DIMITRIS PROIOS
Advanced Image Processing TP Class No 1

Exercise 1.1 Write a function that determines the Mean Squared Error (MSE) between two images x and y.

For two images must have the same dimension the 'Mean Squared Error' between the two images is the sum of the squared difference between the two images	def mse(imageA, imageB): err = np.sum((imageA.astype("float") - imageB.astype("float"))**2) err /= float(imageA.shape[0] * imageA.shape[1]) return err **#From 1ex.py**

Exercise 1.2 Read in a new copy of the image cameraman.tif, keep it in its original datatype and range, i.e. uint8 and {0..255}.

Using scipy imread library we read the image in its original datatype and size.	cameraman_image_original = scipy.misc.imread('data/cameraman.tif') **#From 1ex.py**

Exercise 1.3 Now read in a second copy of the image cameraman.tif but map it to double and {0..1}. See Matlab im2double. Compare the two images using the MSE. Can you explain the result

Using matlab im2double python equivalent
(according to https://stackoverflow.com/questions/29100722/equivalent-im2double-function-in-opencv-python)
The image was mapped to {0,1} spectrum
 	
The mse comparison gavea big difference of # 17842.7666309
	def im2double(img, max=1, norm=cv2.NORM_MINMAX):
	# Convert to normalized floating point
	out = cv2.normalize(
	img.astype('float'),
	None,
	0.0,
	max,
	norm
	)
	return out

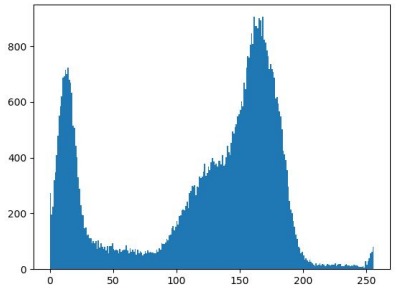
2.1 Refactor the PSNR definition to a function of the noise variance:

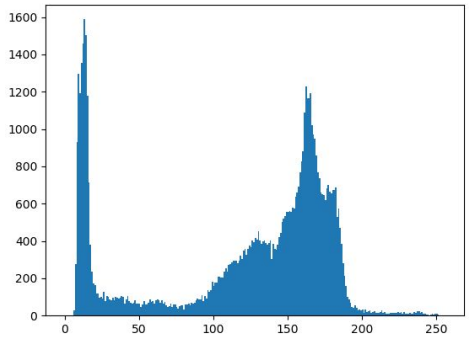
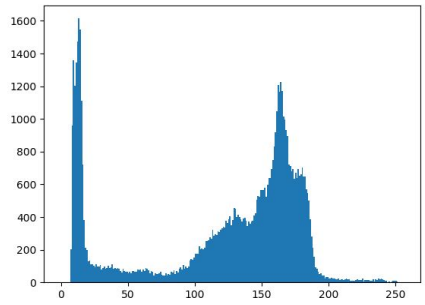
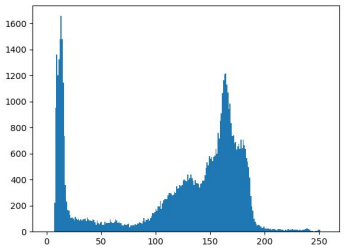
Refractoring the PSNR definition to a function of the noise variance:	$PSNR = 10 \log_{10} (a^2 / \sigma_z^2)$ $\Rightarrow PSNR = 20 \log_{10} a - 10 \log_{10} \sigma_z^2$ $\Rightarrow \sigma_z^2 = 10^{(PSNR - 20 \log a) / -10}$

2.2, Add Gaussian noise to an image such that the PSNR ratio with the original image is 10dB, 20dB, 30dB and 40dB. Use randn, not imnoise.

Gaussian noise was added with the following function	#from 2ex.py
	def get_img_with_noise(im, sigma, mu=0):
	for i in range(0, len(im)-1):
	for j in range(0, len(im[i])-1):
	noise = sigma * np.random.randn() + mu
	im[i][j] = noise + float(im[i][j])
	return im

2.3 Show the noisy images on the screen. How do they look?

PSNR	Variance	Image with noise	Histogram
10dB	**6.4**		

20dB	**0.64**		
30dB	**0.063**		
40dB	**0.0063**		

2.4 Show the histograms for these noisy images, can you explain what you see?

As seen above in the histograms the more variance in the noise the more evident the distortion in the image is. The parameter alpha is the number of bits used to describe the colors of the image in our case 8.

2.5 TODO