CS663 - Assignment 2 - Question 7

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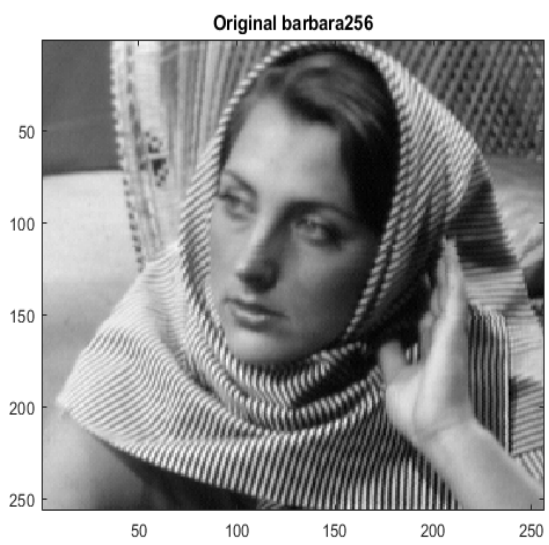
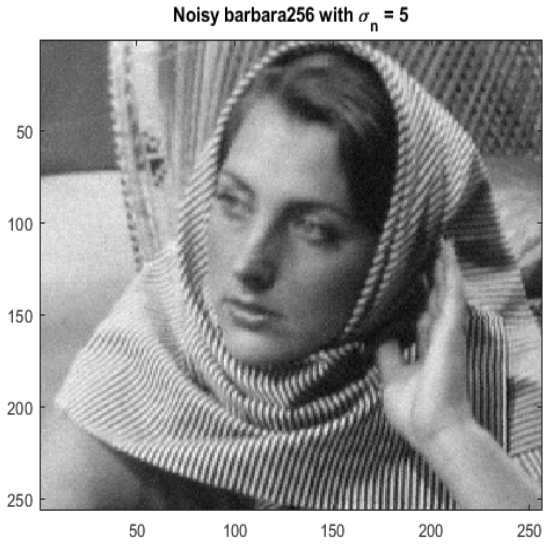
- For $\boldsymbol{\sigma = 5}$

  Barbara256:



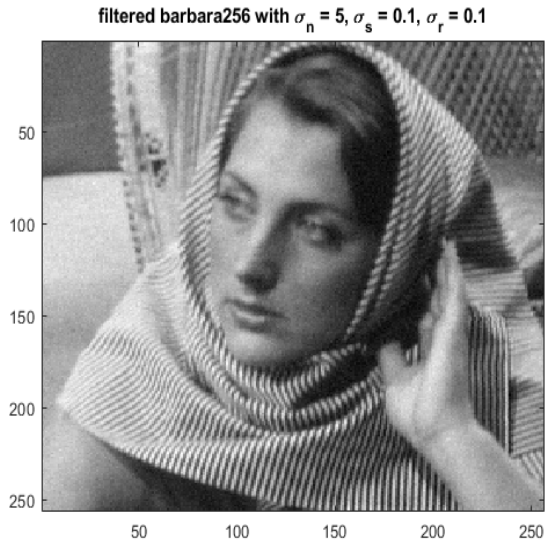
Barbara original image



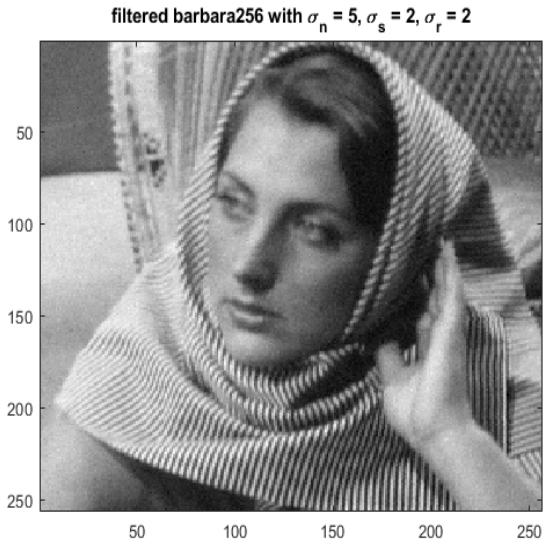
Barbara noisy image for $\sigma = 5$

Above noisy image is getting from adding noise of mean 0 and standard deviation(σ) = 5

