Question1

March 29, 2017

```
In [1]: import cv2
        import numpy as np
        import os
        import glob
```

Read the files and label them

```
In [71]: file = open('labels.txt','w')
```

```
In [72]: for filename in glob.iglob('vehicles/**/*.png' , recursive = True):
             file.write(filename+"\t"+"1\n")
```

```
In [73]: for filename in glob.iglob('non-vehicles/**/*.png' , recursive = True):
             file.write(filename+"\t"+"0\n")
```

```
In [74]: file.close()
```

Make a dataframe

```
In [2]: import pandas as pd
        import random
        import matplotlib.pyplot as plt
        %matplotlib inline
```

```
In [3]: df = pd.read_csv('labels.txt', sep='\t', header=None)
```

```
In [4]: df.columns =  ["Image", "Label"]
```

```
In [5]: df = df.sample(frac=1)
        df = df.sample(frac=1)
        df = df.sample(frac=1)
```

Split the dataset into training and testing

```
In [6]: msk = np.random.rand(len(df)) < 0.8
```

```
In [7]: train = df[msk]
        train = train.reset_index()
```

```
In [8]: test = df[~msk]
        test = test.reset_index()

In [9]: print("Testing size =  " + str(len(test)))
        print("Training size = " + str(len(train)))

Testing size =  3496
Training size = 14264
```

Compute the features

```
In [198]: bin_n = 16 # Number of bins
          def hog(img):
              gx = cv2.Sobel(img, cv2.CV_32F, 1, 0)
              gy = cv2.Sobel(img, cv2.CV_32F, 0, 1)
              mag, ang = cv2.cartToPolar(gx, gy)

              # quantizing binvalues in (0...16)
              bins = np.int32(bin_n*ang/(2*np.pi))

              # Divide to 4 sub-squares
              bin_cells = bins[:10,:10], bins[10:,:10], bins[:10,10:], bins[10:,10:]
              mag_cells = mag[:10,:10], mag[10:,:10], mag[:10,10:], mag[10:,10:]
              hists = [np.bincount(b.ravel(), m.ravel(), bin_n) for b, m in zip(bin_cells, mag_c
              hist = np.hstack(hists)
              return hist
```

Compute the patches from the image

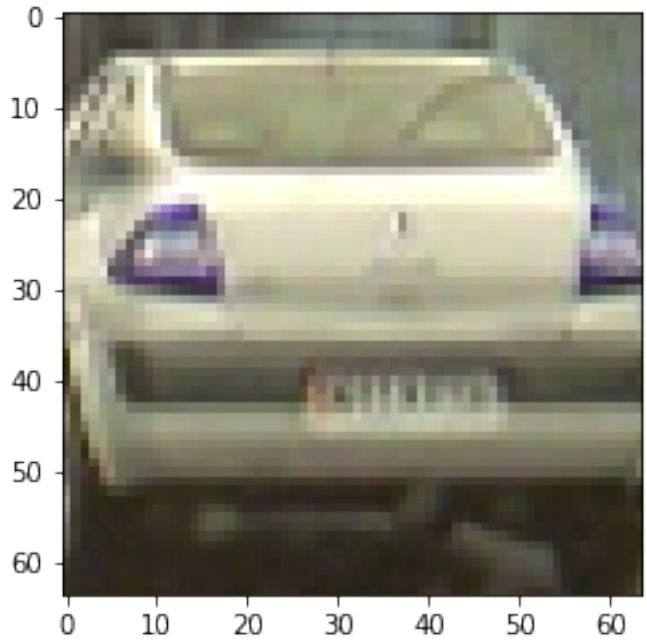
```
In [199]: from sklearn.feature_extraction import image

In [200]: img = cv2.imread(train["Image"][1])
          patches = image.extract_patches_2d(img, (32,32), random_state=1, max_patches=30)
          print(img.shape)

(64, 64, 3)


In [166]: plt.imshow(img)

Out[166]: <matplotlib.image.AxesImage at 0x1cc8cdfe940>
```



In [167]:
```
images = patches
for i in range(9):
    plt.subplot(3,3,i+1),plt.imshow(images[i],'gray')
    plt.xticks([]),plt.yticks([])
plt.show()
```

