Problem4_DrewHill

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L. Drew Hill
CE263N - Problem 4
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In [1]:
```
import numpy as np
import pickle
from sklearn import svm
from mpl_toolkits.mplot3d import Axes3D

from matplotlib import pyplot as plt
from pylab import *

# run matplotlib inline
%matplotlib inline
```

Step 1 Run clicker.py at appropriate path (in current directory) and identify cars (left click) and non-cars (right-click). Close window, and np arrays automatically saved to the current directory. Because the "clicker.py" script flattens the information captured (4 points each [transparent, red, blue, green] for each pixel in a 20x20 pixel box centered at the point we clicked– total of 1600 points per click), we need to unflatten it. This applies to every X-y pair in the numpy array (note the shape of each X array is 1600).

In [2]:
```
# Import numpy array of trained points
X_trn_og = np.load('X_trn.np')
Y_trn_og = np.load('Y_trn.np')
```

In [3]:
```
# make sure every array is 1600 pixels in size
boop = []

for i in xrange(X_trn_og.shape[0]):
    z = X_trn_og[i].shape
    boop = np.append(boop,z, 0)
np.unique(boop)
```

Out[3]:
```
array([    0.,   1360.,   1600.])
```

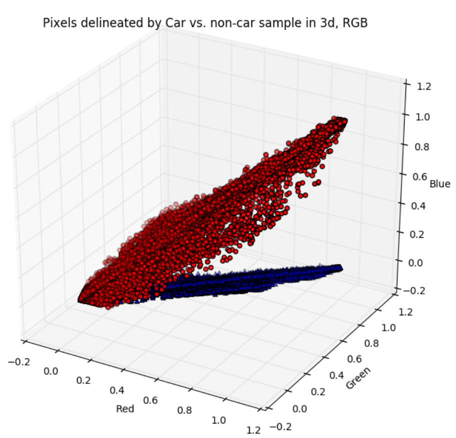
Turns out some only were assigned 1360 or even 0 RGBT sets. So, adjust "unflattening" accordingly:

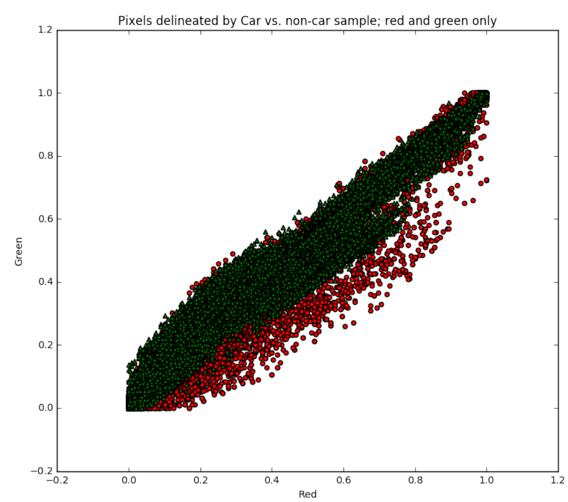
In [4]:
```
# unflatten / reshape each "X_trn" element
# take random sample of each sample (Virtual Sample)

X_trn = np.empty((0,4), float)
Y_trn = np.empty((0,), float)

for i in xrange(X_trn_og.shape[0]):
    # produce [R,G,B,T,car,i] * [pixel number per sample] array for each sa
        # determine length of new array
    row_num_newarray = X_trn_og[i].shape[0]/ 4
    a = X_trn_og[i]
    a = a.reshape(row_num_newarray,4)
        # remove transparency element (4th element)
    b = np.delete(a, 3 , 1)
        # create new element for "car" status
    car = np.array([Y_trn_og[i]] * row_num_newarray)
        # append
    c = np.insert(b, 3,car, 1)

#         # random sample of 25% of each sample
#             # create index
#         idx = np.random.randint(10, size= row_num_newarray/4)
#         e = d[idx,:]

    # append to final array set
    X_trn = np.append(X_trn, c,0)          # stack onto X_trn array
    Y_trn = np.append(Y_trn, car,0)
```

