Digital Image Processing

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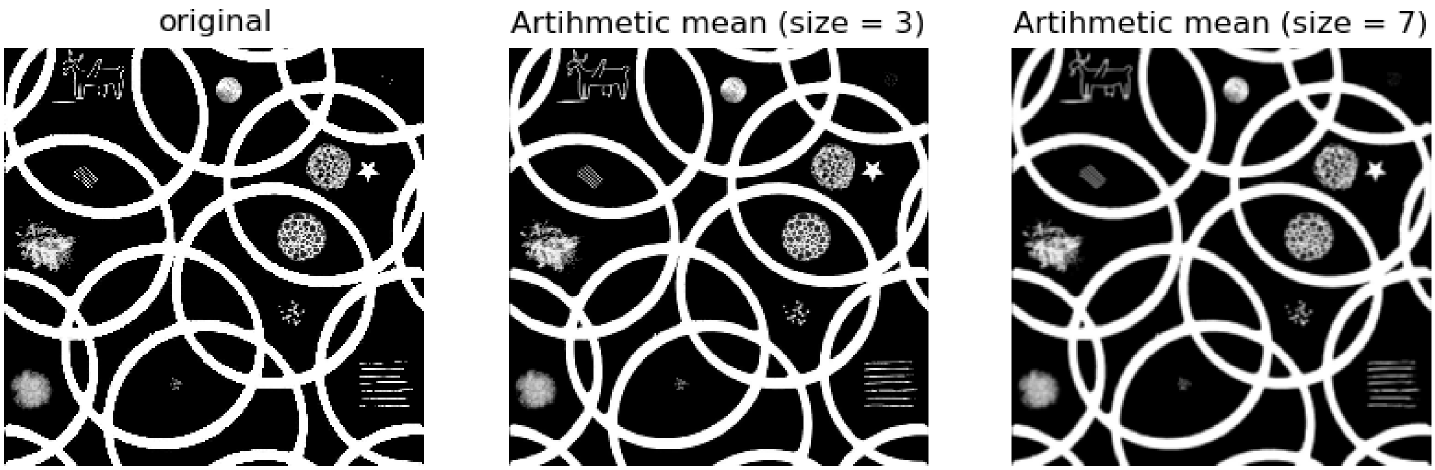
Homework 4

1.

a.

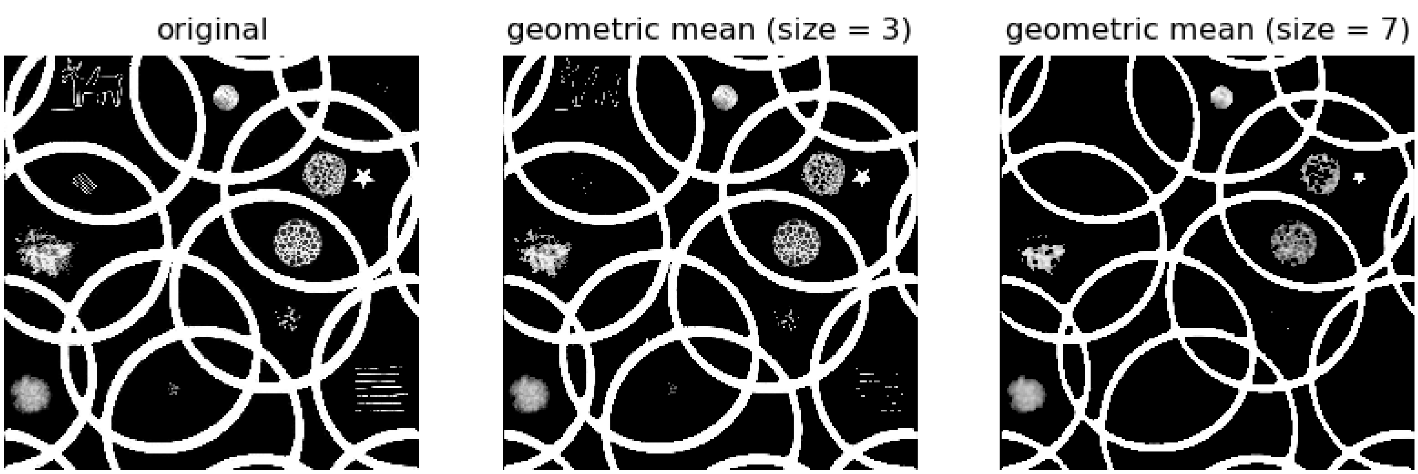
Arithmetic mean filter smooths edges and blurs image.

Mentioned effects get stronger as kernel size increases.



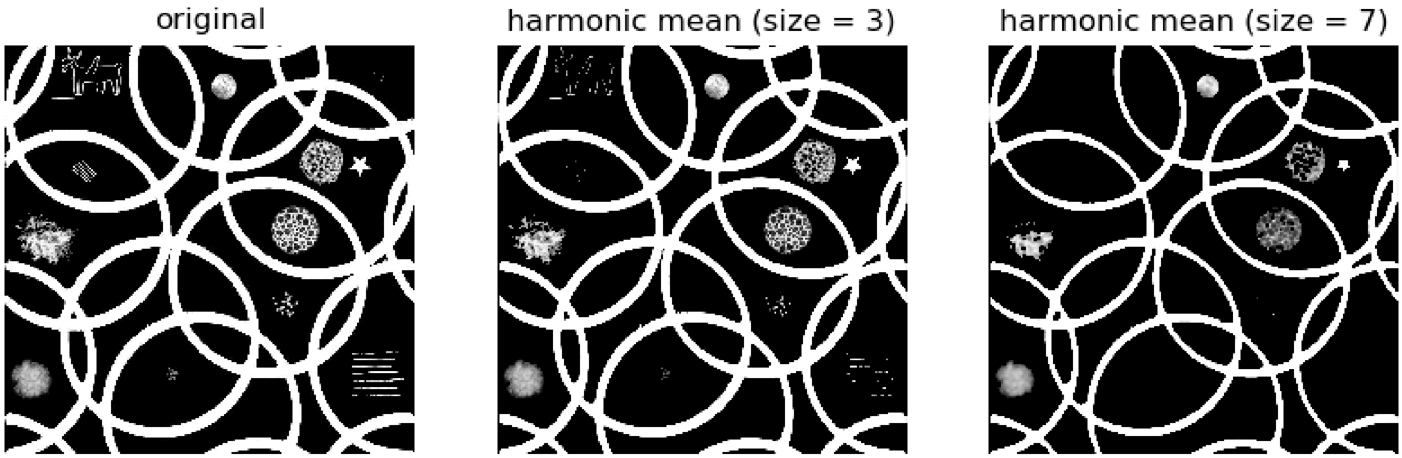
b.

Generally, affects like arithmetic mean filter with preserving more details and better smoothing but in images with black background performs poorly because by existence of only one zero pixel in the filter region, leads to zero output disregard of other values.



c.

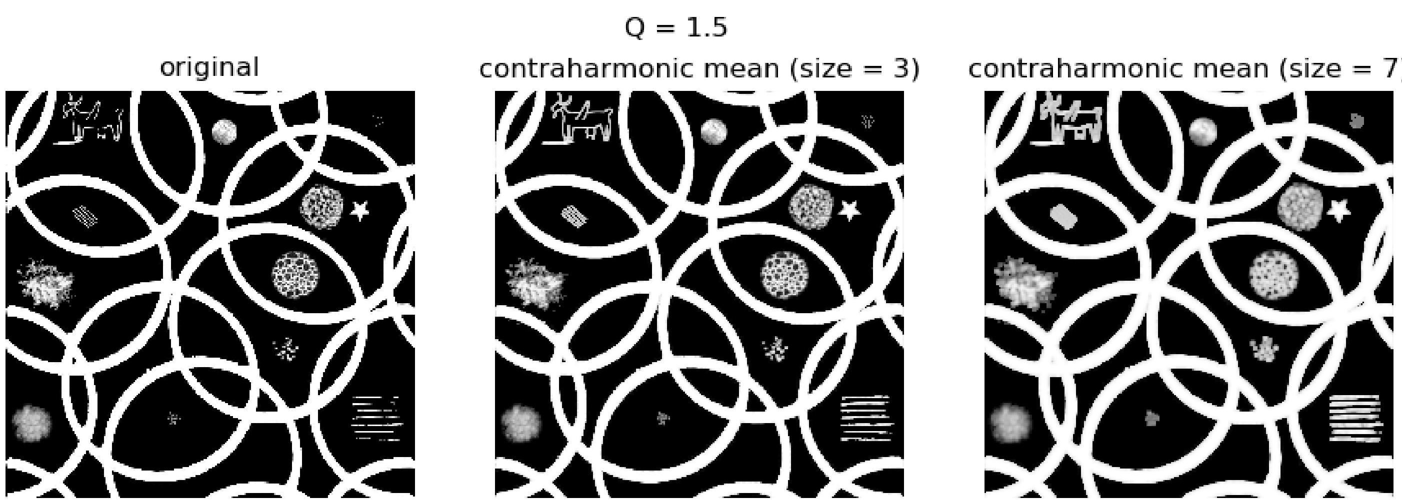
Harmonic mean filter reduces noise by blurring as well. For this image no noticeable difference can be found compared to geometric mean filter



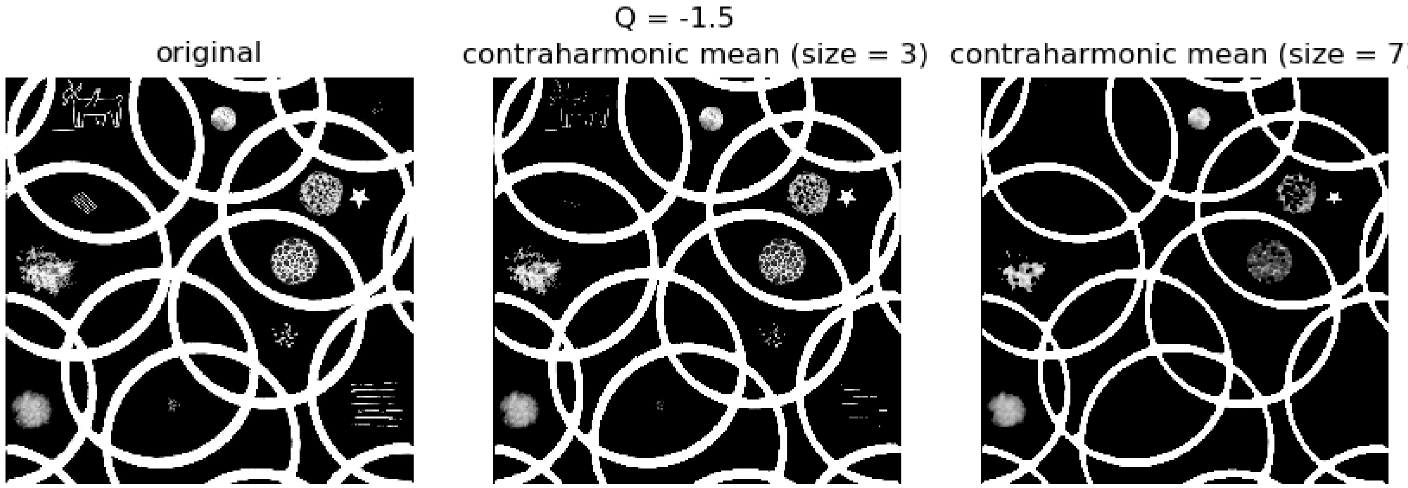
d.

