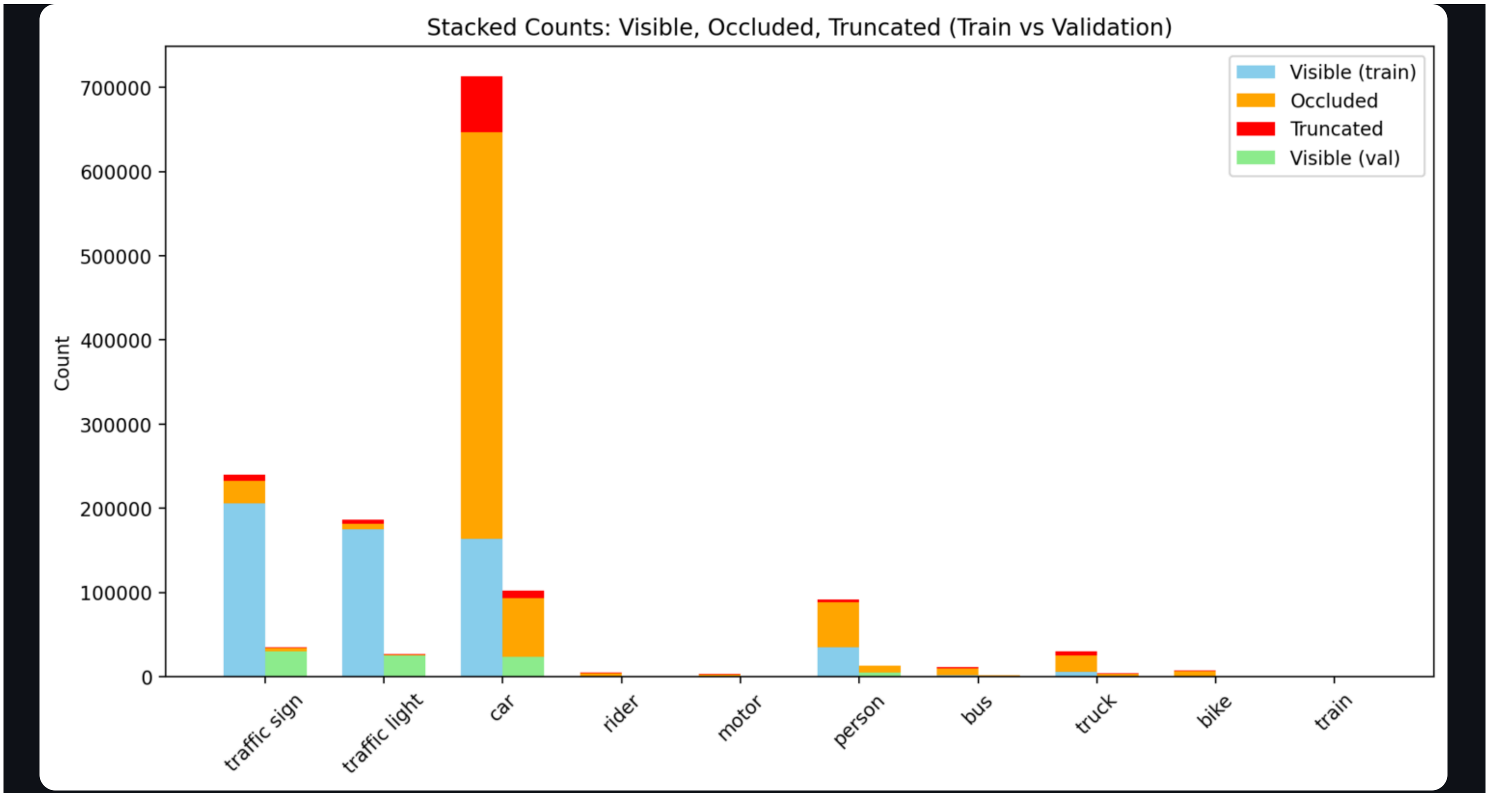
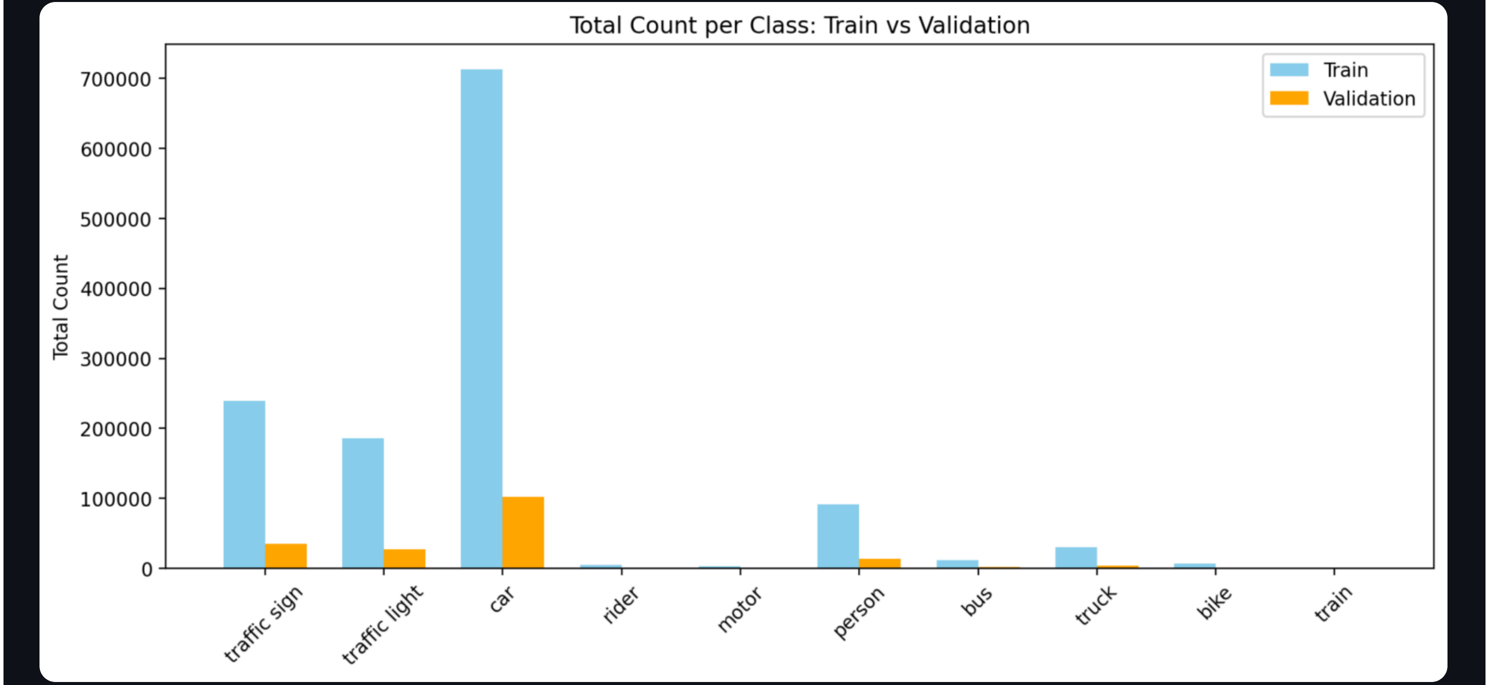