In [204]:
```
list_features = []
i = 0
for image_path in train['Image']:
#     print (image_path)
    i = i + 1
    img  = cv2.imread(image_path)
    patches = image.extract_patches_2d(img, (32,32), random_state=1, max_patches=3)
    print('Downloading File FooFile.txt [%d%%]\r'%i, end="")
    for patch in patches:
        x = hog(patch)
        list_features.append((image_path, x))
```

```
Downloading File FooFile.txt [14264%]
```

In [ ]:

Knn to form clusters

In [205]:
```
descriptors = list_features[0][1]
count = 0
for image_path, descriptor in list_features[1:]:
    count = count + 1
    print('Downloading File FooFile.txt [%d%%]\r'%count, end="")
    descriptors = np.vstack((descriptors, descriptor))
```

```
Downloading File FooFile.txt [42791%]
```

In [206]:
```
from scipy.cluster.vq import *
k = 20
voc, variance = kmeans(descriptors, k, 1)
```

In [207]:
```
im_features = np.zeros((len(train["Image"]), k), "float32")
for i in range(len(train["Image"])):
    words, distance = vq(np.asmatrix(list_features[i][1]),voc)
    for w in words:
        im_features[i][w] += 1
```

In [213]:
```
import pickle
pickle.dump( im_features, open( "save.p", "wb" ) )
```

In [209]:
```
from sklearn.preprocessing import StandardScaler
```

In [210]:
```
# Scaling the words
stdSlr = StandardScaler().fit(im_features)
im_features = stdSlr.transform(im_features)
```

In [215]:
```
im_features[0]
#Histogram equalization
```

```
Out[215]: array([-0.14880218, -0.16633102, -0.13757803, -0.62471843, -0.40159395,
                 -0.10652165, -0.15626049, -0.11336143, -0.16522051, -0.10884062,
                 -0.21316342, -0.1488024 , -0.14355075, -0.13968778, -0.21098495,
                 -0.24163769, -0.26365504,  3.55826426, -0.15002039, -0.26316229], dtype=float32
```

Testing the model

```
In [216]: list_features_test = []
          i = 0
          for image_path in test['Image']:
          #     print (image_path)
              i = i + 1
              img  = cv2.imread(image_path)
              patches = image.extract_patches_2d(img, (32,32), random_state=1, max_patches=3)
              print('Downloading File FooFile.txt [%d%%]\r'%i, end="")
              for patch in patches:
                  x = hog(patch)
                  list_features_test.append((image_path, x))
```

```
Downloading File FooFile.txt [3496%]
```

```
In [218]: descriptors_test = []
          descriptors_test = list_features_test[0][1]
          count = 0
          for image_path, descriptor in list_features_test[1:]:
              count = count + 1
              print('Downloading File FooFile.txt [%d%%]\r'%count, end="")
              descriptors_test = np.vstack((descriptors_test, descriptor))
```

```
Downloading File FooFile.txt [10487%]
```

```
In [219]: from scipy.cluster.vq import *
          k = 20
          voc, variance = kmeans(descriptors_test, k, 1)

In [220]: test_features = np.zeros((len(test["Image"]), k), "float32")
          for i in range(len(test["Image"])):
              words, distance = vq(np.asmatrix(list_features_test[i][1]),voc)
              for w in words:
                  im_features[i][w] += 1

In [221]: from sklearn.preprocessing import StandardScaler
          # Scaling the words
          stdSlr = StandardScaler().fit(test_features)
          test_features = stdSlr.transform(test_features)

In [261]: labels_train = train['Label']
          labels_train = labels_train.values
```

```
In [262]: labels_test = test['Label']
          labels_test = labels_test.values

In [263]: im_features.shape

Out[263]: (14264, 20)

In [264]: test_features.shape

Out[264]: (3496, 20)

In [265]: from sklearn.neighbors import KNeighborsClassifier

In [266]: neigh = KNeighborsClassifier(n_neighbors=30)

In [267]: neigh.fit(im_features, labels_train)

Out[267]: KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
                    metric_params=None, n_jobs=1, n_neighbors=30, p=2,
                    weights='uniform')

In [268]: prediction = neigh.predict(test_features)

In [270]: from sklearn.metrics import accuracy_score

In [271]: accuracy_score(labels_test, prediction)

Out[271]: 0.49685354691075517

In [ ]:

In [ ]:
```