Again, contraharmonic mean filter reduces noise by blurring just like other mean filters. This filter is used by positive value of 'Q' to eliminate pepper noise (hence, number of white pixels are increased) and negative value for salt noise (hence, number of black pixels are increased).

Q = 1.5:

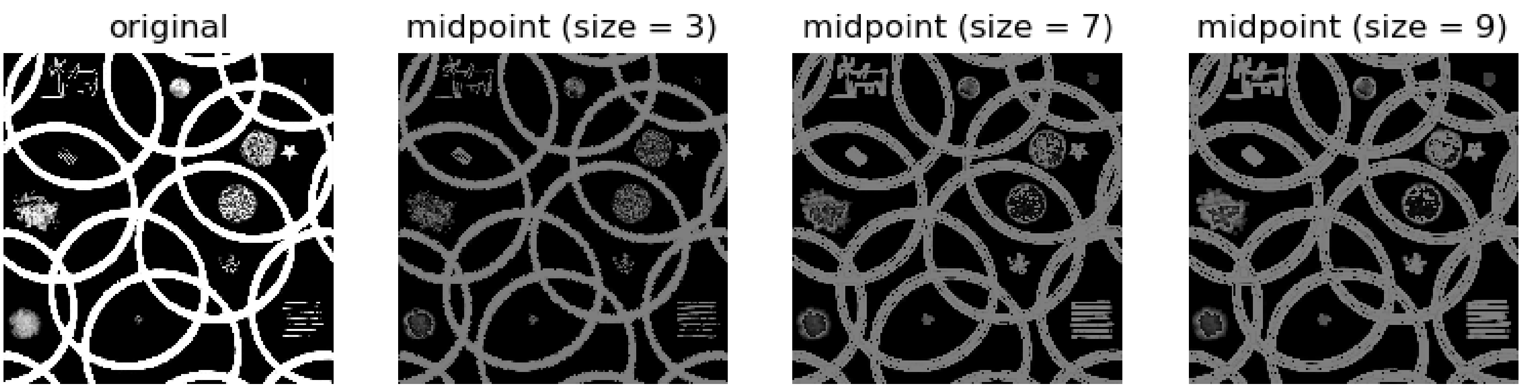


Q = -1.5:



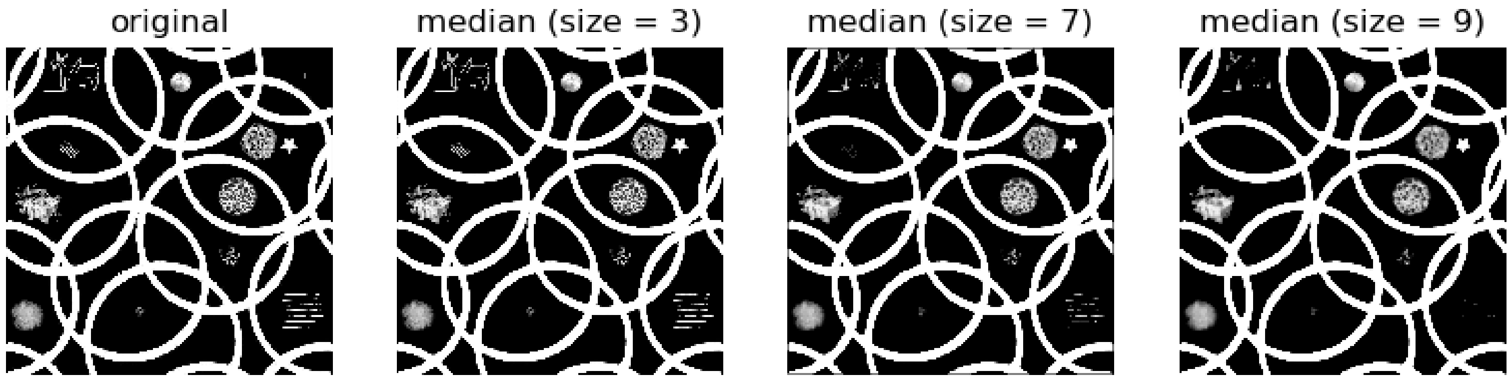
e.

Midpoint filter, generally, handles gaussian noise.



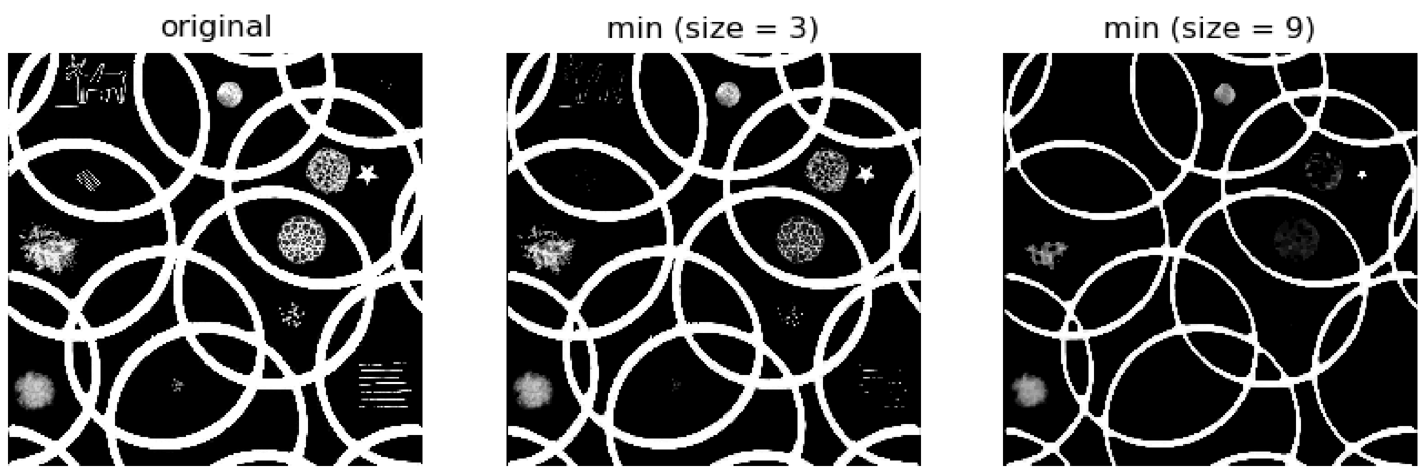
f.

Median filter, generally, handles bipolar and unipolar noise.



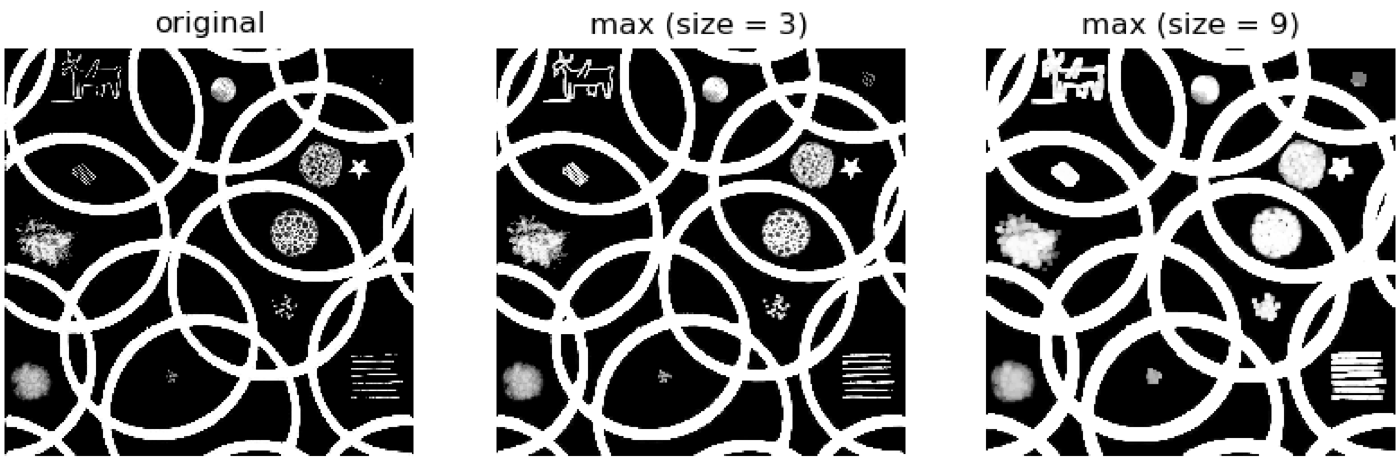
g.

Min filter, generally, finds darkest points in an image and works well with salt noise.



h.

