ex7

May 8, 2019

0.0.1 TODO Exercise 7. ex

RENOIR ### You are given a ”renoir” set of two images (reference and noisy) from the RENOIR dataset 2 . (a) Visualise all color channels of both images. Are the all channels equally affected by the noise?

No green not affected as much as red and blue.

[1]:
```
import scipy.ndimage as ndimage
import matplotlib.pyplot as plt
import cv2
import numpy as np

im1 = ndimage.imread("./data/renoir/Reference.bmp")
im1 = np.asarray(im1)
im2 = ndimage.imread("./data/renoir/Noisy.bmp")
im2 = np.asarray(im2)
plt.imshow(im1, cmap=plt.cm.Spectral)
plt.show()
plt.imshow(im2, cmap=plt.cm.Spectral)
plt.show()

#plt.colormaps()

red_images = im2[:,:,0]
green_images = im2[:,:,1]
blue_images = im2[:,:,2]
plt.imshow(red_images, cmap=plt.cm.Reds)
plt.show()
plt.imshow(green_images, cmap=plt.cm.Greens)
plt.show()
plt.imshow(blue_images, cmap=plt.cm.Blues)
plt.show()
```

```
/usr/local/lib/python3.5/dist-packages/ipykernel_launcher.py:6:
DeprecationWarning: `imread` is deprecated!
`imread` is deprecated in SciPy 1.0.0.
Use ``matplotlib.pyplot.imread`` instead.
```

```
/usr/local/lib/python3.5/dist-packages/ipykernel_launcher.py:8:
DeprecationWarning: `imread` is deprecated!
`imread` is deprecated in SciPy 1.0.0.
Use ``matplotlib.pyplot.imread`` instead.


<Figure size 640x480 with 1 Axes>


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<Figure size 640x480 with 1 Axes>
```
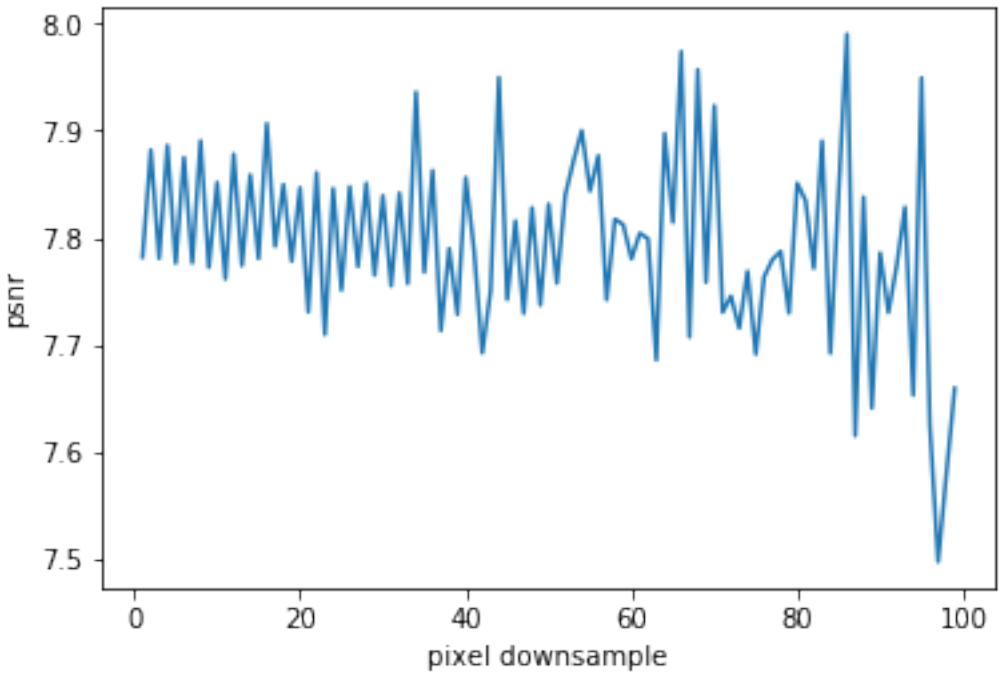

0.0.2 (b) Try to decrease the noise via image down/up sampling.

