Université de Genève

Imagerie Numérique
13X004

TP 12: Frequency domain filtering

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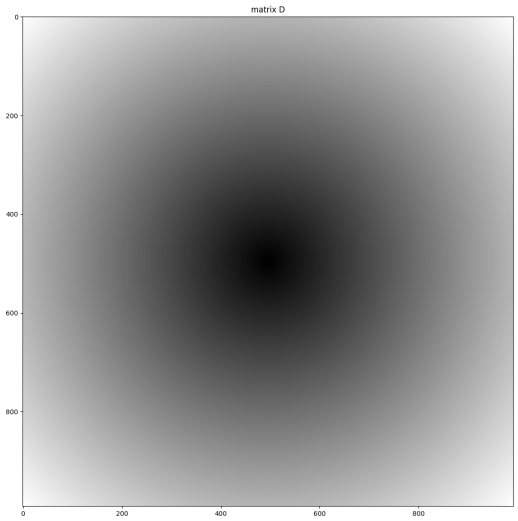
Intro

For the exercises that require the use of a distance matrix, I will us the following, as said matrix. Where the furthest point from the center is at around a distance of 700.

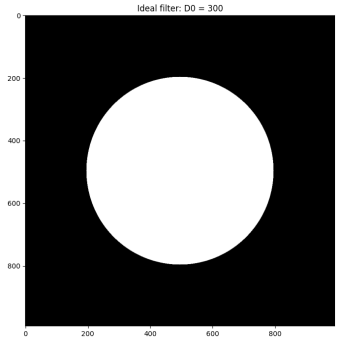


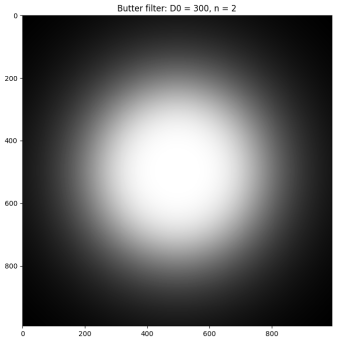
Exercise 1

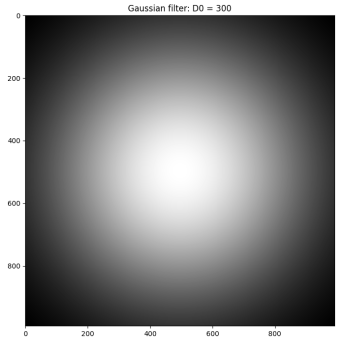
(pre a) First we have to create the noisy lena: MSE(lena, lena noisy) = 15822

(a) We now apply a Gaussian filter in the time domain, like in the previous TP6, we get a better quality visually, as e distribute the noise, but in regards to the mse, the filter got us a worse result: MSE(lena, lena gaussian filter) = 15824

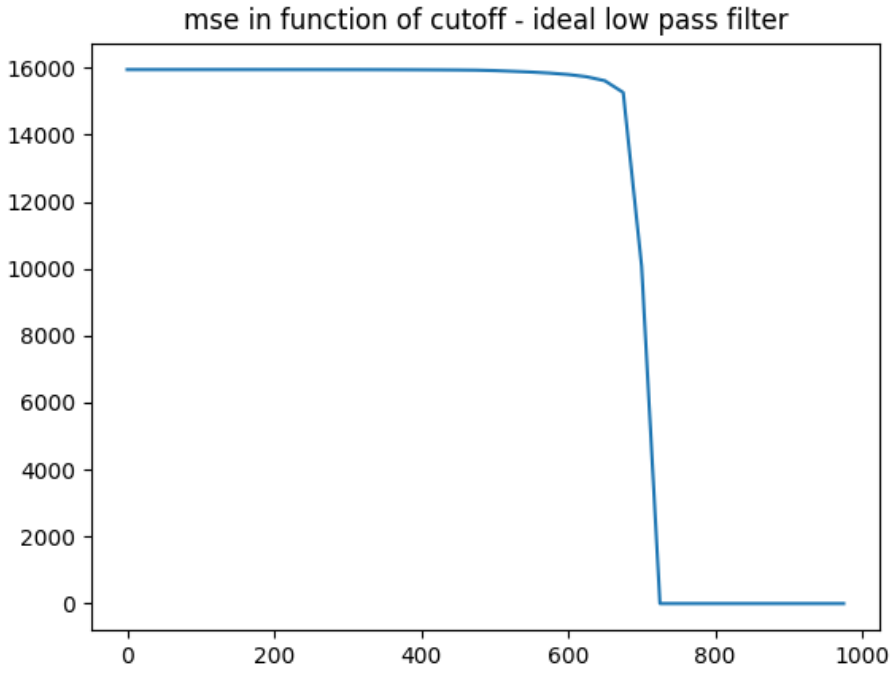
(b) In this exercise we will test 3 different low pass filters. I will now display what the filter matrices look like for every filter:

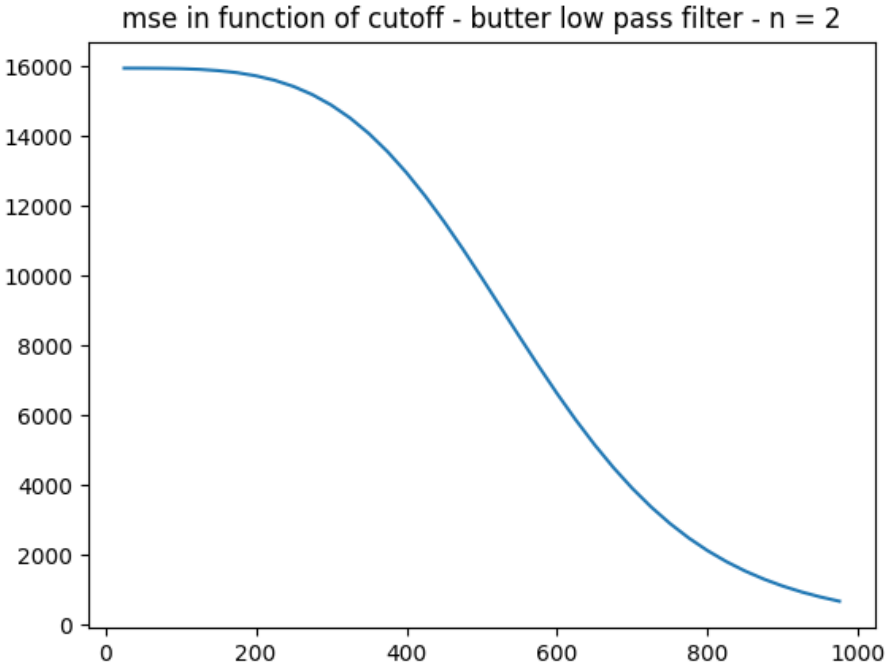


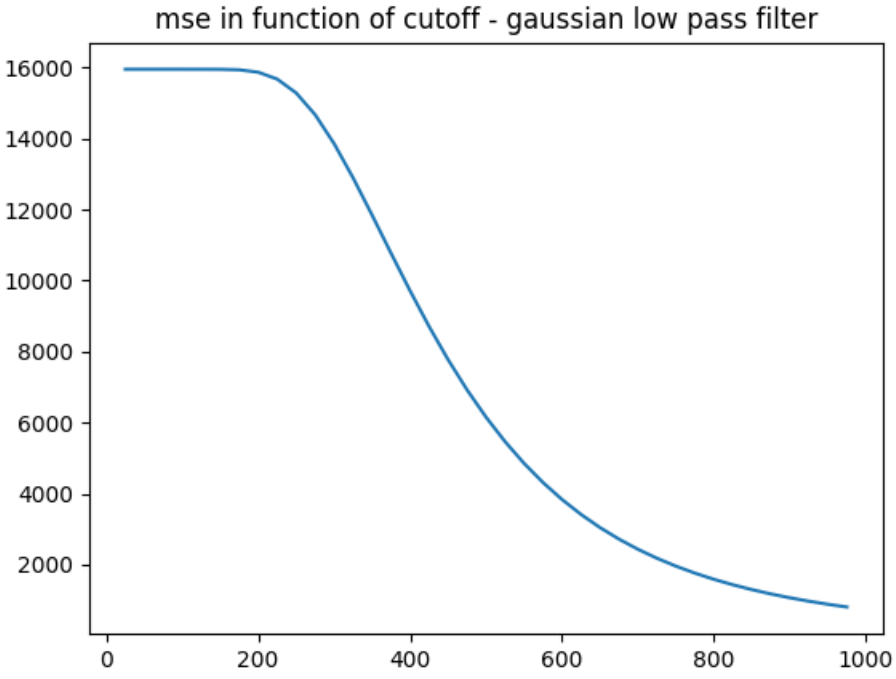




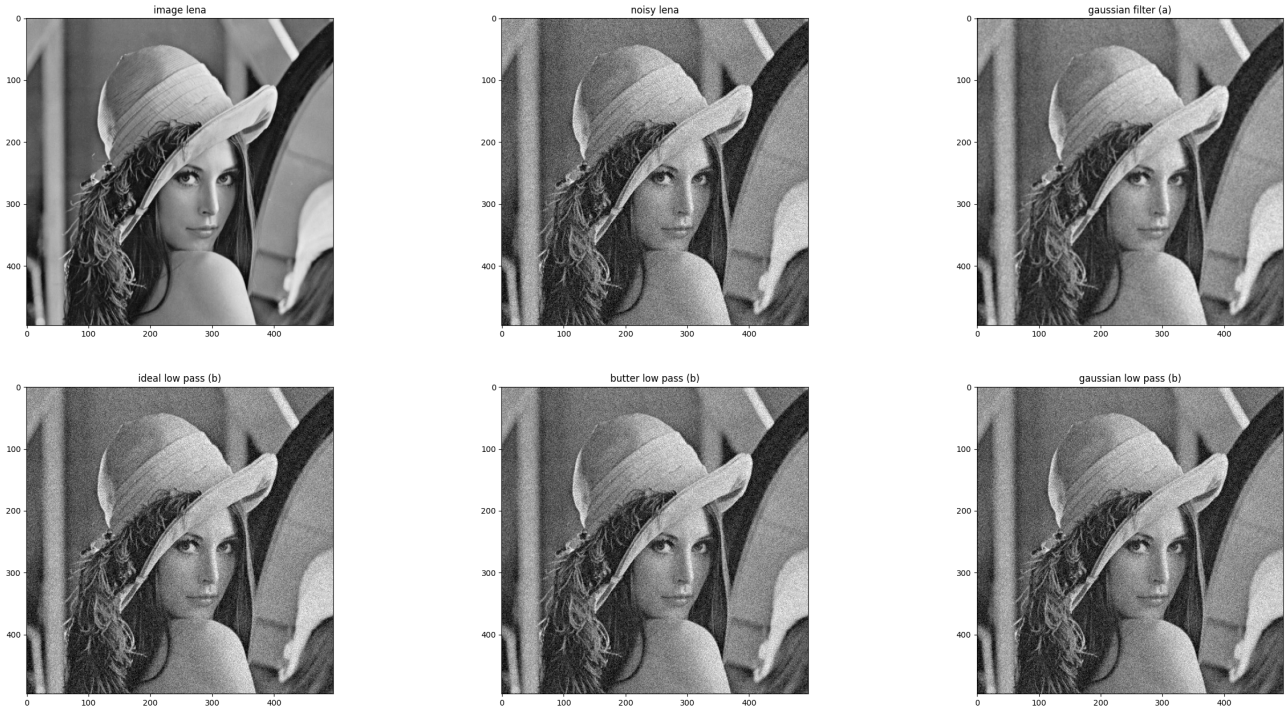
To find the best values, I brute forced it, and ploted the results for each filter:







As we can see the results of all three low pass filters only become good when the H matrix is mostly full of ones.



