DL Lab4

1. In the below given cell, shape of the boxes.eval() is (1783,4). Why are there 1783 boxes? Explain the reason for it. What is the maximum number and minimum number you can get for that? Write these answers in a word file.
    - Change the values like mean and stddev in lines 2 and 4 as well as threshold value in line 5 and observe the different values you get for the boxes.eval().shape.

```
1 with tf.compat.v1.Session() as test_a:
2     box_confidence = tf.compat.v1.random_normal([19, 19, 5, 1], mean=1, stddev=4, seed = 1)
3     boxes = tf.compat.v1.random_normal([19, 19, 5, 4], mean=1, stddev=4, seed = 1)
4     box_class_probs = tf.compat.v1.random_normal([19, 19, 5, 80], mean=1, stddev=4, seed = 1)
5     scores, boxes, classes = yolo_filter_boxes(box_confidence, boxes, box_class_probs, threshold = 0.5)
6     print("scores[2] = " + str(scores[2].eval()))
7     print("boxes[2] = " + str(boxes[2].eval()))
8     print("classes[2] = " + str(classes[2].eval()))
9     print("scores.shape = " + str(scores.shape))
10    print("boxes.shape = " + str(boxes.shape))
11    print("classes.shape = " + str(classes.shape))
12    print(boxes.eval().shape)
```

```
Tensor("boolean_mask/GatherV2:0", shape=(None,), dtype=float32) Tensor("random_normal_1:0", shape=(19, 19, 5, 4
scores[2] = 10.750582
boxes[2] = [ 8.426533   3.2713668 -0.5313436 -4.9413733]
classes[2] = 7
scores.shape = (None,)
boxes.shape = (None, 4)
classes.shape = (None,)
(1783, 4)
```

Answer: The shape of boxes.eval() is (1783, 4) because of the filtering step with the threshold. The YOLO model initially predicts a large number of boxes (19x19x5 = 1805). However, the yolo_filter_boxes function applies a threshold to the box confidence scores. Boxes with scores below this threshold are discarded, resulting in a smaller number of remaining boxes. In this specific case, 1783 boxes had a confidence score above the threshold.

Maximum Number of Boxes: The maximum number of boxes you can get is 1805 (19x19x5) if all boxes have a confidence score above the threshold.

Minimum Number of Boxes: The minimum number of boxes is 0 if none of the boxes meet the confidence score threshold.

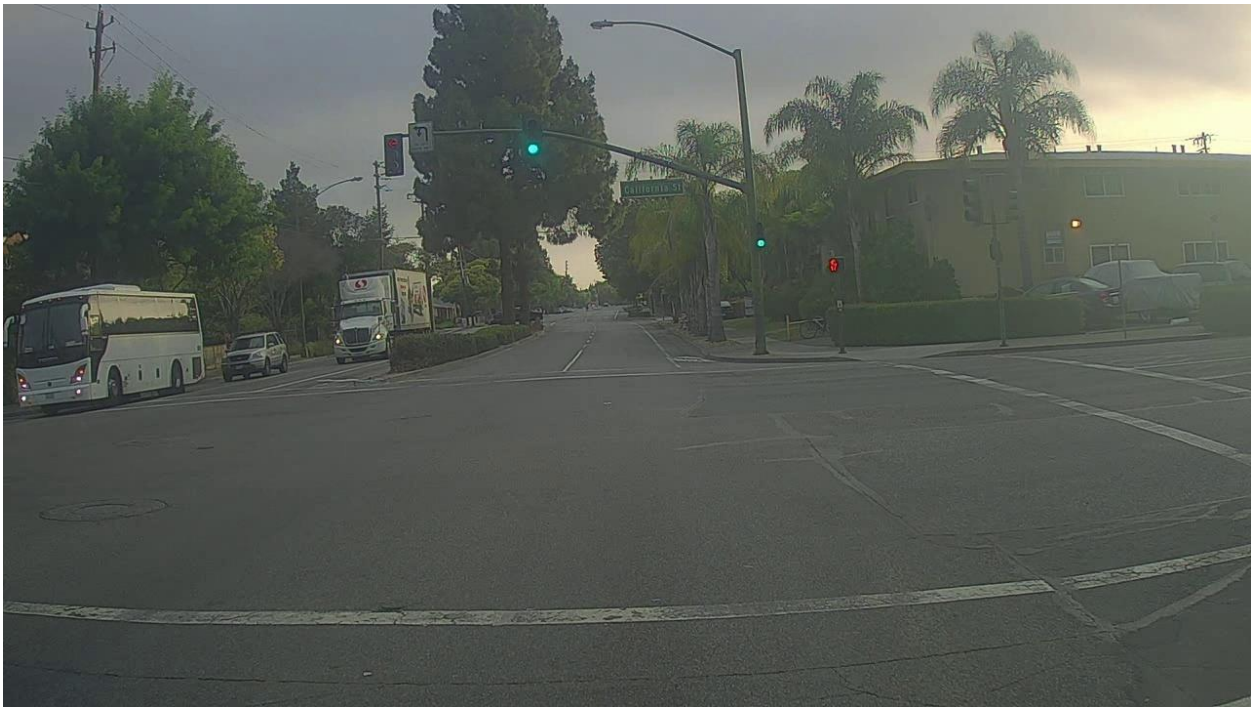
8. yolo_anchors.txt contains 10 values. They can be considered as height and width of 5 anchor boxes. What is the advantage of using such anchor boxes? What was the method used to determine the sizes of these anchor boxes? Give the answers to these questions in the word file.

