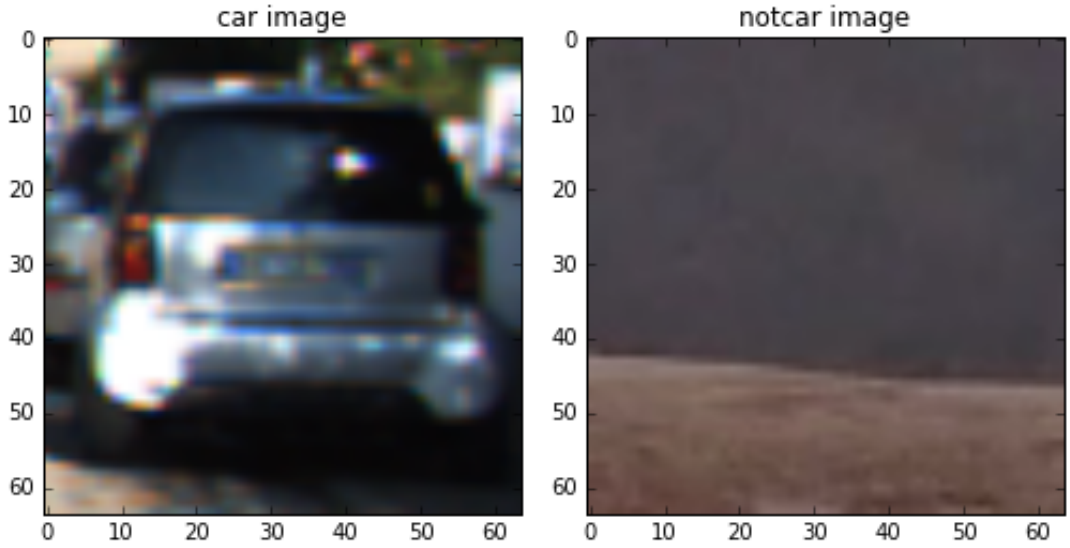
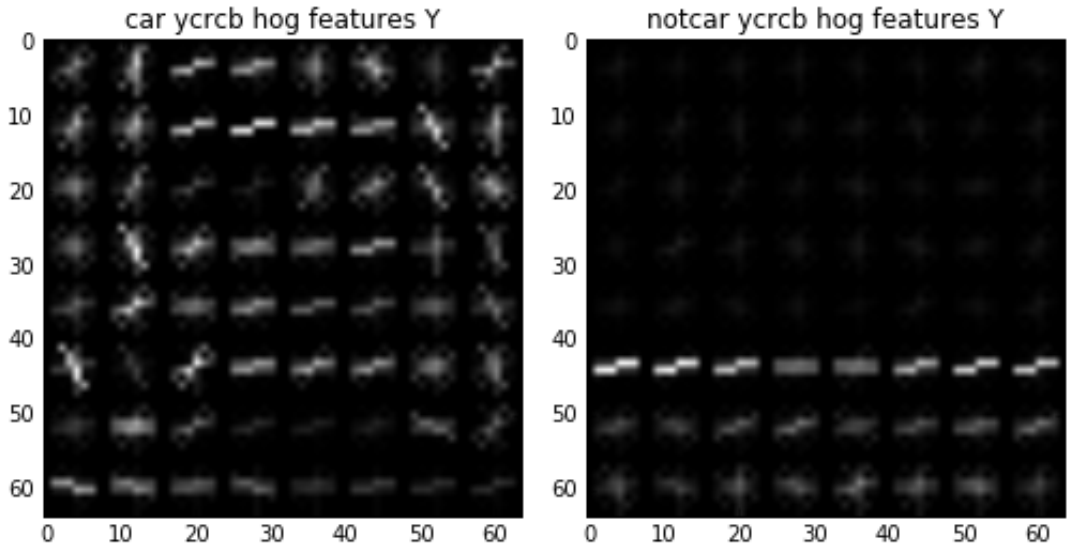
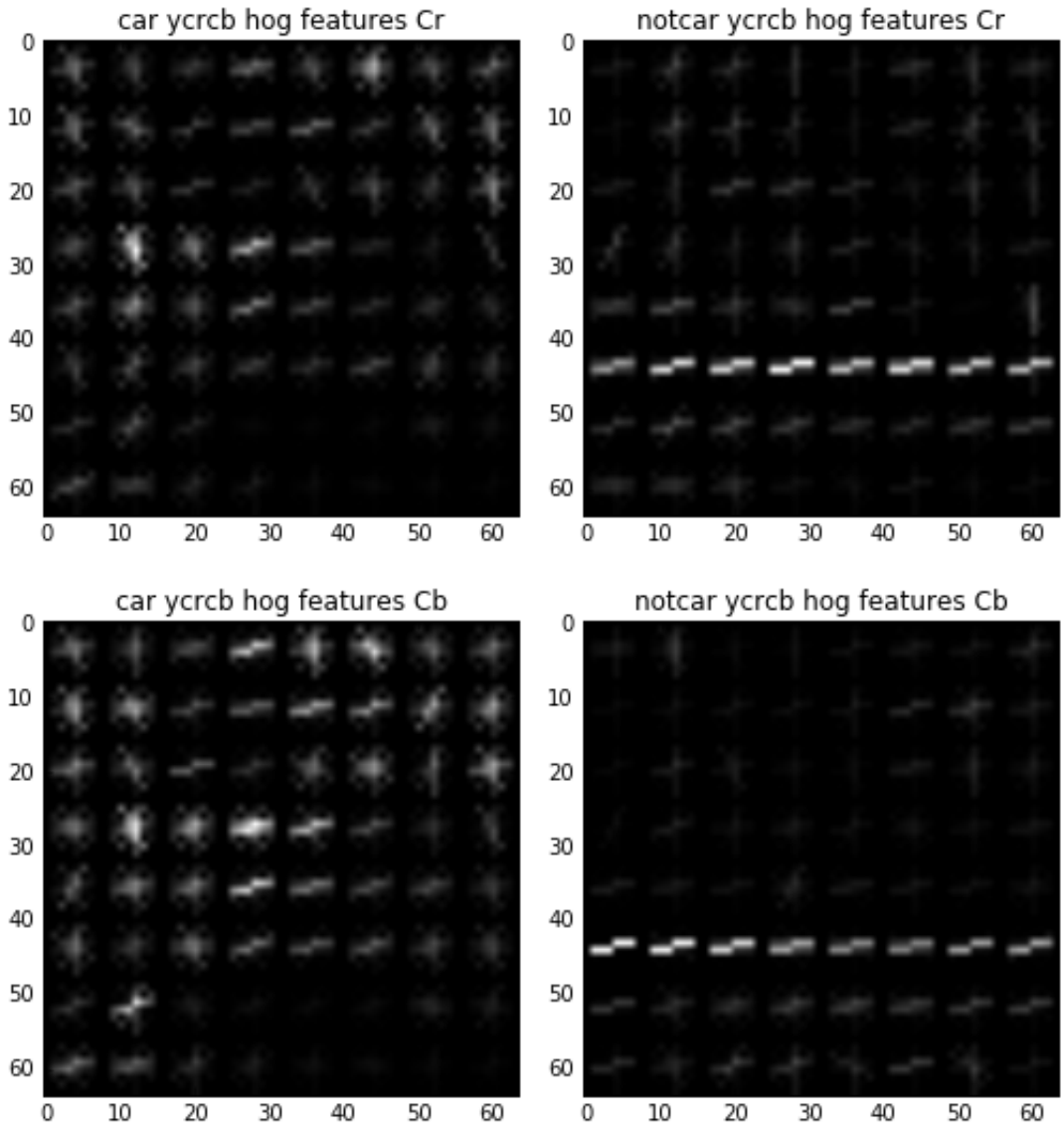
Data Exploration

