plot_psnr_nb_cartoond_Run

June 3, 2019

```
In [1]: %matplotlib inline
        # N=256, L=8, J=8, dk=1, dl=L/2, bump steerable
        N=256
        # obtained with compute_coeff_ps2.py
        nb_dict={
            0:5890,
            1:17426,
            2:27314,
            3:35714,
            4:42434,
            5:47474,
        }
        RUNs = 10
        pt_dict = dict()
        import os.path
        for dj in nb_dict.keys():
            pt_dict[dj]=[]
            for runid in range(1,RUNs+1):
                ptfile = './cartoond/Run' + str(runid) + '/' +\
                    'test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_' + 'dj' +str(dj) + '.pt'
                print('check',ptfile)
                assert os.path.isfile(ptfile)
                pt_dict[dj].append(ptfile)
        csvfile = 'plot_pnsr_nb_cartoond_Run.csv'
```

```
check ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt
check ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt
check ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt
check ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt
check ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt
check ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt
check ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt
check ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt
check ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt
check ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt
check ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt
check ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt
```

```
check ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt
check ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt
check ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt
check ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt
check ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt
check ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt
check ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt
check ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt
check ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt
check ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt
check ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt
check ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt
check ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt
check ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt
check ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt
check ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt
check ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt
check ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt
check ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt
check ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt
check ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt
check ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt
check ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt
check ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt
check ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt
check ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt
check ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt
check ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt
check ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt
check ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt
check ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt
check ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt
check ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt
check ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt
check ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt
check ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt
check ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt
check ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt
check ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt
check ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt
check ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt
check ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt
check ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt
check ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt
check ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt
check ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt
check ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt
check ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt
```

```
In [76]: import scipy.io as sio
         droot0='../kymatio_wph_data/'
