Université de Genève

Imagerie Numérique
13X004

TP 3: Image acquisition and sensing

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Exercise 1

To store an image of size: M by N with L levels of grey-scale $M \times N \times k$ bits where $L = 2^k$.

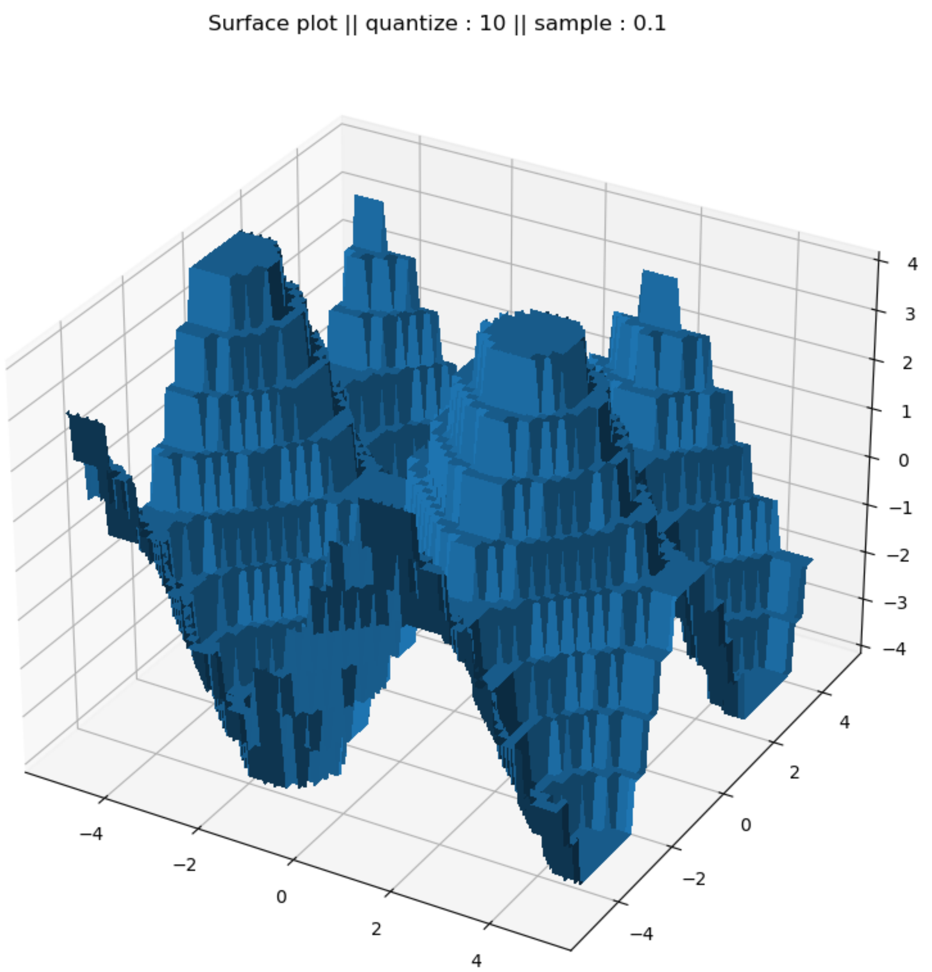
(a) $M = 100$, $N = 100$, $L = 256 \Rightarrow k = 8$. This results in $100 \times 100 \times 8 = 80000$ bits $= 10000$ bytes (8 bits $=$ 1 byte) to store the image.

(b) $M = 100$, $N = 100$, $L = 4 \Rightarrow k = 2$. This results in $100 \times 100 \times 2 = 20000$ bits $= 2500$ bytes (8 bits $=$ 1 byte) to store the image.