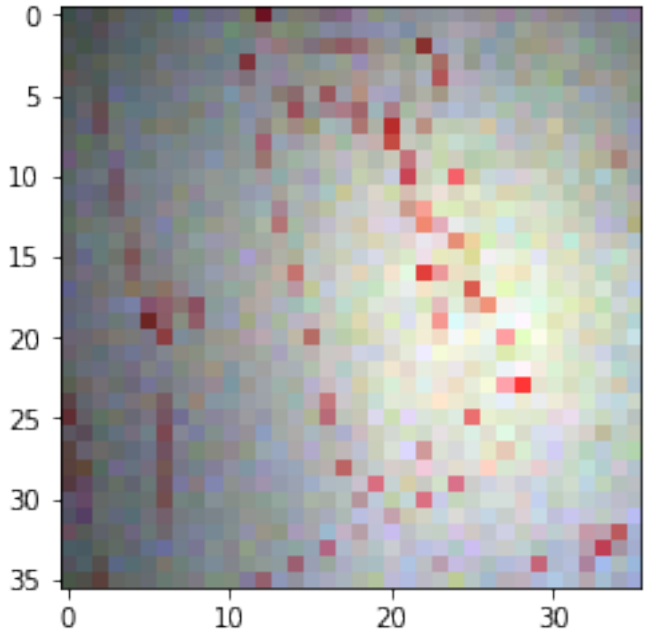
b.a) Do it for the RGB image. Measure the PSNR between the reference and de-noised images.

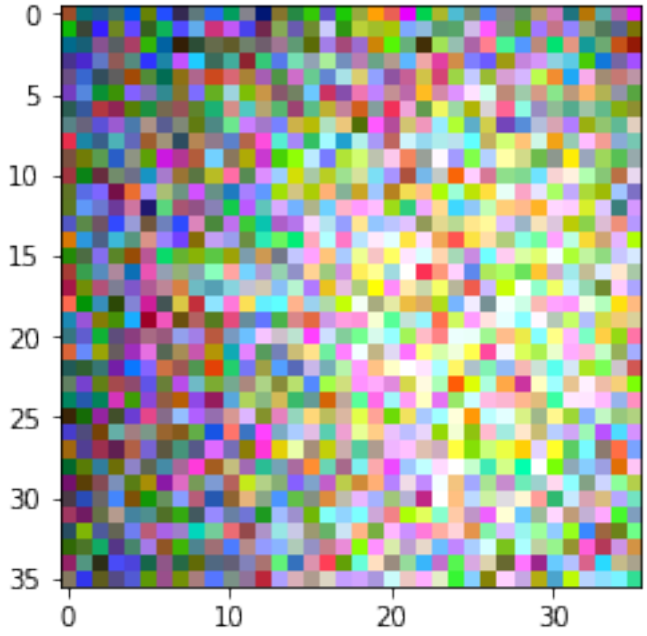
[33]:
```
from helpers import mse
import math
# Downsample an image by skipping indicies

def downsample_image(img, skip):
     return img[::skip,::skip]

def psnr(mseres, PIXEL_MAX_SQUARE = 255):
    mse_square = math.sqrt(mseres )
    part1 =  math.log10(PIXEL_MAX_SQUARE / mse_square)
    return 20 * part1



# downsampling
psnr_list = [psnr(mse( downsample_image(im1, skip), downsample_image(im2,␣
 ↪skip))) for skip in range(1,100)]
plt.plot([skip for skip in range(1,100)], psnr_list)
plt.xlabel("pixel downsample")
plt.ylabel("psnr")
plt.show()

print("no downsampled pair value psnr: " )
print(psnr(mse(im1,im2)))
print("max psnr downsampled value: ")
```

```
print(max(psnr_list))
print("best downsampling skip value: ")

print(psnr_list.index(max(psnr_list)))
best_ratio = psnr_list.index(max(psnr_list))

plt.imshow(downsample_image(im1, best_ratio))
plt.show()
plt.imshow(downsample_image(im2, best_ratio))
plt.show()


# best_ratio, im1.shape, downsample_image(im1, best_ratio).shape
```



