

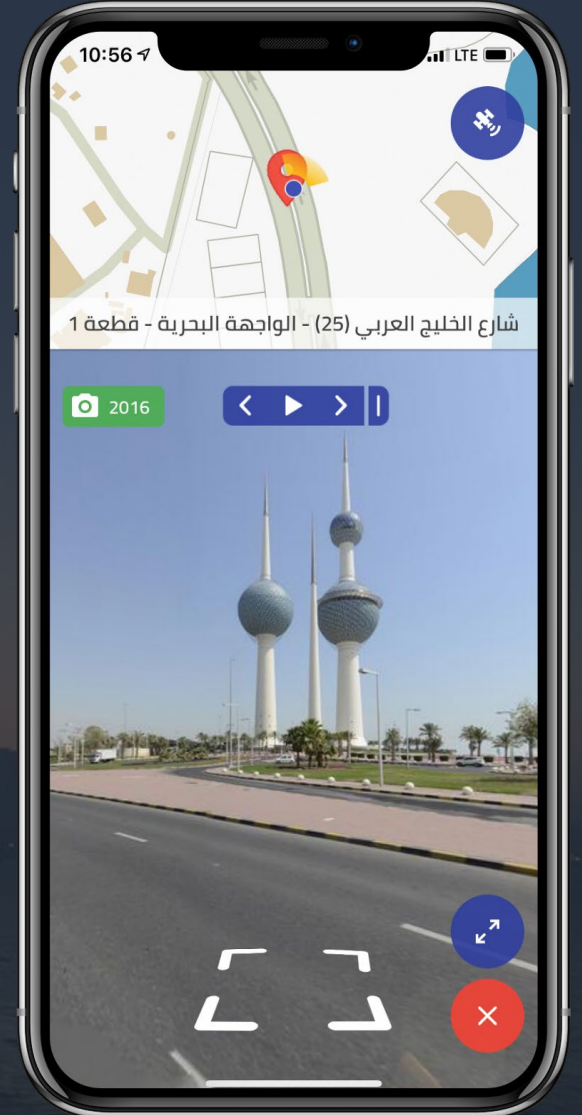
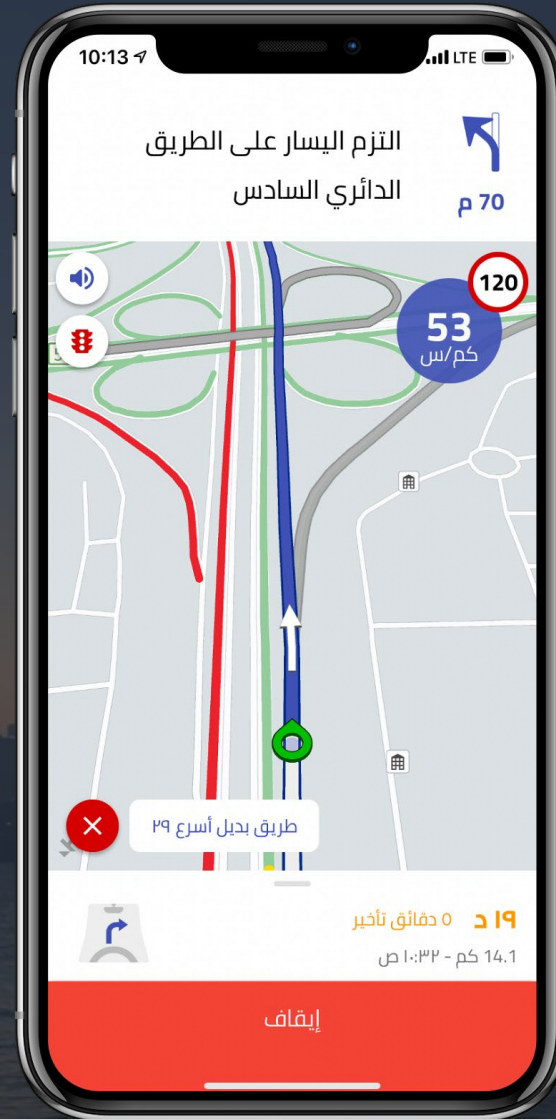
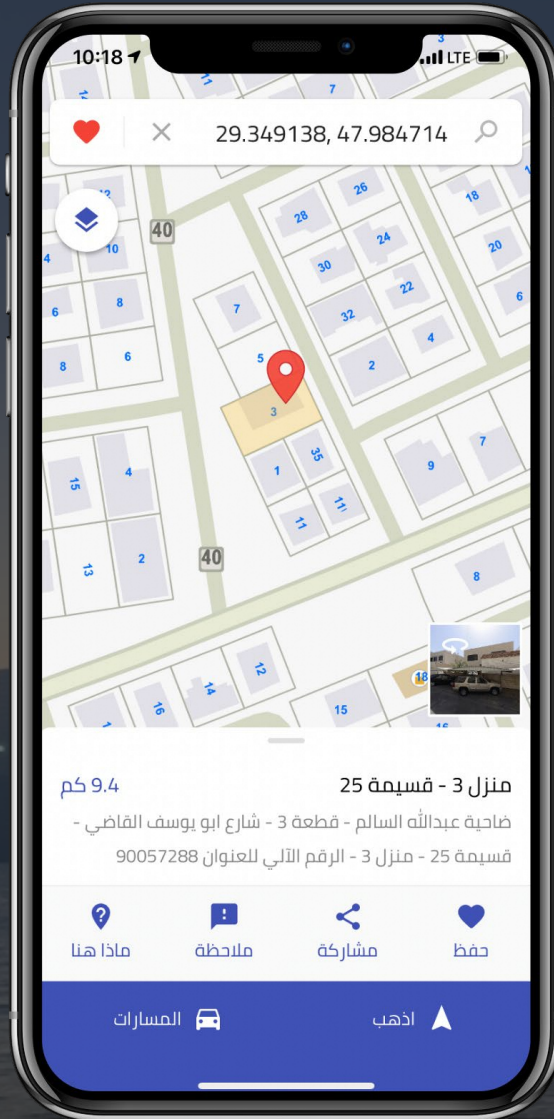
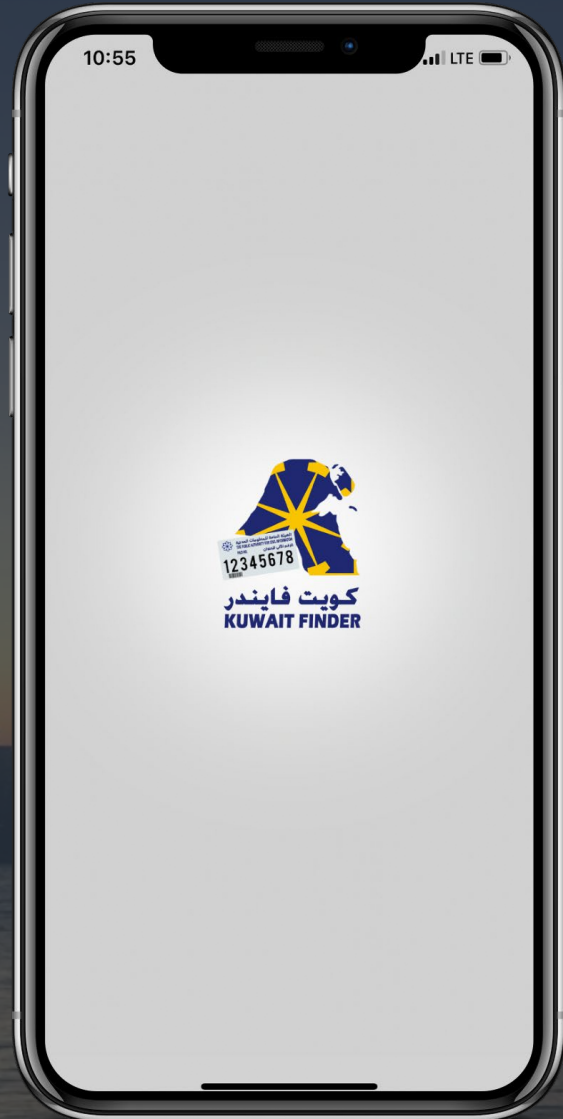