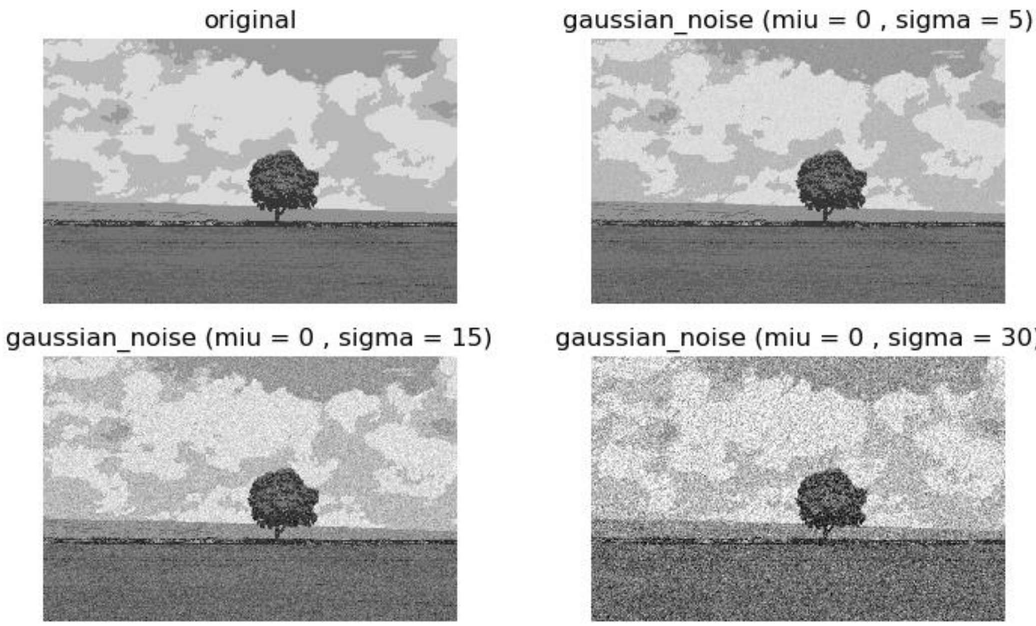
Max filter, generally, finds brightest points in an image and works well with pepper noise.

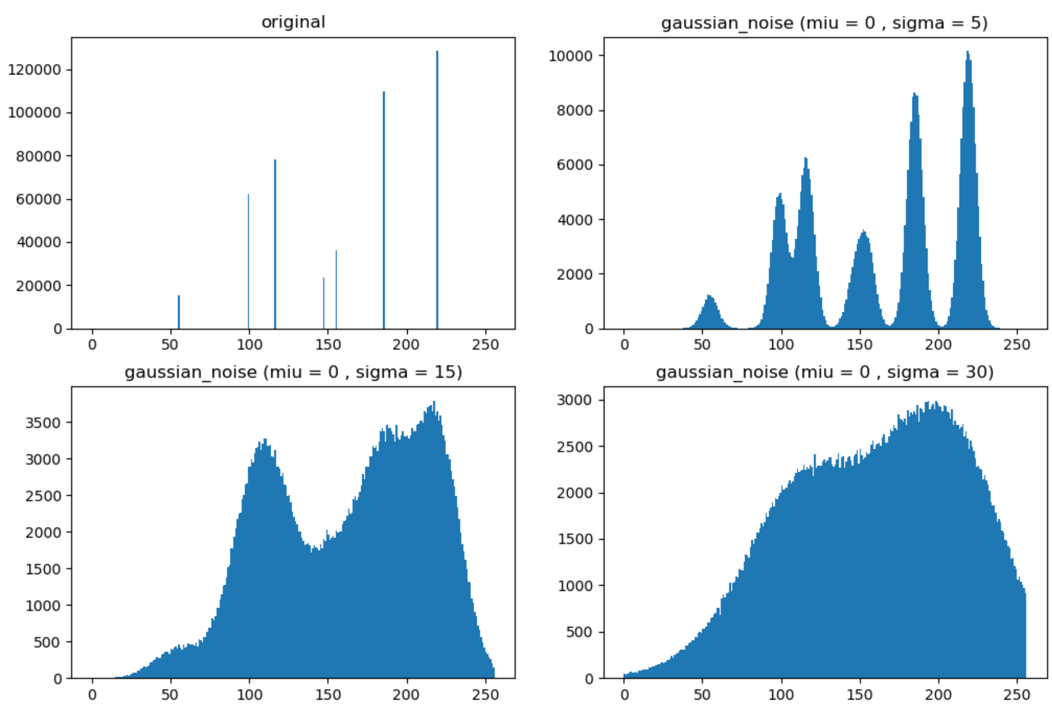


2.

a.

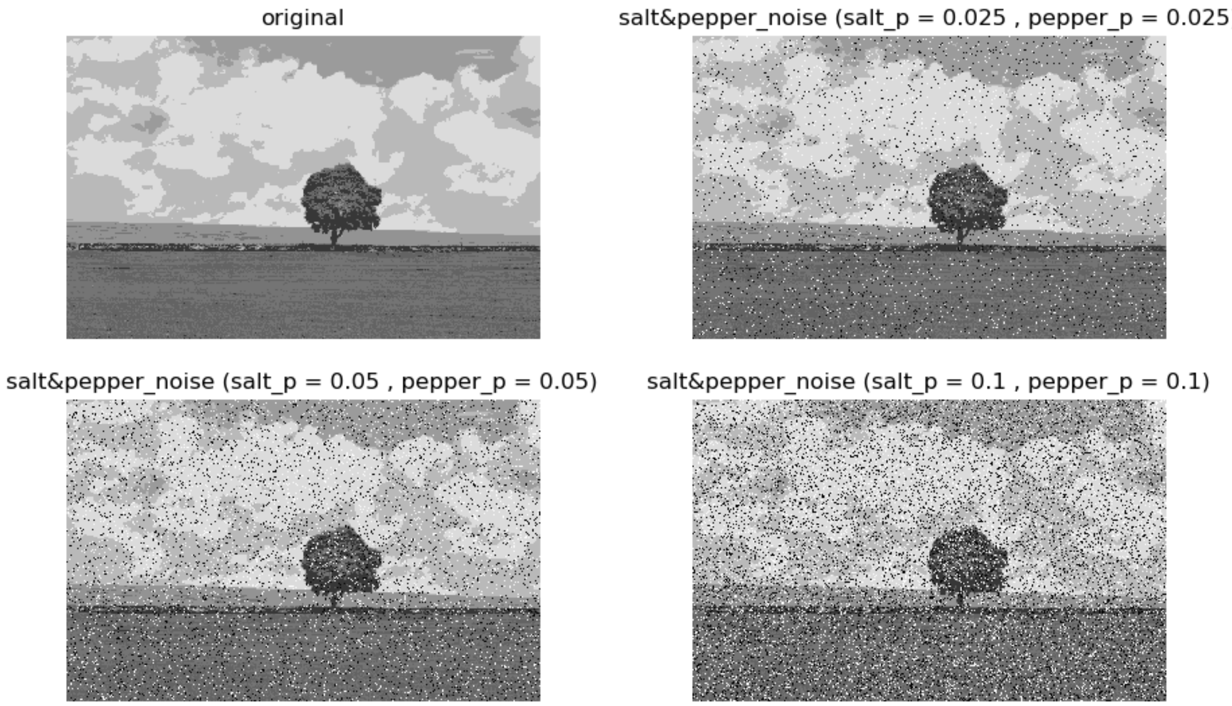
Adding gaussian noise to an image by setting parameters of sigma and mean:

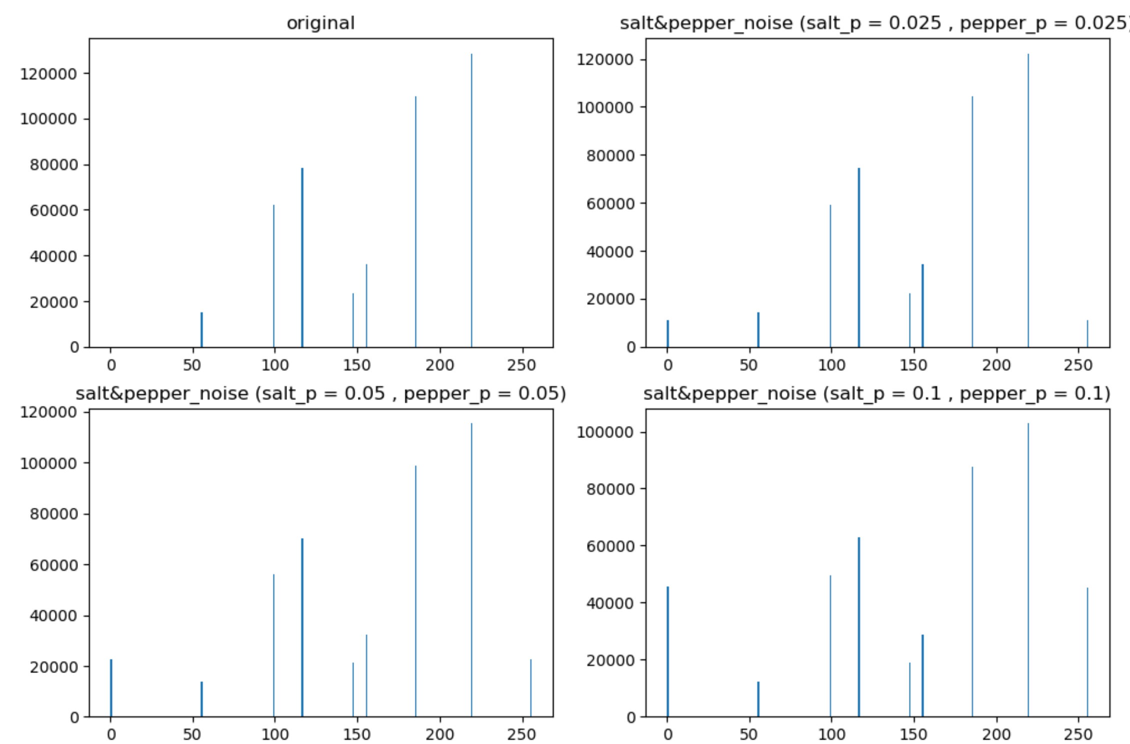




b.