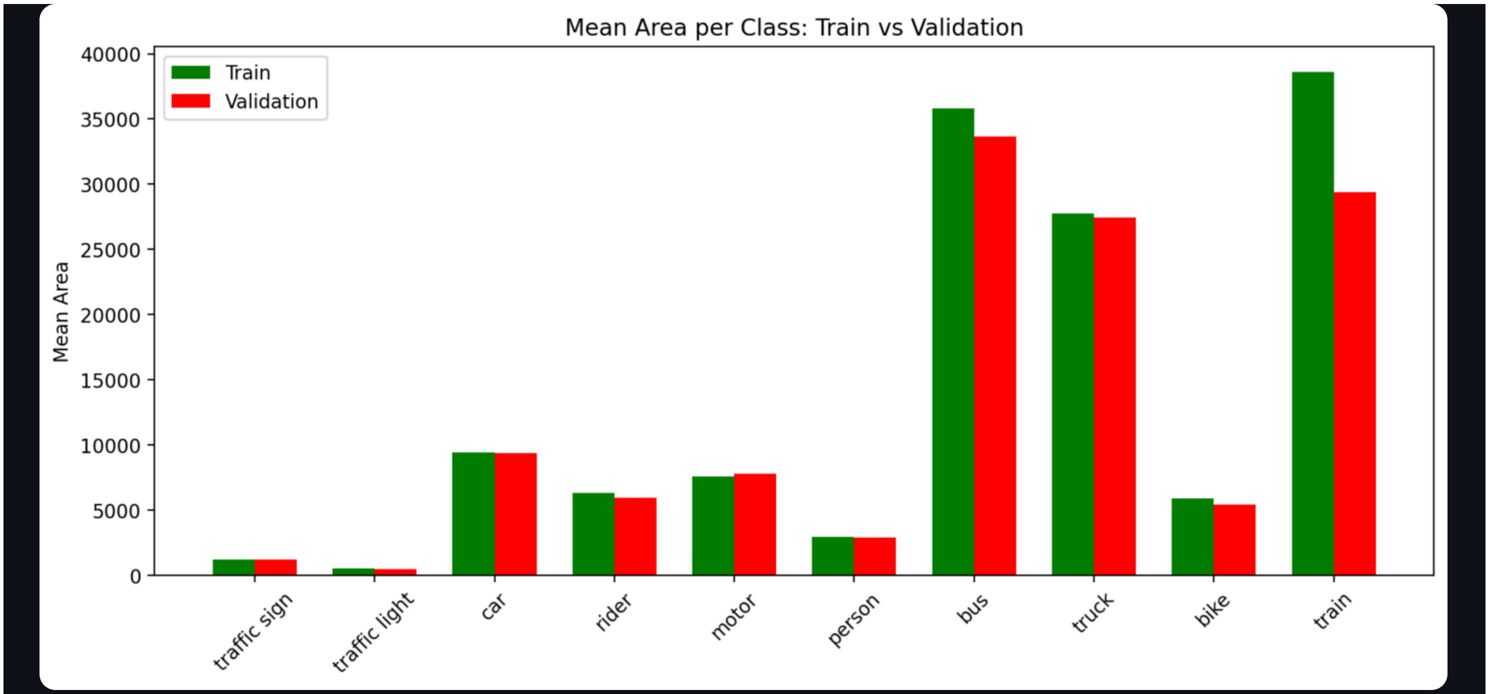