Transforming Reality

The Public Authority for Civil Information (PACI)
State of Kuwait



Meeting the Public



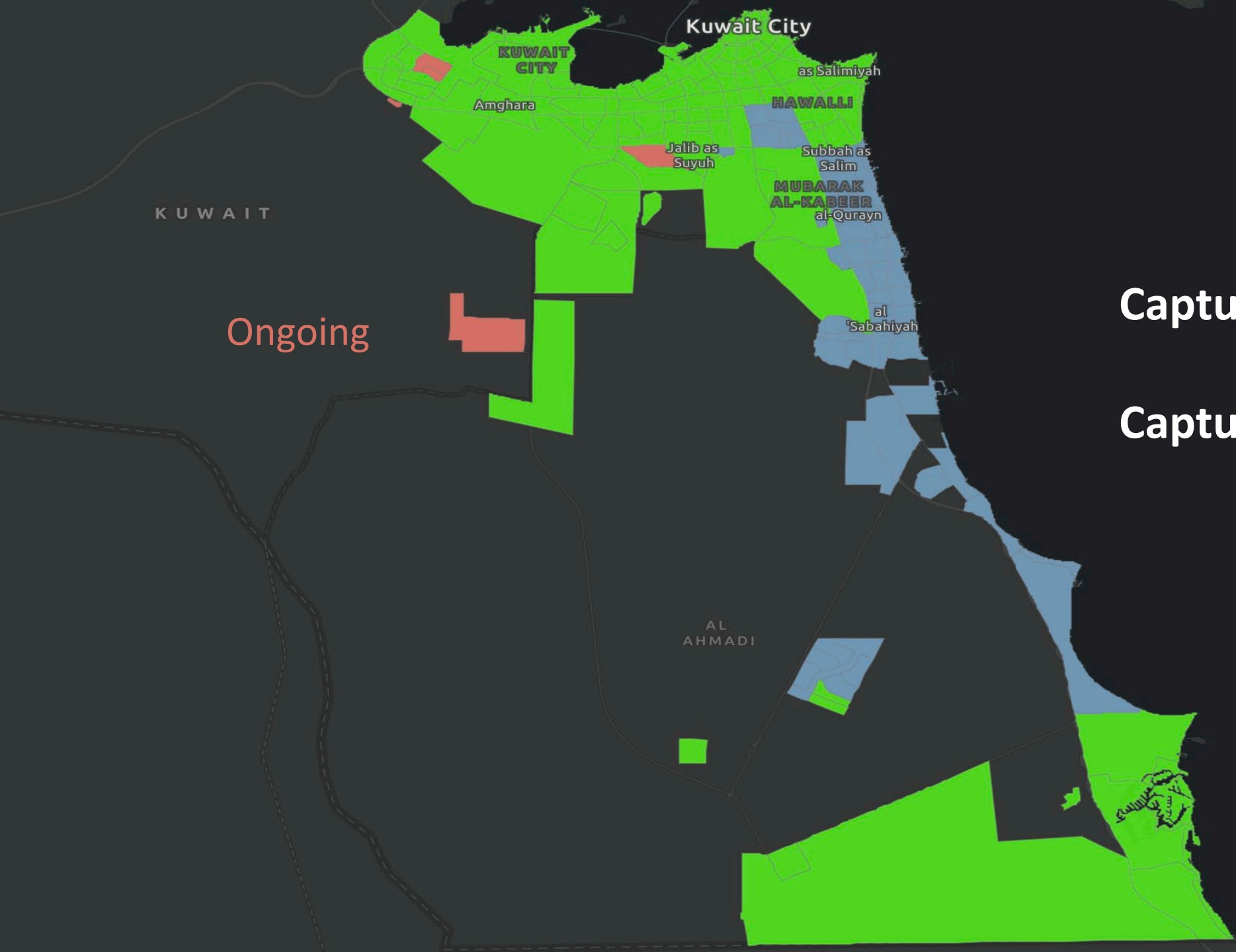
KuwaitFinder





Top Actions Per Month							
Month	SearchText	QuickSearch	Identify	RequestStreetView	NavigateViaKuwaitFinder	ReachedToDestination	OpenStreetView
20-Dec	3,788,791	17,661,315	12,756,741	9,841,675	5,234,490	3,180,362	448,965
21-Jan	4,114,059	17,582,619	17,761,262	14,166,818	5,479,721	3,323,592	612,061
21-Feb	4,619,345	17,080,548	17,029,069	13,566,126	5,524,064	3,357,217	591,780
21-Mar	5,229,444	17,768,699	16,938,061	13,333,094	5,925,460	3,497,830	582,138
21-Apr	5,676,352	20,063,982	18,147,262	14,382,227	6,704,081	4,039,258	609,599
21-May	5,597,217	22,528,256	18,962,822	15,072,244	7,537,134	4,670,738	638,328
21-Jun	5,296,623	21,282,953	18,109,769	14,337,456	7,360,576	4,564,693	669,445
21-Jul	5,613,795	23,823,016	19,181,176	15,244,773	8,251,633	5,173,366	660,046
Average	4,991,953	19,723,924	17,360,770	13,743,052	6,502,145	3,975,882	601,545