         datalabel='demo_toy7d_N' + str(N)
         data = sio.loadmat(droot0 + datalabel)
         im = data['imgs']
```

```
In [77]: import numpy as np
         def minMse_match(img1,img2):
             assert len(img1.shape)==2, 'input img should be dim 2'
             N=img1.shape[0]
             M=img1.shape[1]
             assert(img2.shape[0]==N and img2.shape[1]==M)
             minMse = -1
             minC0 = 0
             minC1 = 0
             for cn in range(N):
                 oimg1 = np.roll(img1,cn,axis=0)
                 for cm in range(M):
                     ooimg1 = np.roll(oimg1,cm,axis=1)
                     Mse = np.linalg.norm(ooimg1-img2,'fro')**2
                     if minMse<0:
                         minMse = Mse
                     elif minMse>Mse:
                         minMse = Mse
                         minC0 = cn
                         minC1 = cm
                         #print('minMSE',minMse,'cn',cn,'cm',cm)
             return minMse, minC0, minC1
```

```
In [78]: import torch
         psnr_dict = {}
         for dj in pt_dict.keys():
             psnr_dict[dj] = []
             for i, ptfile in enumerate(pt_dict[dj]):
                 saved_result = torch.load(ptfile)
                 im_opt = saved_result['tensor_opt'].numpy()
                 minMSE,minC0,minC1 = minMse_match(im_opt[0,0,:,:],im)
                 psnr_dict[dj].append( -10*np.log10(minMSE/(N*N)) )
                 print('eval', ptfile, 'PSNR',-10*np.log10(minMSE/(N*N)))

         print("PNSR eval complete")
```

```
eval ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt PSNR 25.238431290114
eval ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt PSNR 24.600170581764
eval ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt PSNR 24.555403403357
eval ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt PSNR 25.296203150639
eval ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt PSNR 25.104831879468
```

```
eval ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt PSNR 25.826417787034
eval ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt PSNR 25.668886690822
eval ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt PSNR 25.166739358303
eval ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt PSNR 24.984879990267
eval ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj0.pt PSNR 24.76554275263
eval ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt PSNR 37.189240451671
eval ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt PSNR 17.163087766485
eval ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt PSNR 37.960448449125
eval ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt PSNR 17.144887200593
eval ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt PSNR 39.846698278561
eval ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt PSNR 37.497693176809
eval ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt PSNR 39.303556540612
eval ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt PSNR 17.188522305163
eval ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt PSNR 39.512587144844
eval ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj1.pt PSNR 41.09340039423
eval ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt PSNR 16.479199631786
eval ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt PSNR 38.905453730985
eval ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt PSNR 42.201836585045
eval ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt PSNR 38.815043735343
eval ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt PSNR 41.213843731167
eval ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt PSNR 37.806708859789
eval ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt PSNR 40.648010222875
eval ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt PSNR 41.444731325161
eval ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt PSNR 38.895086793084
eval ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj2.pt PSNR 37.62834588177
eval ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt PSNR 37.686074736540
eval ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt PSNR 42.163836395099
eval ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt PSNR 39.747304027576
eval ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt PSNR 37.576341195158
eval ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt PSNR 37.629970792169
eval ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt PSNR 38.490178848161
eval ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt PSNR 39.087977180841
eval ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt PSNR 16.212092352042