We see here that a huge number of cars in the train set are either truncated and occluded.

While this is undesirable in a small dataset, the large size of this dataset will help the model identify cars in various settings.

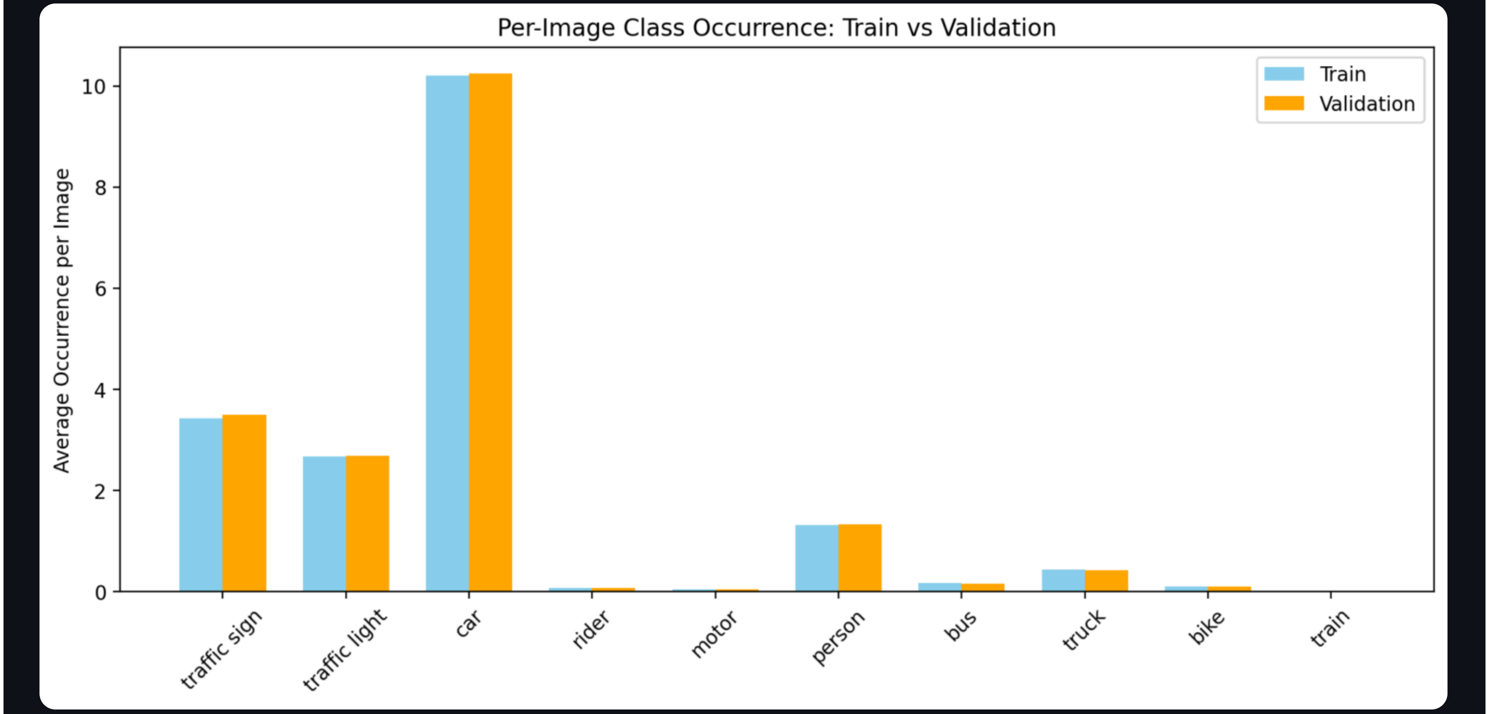




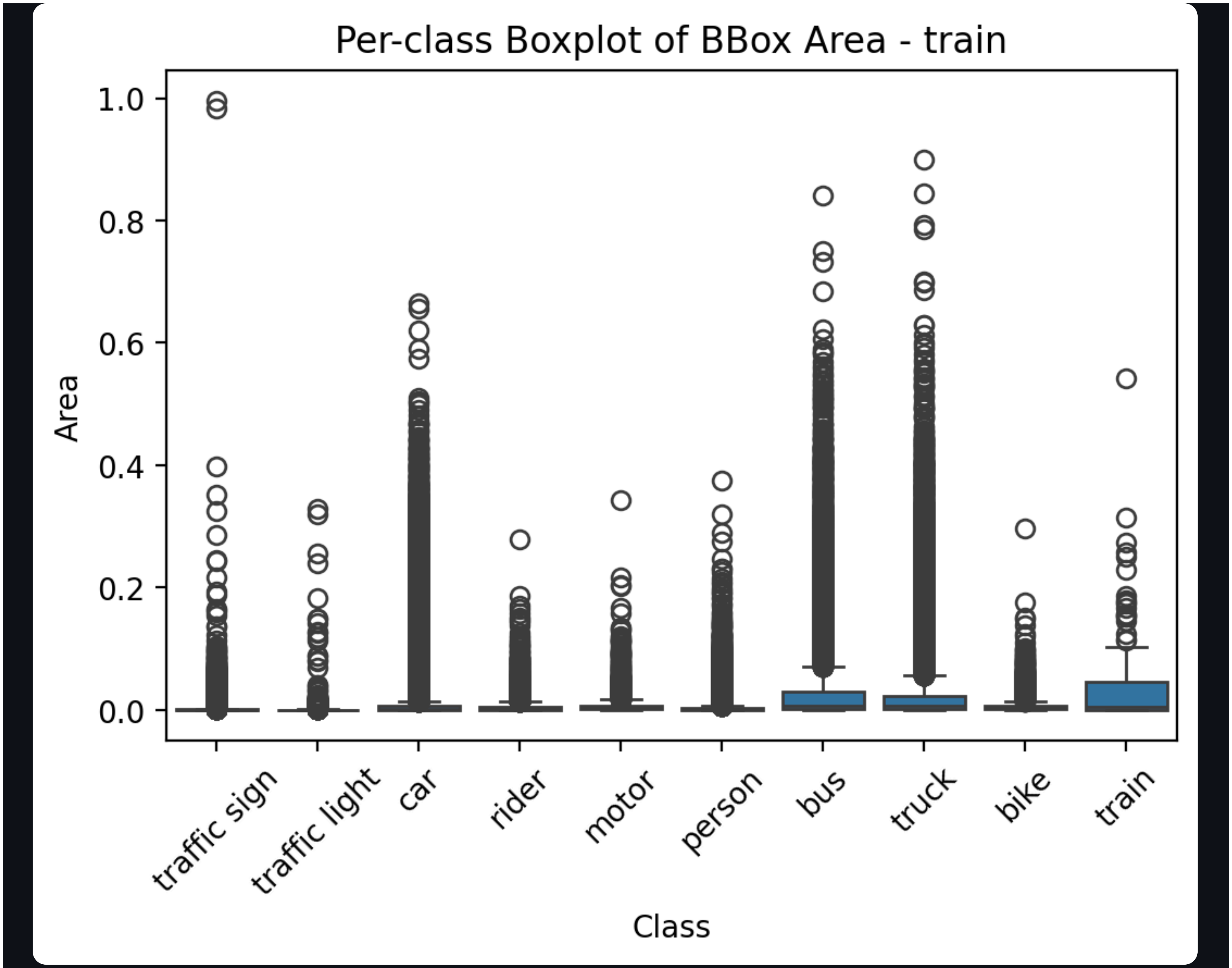
The train class has a smaller average area in the validation set

