

# Project 3: Fast R-CNN for Object Detection

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November 28, 2017

## Task 1: Single-class object detection in one image

We use pre-trained Fast R-CNN model to do object detection in one example image. Figure 1 shows the number of detections over the value of threshold. The total number of bounding boxes after non-maximum suppression with a threshold of 0.15 is 247. We observe that as the threshold increases, the number of positive detections decreases, and we finalize the threshold as about 0.65.

Figure 2 displays the car detections on the sample image.

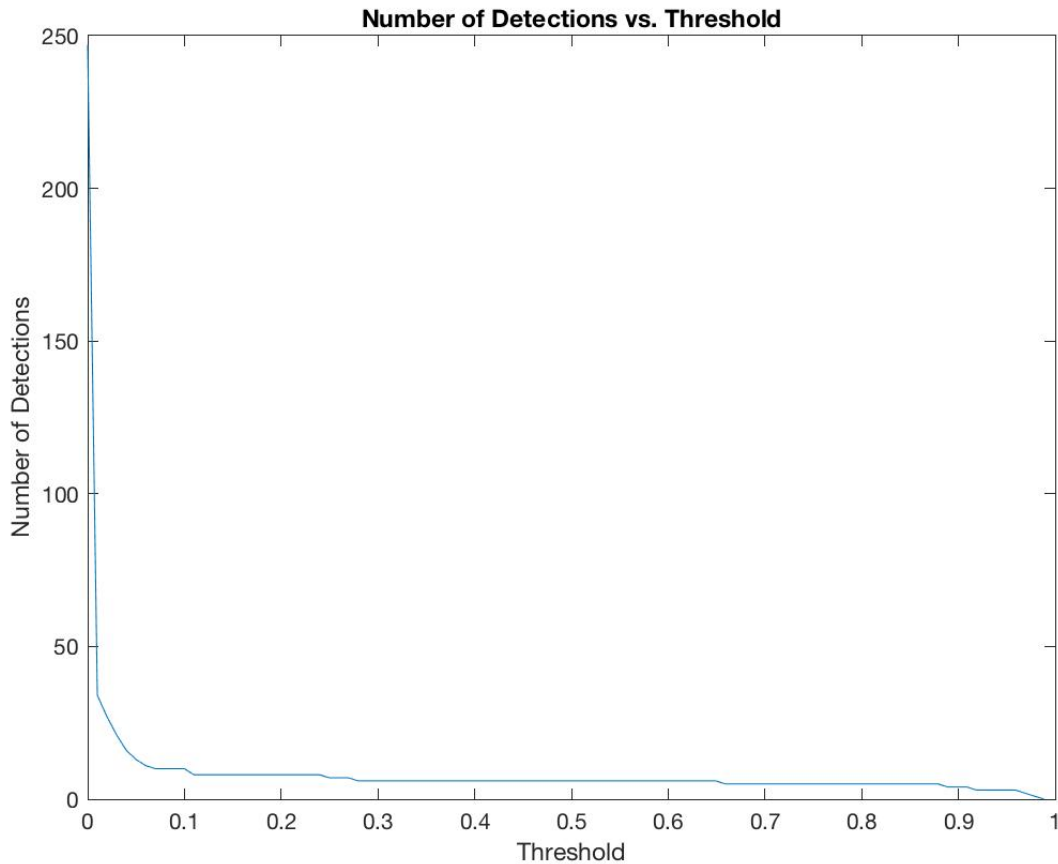


Figure 1: Number of detections over threshold.



Figure 2: Car detections on the sample image.

## Task 2: Object detection on Pascal VOC 2007 dataset

We use the same model to do object detection on testing dataset of Pascal VOC 2007. Figure 3 displays an example with true positive detections of multi-classes. In this example, the chairs, the potted plant, the dining table and the sofa can be considered as true positives, while the car and the person are false positives.