Exercise 2

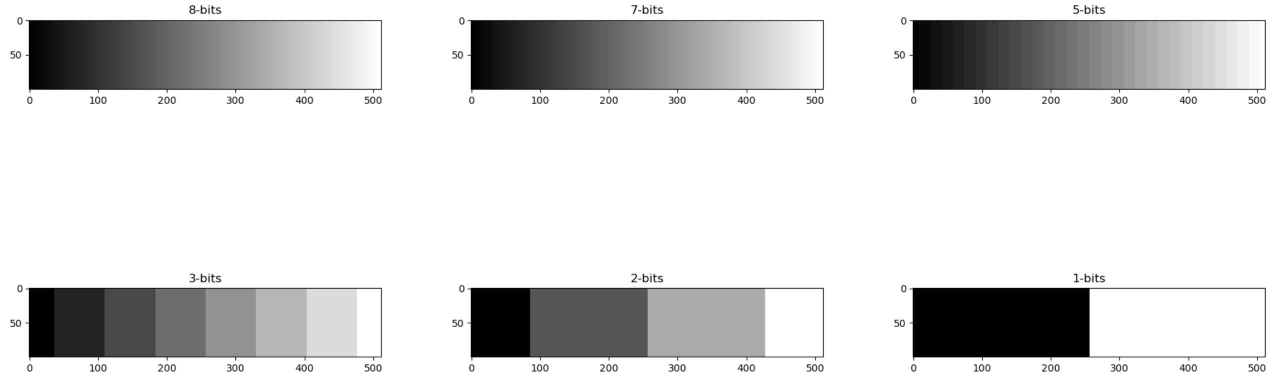
We use sampling and quantization to create a digital image from a continuous form f(x,y). Sampling is the first step, we need to simply coordinate values this determines the spatial resolution of the digitized image. Having done the sampling, we need to digitize the values by qunatization, this means turning the sampled values into discrete values.