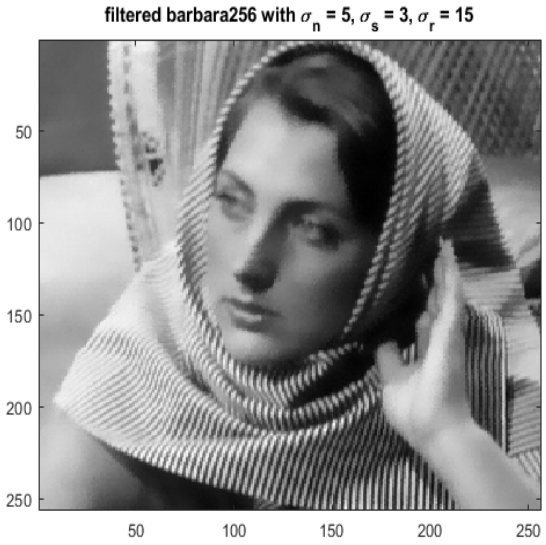
Bilateral Filtering:



Filtered barbara image with $\sigma_s = 0.1,\ \sigma_r = 0.1$



Filtered barbara image with $\sigma_s = 2,\ \sigma_r = 2$

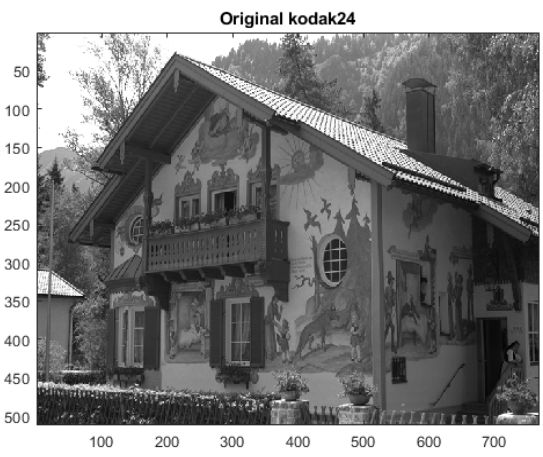


Filtered barbara image with $\sigma_s = 3,\ \sigma_r = 15$

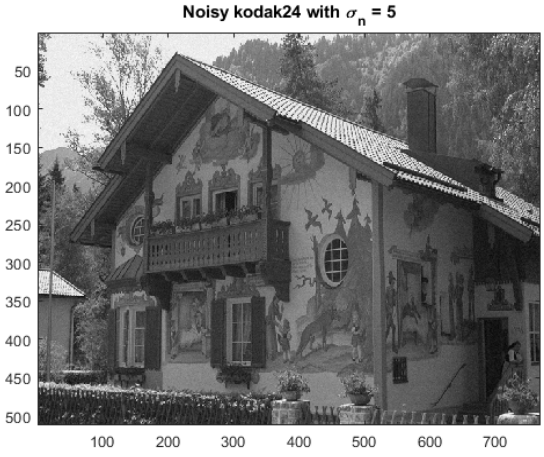
From the above figures, we observe that increasing the values of σ_s and σ_r leads to more blurring of the image. This occurs because more neighboring pixels have significant weights in the Gaussian filters, and the Gaussian distribution widens as the standard deviation increases. Additionally, blurring becomes more pronounced when σ_r is large, as σ_r controls the extent to which pixels of different intensities contribute to the mean. Despite the blurring effect of bilateral filtering, the edges remain preserved.

The same effect can be observed in tkodak26 also.

