HW8

May 17, 2016

```
In [2]: import numpy as np
        import cv2
        %matplotlib inline
        import matplotlib.pyplot as plt
        import pandas as pd
```

```
In [3]: x =np.reshape([2,4,11,5,3,4,5,12,3,8,2,6,2,2,12,3,10,9,14,5,10,2,14,12,2],(5,5))
        print len(np.unique(x))
```

```
11
```

```
In [4]: y = np.bincount(x.reshape((25,)))
        ii = np.nonzero(y)[0]
```

```
In [5]: a = pd.Series(ii,name='value')
        b = pd.Series(y[ii],name='Count')
        df = pd.concat([a,b],axis=1)
        df
```

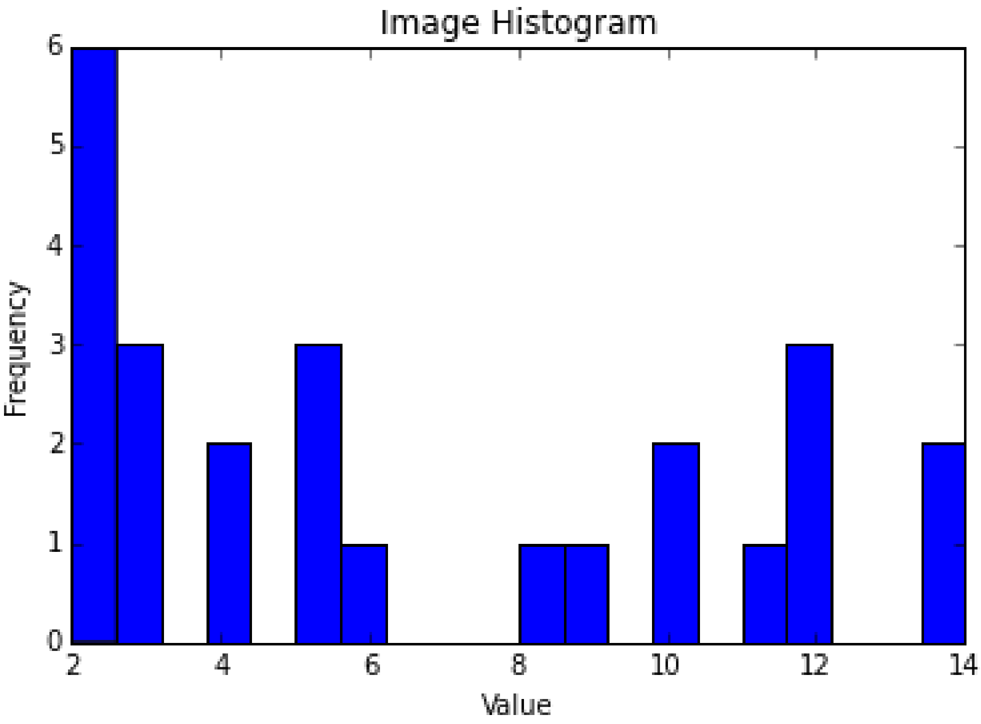
```
Out[5]:     value  Count
        0       2      6
        1       3      3
        2       4      2
        3       5      3
        4       6      1
        5       8      1
        6       9      1
        7      10      2
        8      11      1
        9      12      3
        10     14      2
```

1 a)

Draw the histogram of this image

```
In [6]: plt.hist(x.reshape((25,)),bins=20)
        plt.title("Image Histogram")
        plt.xlabel("Value")
        plt.ylabel("Frequency")
        plt.xlim(np.min(x),np.max(x))

        fig = plt.gcf()
        plt.show()
```



2 b)

Find the output of HE and draw the histogram of equalized image

```
In [7]: table = zip(ii,y[ii])
        p =map(lambda x:x[1]/float(25),table)
        cdf = []
        for i in range (len(p)):
            cdf.append(sum(p[:i+1]))
        p =pd.Series(p,name='Probablitiy').to_frame()
        cdf = pd.Series(cdf,name='CDF').to_frame()
        df = df.join([p,cdf])
        df
        #table = zip(ii,y[ii],p,cdf)
        #table
```

```
Out[7]:     value  Count  Probablitiy   CDF
        0       2      6         0.24  0.24
        1       3      3         0.12  0.36
        2       4      2         0.08  0.44
        3       5      3         0.12  0.56
        4       6      1         0.04  0.60
        5       8      1         0.04  0.64
        6       9      1         0.04  0.68
        7      10      2         0.08  0.76
        8      11      1         0.04  0.80
```

```
9       12       3           0.12  0.92
10      14       2           0.08  1.00
```

```
In [8]: df['HE'] = (((df.CDF-df.CDF.min())/(1-df.CDF.min())) *15).round()
```

