HOG_Demo

February 18, 2019

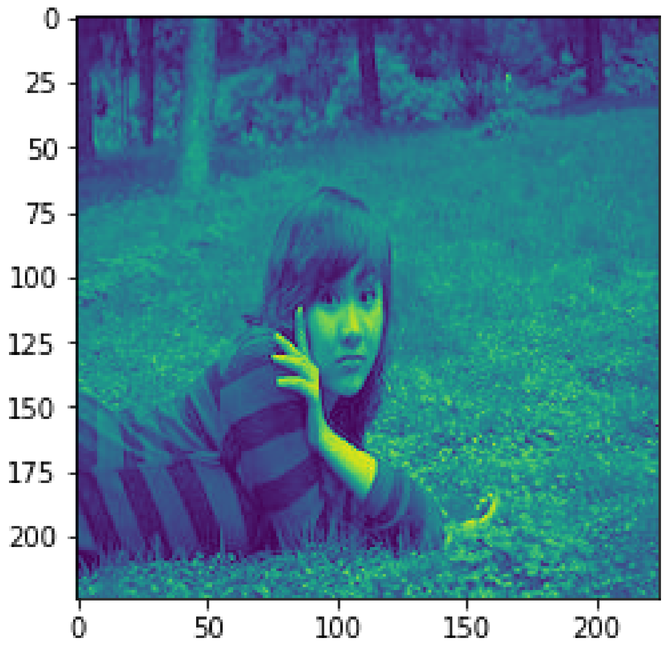
0.1 HOG implementation with python and numpy

```
In [44]: import numpy as np
         import math
         import matplotlib.pyplot as plt

         PI = 3.1415926

         class HOG:
             def __init__(self, img):
                 self.img = img

             def shifted_x(self, step=1):
                 '''
                 Reture shifted image to compute graident in x direction
                 '''
                 img_padded = np.pad(self.img, ((0, 0), (0, step)), 'constant', constant_value
                 return img_padded[:, 1:]

             def shifted_y(self, step=1):
                 '''
                 Reture shifted image to compute graident in y direction
                 '''
                 img_padded = np.pad(self.img, ((0, step), (0, 0)), 'constant', constant_value
                 return img_padded[1:, :]

             def mag(self, gx, gy):
                 '''
                 Compute the magnitude of the gradients

                 '''
                 return np.sqrt(np.power(gx, 2) + np.power(gy, 2))

             def theta(self, gx, gy, eps=1e-6):
                 '''
                 Compute the angle of the gradients
                 eps: prevent dividing by 0
```

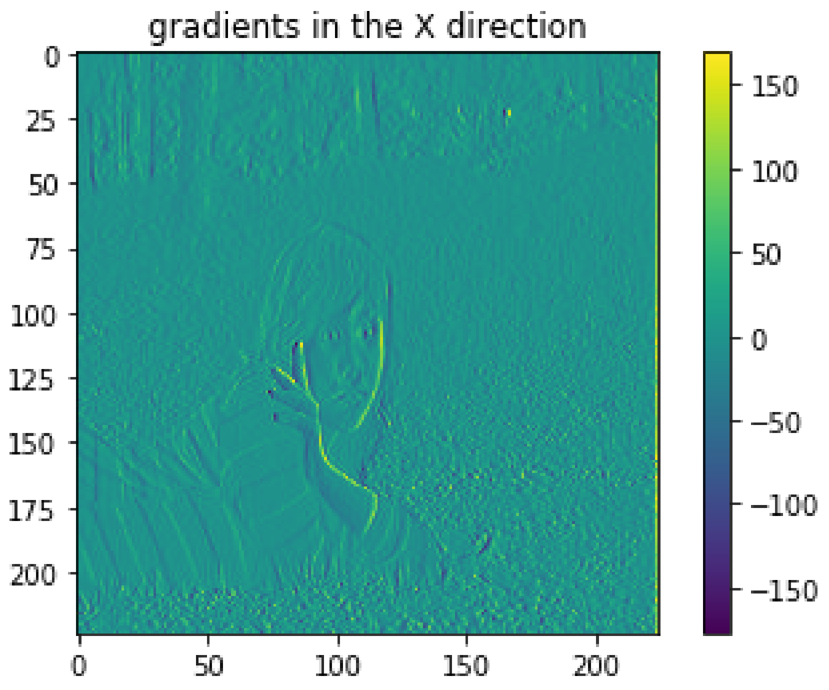
```
        '''
        return np.arctan(gy/(gx+eps))

    def forward(self, interval_size=9, show_grad=True):
        '''
        Arguements:
        -interval_size: how many gridients interval are desired.
            e.g. if 9, all direction will be divided into 2*9 = 18 directions.
                 with a resolution of 360/2*9 = 20 degree
        -show_grad: if true, plot the gradients in x and y directions

        '''
        interval = int(360 / (interval_size * 2))
        self.historgram_x = np.arange(-180, 180, interval)

        #compute gradients in x and y directions
        xgrad = self.img - self.shifted_x()
        ygrad = self.img - self.shifted_y()

        if show_grad:
            plt.imshow(xgrad)
            plt.title('gradients in the X direction')
            plt.colorbar()
            plt.show()
            plt.imshow(ygrad)
            plt.title('gradients in the Y direction')
            plt.colorbar()
            plt.show()

        #compute the magnitude and angle for each gradient components
        self.g_theta = self.theta(xgrad, ygrad).flatten() * 180/PI #change rad to deg
        self.g_mag = self.mag(xgrad, ygrad).flatten()

    def plot_hog(self, normalization=True):
        '''
        Plot the Histogram of graidents.
        Arguments:
        -normalization: if true, normalize the area under histogram to 1
        '''
        plt.hist(self.g_theta,
                 bins=self.historgram_x,
                 weights=self.g_mag,
                 density=normalization)
        plt.title('Histrogram of Graidents')
        plt.xlabel('Directions from -180 to 180')
        plt.ylabel('Frequency')
        plt.show()
```