Exercise 3

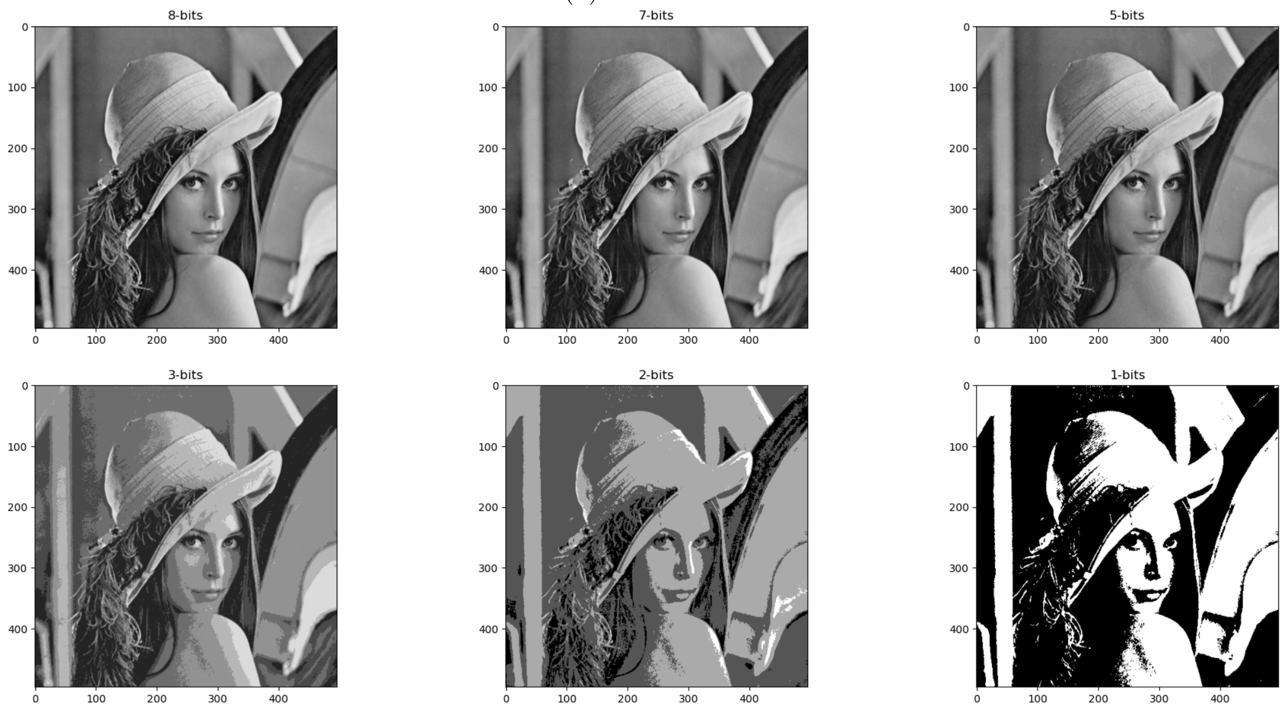


Exercise 4

(a)



(b)



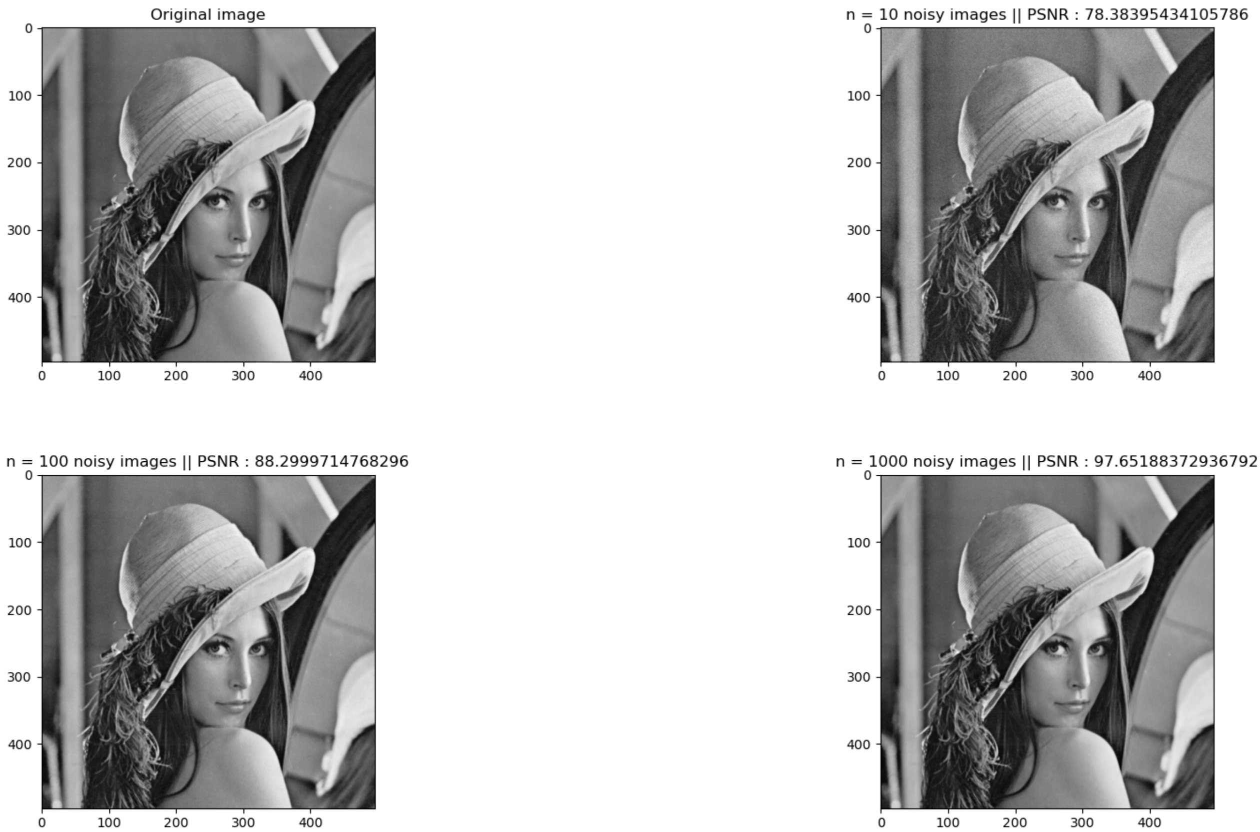
Exercise 5

(a) See code

(b) The average PSNR between each noisy image and the original is 68.390 dB.