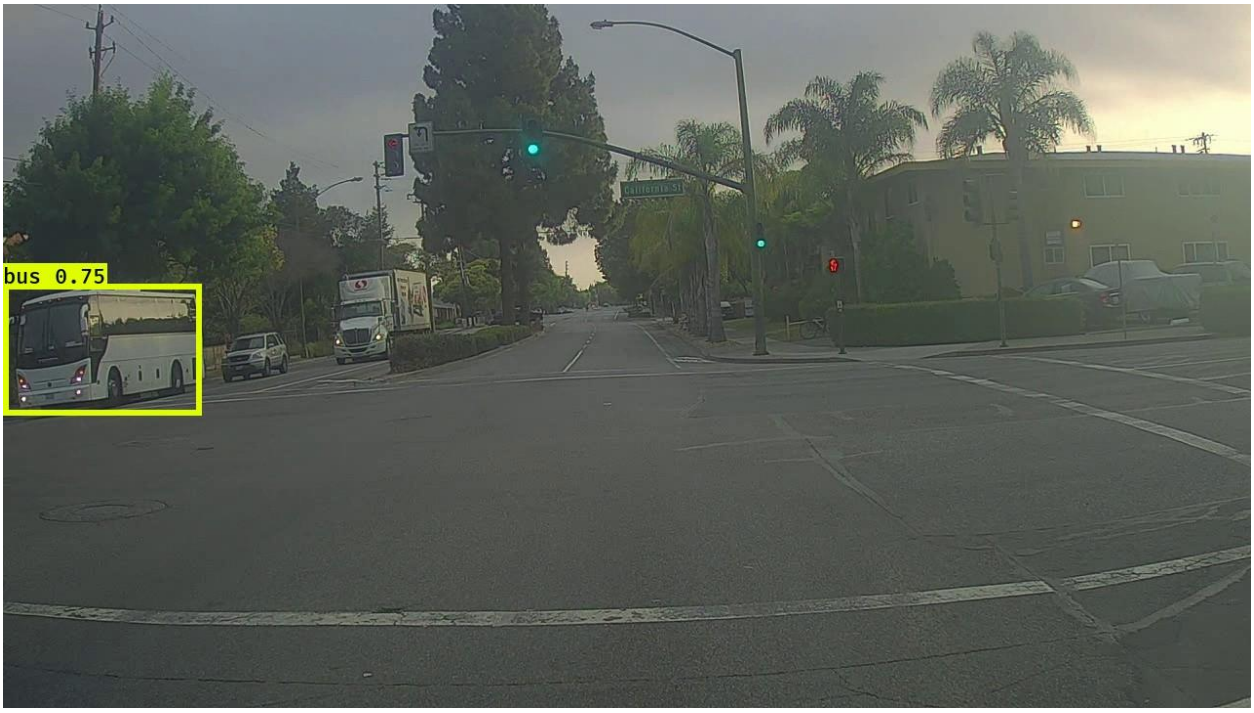
Answer: Anchor boxes, also known as prior boxes, are pre-defined boxes of various sizes and aspect ratios. Using anchor boxes in object detection offers several advantages:

- Anchor boxes help the model detect objects of varying sizes and aspect ratios by providing a set of reference boxes.
- By starting with pre-defined shapes, the model can focus on refining the position and size of the boxes, leading to better localization accuracy.
- Anchor boxes provide a good initialization for the bounding box regression task, potentially leading to faster convergence during training.

2. 10. Download the output images zip file from the google drive and observe the bounding boxes in the autonomous driving dataset (i.e., 21 images from 0100.jpg to 0120.jpg). Select 2 images from these 21 images and,
    - Write what you observe regarding correctly detected objects, incorrectly detected objects, undetected objects and incorrect bounding boxes in the word file.
    - Include these output 2 images as well as the original 2 images in the word file.

    Answer:

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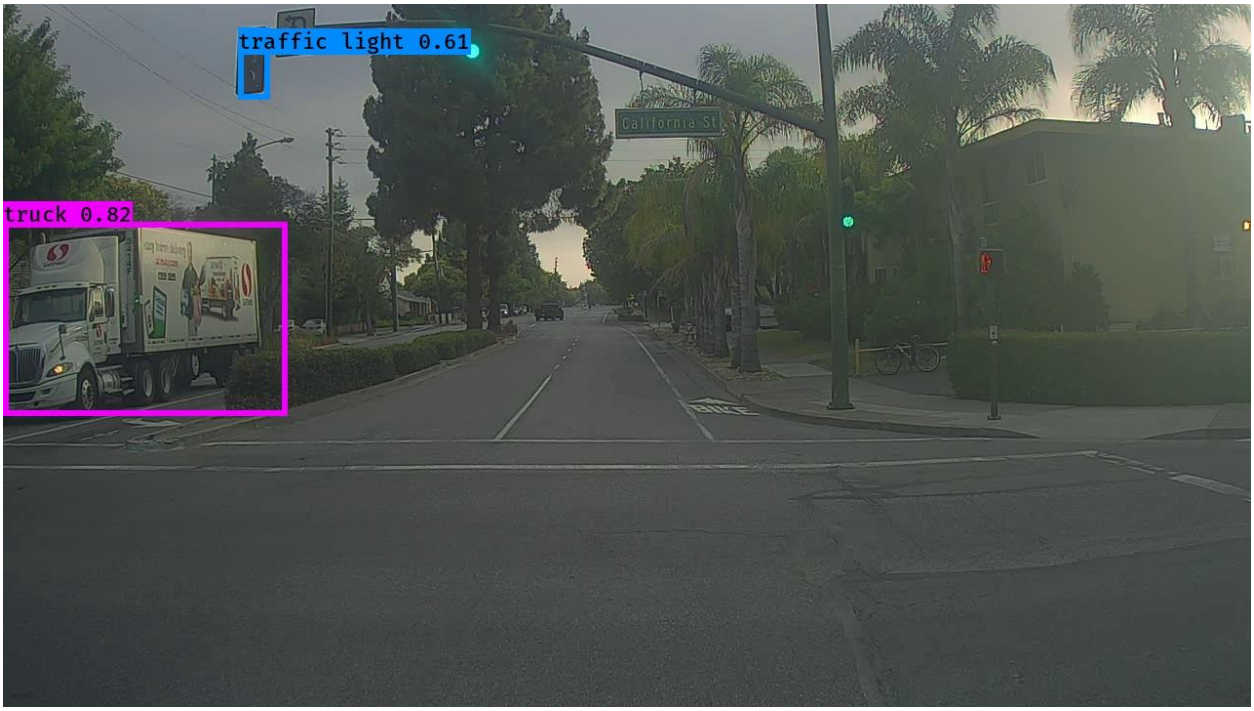

It was clear identify the image with higher resolution of object were able identify the model with more accuracy rather than the vehicle objects with low zoom conditions