But considering the small number of samples, this differnce is expected

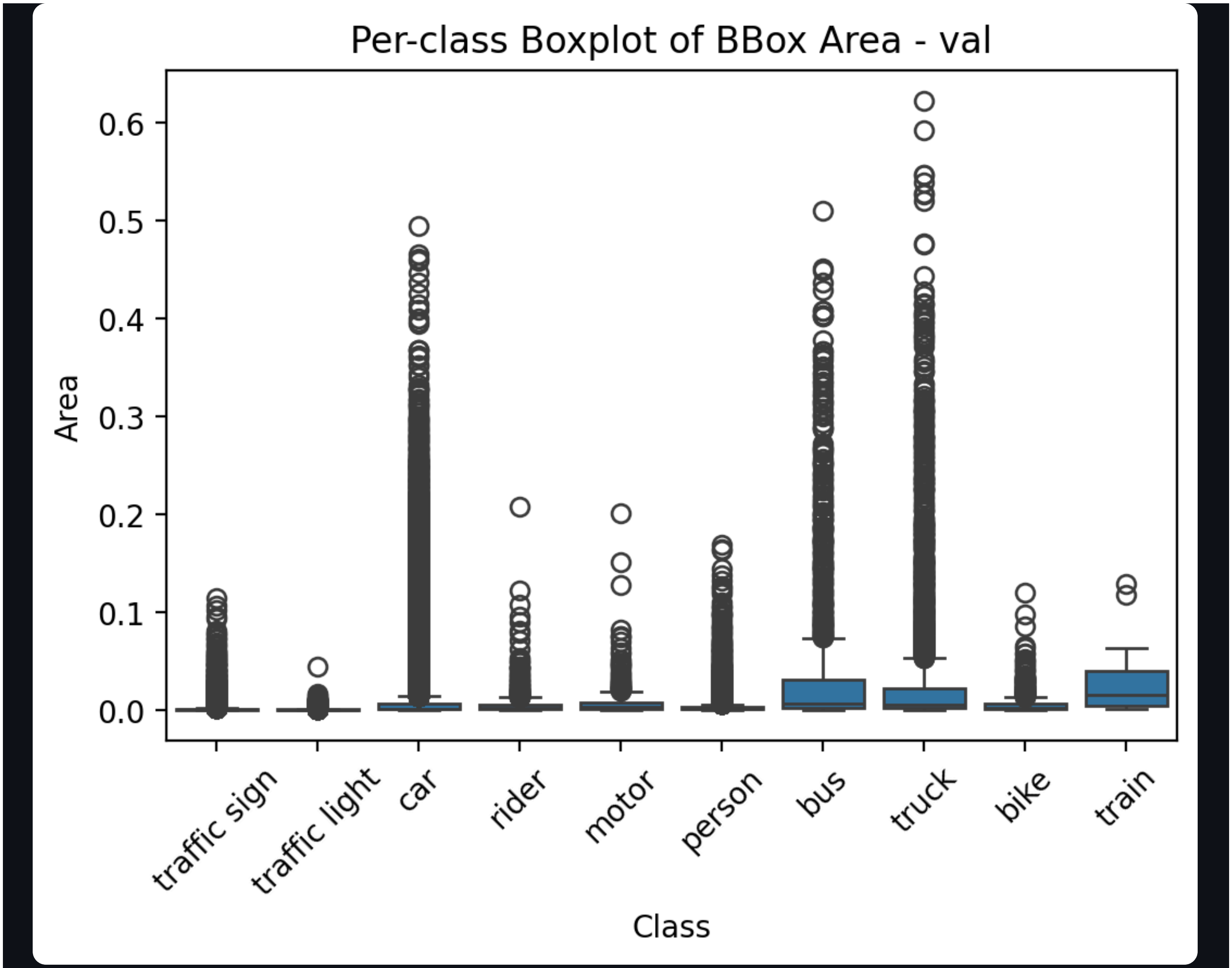
Otherwise, all other classes except bus have more or less the same average size in both splits



It can be seen that both splits have a similar average number of class occurences per image