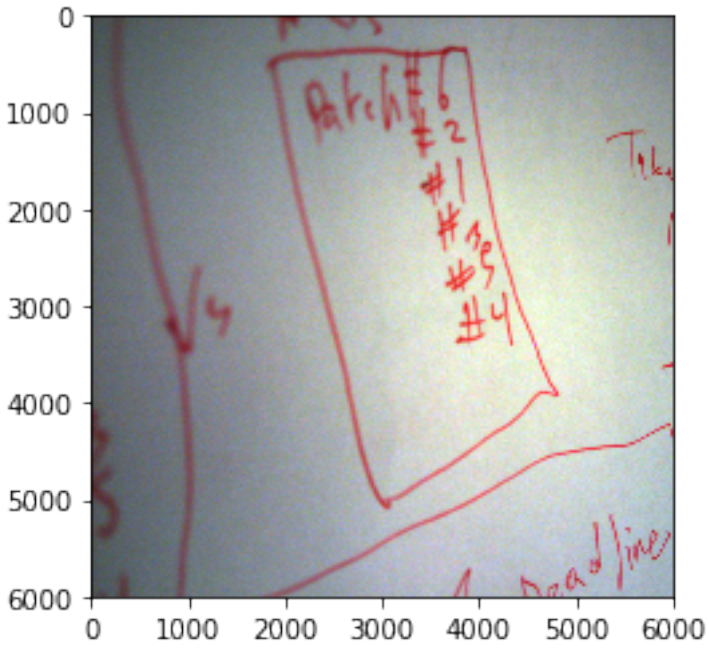

```
no downsampled pair value psnr:
7.781946412448223
max psnr downsampled value:
7.989865945271479
best downsampling skip value:
85
```



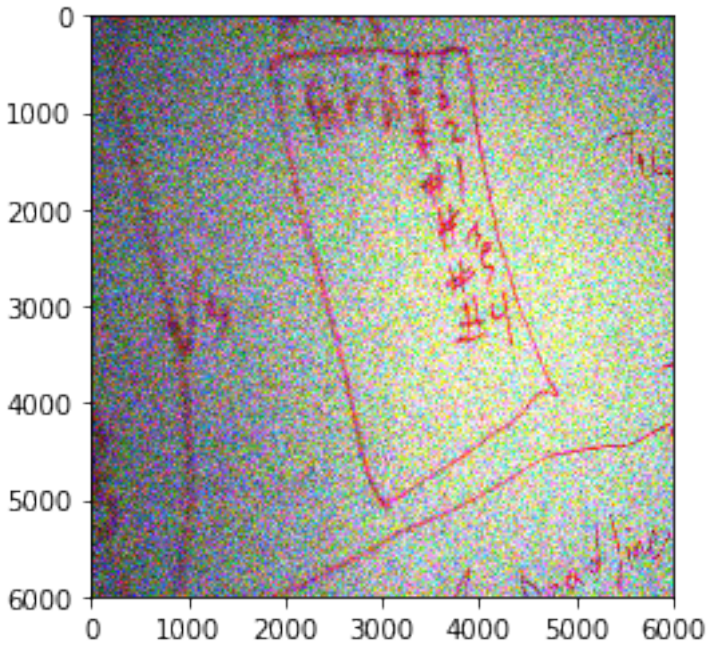


[5]:
```
#upsampling using scipy.ndimage
import skimage.transform
def upsample_skimage(factor, input_img):
        # Order=1 is bilinear upsampling
```

```
    return skimage.transform.rescale(input_img,
                                     factor,
                                     mode='constant',
                                     cval=0,
                                     order=1)

upsampled_im1 = upsample_skimage(factor=2, input_img=im1)
upsampled_im2 = upsample_skimage(factor=2, input_img=im2)
plt.imshow(upsampled_im1)
plt.show()
plt.imshow(upsampled_im2)
psnr(mse(upsampled_im1,upsampled_im2))
```



