Yihao Qian

Team A: Aware

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Individual Progress

During the last week, I was in charge of object detection. I was also in charge of camera's performance.

<u>Object detection</u>

The algorithm we are using is called faster r-cnn. The input of this algorithm is the image we captured from the camera. The output of this algorithm are as follow: 1. The bounding box of the interest object, which describe the relate position of the object. 2. The category that the object belongs to 3. The possibility that the object belongs to this category.

I downloaded the image from the internet and fed it into the faster r-cnn. You may find the result in Figure 1 and Figure 2. As you can see from this pictures. The faster r-cnn network can detect the vehicles perfectly.

Faster r-cnn's accuracy reaches around 72.3 mAP, which is the most cutting edge algorithm. However, the algorithm would take around 20s to run my computer. Then with a high performance GPU, such as TitanX, it would take 0.2s to detect 1 image.

There are two ways to solve this problem, the first one is to use this algorithm, however we reduce the category to 3 (Pedestrians, vehicles, traffic light) from the 20 category. This may reduce the time for detection. The second way is to use the other algorithm, one paper just published several months ago, called "SSD". This algorithm is as accurate as faster r-cnn, however this algorithm is much faster, it could reach 50-60 fps.

<u>Camera performance:</u>

I tested the camera's performance from two perspectives. 1. Speed 2. Light

1. Speed: I would like to figure out whether the speed of the vehicle may affect the performance of the camera. So I putted the camera inside the car and let the car to drive at a constant speed (10, 20, 30, 40 miles/h). The result shows that the camera can capture the clear image at 120 fps.
2. Light: We captured the image both in strong sunlight situation and low light situation. The result shows that our camera behaves well in strong light situation, while behaves poorly in low light situation. In order to solve this problem, we need to change the parameters of the camera (Brightness, exposure). We may also need the additional light source such as high beam.

Teamwork:

I read the paper for object detection (Faster r-cnn, SSD, R-FCN). And tried to find out which is the best algorithm for our project. Zihao and Amit tried to let the radar work. Harry was in charge of using the GPIO to capture the image.

Plans:

From now on, we are going to build our own perception system.

Harry and Amit will finish the camera housing design and test the performance of the housing in the next week.

Zihao and Amit are going to test the data from the radar.

The potential challenge is that our sponsor doesn't want to buy us a computer. However, the computer with a high performance GPU would cost us a lot of money, which means that there would be no money left to build other stuff.
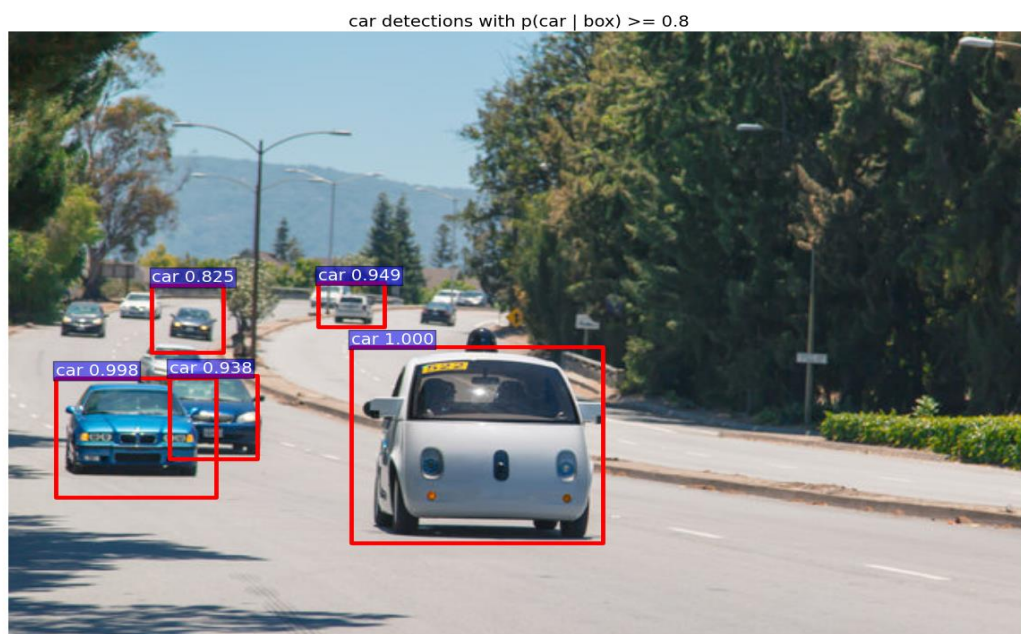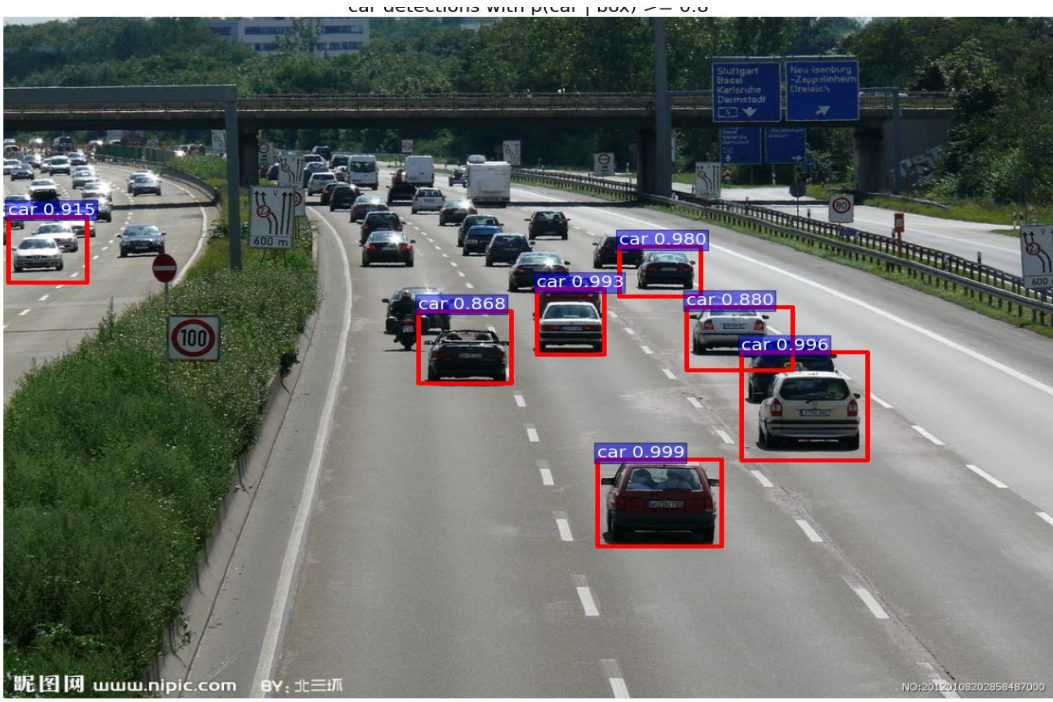
Figures:

Figure 1. Object detection (Vehicles)

Figure 2. Object detection (Vehicles)