Kodak26:

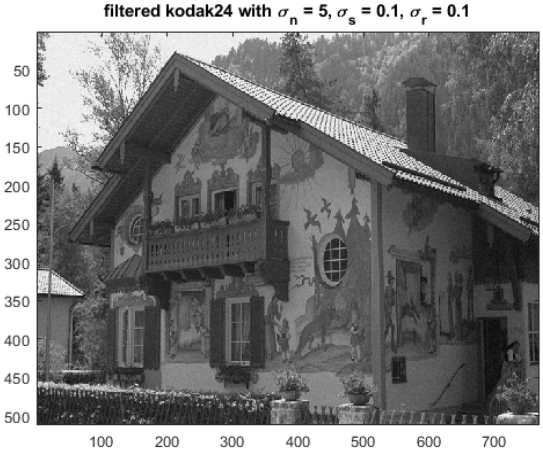


Kodak original image

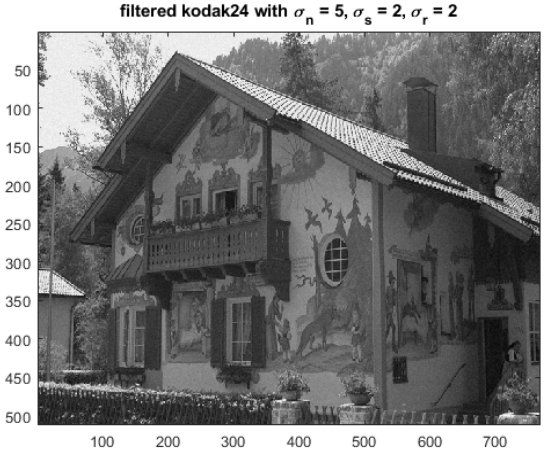


Kodak noisy image for $\sigma = 5$

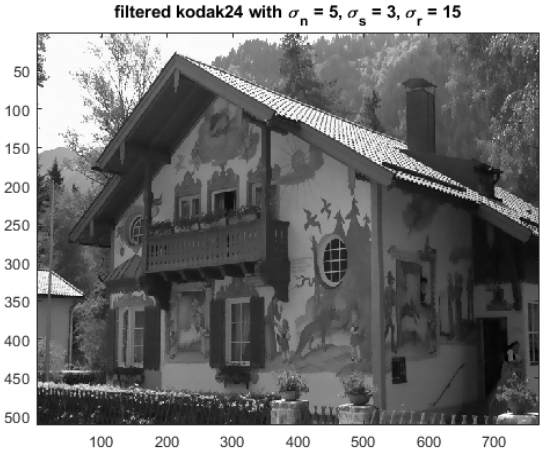
Bilateral Filtering:



Filtered kodak image with $\sigma_s = 0.1,\ \sigma_r = 0.1$



Filtered barbara image with $\sigma_s = 2,\ \sigma_r = 2$

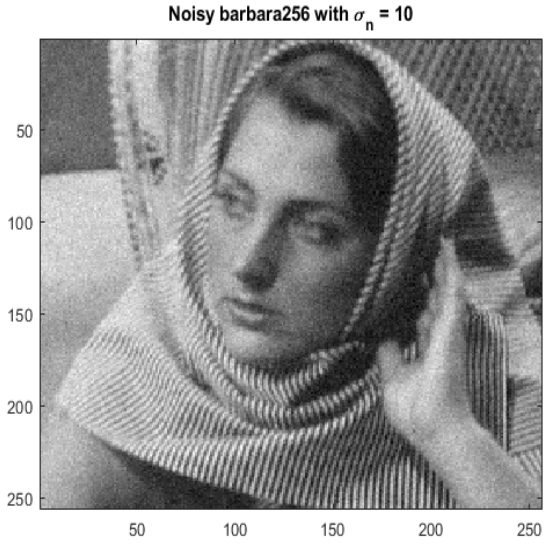


Filtered kodak image with $\sigma_s = 3,\ \sigma_r = 15$

- For $\boldsymbol{\sigma = 10}$

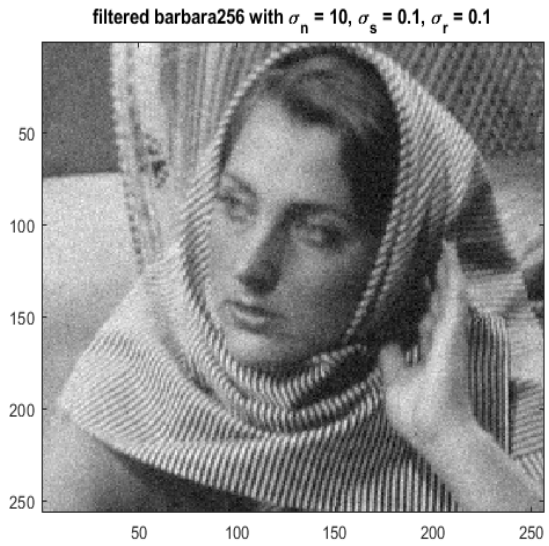
  Barbara256:

Barbara original image

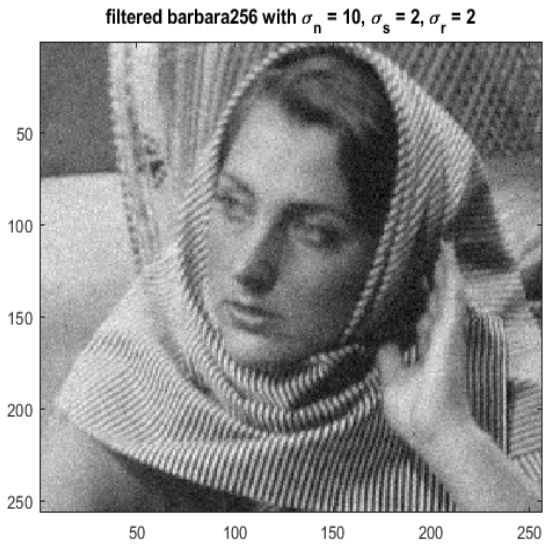


Barbara noisy image for $\sigma = 10$

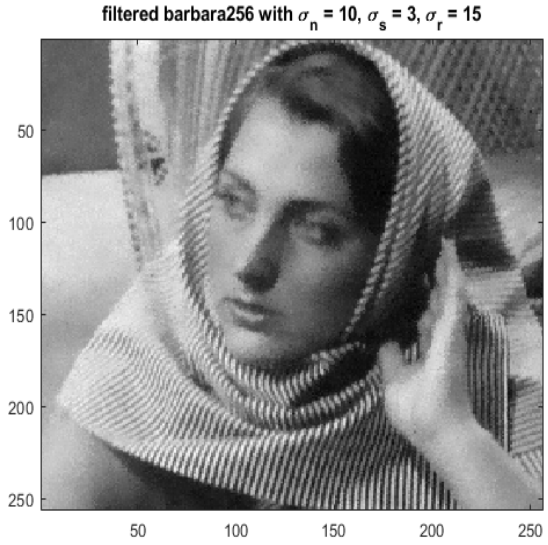
Bilateral Filtering:



Filtered barbara image with $\sigma_s = 0.1,\ \sigma_r = 0.1$

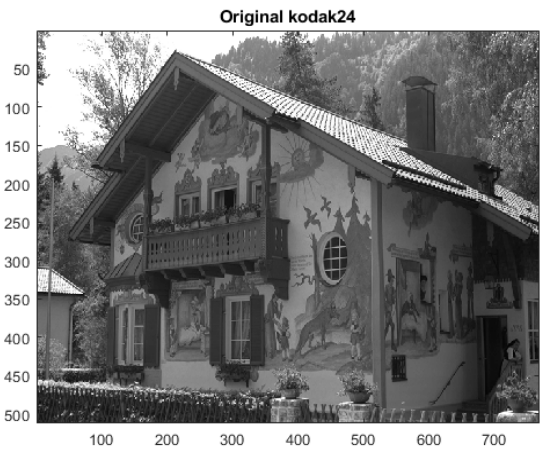


Filtered barbara image with $\sigma_s = 2,\ \sigma_r = 2$

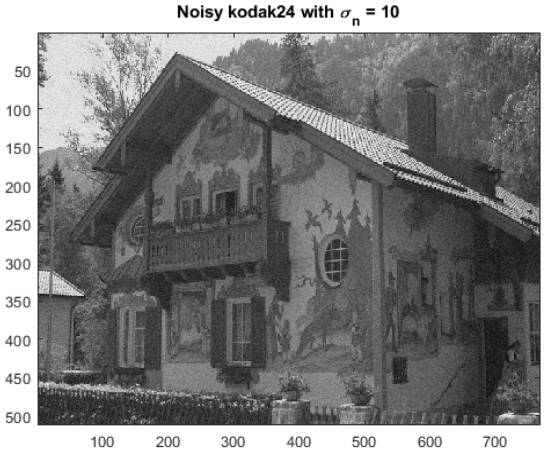


Filtered barbara image with $\sigma_s = 3,\ \sigma_r = 15$

Kodak26:

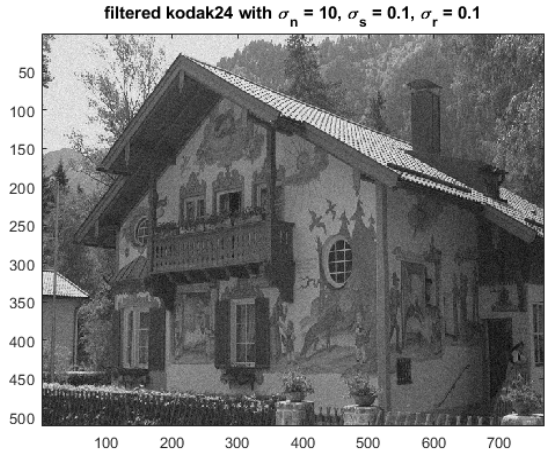


Kodak original image

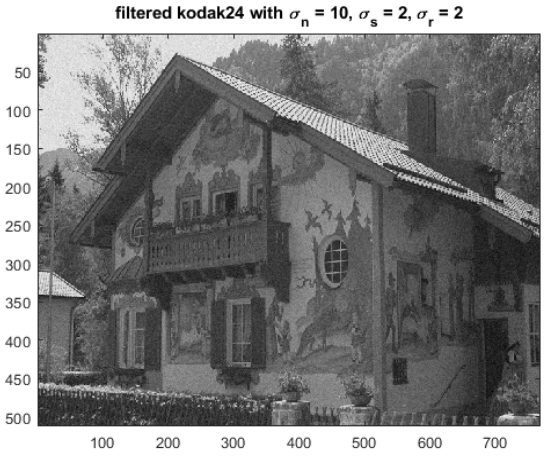


Kodak noisy image for $\sigma = 10$

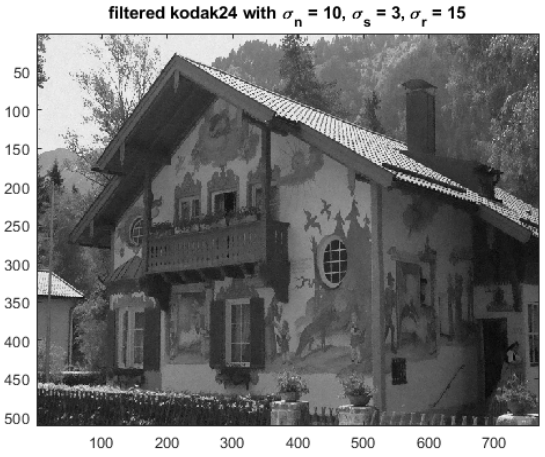
Bilateral Filtering:



Filtered kodak image with $\sigma_s = 0.1,\ \sigma_r = 0.1$



Filtered barbara image with $\sigma_s = 2,\ \sigma_r = 2$



Filtered kodak image with $\sigma_s = 3,\ \sigma_r = 15$

As the standard deviation of Gaussian noise increases, the intensities become more erratic. Therefore, we expect to see improved filtering results compared to the previous case. However, low values of σ_s and σ_r do not provide significant smoothing for noisy images. Consequently, noticeable smoothing is only observed for $\sigma_s = 3$ and $\sigma_r = 15$.