Per-class Boxplot of BBox Area - train



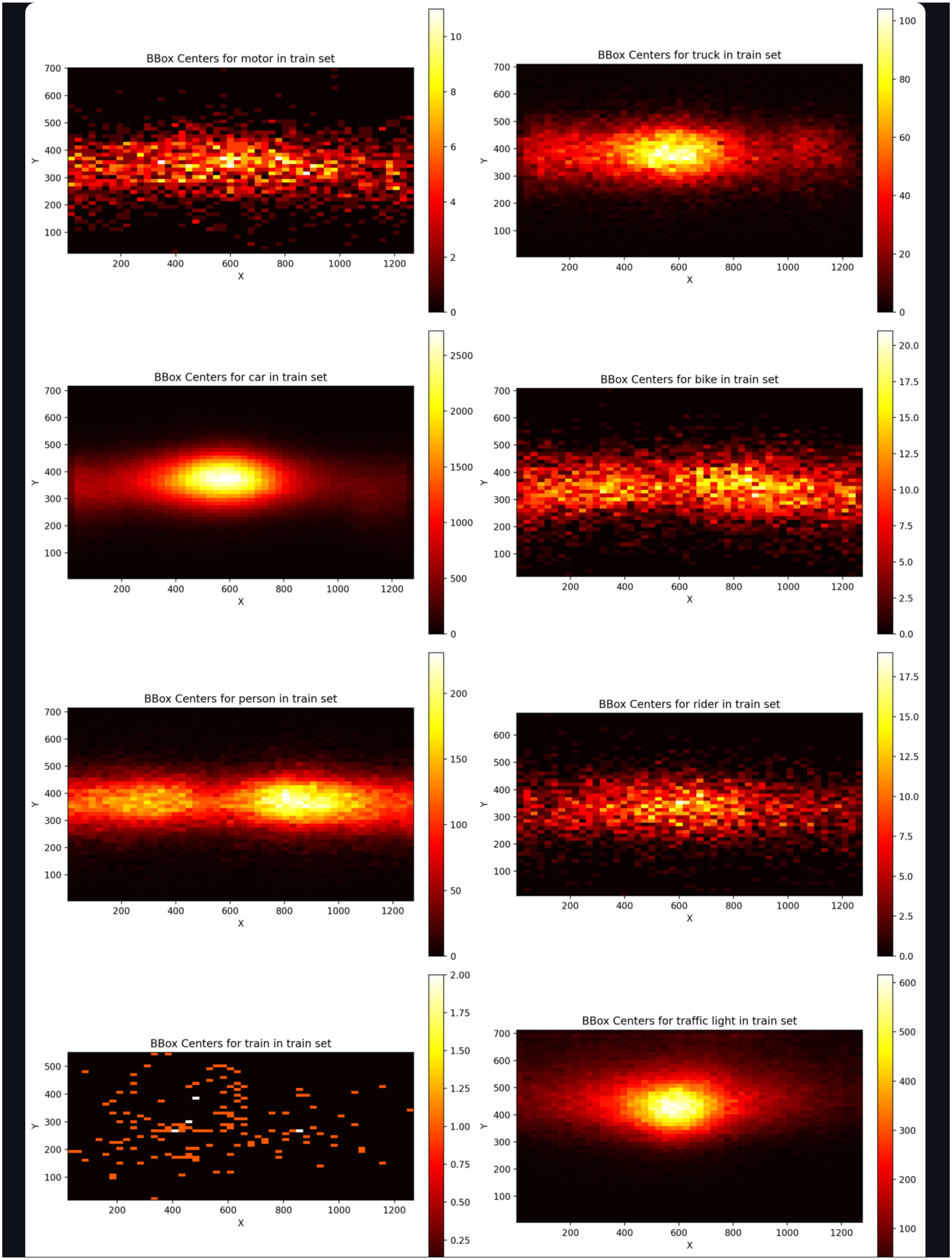
The boxplots reveal that the train set has several large outliers that cover over 40 percent of the image.

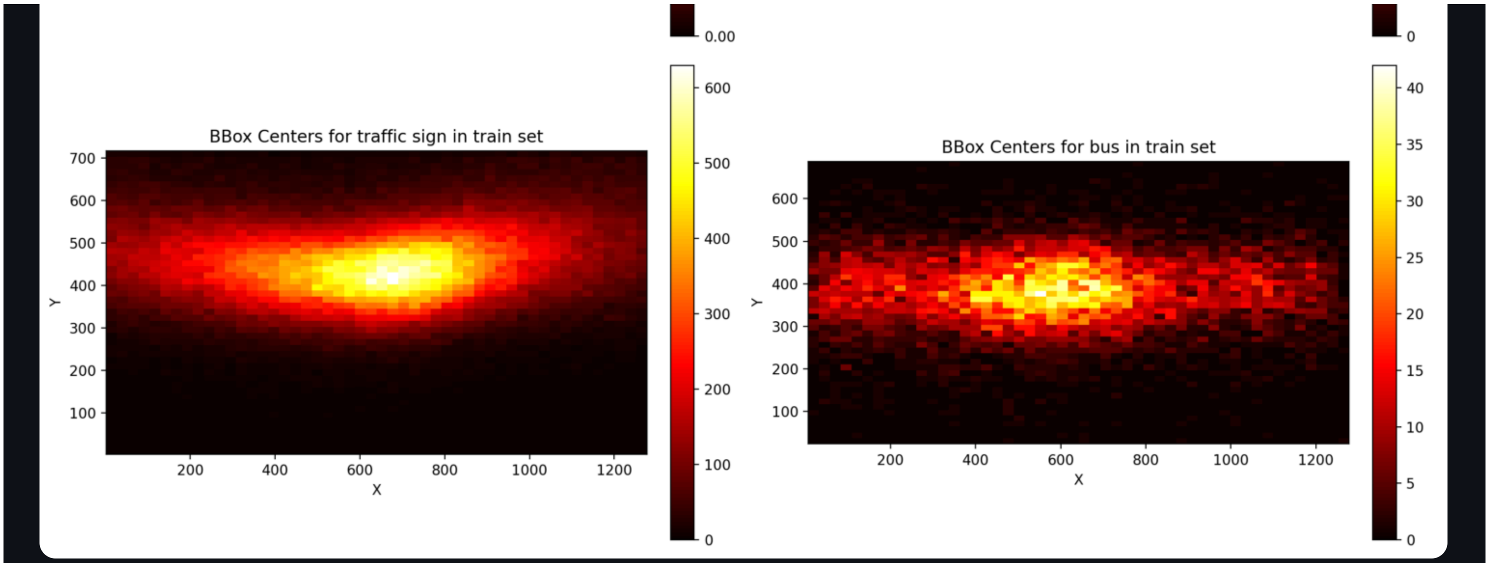
There are two images in the train set with traffic lights that cover almost the entire image.