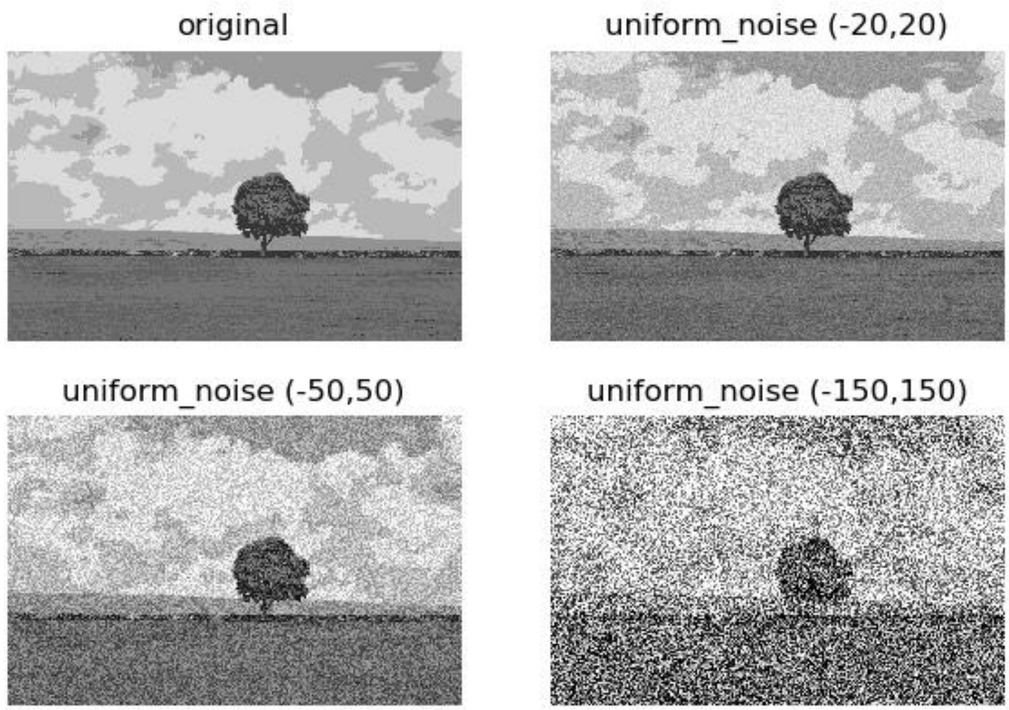
Adding gaussian noise to an image by setting parameters of salt probability and pepper probability:

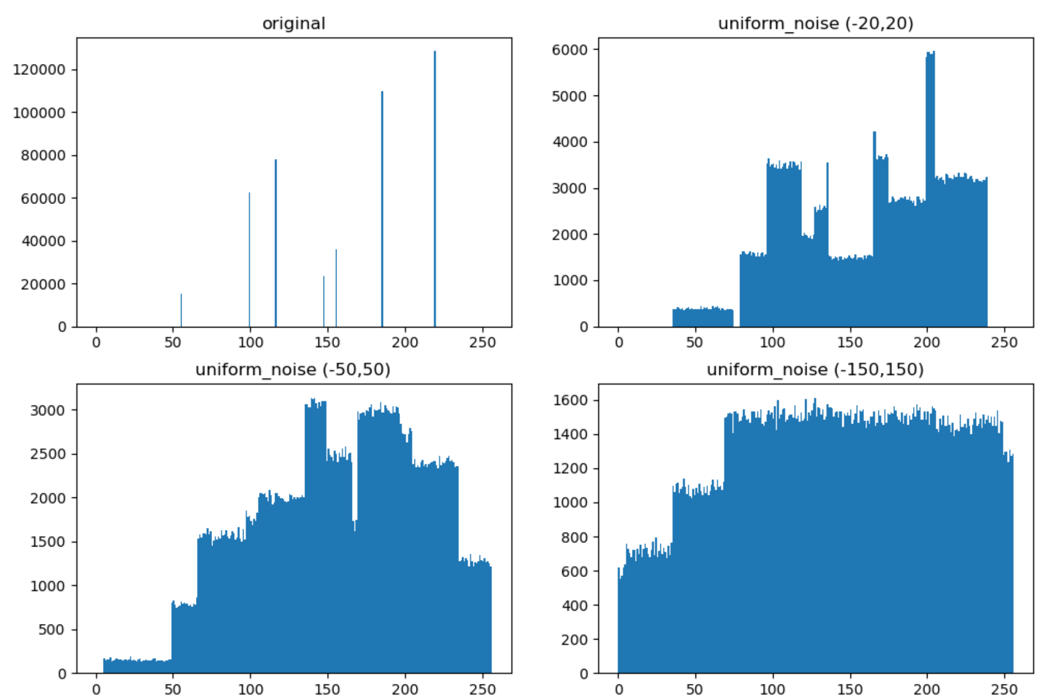




c.

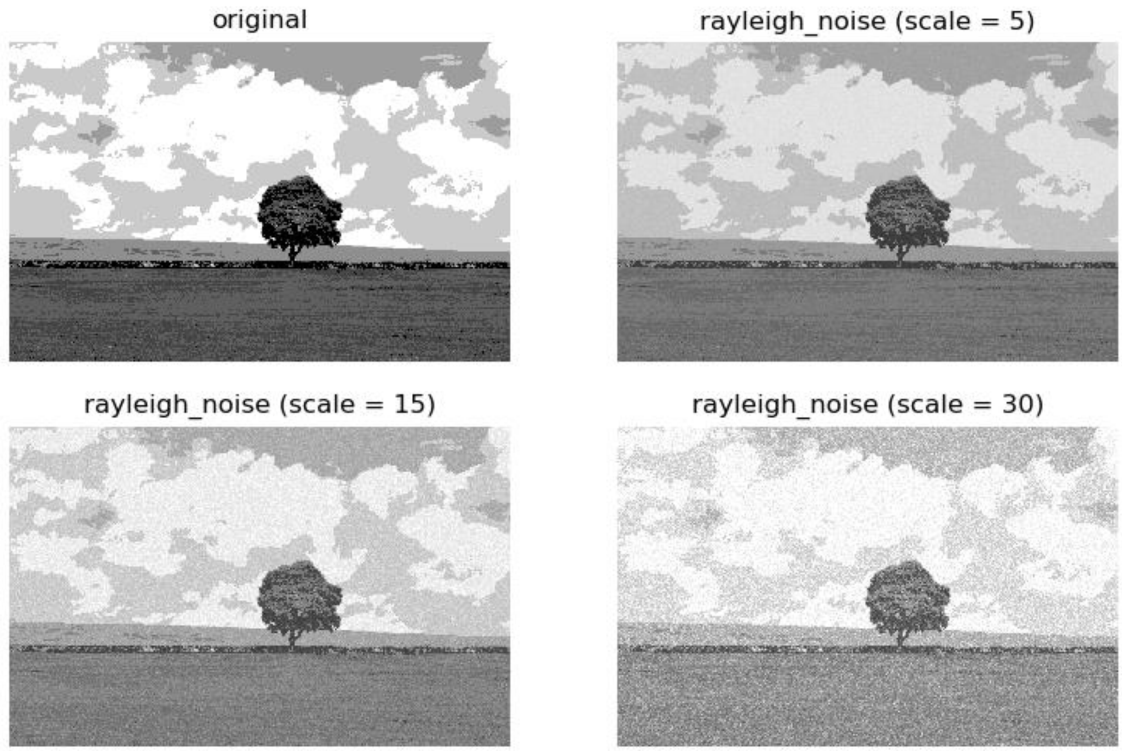
Adding uniform noise to an image by setting parameters of lower and upper boundary:

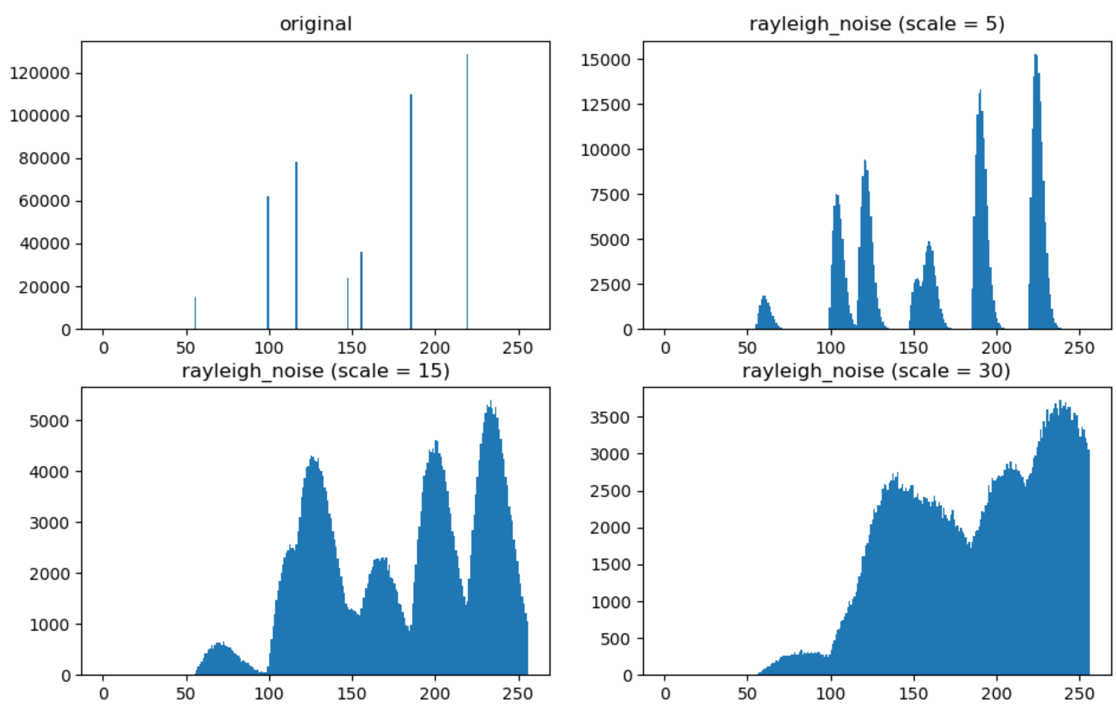




d.