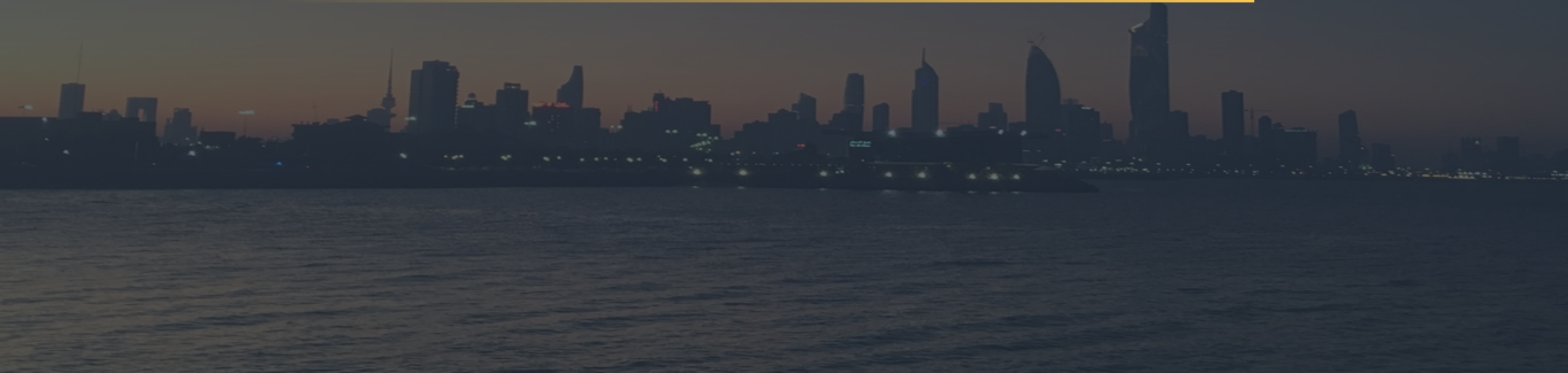
Ongoing

Captured: 2020

Captured : 2021

What If ?