In [5]:
```
## Plot
def plot_RGB_3d():
    X_cars = X_trn[X_trn[:,3] == 1]
    X_notcars = X_trn[X_trn[:,3] == 0]

    fig = plt.figure(figsize=(20,8))
    ax = fig.add_subplot(121, projection='3d')

    ax.scatter(X_cars[:,0], X_cars[:,1], X_cars[:,1], c='r', marker='o')
    ax.scatter(X_notcars[:,0], X_notcars[:,1], X_notcars[:,3], c='b', marke

    ax.set_xlabel('Red')
    ax.set_ylabel('Green')
    ax.set_zlabel('Blue')
    ax.set_title("Pixels delineated by Car vs. non-car sample in 3d, RGB")

    # Project data to X/Y plane - RG
    ax2d = fig.add_subplot(122)
    ax2d.scatter(X_cars[:,0], X_cars[:,1], c='r', marker='o')
    ax2d.scatter(X_notcars[:,0], X_notcars[:,1], c='g', marker='^')
```

```
        ax2d.set_xlabel('Red')
        ax2d.set_ylabel('Green')
        ax2d.set_title("Pixels delineated by Car vs. non-car sample; red and gr

#       # Project data to X/Y plane - RB
#       ax3d = fig.add_subplot(122)
#       ax3d.scatter(X_cars[:,0], X_cars[:,2], c='r', marker='o')
#       ax3d.scatter(X_notcars[:,0], X_notcars[:,2], c='b', marker='^')

#       ax3d.set_xlabel('Red')
#       ax3d.set_ylabel('Blue')
#       ax3d.set_title("Pixels delineated by Car vs. non-car sample; red and

#       # Project data to X/Y plane - BG
#       ax2d = fig.add_subplot(122)
#       ax2d.scatter(X_cars[:,2], X_cars[:,1], c='b', marker='o')
#       ax2d.scatter(X_notcars[:,2], X_notcars[:,1], c='g', marker='^')

#       ax2d.set_xlabel('Blue')
#       ax2d.set_ylabel('Green')
#       ax2d.set_title("Pixels delineated by Car vs. non-car sample; blue and


        plt.show()
```

In [6]:
```
plot_RGB_3d()
```





Step 2 Create a support vector machine classifier, using different classifiers.

In [ ]:
```
kernel = 'linear'
clf_l = svm.SVC(kernel = kernel,C=10000.0)
clf_l.fit(X_trn[:,:-1], Y_trn)
```

```
In [18]: # kernel = 'rbf'
         # clf_rbf = svm.SVC(kernel = kernel,C=100.0)
         # clf_rbf.fit(X_trn[:,:-1], Y_trn)
```

```
In [10]: kernel = 'poly'
         clf_p = svm.SVC(kernel = kernel,C=100.0)
         clf_p.fit(X_trn[:,:-1], Y_trn)
```

```
Out[10]: SVC(C=100.0, cache_size=200, class_weight=None, coef0=0.0,
           decision_function_shape=None, degree=3, gamma='auto', kernel='poly',
           max_iter=-1, probability=False, random_state=None, shrinking=True,
           tol=0.001, verbose=False)
```

Step 3 Pickle my classifier.

```
In [ ]: with open('classifier_DrewHill_linear_C10000.pickle','wb') as f:
            pickle.dump(clf_l, f)
```

Step 4 My Submission (as tested on the 'preview' data)

```
In [ ]: import numpy as np
        import pickle

        from matplotlib import pyplot as plt
        from pylab import *


        ### this will be replaced with the real test image ###
        im_test = plt.imread('parking_test_preview.png')
        ###


        # This function MUST take locations (loc) and an image (im)
        # as input parameters and return the feature vector
        def my_feature_vector(loc, im, size = 10):
          w = size
          # a patch of the size w cenetered at loc is extracted as a feature vector
          patch = im[loc[1]-w:loc[1]+w, loc[0]-w:loc[0]+w]
          p = np.array(patch).flatten()
          return p


        ## 10 preview test locations
        ### these will be replaced with the real set of 100 test locations ###
        test_locs_labs = np.load('test_locations_and_labels_preview.np')

        test_locs   = test_locs_labs[:,0:2]
        test_labels = test_locs_labs[:,2]
```

```
X_test = []
for loc in test_locs:
  X_test.append( my_feature_vector(loc, im_test) )


######
# Feature selection

## load classifier
my_classifier = pickle.load(open('classifier_DrewHill_linear_truncated.pick


def drew_predict(X):
    X_i = np.empty((0,3), float)

    for i in xrange(np.array(X).shape[0]):
        row_num_newarray = np.array(X).shape[0]/ 4
        a = np.array(X)
        a = a.reshape(row_num_newarray,4)
        b = np.delete(a, 3 , 1)
#         car = np.array([test_locs_labs[i,2]] * row_num_newarray)
#         c = np.insert(b, 3,car, 1)

        x_i = np.empty((0,), int)

        for i in xrange(b.shape[0]):
            boop = my_classifier.predict(b[i])
            x_i = np.append(x_i, boop, 0)

        predicted = int(round(np.mean(x_i)))

        return predicted
    return predicted

## perform classification

score = 0
for i, xtest in enumerate(X_test):

  predicted = drew_predict(xtest)

  if (test_labels[i] == 1.0)&(predicted == 1.0):
     score = score + 2

  if (test_labels[i] == 1.0)&(predicted == 0.0):
     score = score - 0.5

  if (test_labels[i] == 0.0)&(predicted == 1.0):
```

```
        score = score - 0.5

    if (test_labels[i] == 0.0)&(predicted == 0.0):
        score = score + 0.25

    print test_labels[i], predicted, score

print 'You final Score is: %.2f' % score
```