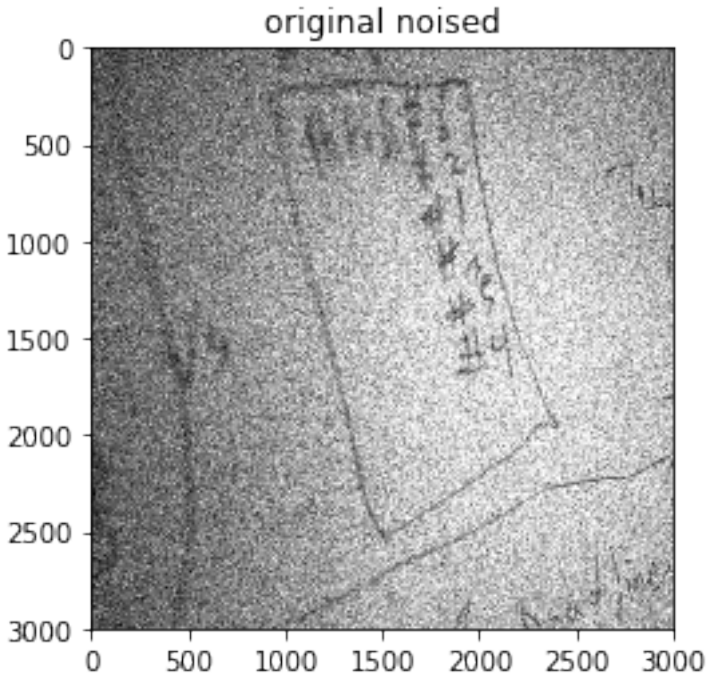
[5]: `57.29515427642124`

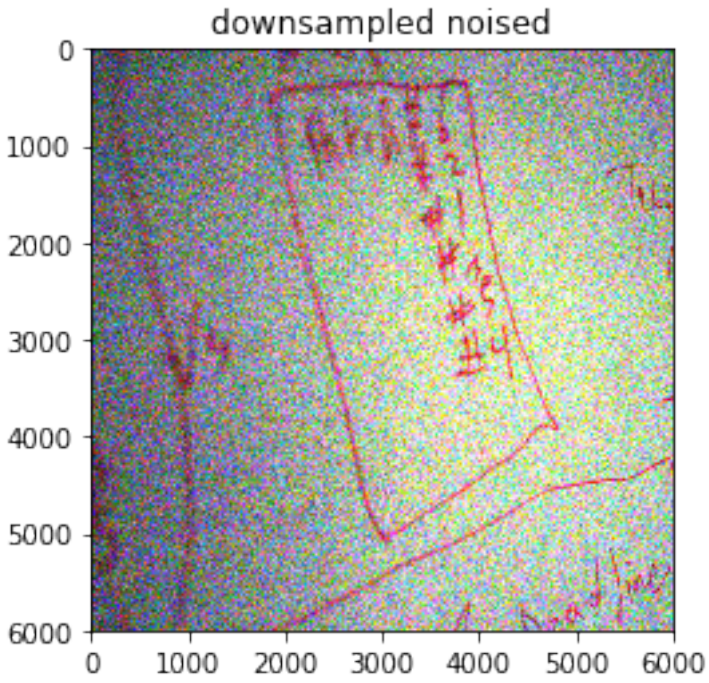


b.b) Do it for the grayscale image. Measure the PSNR between the grayscale reference and de-noised images.

[38]:
```
im1_gr = cv2.cvtColor(
    im1,
    cv2.COLOR_RGB2GRAY
)
im2_gr = cv2.cvtColor(
    im2,
    cv2.COLOR_RGB2GRAY
)
plt.title("original noised")
plt.imshow(im2_gr, cmap = 'gray' )
plt.show()

d1=downsample_image(im1_gr, 3)
d2=downsample_image(im2_gr, 3)
plt.imshow(upsampled_im2, cmap = 'gray')
plt.title("downsampled noised")
plt.show()
print("downsampled psnr")
print(psnr(mse( d1, d2)))

#upscale
upsampled_im1 = upsample_skimage(factor=3, input_img=im1_gr)
```

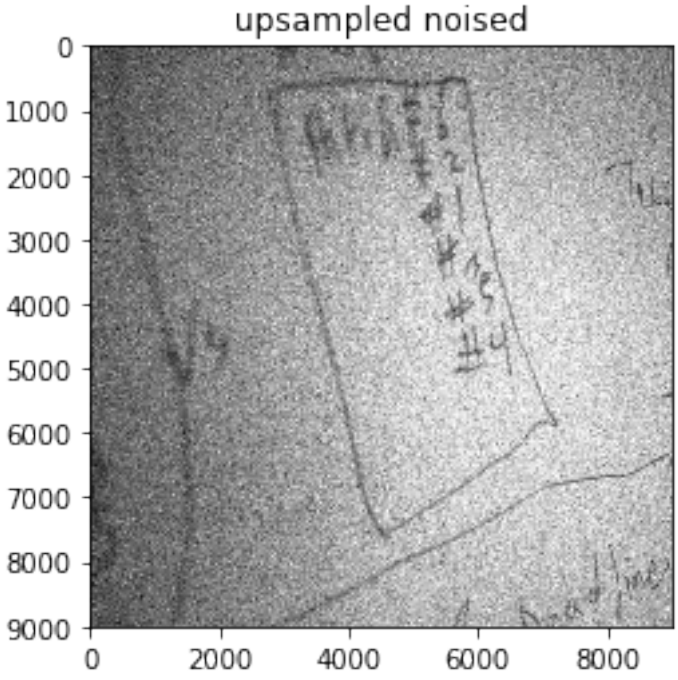
```
upsampled_im2 = upsample_skimage(factor=3, input_img=im2_gr)
plt.title("upsampled noised")
plt.imshow(upsampled_im2, cmap = 'gray')
print("upsampled psnr")
psnr(mse(upsampled_im1,upsampled_im2))
```