Deep Learning ++ GIS



Data Availability

Planner vs Panorama

Objects to extract

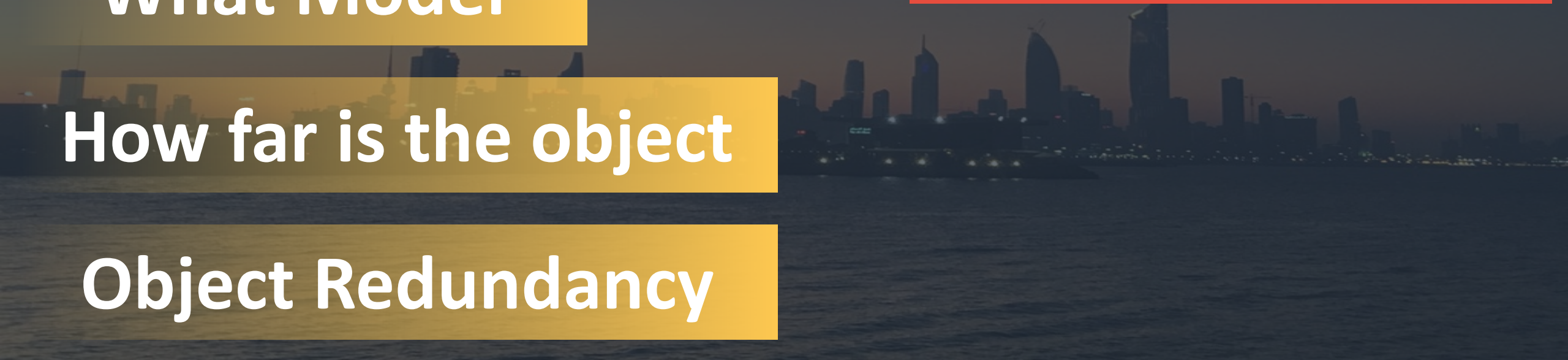
What Model

How far is the object

Object Redundancy

Ground Truth