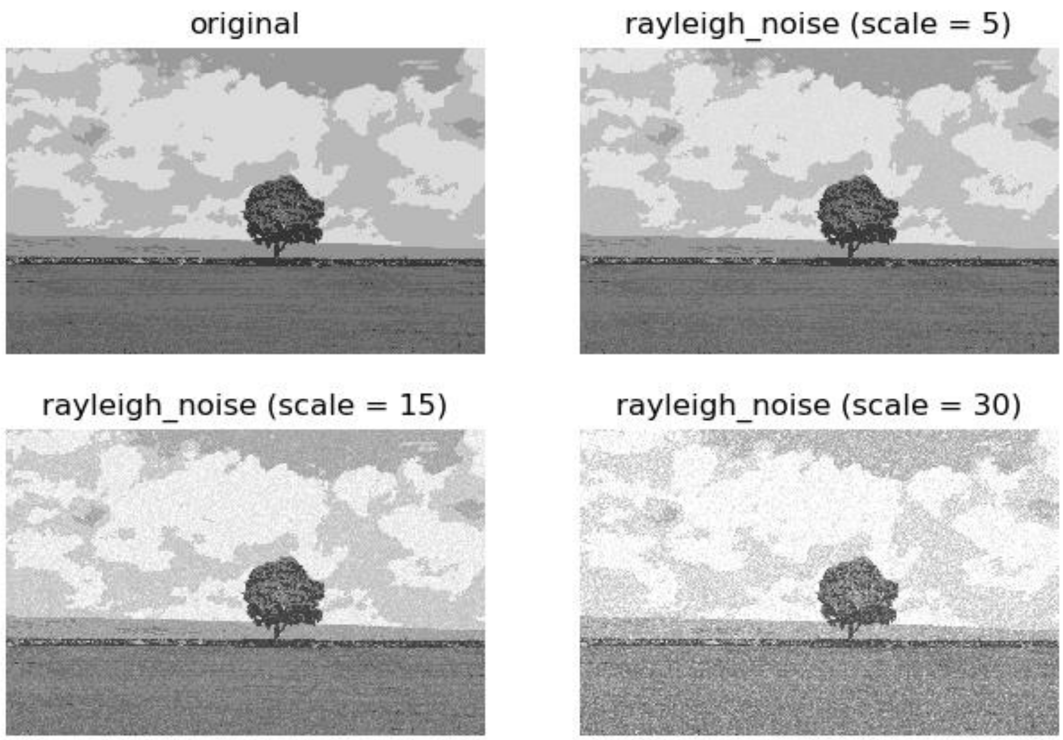
Adding gaussian noise to an image by setting parameter of scale:

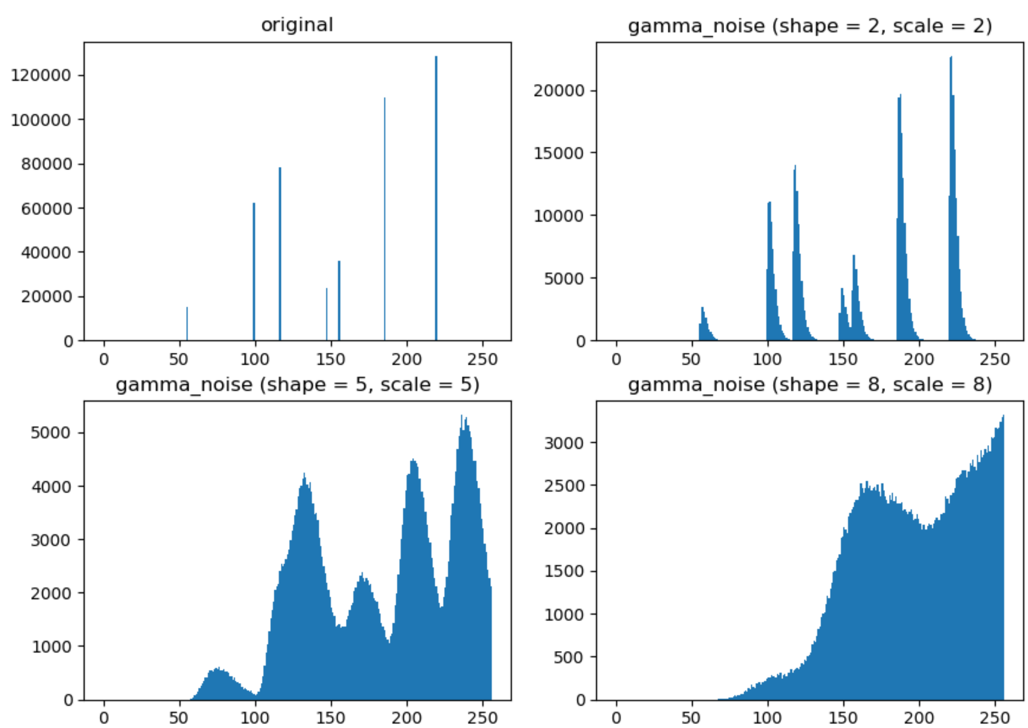




e.

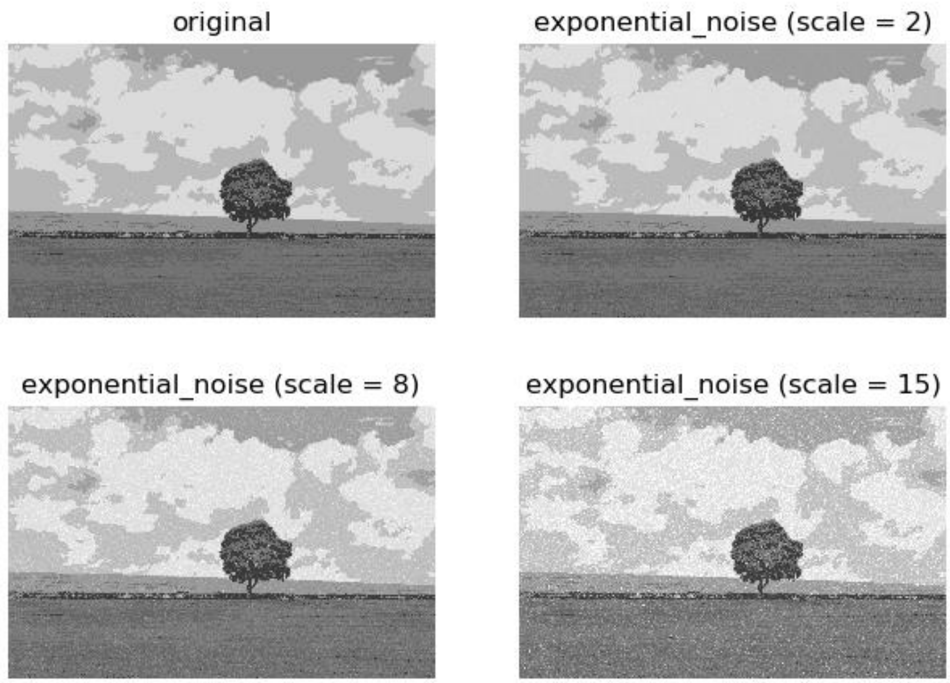
Adding gamma noise to an image by setting parameters of shape and scale:

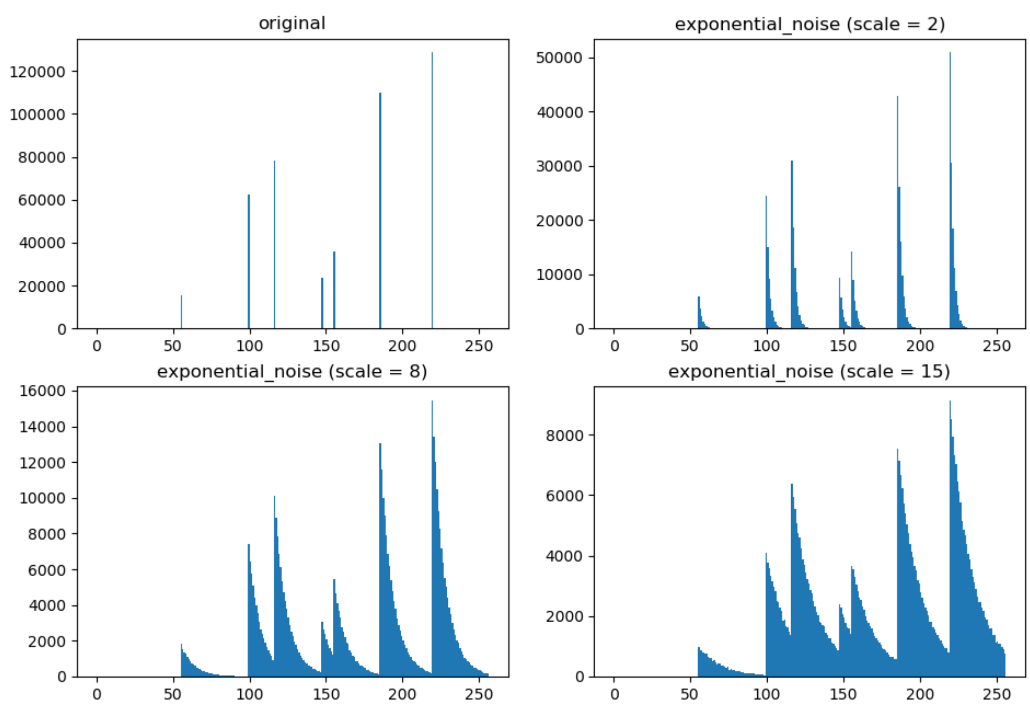




f.

Adding exponential noise to an image by setting parameter of scale:



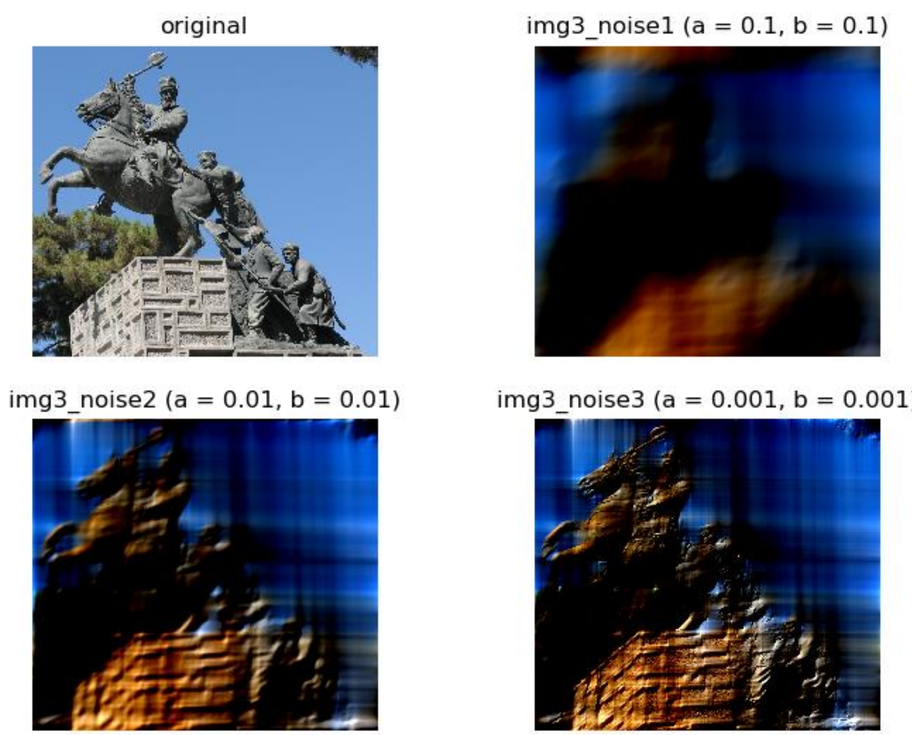


g.