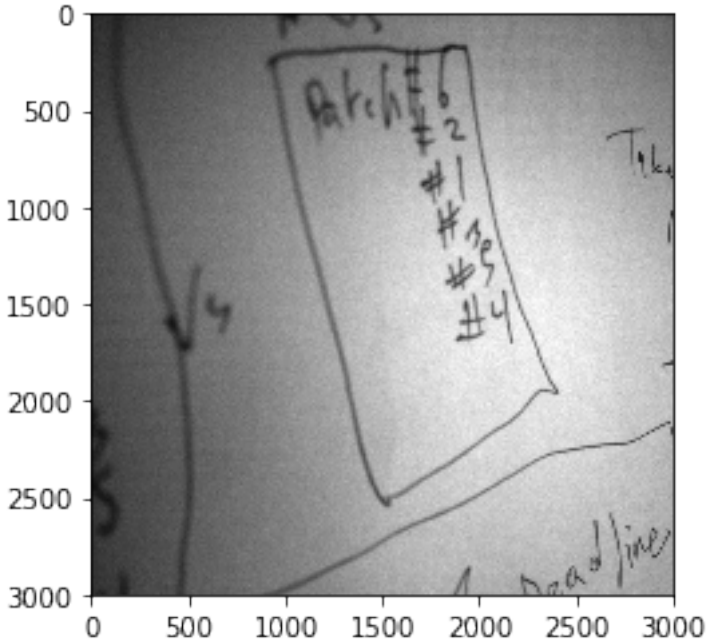

```
downsampled psnr
19.06967847453363
upsampled psnr
```

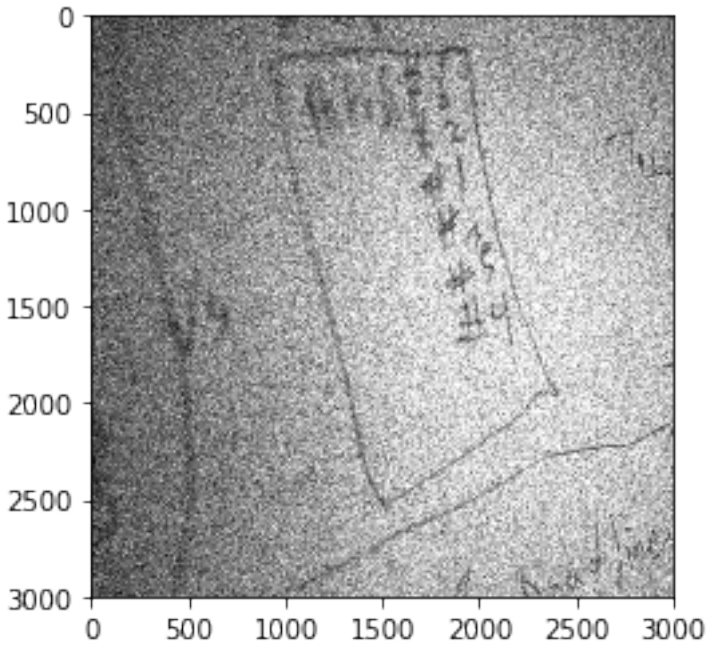
[38]: `69.10304970013075`



b.c) Do the denoising for the RGB image and after convert it to the grayscale. Measure the PSNR. Does the obtained result is different from the (b)? Explain the result. I used the best from the two techniques the psnr dropped which implies quality drop. Upsampling is sensitive to color mapping since the transform from rgb to grayscale is not linear.

[39]:
```
upsampled_im1 = upsample_skimage(factor=3, input_img=im1)
upsampled_im2 = upsample_skimage(factor=3, input_img=im2)

upsampled_im1_gr = cv2.cvtColor(
    im1,
    cv2.COLOR_RGB2GRAY
)
upsampled_im2_gr = cv2.cvtColor(
    im2,
    cv2.COLOR_RGB2GRAY
)
plt.imshow(upsampled_im1_gr,cmap='gray')
plt.show()
plt.imshow(upsampled_im2_gr, cmap='gray')
plt.show()

print(psnr(mse(upsampled_im1_gr,upsampled_im2_gr)))
```






```
19.076533001482233
```

0.0.3 (c) What other methods can you suggest to improve the noisy image quality?

Deep neural network autoencoder eg. https://papers.nips.cc/paper/4686-image-denoising-and-inpainting-with-deep-neural-networks.pdf