Parking Spot Detection OpenCV

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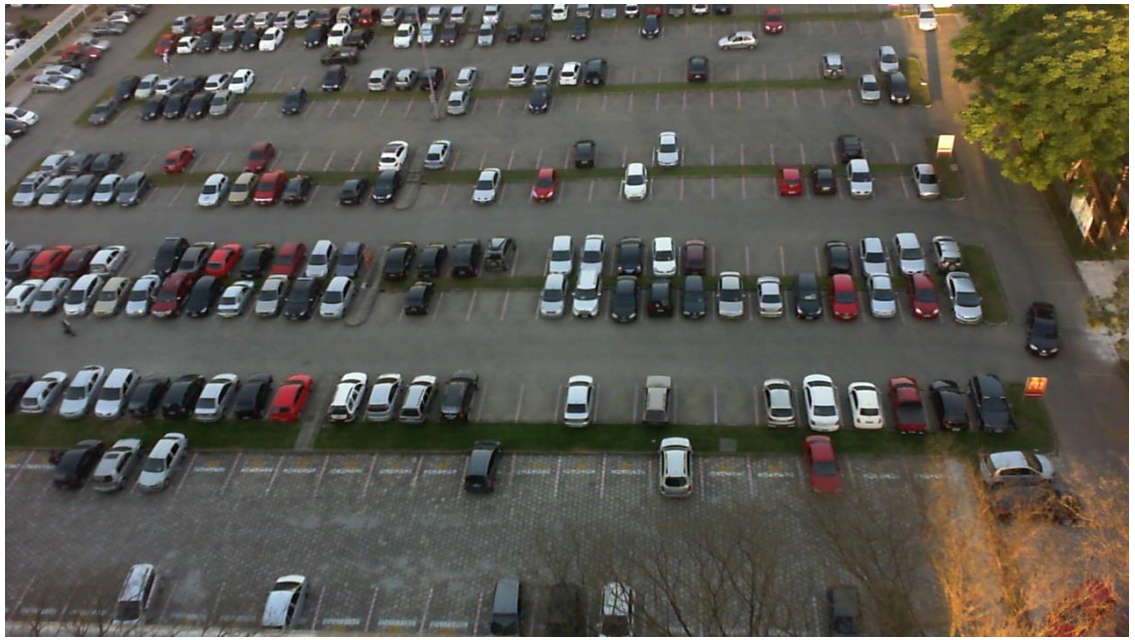
Problem

- Manual parking boosts car emissions in cities by forcing people to loop city blocks in search of parking. It also increases traffic congestion in cities due to insufficient parking, as well as the daily stress connected with parking issues.

Solution

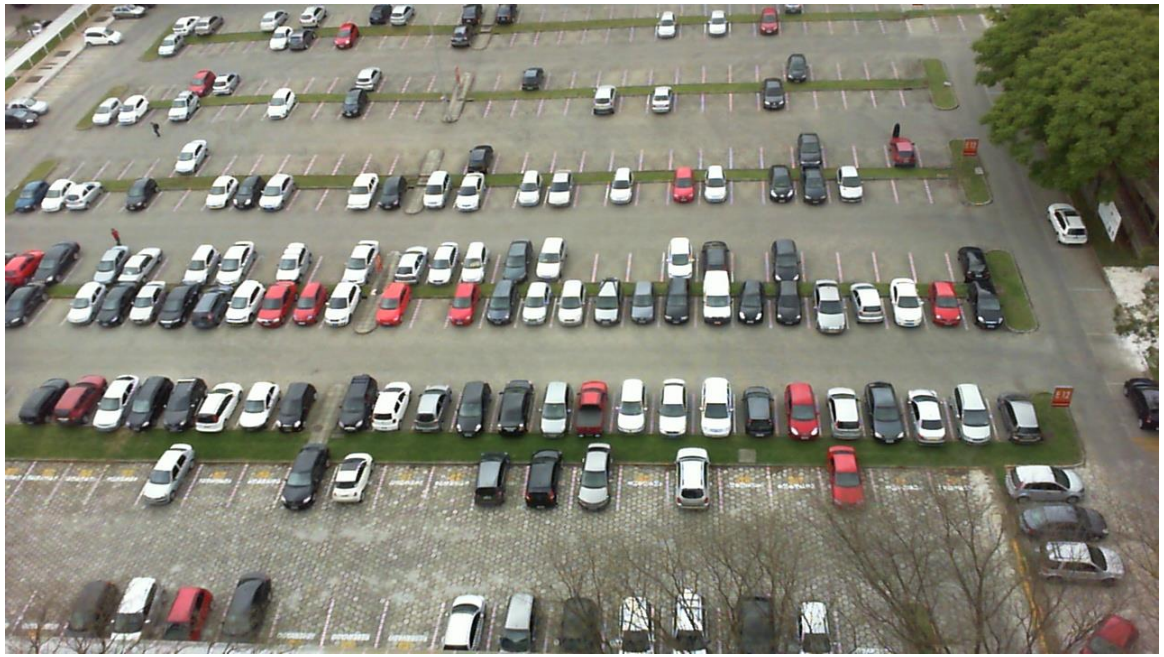
- Need a smart car parking system which shows empty car park slots for car drivers to park in a given parking area.
- Developed a system which uses Deep learning image classification model (Yolo_v3, Keras, Tensorflow, TensorBoard) with object detection technique
- Trained my model using Cross entropy classifier and Sigmoid as the activation
- Using trained model collected all the slots for Fully car parked image and similarly predict occupied car slot for interference