Defining a function named ‘athmospheric_turbulence’, following results were obtained

h.

Defining a function named ‘motion_blue’, following results were obtained



3.

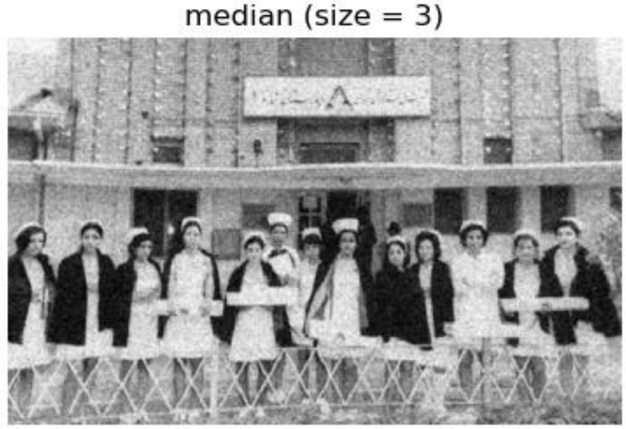
a.

Applying arithmetic mean filter with kernel size of 3 then median filter with kernel of size 3:

original

mean (size = 3)

median (size = 3)

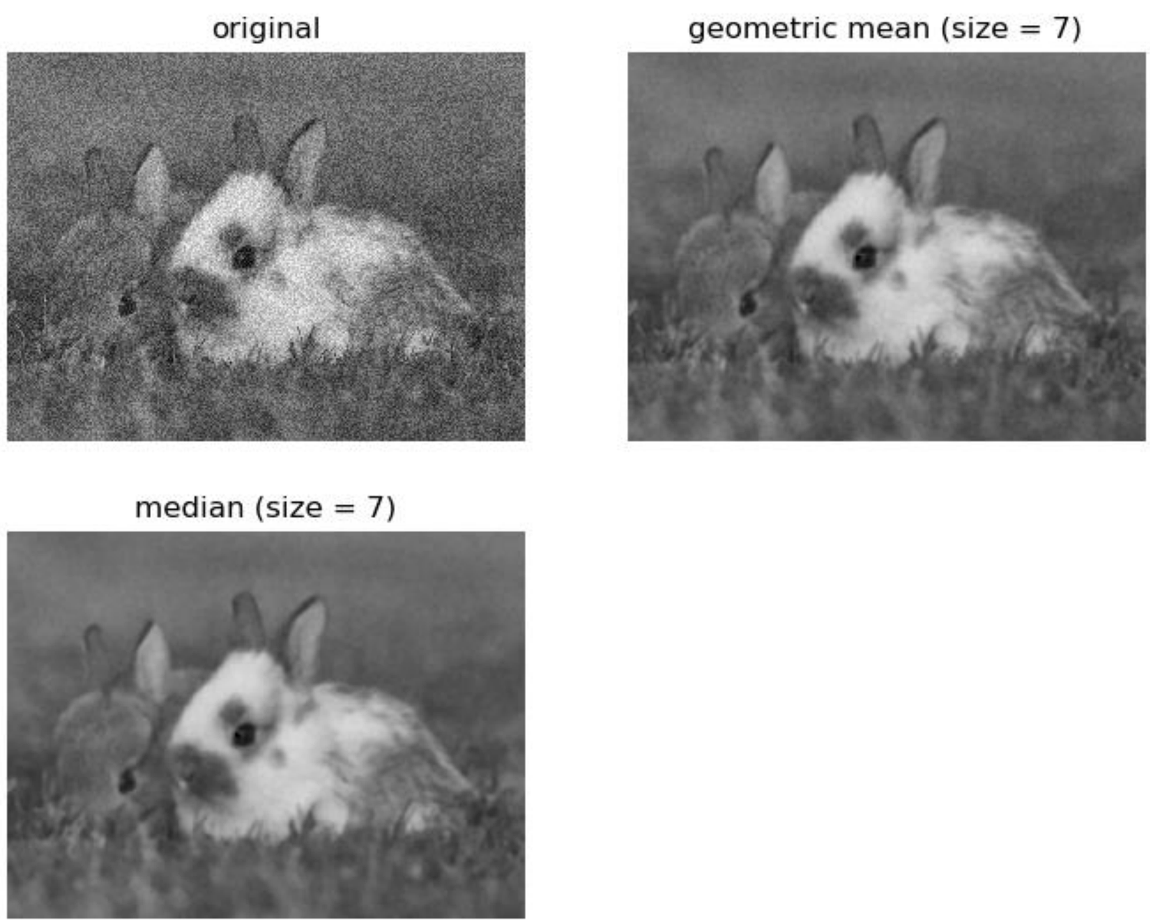


b.

Applying median filter with kernel of size 5:

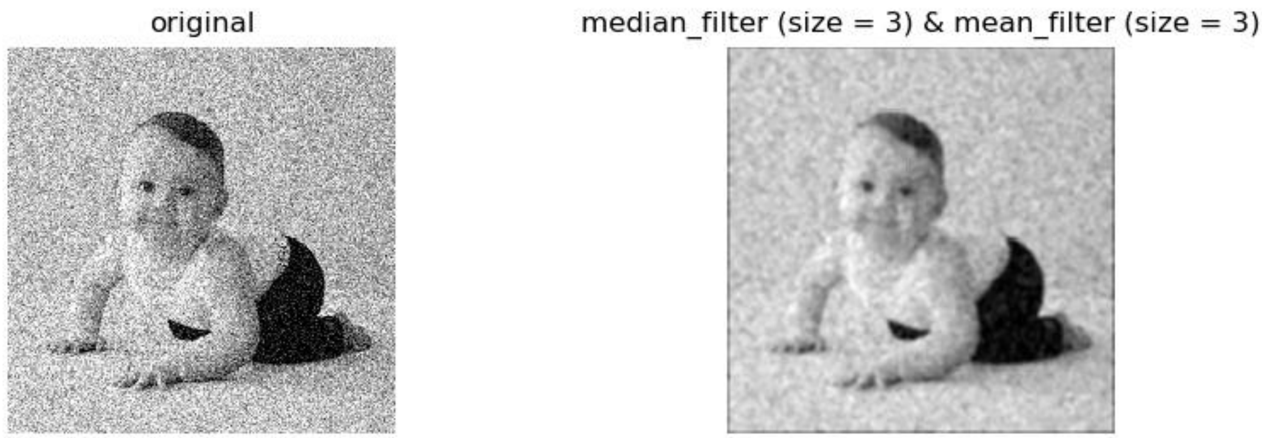
c.

Applying geometric mean filter with kernel size of 7 then median filter with kernel of size 7:



d.

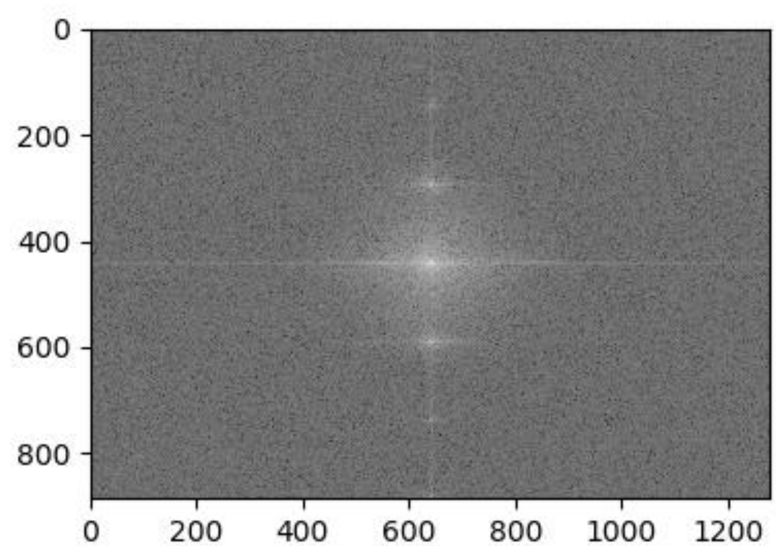
Applying median filter with kernel size of 3 then mean filter with kernel of size 3:



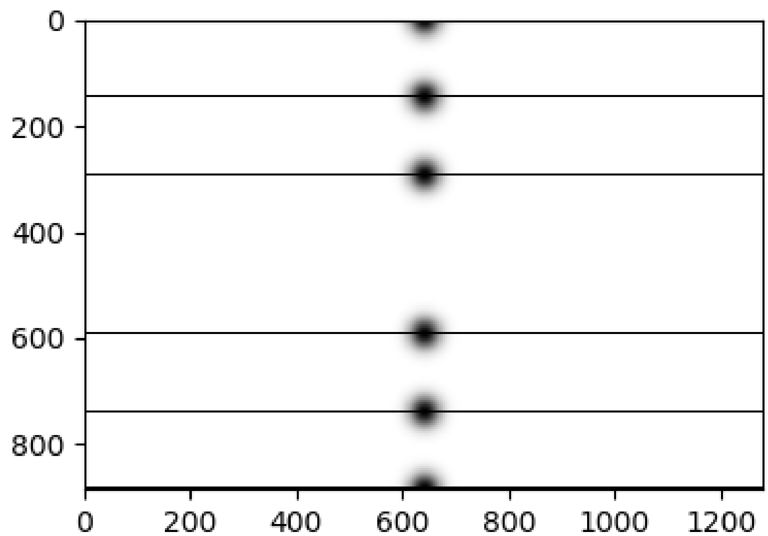
e.