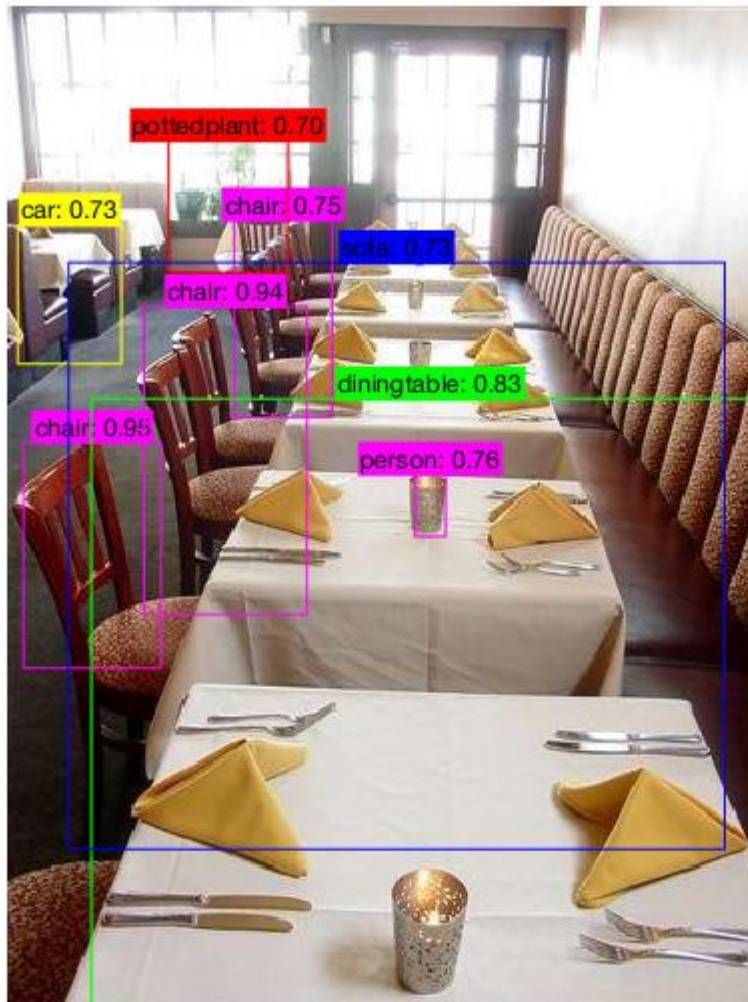


Figure 3: An example with true positive detections of multi-classes.

To quantitatively the decision results, we plot the precision-recall curve for car class in Figure 4. From the curve, we observe that it is impossible achieve very high precision rate and recall rate simultaneously.

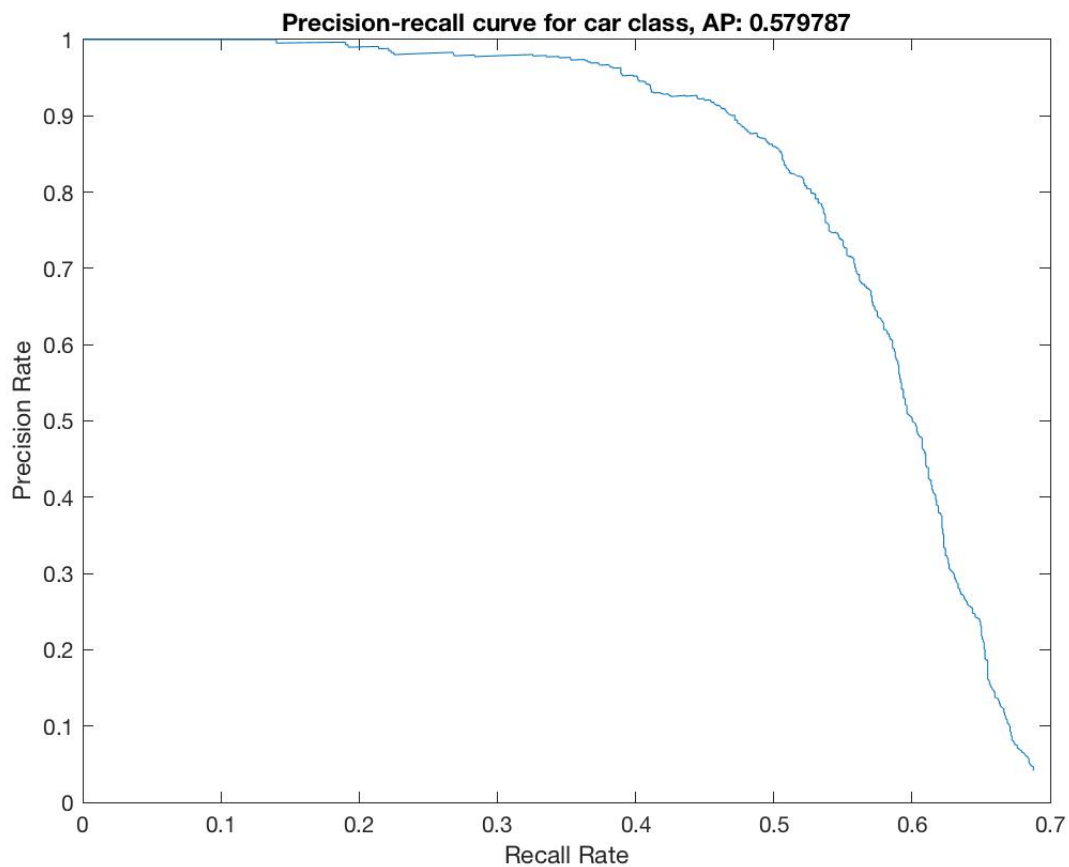


Figure 4: Precision-recall curve for car class.

Finally, we compute the average precision (AP) of every category and calculate the mean average precision (mAP) over 20 classes. Table 1 summarizes the results. From the table, we see that the mAP of our model is 0.481034, which is good enough in general object detection.

Class	AP
aeroplane	0.585358
bicycle	0.604260
bird	0.406702
boat	0.296687
bottle	0.145479
bus	0.615982
car	0.579787
cat	0.671733
chair	0.206817
cow	0.496006
dining table	0.492875
dog	0.567848
horse	0.645948
motorbike	0.610507
person	0.477116
potted plant	0.201672
sheep	0.415092
sofa	0.431161
train	0.649127
tv monitor	0.520533
total	0.481034

Table 1: Summary of average precisions for Pascal VOC 2007.