There are three images with buses and four images with trucks that cover over 70 percent of the images in the train set.

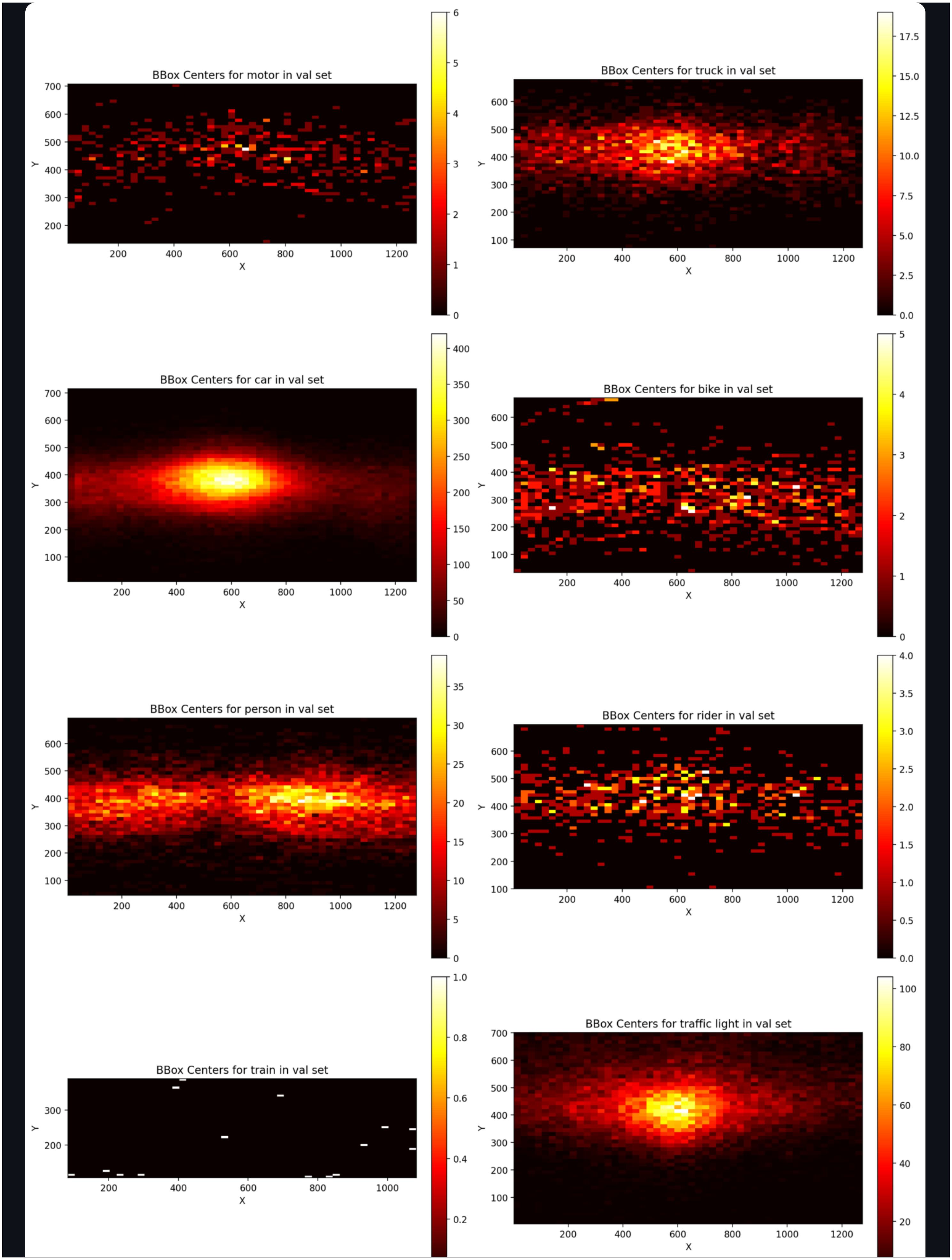
The validation set outliers are much smaller, and there are only about 5 truck images that cover more than 50% of the image.