By filtering in frequency domain, following result will be obtained:

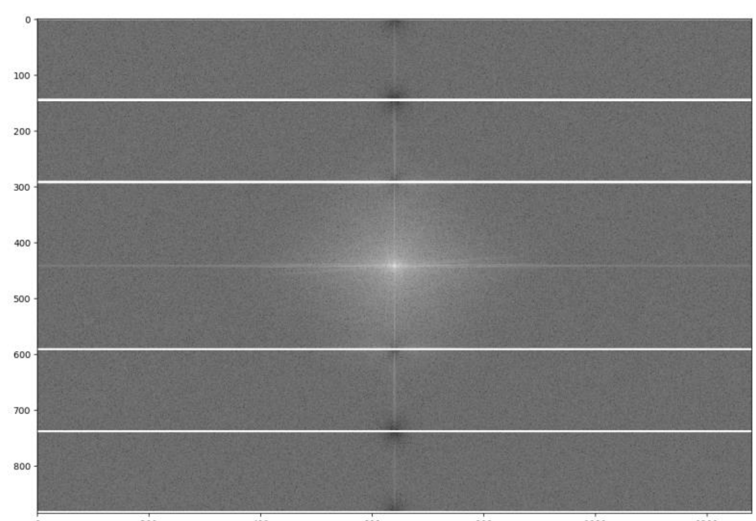
DFT of original image:



Implementing following filter:



Results in the following DFT:



Taking reverse DFT and implementing median filter with kernel of size 5 we have (compared by original image):

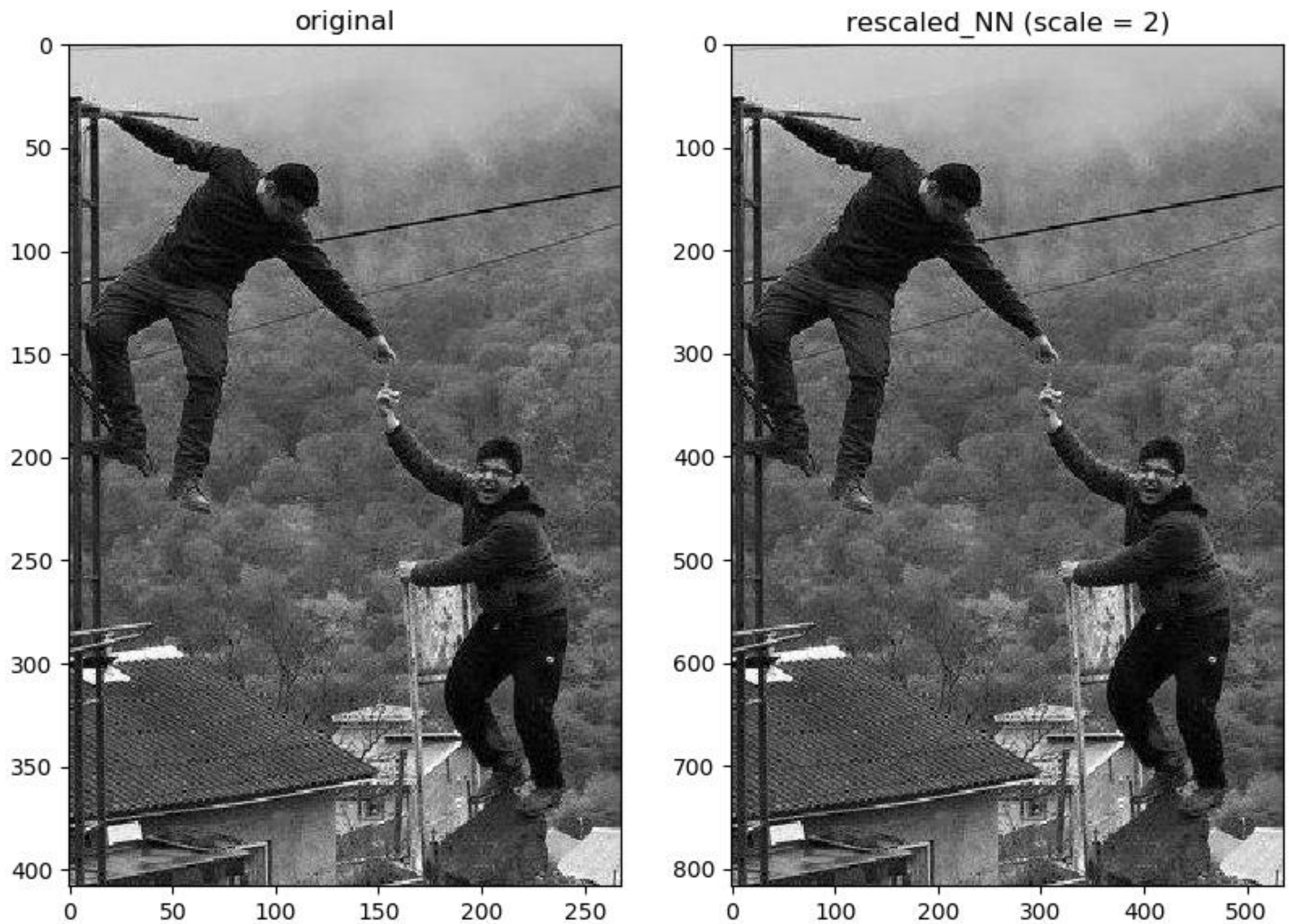
original

frequency domain filter & median_filter (size = 5)

4.

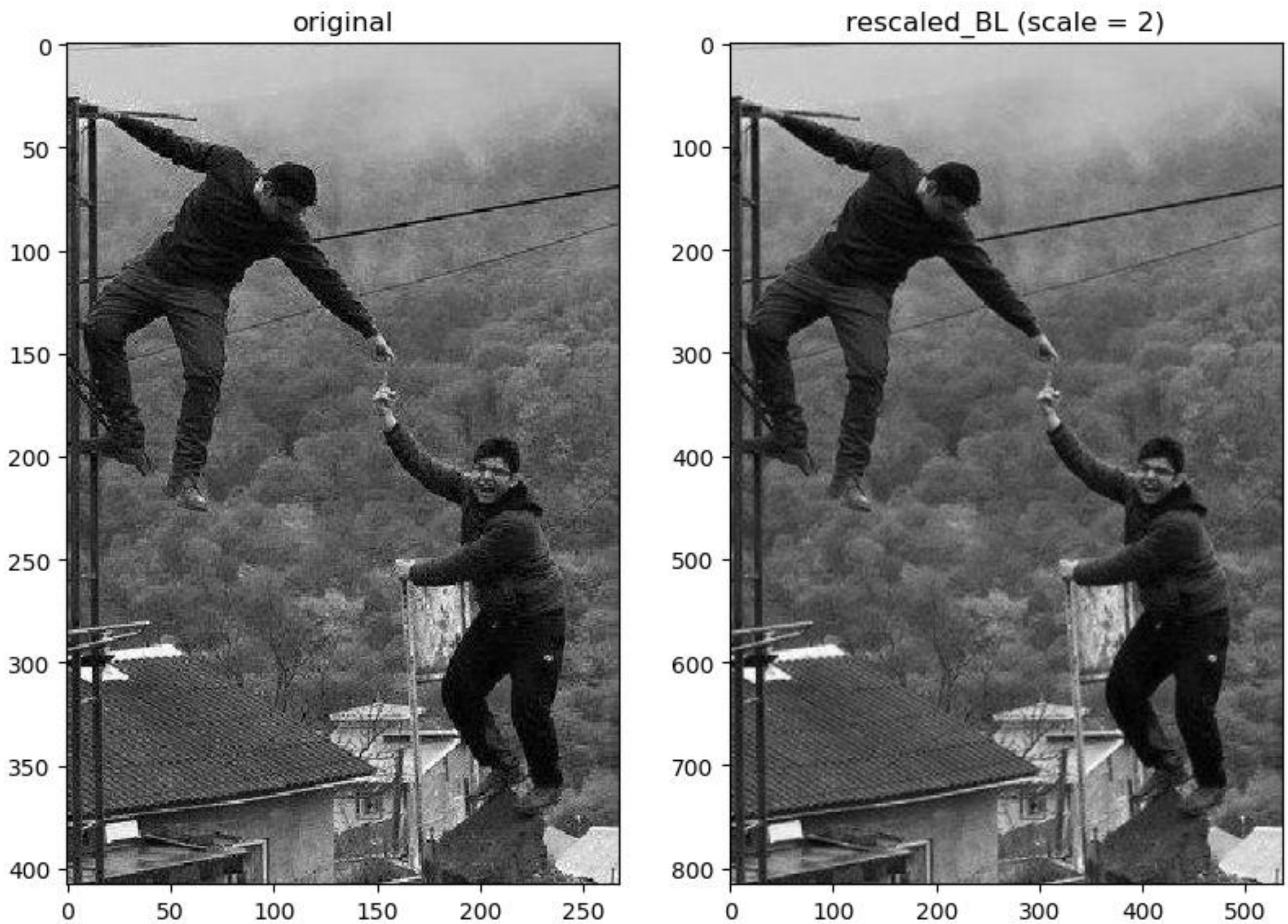
a.

Implementation of nearest-neighbor rescaling:



b.

Implementation of bilinear rescaling:



c.

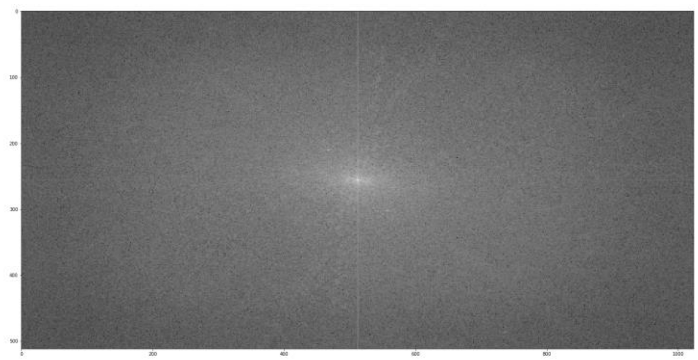
???

5.