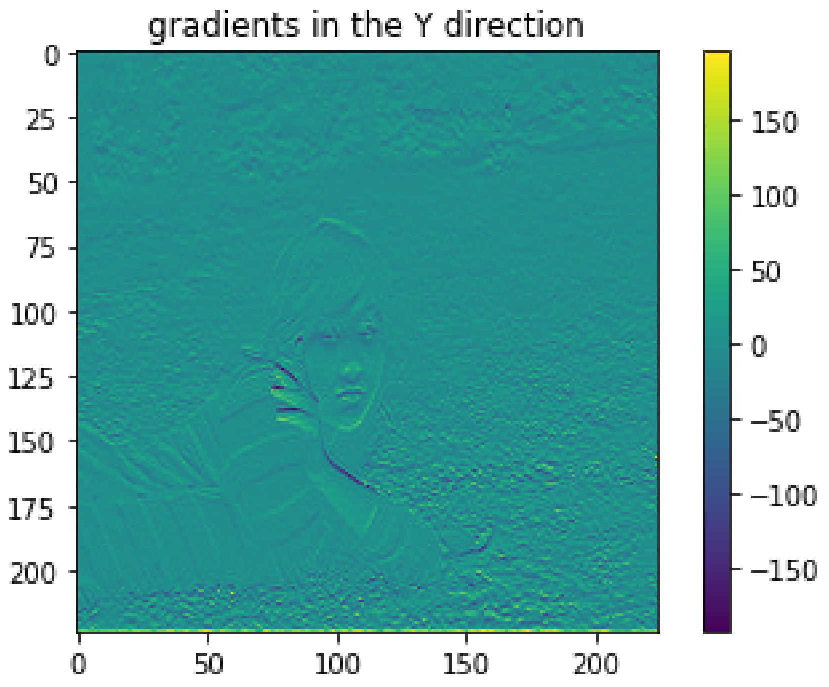
```
In [45]: from scipy import misc

         img = misc.imread('demo.jpg')
         img = img.mean(axis=2) #use grayscale image
         plt.imshow(img)
         plt.show()
```

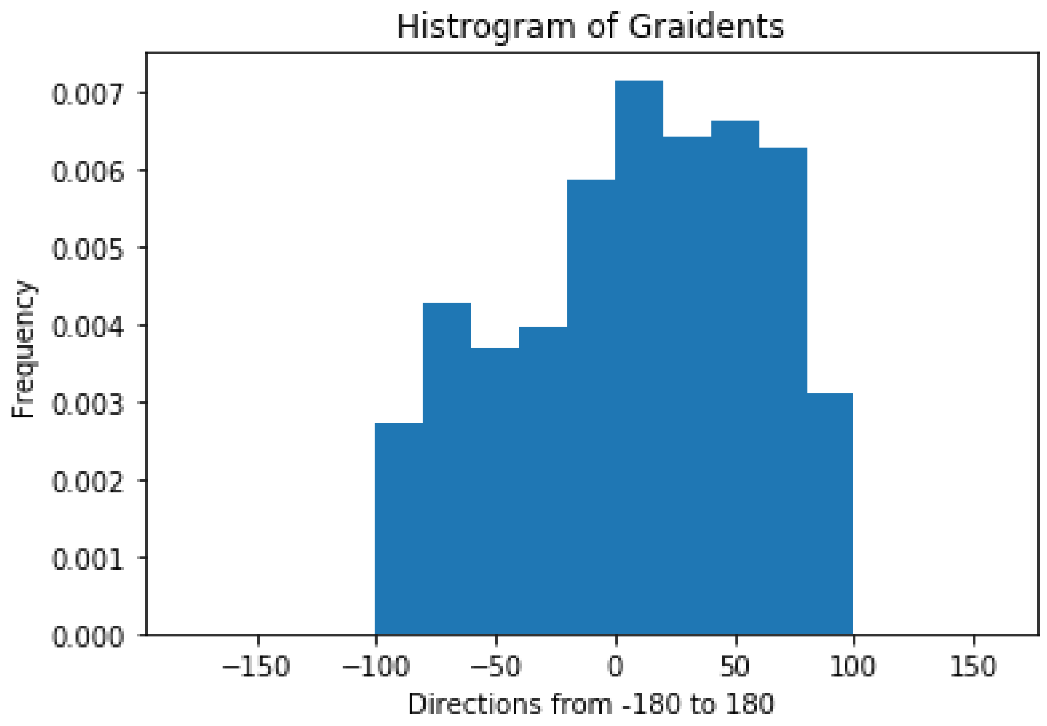
```
/usr/local/lib/python3.6/site-packages/ipykernel_launcher.py:3: DeprecationWarning: `imread` is
`imread` is deprecated in SciPy 1.0.0, and will be removed in 1.2.0.
Use ``imageio.imread`` instead.
  This is separate from the ipykernel package so we can avoid doing imports until
```



```
In [46]: hog = HOG(img)
         hog.forward()
         hog.plot_hog()
```


gradients in the X direction
0
25
50
75
100
125
150
175
200
0
50
100
150
200
150
100
50
0
−50
−100
−150


gradients in the Y direction
0
25
50
75
100
125
150
175
200
0
50
100
150
200
150
100
50
0
−50
−100
−150


Histrogram of Graidents
Frequency
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
−150
−100
−50
0
50
100
150
Directions from -180 to 180

```
In [ ]:
```