Visualize the original image.



Visualize the hog features.





Feature Extraction

There are 3 features, hog, color histogram and spatial bins.
At first, I think use shape-based feature hog is enough, but when I test the classifer on the test images, there are false positives in the lane line.So I decide to use the hog and color histogram.
The reason of not use spatial bins feature is to make predicting faster.

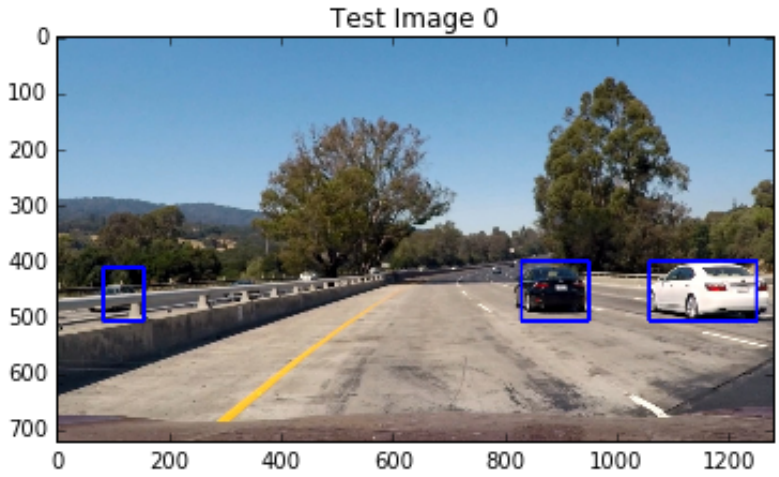
I choose YCrCb for the hog. Because from the hog features visualization above, I think hog with YCrCb can detect edges well.
The parameters I use:
* orient = 9
* pix_per_cell = 8
* cell_per_block = 2
* hog_channel = 'ALL'
I think 20 degree is precise enough for this task, so I choose orient=9. pix_per_celll=8 and cell_per_block=2 is just as usual.
I tried if I use only one channel, the svc accuracy on training set is below 0.95. And above 0.98 when use 3 channels together.