(c) As we can see from the mse results, these filters didn't do a good job at all.

```
MSE -> lena & lena noisy -> 15822.758827057569
MSE -> lena & lena gaussian (a) -> 15824.11295402213
MSE -> lena & ideal low pass (b) - cutoff = 700 -> 15910.862497483628
MSE -> lena & butter low pass (b) - cutoff = 1000 - n = 2 -> 15846.537275547367
MSE -> lena & gaussian low pass (b) - cutoff = 1000 -> 15849.604313967264
```

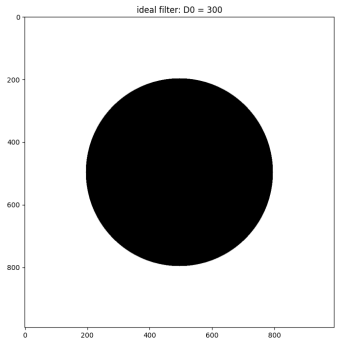
(d)

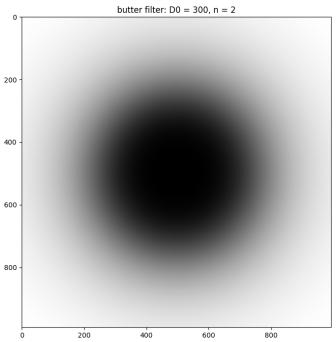
Exercise 2

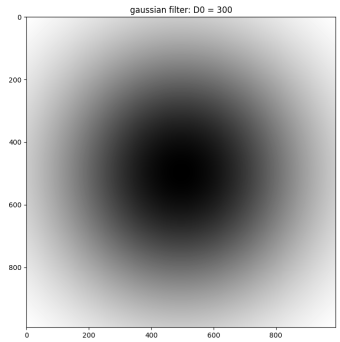
(pre a) First we have to create the lena with box filter: MSE(lena, lena box) = 173

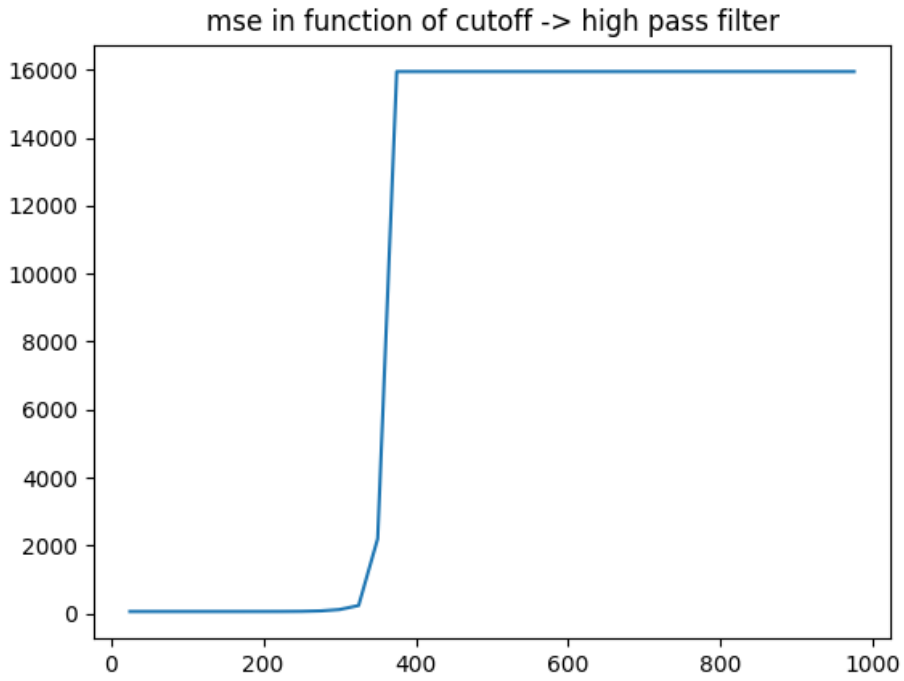
(a) We now apply a Gaussian filter in the time domain, like in the previous TP6, it results in a good mse: MSE(lena, lena gaussian filter) = 55

