Vehicle Detection and Tracking **Hardik Patel**
Udacity – Self Driving Car – Term 1

(Images in the output_images folder)

Histogram of Oriented Gradients (HOG)

The Hog parameters are defined in cell 13, which include variables like color space, orient, pix_per_cell, etc. The values chosen here are based on the tips for the project in the discussion forum of Udacity, including quite a bit of trial and error. For example, before implementation color_space as 'YCrCb", 'RGB' was used, as in lecture. However, the issue that with 'RGB' was many false positives.

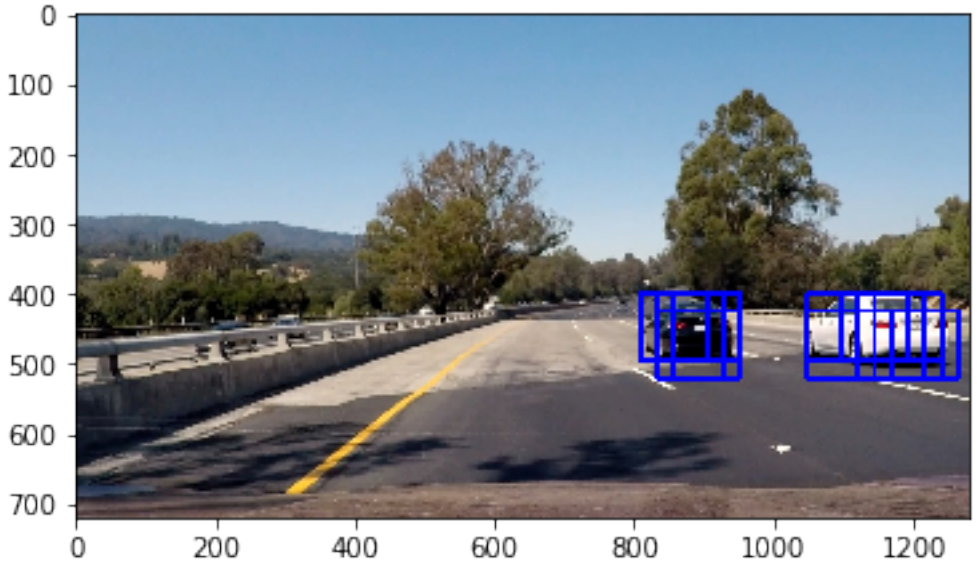
As values of other variables were increased, significant gains of accuracy in detecting and boxes in the video wobbled less. Earlier cells in the notebook include the function for HOG feature extraction.

The classifier chosen for the project was LinearSVM, and StandardScaler is used to normalize the data.

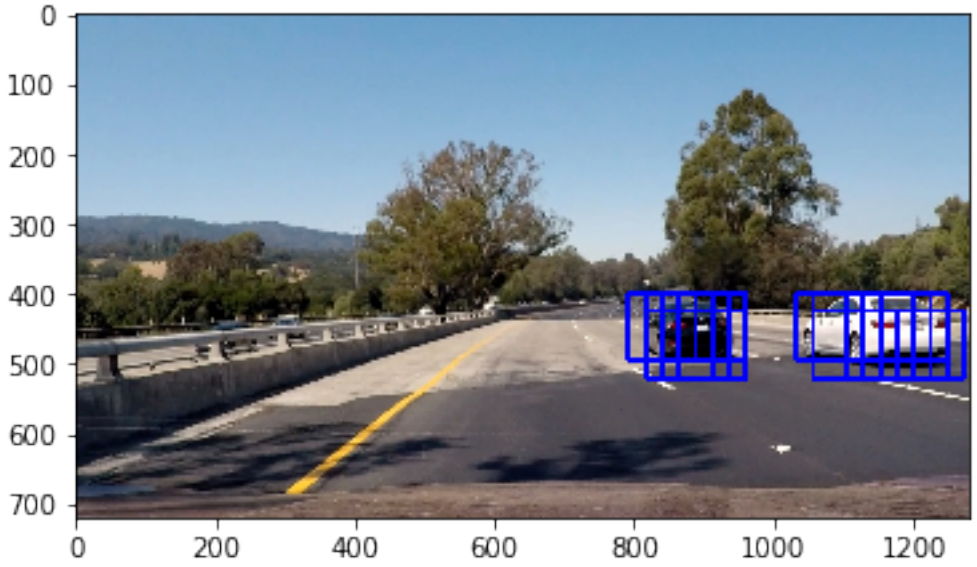
Sliding Window Search

As the first method of detection was implemented, it registered many false rectangles, hence, the overlap was increased. The number of false rectanges reduced, however, they did not disappear completely. Therefore, instead of tuning overlap, the HOG parameters were tuned further. Overlap was set back to original. Note: With such small overlap, the processing takes a little while.

The classifier was optimized mainly by tuning HOG parameters, by trial and error.
The detection by first method:



Detection by 2nd method:

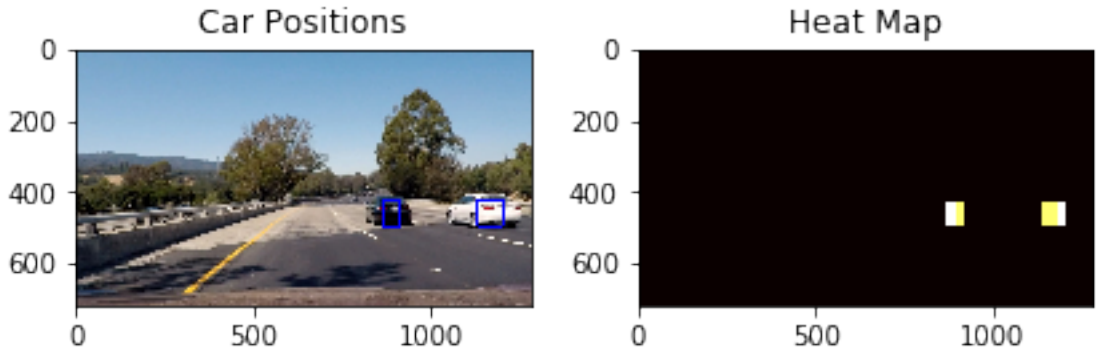


Video Implementation

In third to last cell block, methods are defined to significantly reduce false positive and finding boxes in subsequent frames, where they are expected to occur.

A correction term is used with svc.decision_function to further weed out false positives.

The threshold and other parameter were changed, however, they did not provide any meaningful gains.
Heatmap example:



Discussion

The main problem that I faced is of false positives. Most frames are ok. However, two frames have points where, in a real car situation problems may arise. The pipeline also detects cars on the other side of the road, and while it may not be desirable on the freeway, it could be useful on city streets.