Who Will Label



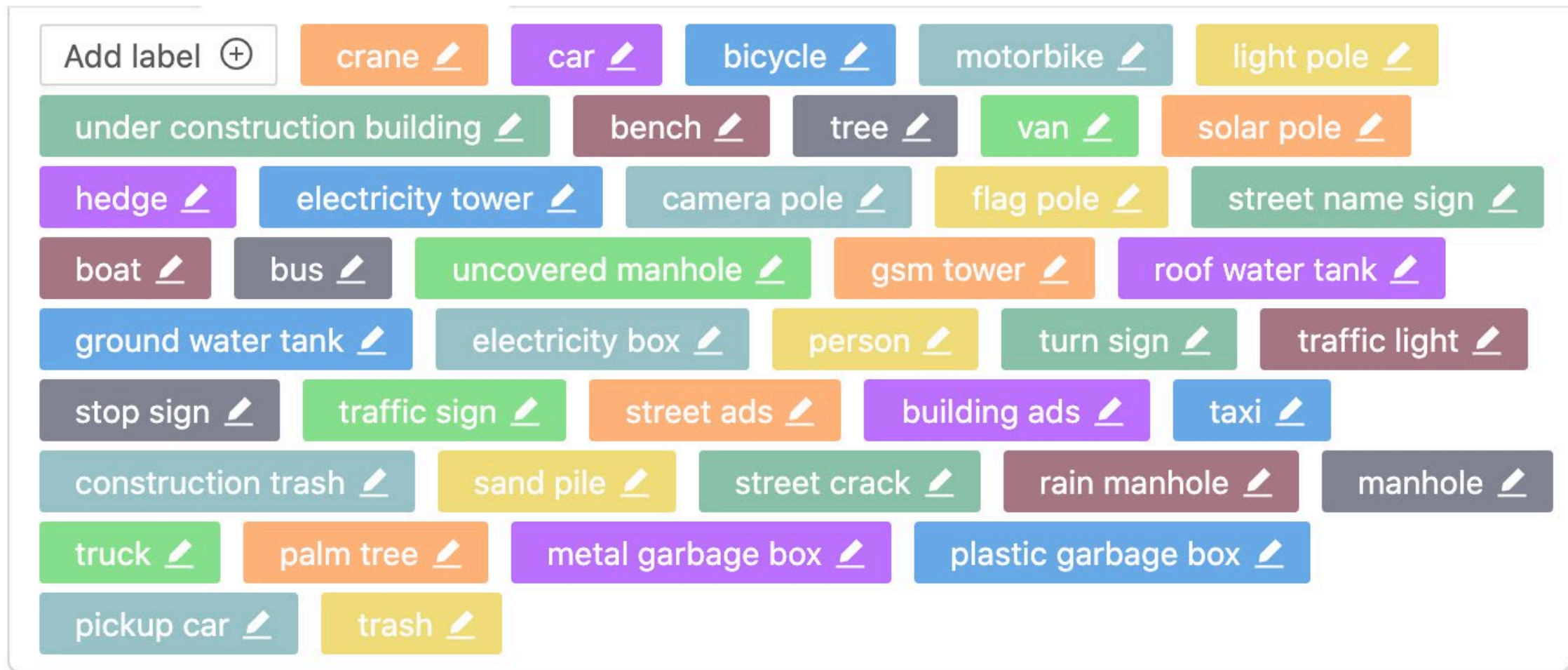


Multi Angle Capture Image planners





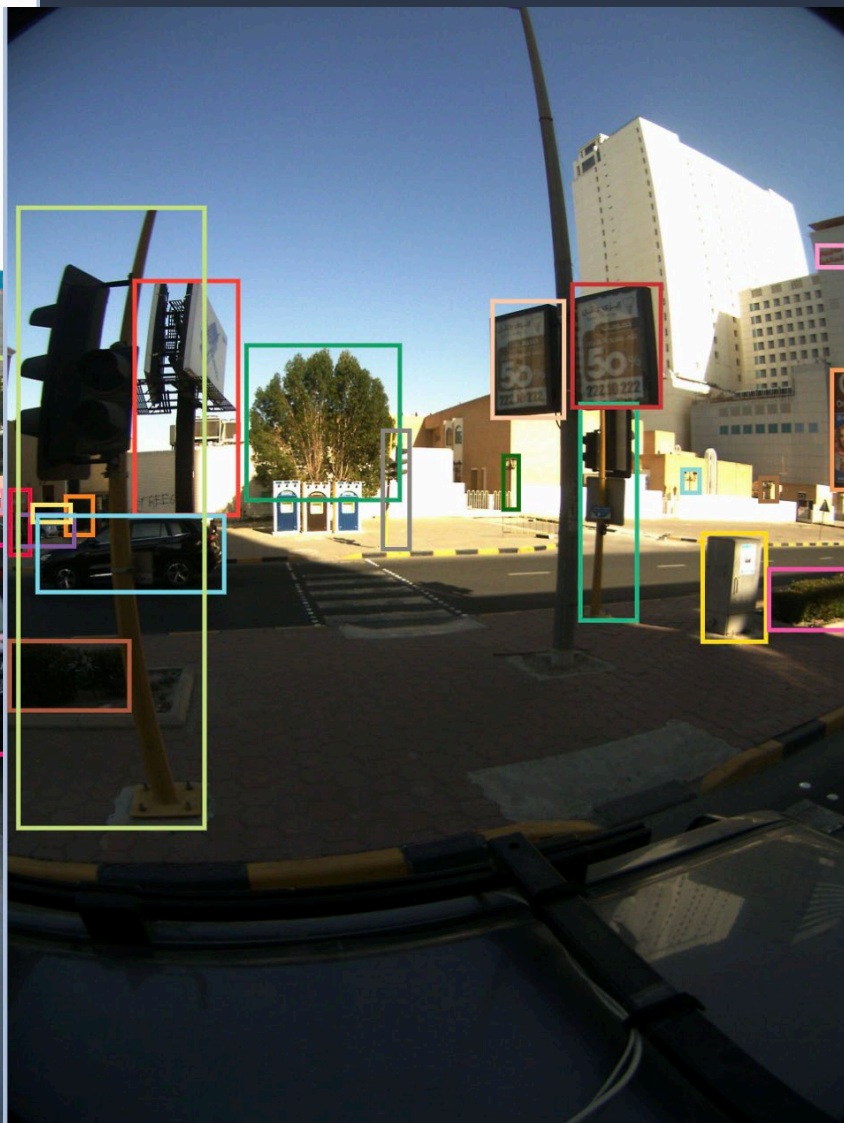
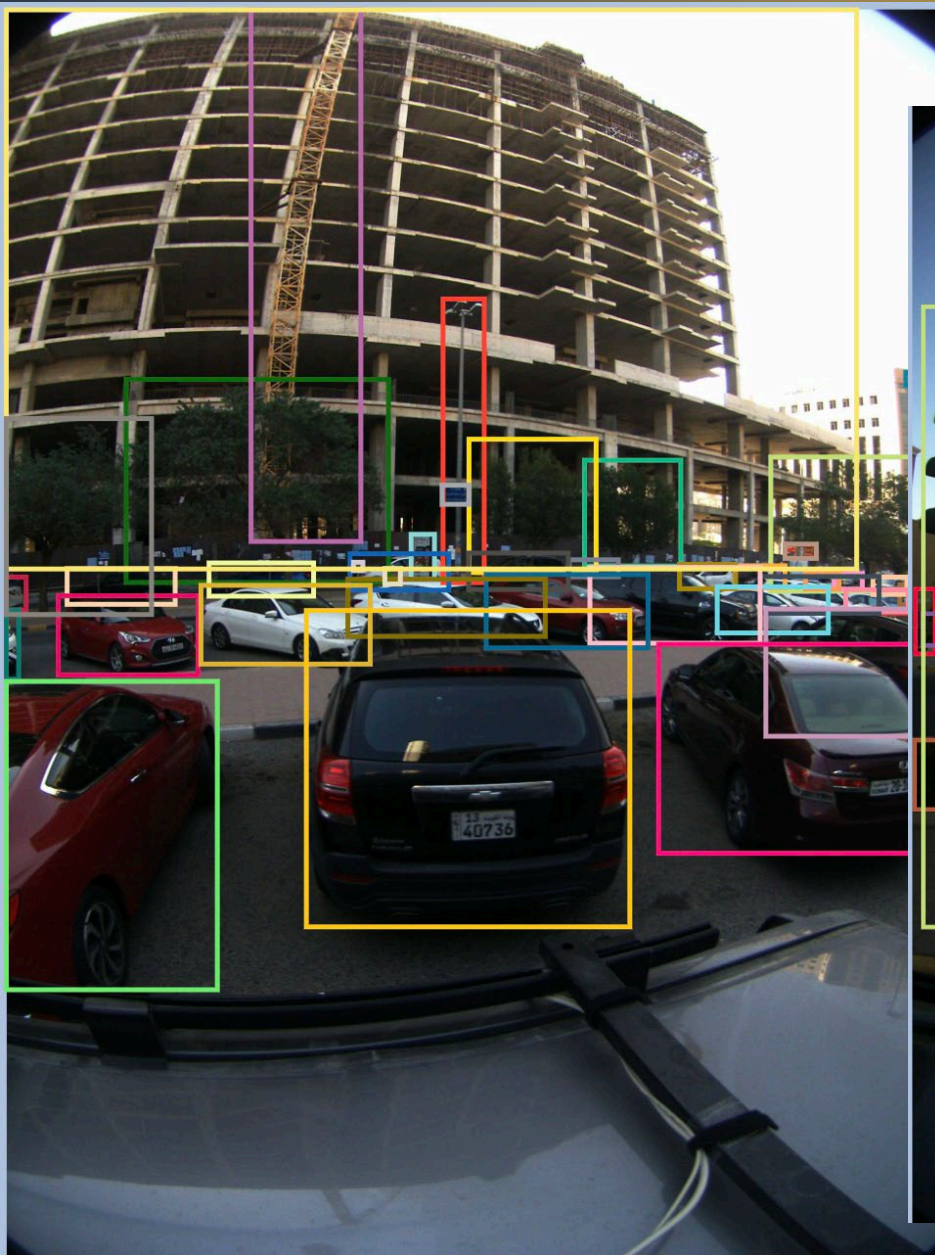
Data Labeling