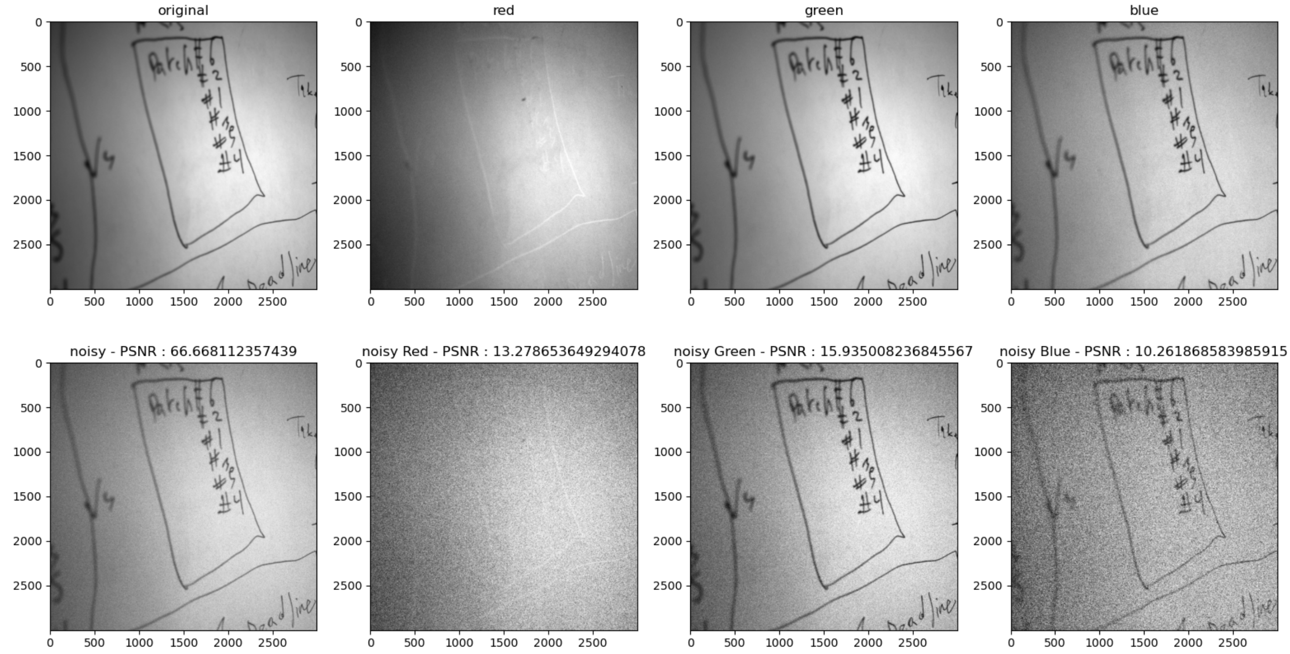
(c) See code

(d) The PSNR between the orginal image and the result of the frame averaging approach is 78.395 dB.
This is an impressive upgrade, this becomes even bigger with the increase the number of noisy images. Using 1000 noisy images we end up with a PSNR of 97.652 dB, which is very impressive.
This method works very well when it's requirements are met, due to this it is hard to use it in the real world, as we saw we get better results when the number of noisy images increases, which we won't have available when trying to denoise one single noisy image, exercice 6 is a good example of a situation where this approach can't be applied since we only have one image.



Exercise 6

(a) All the different channels are very noisy, but we can visually see that both the red and blue channels are more noisy than the green channel, this is also seen in the PSNR computation, the avearage PSNR for the 3 chanels is 13.159 dB



(b) The average PSNR for RGB channels is 18.015 dB, previous to denoising it was 13.159.

(c) The PSNR for grayscale image is 73.491 dB, previous to denoising it was 66.668.

(d)