Dataset



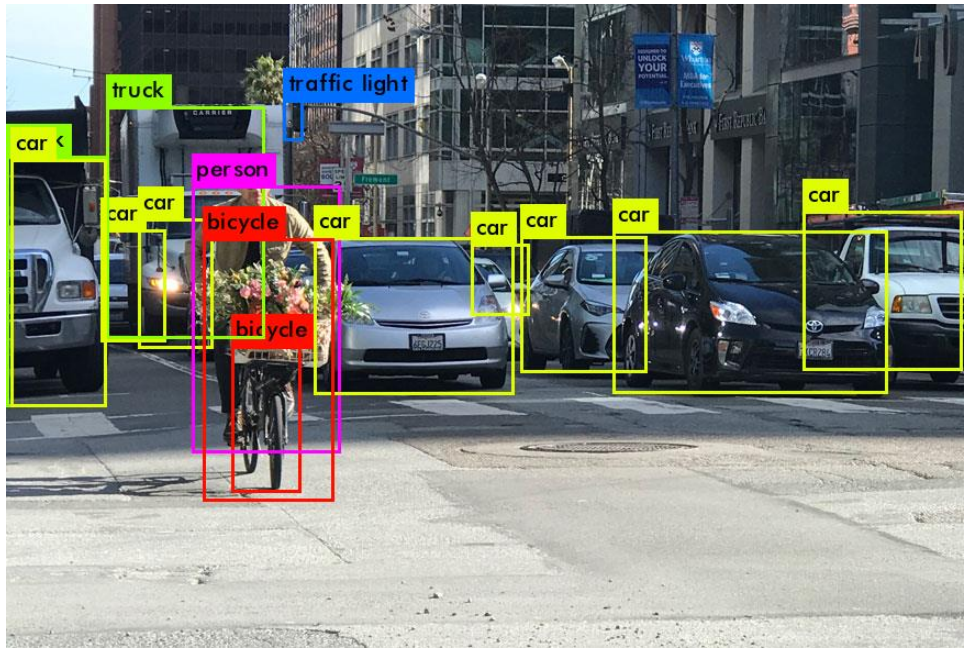
Used PUCPR Parking dataset from https://docs.activeloop.ai/datasets/pucpr-dataset which is released in 2016

This dataset contains information of the 16,456 cars.
Images of parking lot PUCPR

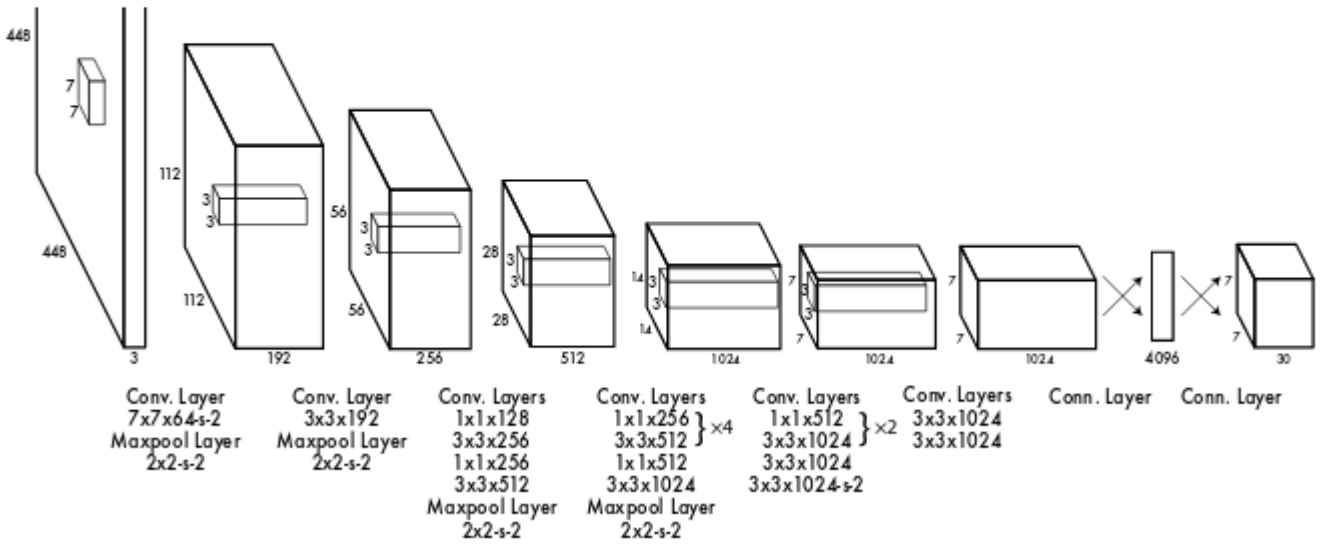


YOLO V3

- YOLOv3 is an object identification algorithm that detects specific items in films, live feeds, or photos in real time.
- To detect an item, YOLO uses features learned by a deep convolutional neural network.