Labeled Classes

41 Classes

Data Labeling





Model Training

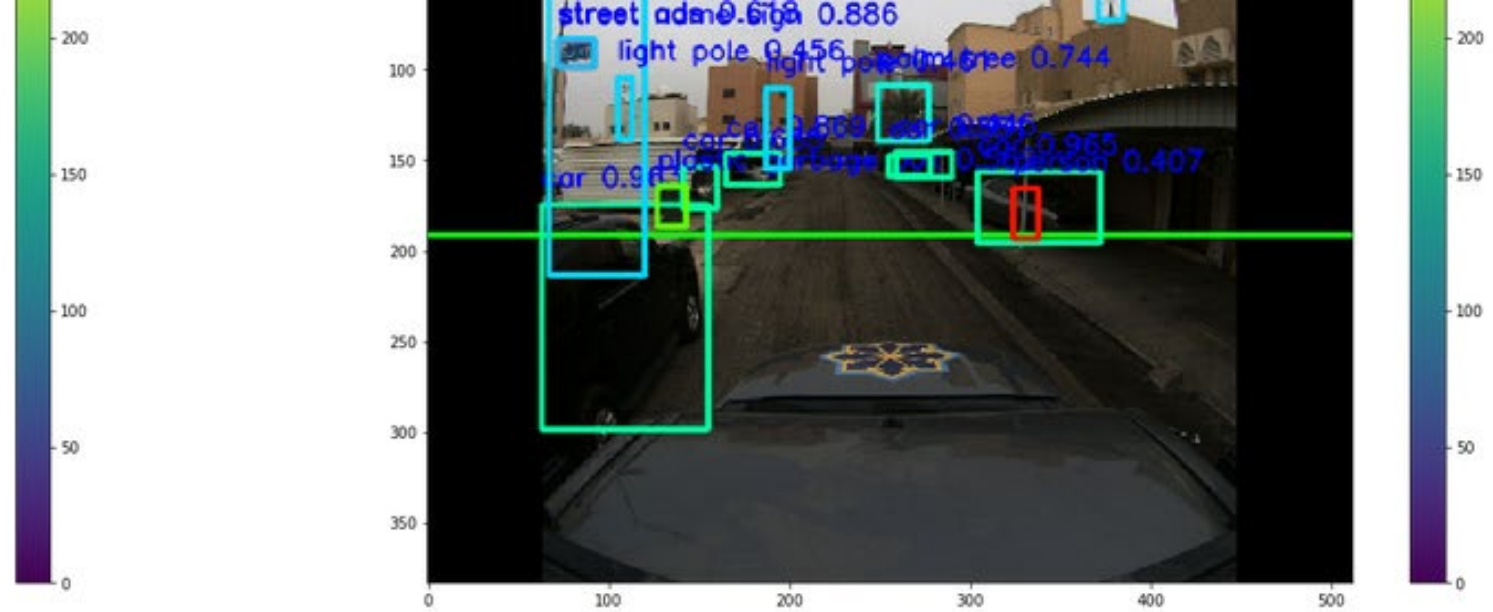


Image disparity

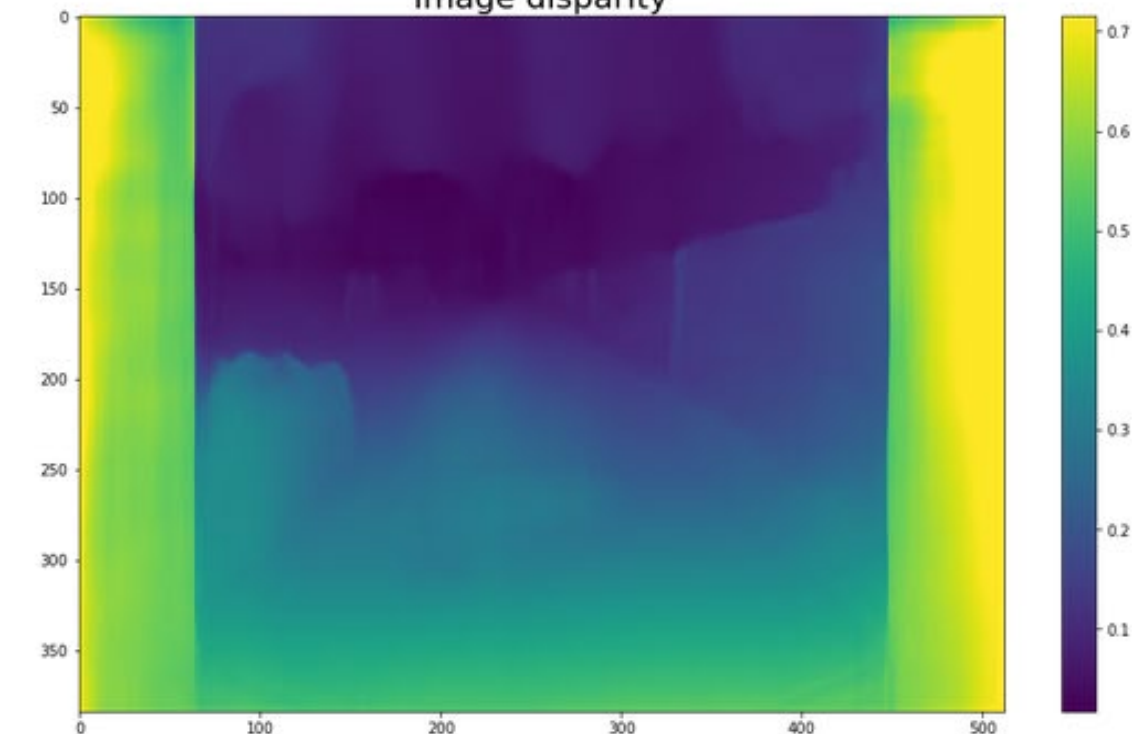


Image Depth





Clustering



Multi Object Detection
Light pole


```

df = dfDetections['class'].unique()
for classVal in df:
    print ('Class Value',classVal)
    predictionDFLocationSub = dfDetections[dfDetections['class']==classVal]
    print ('Class Records Count',predictionDFLocationSub.shape[0])

    if (predictionDFLocationSub.shape[0]!=1):
        coords = predictionDFLocationSub[["pred_lat", "pred_lon"]].values

        kms_per_radian = 6378137
        epsilon = eps / kms_per_radian
        db = DBSCAN(eps=epsilon, min_samples=min_features, algorithm='ball_tree', metric='haversine').fit(np.radians(coords))
        cluster_labels = db.labels_
        num_clusters = len(set(cluster_labels))
        clusters = pd.Series([coords[cluster_labels == n] for n in range(num_clusters)])
        print('Number of clusters: {}'.format(num_clusters))

        centermost_points = clusters.map(get_centermost_point)
        lats, lons,count,centroid_lat,centroid_lon = zip(*centermost_points)
        rep_points = pd.DataFrame({'lon':lons, 'lat':lats,'count':count,'centroid_lat':centroid_lat,'centroid_lon':centroid_lon,
                                   'classvalue':classVal,'classname':labels_to_names[classVal]})
        mainDF = pd.concat([mainDF,rep_points])
    else:
        rep_points = pd.DataFrame({'lon':predictionDFLocationSub['3:lon'], 'lat':predictionDFLocationSub['2:lat'],'count':1,
                                   'centroid_lat':predictionDFLocationSub['pred_lat'],'centroid_lon':predictionDFLocationSub['pred_lon'],
                                   'classvalue':classVal,'classname':predictionDFLocationSub['classname']})
        mainDF = pd.concat([mainDF,rep_points])

outClassCSV = "G:\PACI-DL\PACI_OD\streetview_objectmapping\Sample dataset\Traffic lights 50\lights_all.csv"
mainDF[mainDF['lat']!=0].to_csv(outClassCSV,index=False)

print ('Done')
return mainDF

```



Results



ClassName	Class Code	Distance
building ads	0	2
hedge	1	8
manhole	2	5
person	3	5
tree	4	10
van	5	5
gsm tower	6	20
electricity box	7	10
rain manhole	8	6
bicycle	9	5
turn sign	10	10

Weighted Clustering



Before Clustering





After Clustering

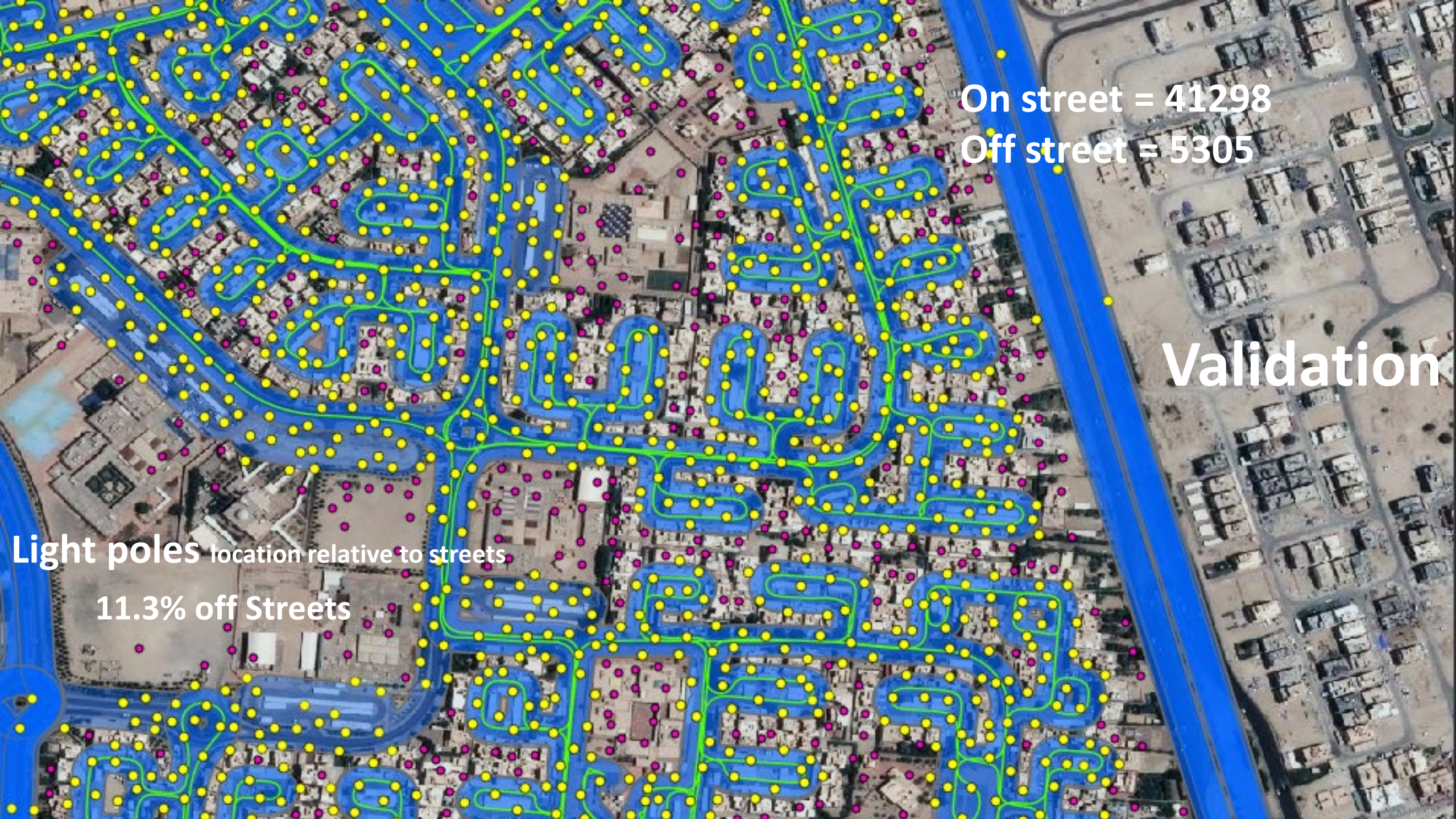


Considerations:

- **Object size**
- **Distance (depth)**
- **Prediction accuracy**



Validation



On street = 41298
Off street = 5305

Validation

Light poles location relative to streets
11.3% off Streets



Light poles

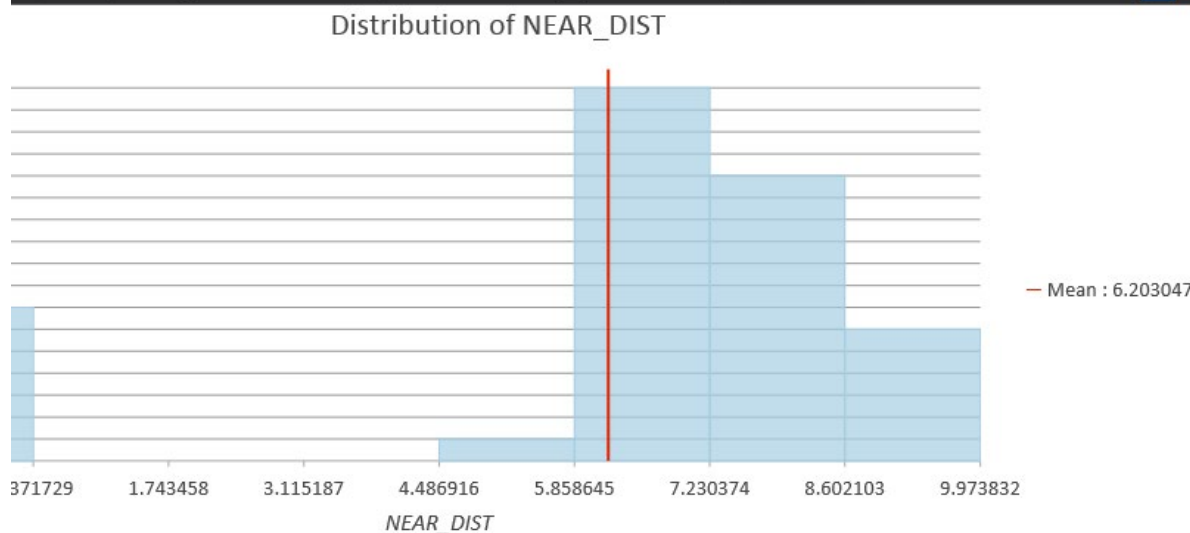
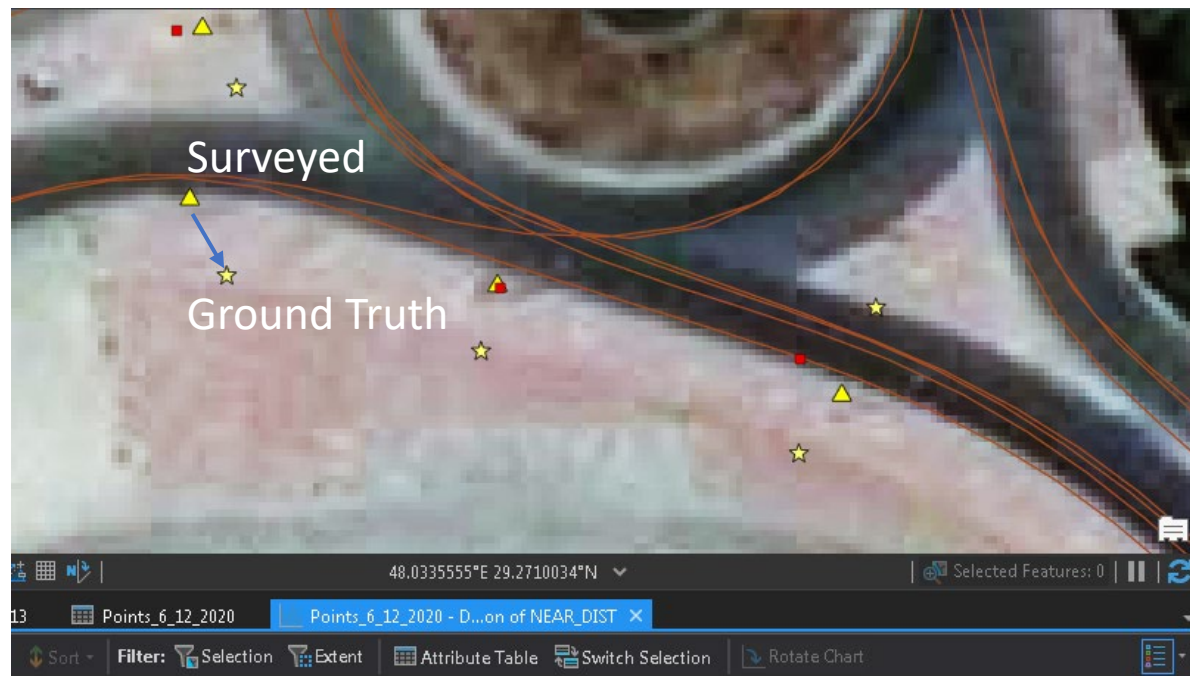
Ground Truth