Training

I use sklearn LinearSVC classifier.
Before training, I use StandardScaler to normalize the combined-features.

Predicting

When Predicting, there are 2 important parameters:
* scales = [1, 1.5]
* cells_per_step = 1
Use scales = [1, 1.5] cause I when car is big, it scale it to a small size.
Use cells_per_step = 1 cause I think when cells_per_step>=2 the sliding window algorithm may offen lose 16 pixels information, and made the rectangle not stable.
And for decrese false positves, I use heat map and thresholding tricks.


Test Image 0
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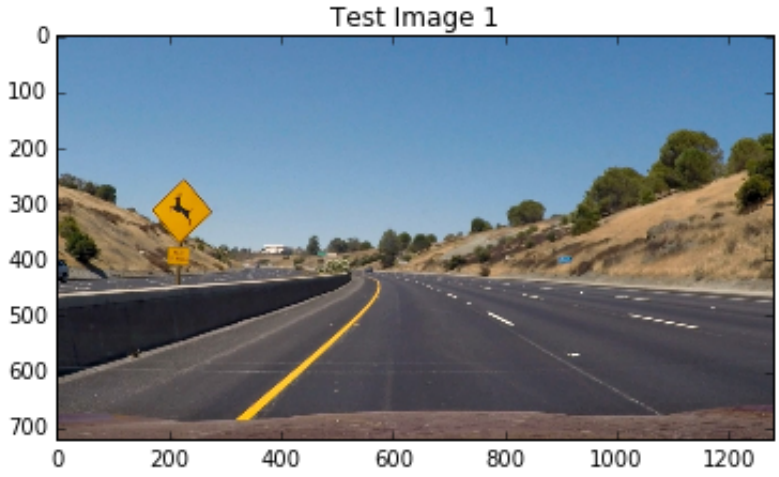
Test Image 1
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Test Image 2
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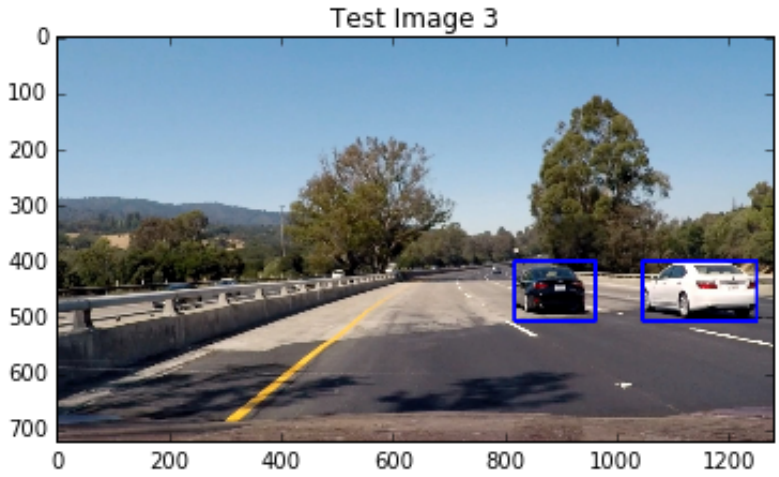

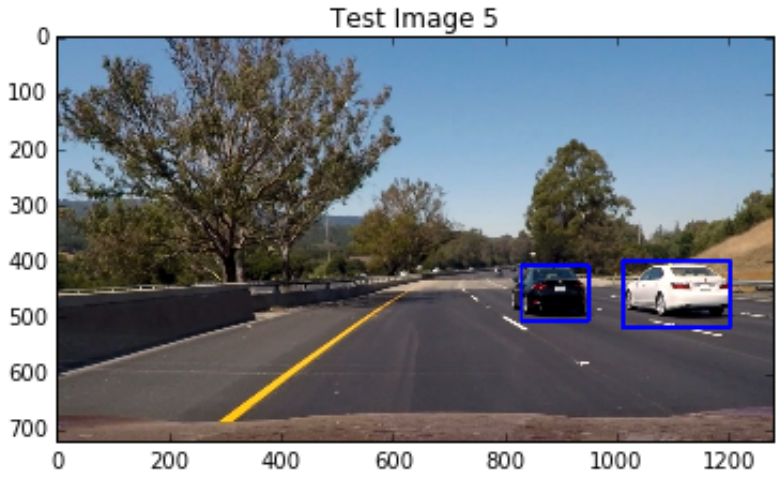

Problems

Now the car's border is not very stable, and I want to know the industry standard and method for solving this problem.And the algorithm cannot recognize small cars now, I know more scales will do that but it maybe cause more false positives.