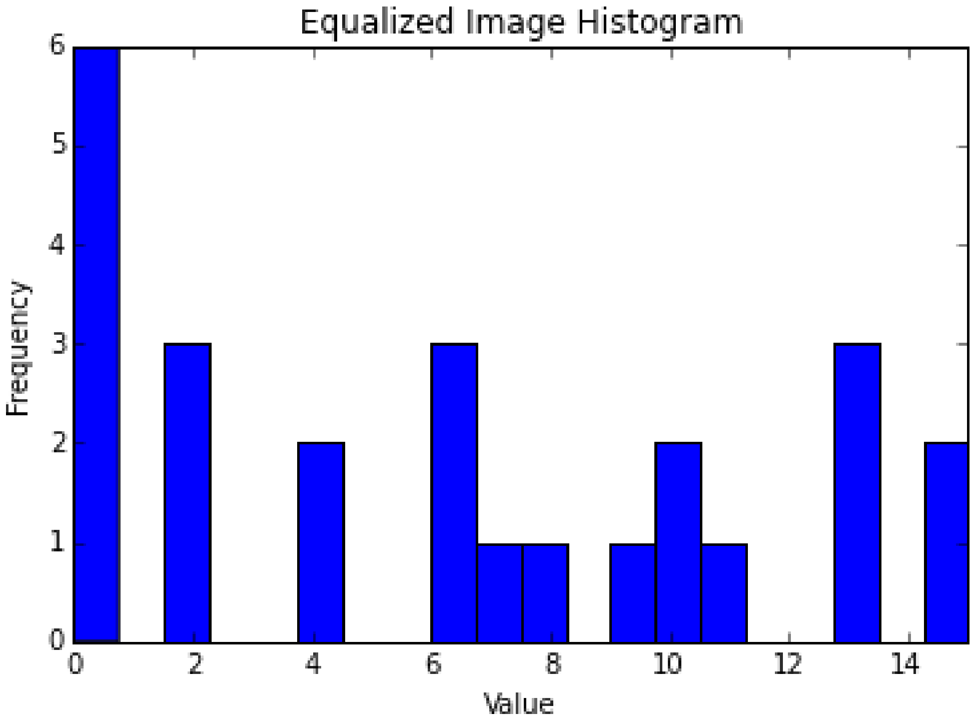
```
In [9]: df
```

```
Out[9]:      value  Count  Probablitiy   CDF  HE
        0        2      6         0.24  0.24   0
        1        3      3         0.12  0.36   2
        2        4      2         0.08  0.44   4
        3        5      3         0.12  0.56   6
        4        6      1         0.04  0.60   7
        5        8      1         0.04  0.64   8
        6        9      1         0.04  0.68   9
        7       10      2         0.08  0.76  10
        8       11      1         0.04  0.80  11
        9       12      3         0.12  0.92  13
        10      14      2         0.08  1.00  15
```

```
In [10]: Eimg = map(lambda x:df[df.value==x].HE.values[0],x.reshape((25,)))
```

```
In [11]: plt.hist(Eimg,bins=20)
         plt.title("Equalized Image Histogram")
         plt.xlabel("Value")
         plt.ylabel("Frequency")
         plt.xlim(np.min(Eimg),np.max(Eimg))

         fig = plt.gcf()
         plt.show()
```



3 c)

If the equalized image in subject to compression by () Find the average length of the compression image.

```
In [12]: Ey = np.bincount(Eimg)
         Eii = np.nonzero(Ey)[0]
         Ea = pd.Series(Eii,name=’value’)
         Eb = pd.Series(Ey[Eii],name=’Count’)
         Edf = pd.concat([Ea,Eb],axis=1)
         Edf[’Pr’] = Edf[’Count’]/25
         Edf = Edf.sort(’Count’,ascending=False)
         Edf
```

```
Out[12]:     value  Count    Pr
         0       0      6  0.24
         1       2      3  0.12
         3       6      3  0.12
         9      13      3  0.12
         2       4      2  0.08
         7      10      2  0.08
         10     15      2  0.08
         4       7      1  0.04
         5       8      1  0.04
         6       9      1  0.04
         8      11      1  0.04
```

```
In [39]: Ey = np.bincount(Eimg)
         Eii = np.nonzero(Ey)[0]
         Ea = pd.Series(Eii,name=’value’)
         Eb = pd.Series(Ey[Eii],name=’Count’)
         Edf = pd.concat([Ea,Eb],axis=1)
         Edf[’Pr’] = Edf[’Count’]/25
         Edf.sort(’Count’,ascending=False, inplace=True)
         Edf = Edf.reset_index(drop=True)
         Edf[’Code_Length’]= pd.Series([2,3,3,3,3,4,4,5,5,5,5])#2,3,3,3,3,4,4,5,5,5,5])
         Edf
```

```
Out[39]:     value  Count    Pr  Code_Length
         0       0      6  0.24            2
         1       2      3  0.12            3
         2       6      3  0.12            3
         3      13      3  0.12            3
         4       4      2  0.08            3
         5      10      2  0.08            4
         6      15      2  0.08            4
         7       7      1  0.04            5
         8       8      1  0.04            5
         9       9      1  0.04            5
         10     11      1  0.04            5
```

```
In [40]: np.sum( Edf[’Pr’]*Edf[’Code_Length’])
```

```
Out[40]: 3.2400000000000007
```

4 d)

if a 3X3 laplacian with isotropy of 45 degree is applied to the pixel indicated in the circul of the equalized image find the new value.

```
In [41]: eimgnp = np.reshape(Eimg,(5,5))
         eimgnp

Out[41]: array([[  0.,   4.,  11.,   6.,   2.],
                [  4.,   6.,  13.,   2.,   8.],
                [  0.,   7.,   0.,   0.,  13.],
                [  2.,  10.,   9.,  15.,   6.],
                [ 10.,   0.,  15.,  13.,   0.]])

In [42]: laplacian = np.reshape([1,1,1,1,-8,1,1,1,1],(3,3))
         imageImportantMatrix = np.reshape([6,13,2,7,0,0,10,9,15],(3,3))

In [43]: print laplacian
         print '============'
         print imageImportantMatrix

[[ 1  1  1]
 [ 1 -8  1]
 [ 1  1  1]]
============
[[ 6 13  2]
 [ 7  0  0]
 [10  9 15]]
```

Since we used negative center then we substract :

```
In [44]: imageImportantMatrix[1,1]- (np.sum(laplacian*imageImportantMatrix))

Out[44]: -62
```