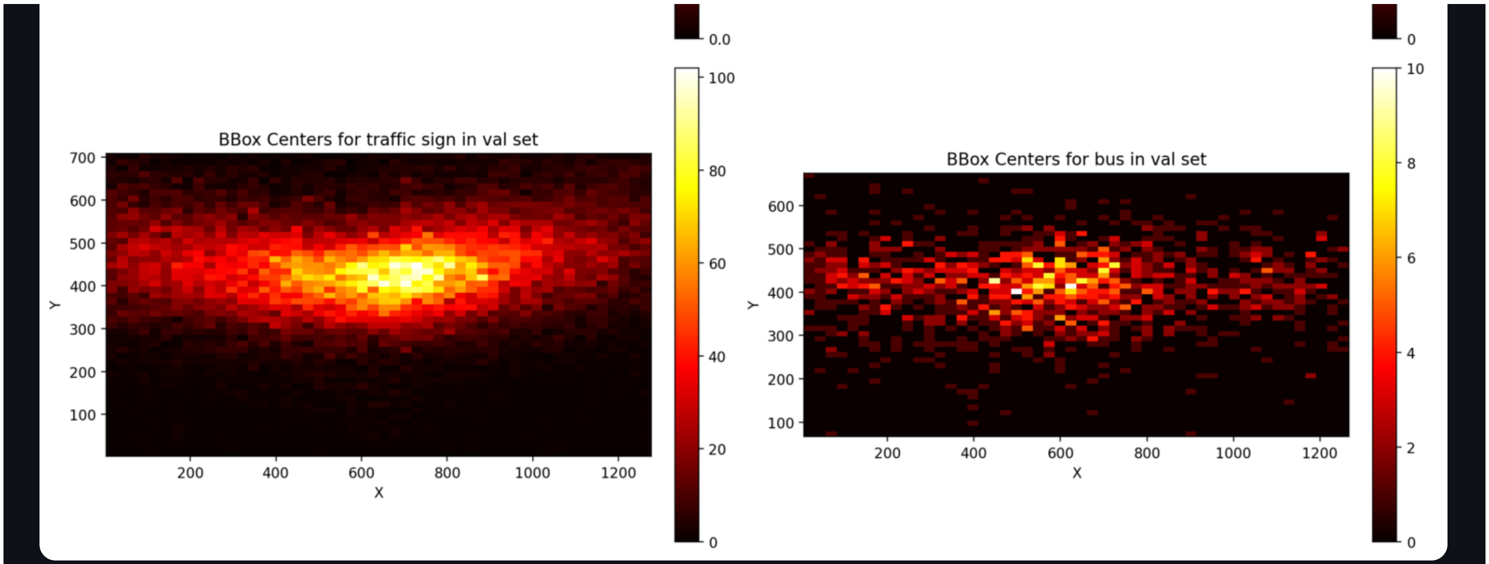
Here is what the class-wise heatmaps look like for the train set


BBox Centers for motor in train set
700
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
10
8
6
4
2
0
BBox Centers for truck in train set
700
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
100
80
60
40
20
0
BBox Centers for car in train set
700
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
2500
2000
1500
1000
500
0
BBox Centers for bike in train set
700
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
BBox Centers for person in train set
700
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
200
150
100
50
0
BBox Centers for rider in train set
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
BBox Centers for train in train set
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
BBox Centers for traffic light in train set
700
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
600
500
400
300
200
100



Here is what the class-wise heatmaps look like for the val set


BBox Centers for motor in val set
700
600
500
400
300
200
Y
200
400
600
800
1000
1200
X
6
5
4
3
2
1
0
BBox Centers for truck in val set
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
BBox Centers for car in val set
700
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
400
350
300
250
200
150
100
50
0
BBox Centers for bike in val set
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
5
4
3
2
1
0
BBox Centers for person in val set
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
35
30
25
20
15
10
5
0
BBox Centers for rider in val set
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
BBox Centers for train in val set
300
200
Y
200
400
600
800
1000
X
1.0
0.8
0.6
0.4
0.2
BBox Centers for traffic light in val set
700
600
500
400
300
200
100
Y
200
400
600
800
1000
1200
X
100
80
60
40
20



We see from these heatmaps that the distribution of cars, traffic lights, and traffic signs are somewhat uniform

and the distribution of bike, motor, and rider are rather haphazard in both sets, despite their small counts.

The distribution of the person class, which has two modes, is an interesting way to learn that the dataset features several scenes where pedestrians are on either side of the road

That brings us to the end of the analysis.

While I would have liked to do a lot more in this task and visualize individual examples, I have unfortunately run out of time.

Thank you!