eval ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt PSNR 16.267213314438
eval ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj3.pt PSNR 45.65637197713
eval ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt PSNR 37.192937862113
eval ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt PSNR 38.289929619886
eval ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt PSNR 37.967658787622
eval ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt PSNR 16.195890290031
eval ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt PSNR 42.009146014340
eval ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt PSNR 38.510355986999
eval ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt PSNR 36.301181796509
eval ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt PSNR 42.978550905121
eval ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt PSNR 42.508816306109
eval ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj4.pt PSNR 45.27267458461
eval ./cartoond/Run1/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt PSNR 49.742822458717
eval ./cartoond/Run2/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt PSNR 48.880332591801
eval ./cartoond/Run3/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt PSNR 41.463828112021
```

```
eval ./cartoond/Run4/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt PSNR 49.602322515401
eval ./cartoond/Run5/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt PSNR 37.953816840510
eval ./cartoond/Run6/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt PSNR 16.230923503506
eval ./cartoond/Run7/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt PSNR 36.996318339747
eval ./cartoond/Run8/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt PSNR 43.462509984043
eval ./cartoond/Run9/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt PSNR 40.933657823757
eval ./cartoond/Run10/test_rec_bump_chunkid_lbfgs_gpu_N256_ps2par_dn0_dj5.pt PSNR 16.23782517998
PNSR eval complete
```

```
In [79]: # save to csv file
         import csv

         myData = [["ptfile", "dj", "M", "PSNR"]]

         for dj in psnr_dict.keys():
             for i, psnr in enumerate(psnr_dict[dj]):
                 M = nb_dict[dj]
                 myData.append([pt_dict[dj][i],dj,M,psnr])

         myFile = open(csvfile, 'w')
         with myFile:
             writer = csv.writer(myFile)
             writer.writerows(myData)
         print("Writing complete")
```

```
Writing complete
```

```
In [ ]: # LOAD CSV
```

```
In [2]: import pandas as pd
        import numpy as np
        df = pd.read_csv(csvfile)
        psnr = np.array(df['PSNR'].astype(float))
        M = np.array(df['M'].astype(int))
        dj = np.array(df['dj'].astype(int))
        # select smallest PSNR for each dj
        lnb = []
        lpsnr=[]
        Nd=float(N*N)
        for delta_j in range(6):
            Mj = np.min(M[dj==delta_j])
            lnb.append(np.log10(Mj/Nd))
            lpsnr.append(np.max(psnr[dj==delta_j]))
            print('largest psnr idx+1 is',np.argmax(psnr[dj==delta_j])+1, ' for dj=', delta_j)

        lnb=np.array(lnb)
```

```
        lpsnr=np.array(lpsnr)
        print(lnb, lpsnr)
```

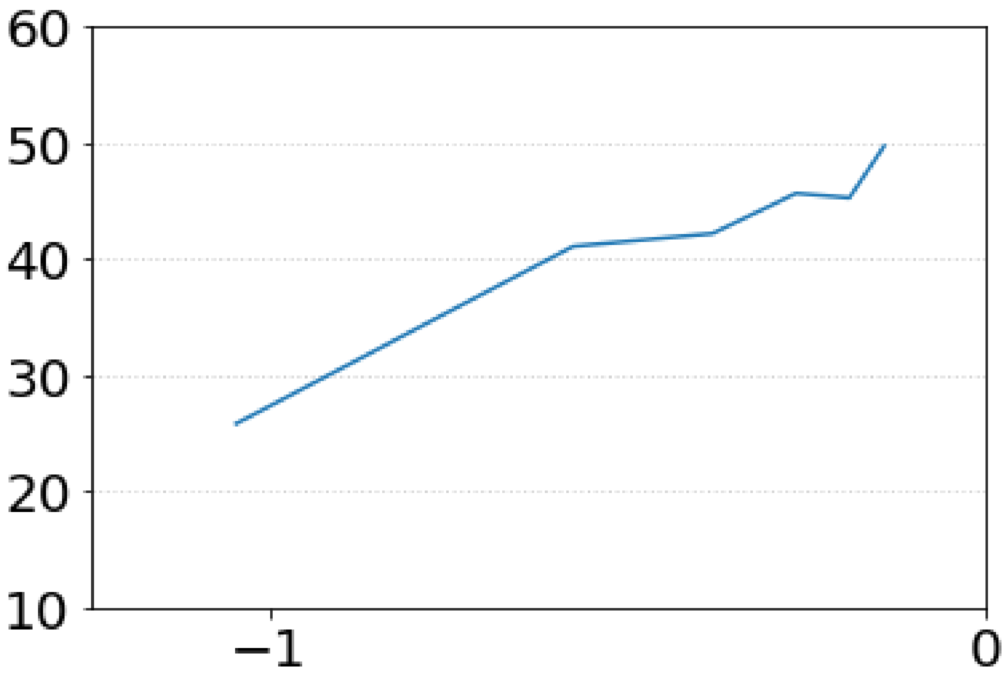
```
largest psnr idx+1 is 6  for dj= 0
largest psnr idx+1 is 10  for dj= 1
largest psnr idx+1 is 3  for dj= 2
largest psnr idx+1 is 10  for dj= 3
largest psnr idx+1 is 10  for dj= 4
largest psnr idx+1 is 1  for dj= 5
[-1.04636464 -0.57528222 -0.38009463 -0.26364144 -0.18876596 -0.14002411] [25.82641779 41.093400
```

```
In [3]: import matplotlib
        #matplotlib.style.use('ggplot')
        import matplotlib.pyplot as plt
        #print matplotlib.__version__
        do_color = False
        blue = 'b' if do_color else 'k'
```

```
In [11]: plt.figure()
         plt.axhline(y=10, Color='lightgray', Linestyle=":", Linewidth=1)
         plt.axhline(y=20, Color='lightgray', Linestyle=":", Linewidth=1)
         plt.axhline(y=30, Color='lightgray', Linestyle=":", Linewidth=1)
         plt.axhline(y=40, Color='lightgray', Linestyle=":", Linewidth=1)
         plt.axhline(y=50, Color='lightgray', Linestyle=":", Linewidth=1)
         plt.plot(lnb, lpsnr) #, Linewidth=3, Color=blue)

         plt.xticks([-1, 0],fontsize=20)
         plt.yticks([0, 10, 20, 30, 40, 50, 60],fontsize=20)
         plt.xlim(xmin=-1.25, xmax=0)
         plt.ylim(ymin=10, ymax=60)

         plt.savefig('fig8_cartoond_psnr.pdf')
```



```
In [12]: import scipy.stats as sps
         slope, intercept, r_value, p_value, std_err = sps.linregress(lnb, lpsnr)
         print(slope/20)
```

```
1.1987960868090026
```