Prediction

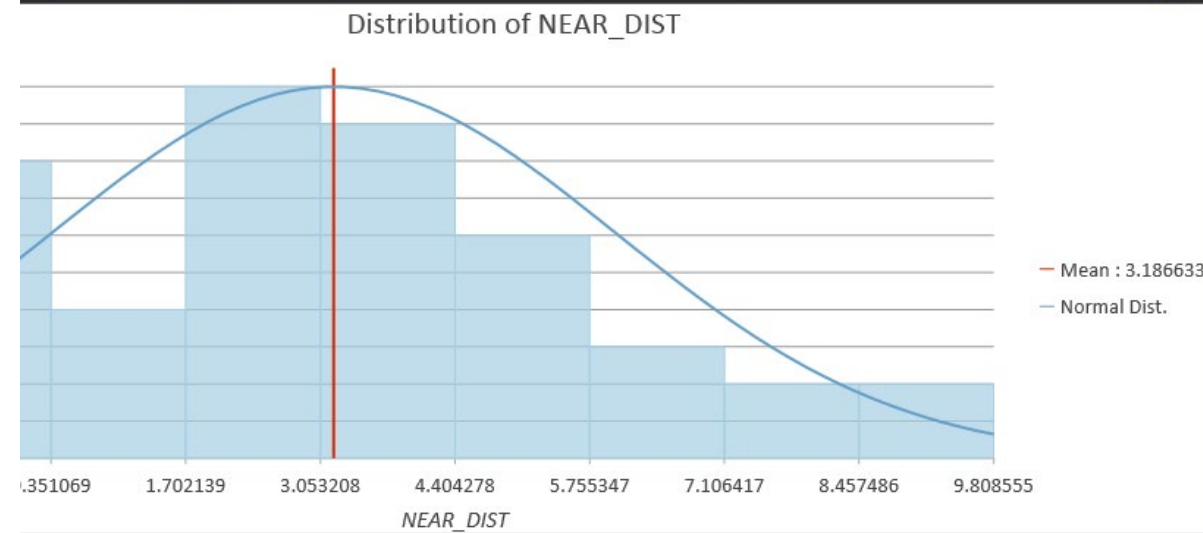
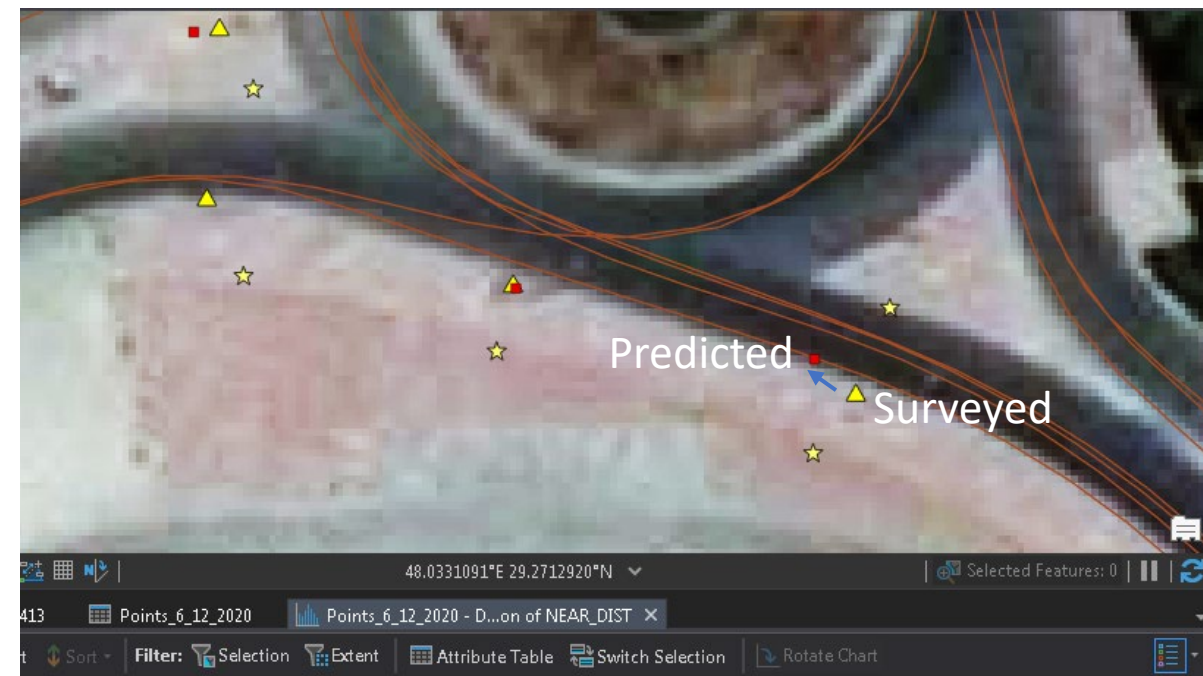
★ MEW Ground truth

▲ Survey Data

■ Prediction



Surveyed vs Ground Truth Data



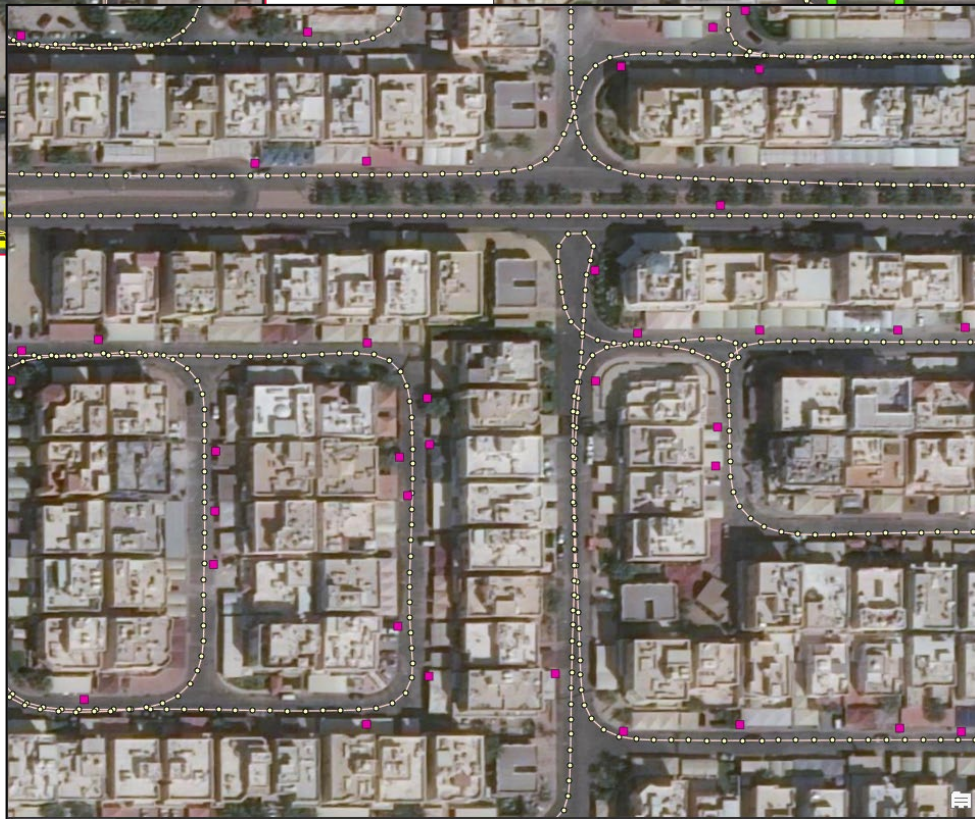
Surveyed vs PredictedData



Cars



Trees



Plastic garbage box





Summary:

- Update Kuwait Finder underlying services
- Provide data products to other organizations
- Enhance government services
- Reduce time for GIS data update from new data sources
- Enrich GIS data repository with new data features
- Maximize the utilization of CAMERA output to new data products
- Moving from Satellite imagery towards oriented imagery



Future

- Build Localized Depth Model
- Add More Images
- Add More Classes
- Use Lidar Point Cloud