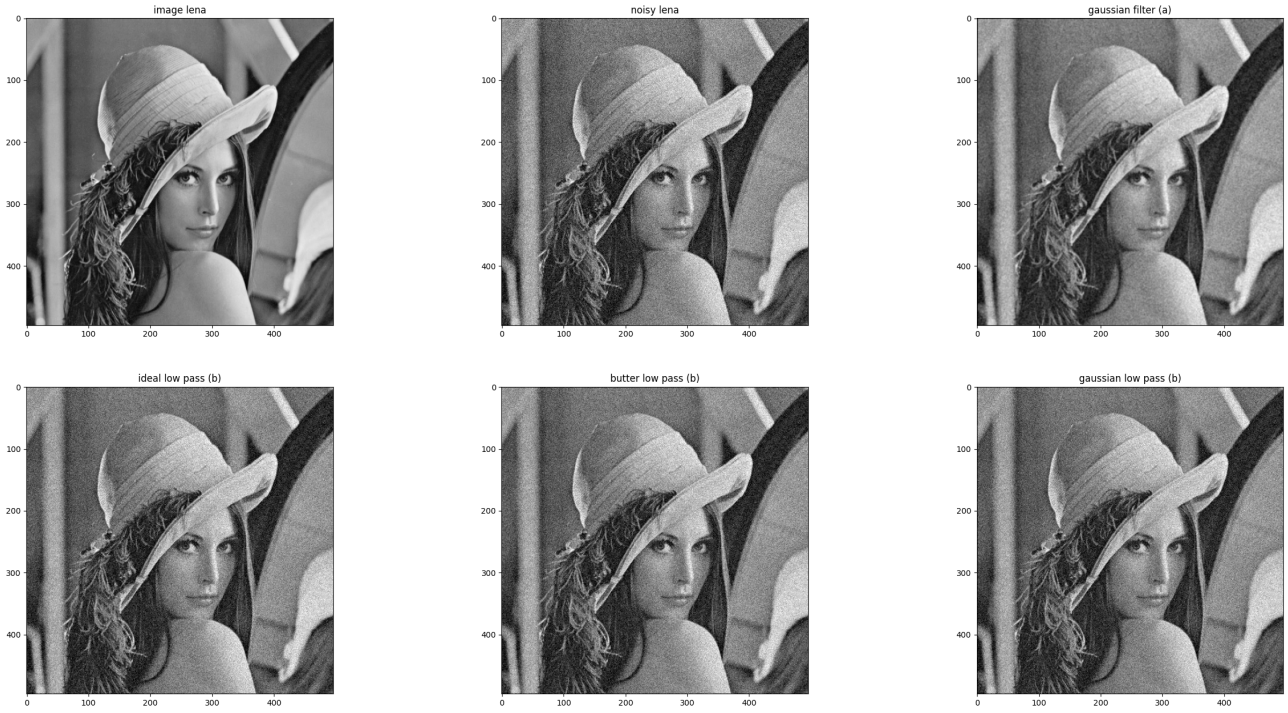
(b) I chose ideal high pass filter, it is a good filter for this problem, gaussian high pass filter would have worked as well. The bes mse looks to be at around cutoff = 200











(c) As we can see from the mse results, unlike in exercice 1, we acutally got good results.

```
MSE -> lena & lena box filter -> 173.85126983610823
MSE -> lena & lena gaussian (a) -> 55.503276209677416
MSE -> lena & ideal high pass (b) - cutoff = 200 -> 55.640847950619836
```

(d)

Exercise 3

(a)

Exercise 4

(a)