YOLO Arctitecture

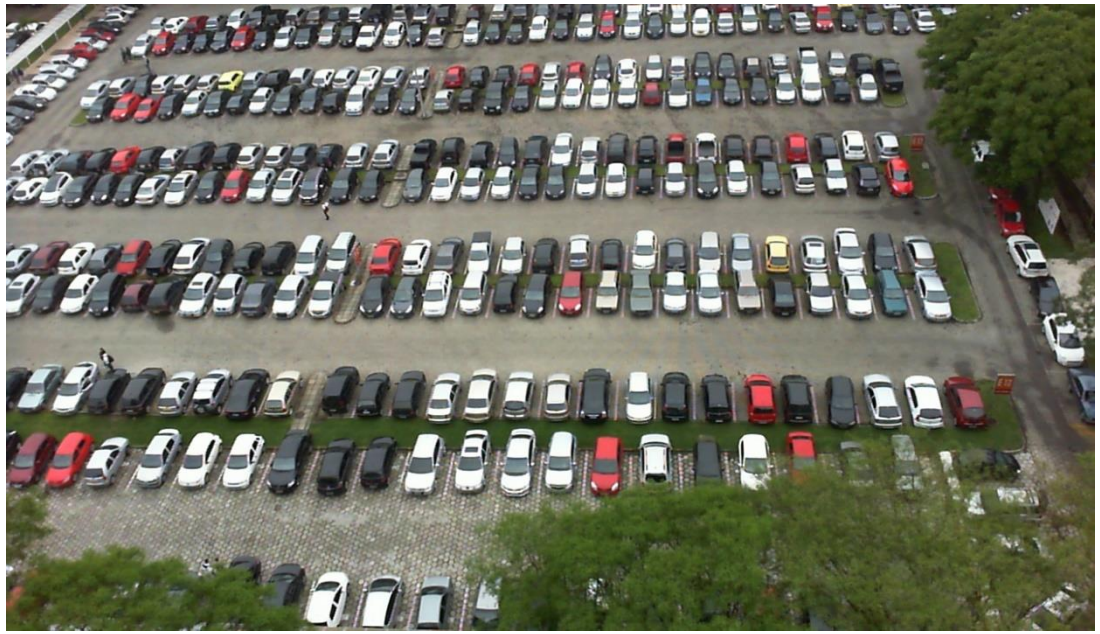


Approach

- Yolo first takes an input image and divides it into grids(3x3 grid)
- Image classification and localization are applied on each grid after which YOLO predicts the bounding boxes and their corresponding probabilities.
- To find the correct box from all the boxes we use Non-Max suppression technique.
- We have selected the rectangles above a confidence threshold and sort the threshold rectangles in descending rectangles in descending order.
- We loop over the sorted threshold kept bounding boxes and compute the IOU between the bounding boxes and the boxes which meet the threshold.

Approach

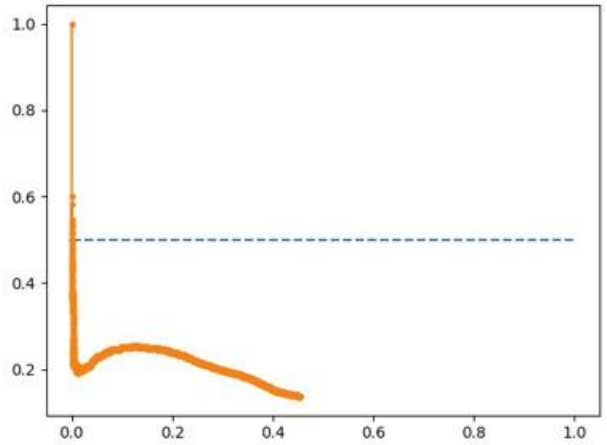
- We get the IOU threshold values for Carparked image and inference images which helps in reducing multiple overlapping images.
- The model is trained using Cross entropy classifier and Sigmoid as the activation



- Using trained model we collect the slots for Fully car parked image and similarly predict occupied car slot for interference
- Using IOU and NMS we find empty slots for inference image

Evaluation

- We compute the mean average precision of the defined model on validation dataset and we have depicted the IOC curve for it, which is plotted between precision and recall curve.



Future Work

- We can increase the model accuracy further more using Inception v3 or v4
- Can include the model into a system to enable real time parking slot allocation to public
- If car park area has multiple cameras then we can implement car park number plate detection and mapped exact location of each car parked

Thank You