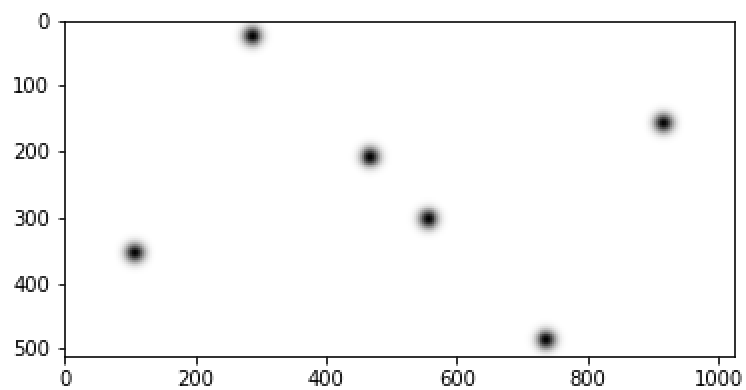
a.

By filtering in frequency domain, following result will be obtained:

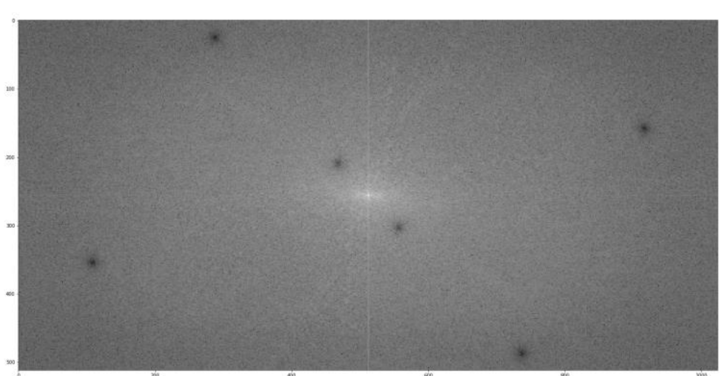
DFT of original image:



Implementing following filter:

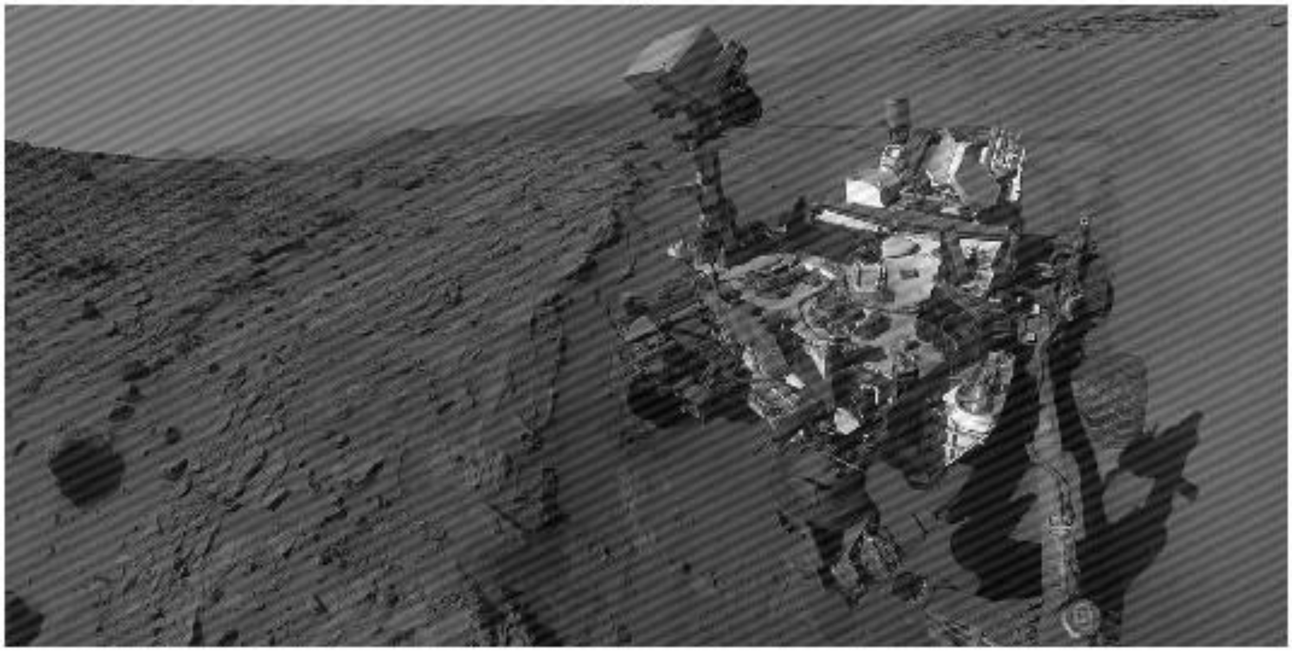


Results in the following DFT:

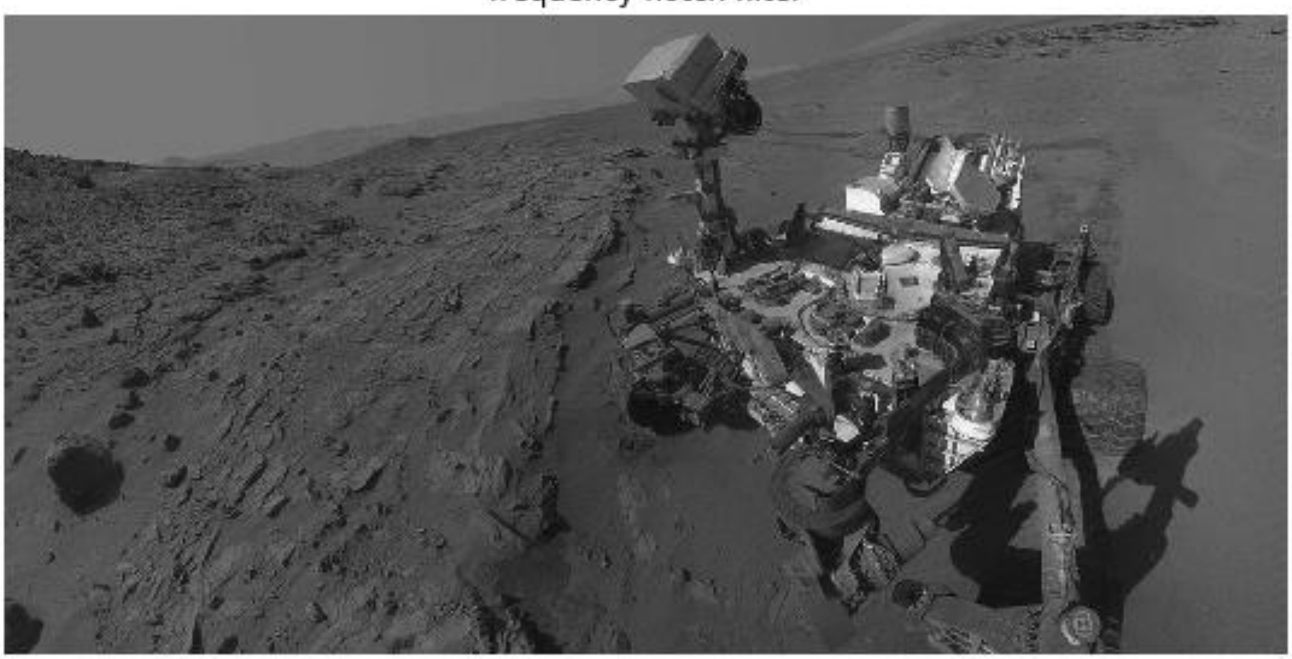


Taking reverse DFT we have (compared by original image):

original



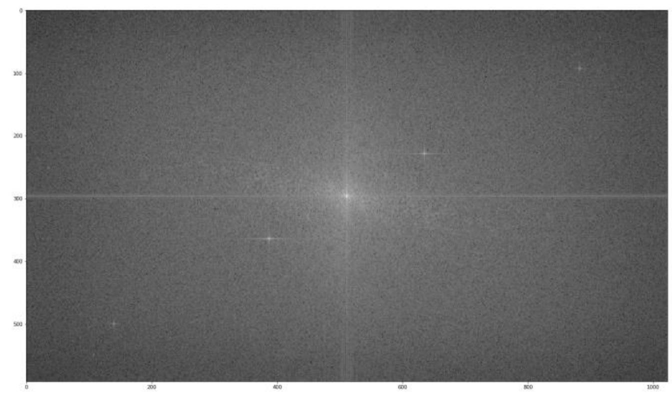
frequency notch filter



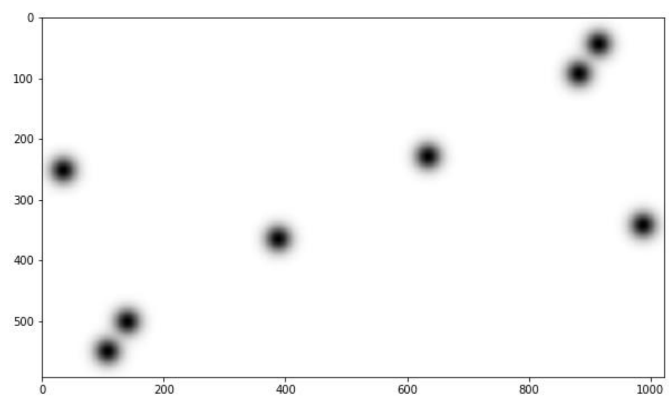
b.

By filtering in frequency domain, following result will be obtained:

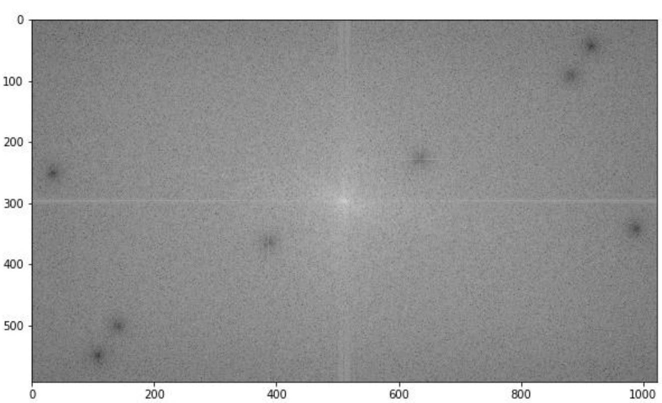
DFT of original image:



Implementing following filter:



Results in the following DFT:



Taking reverse DFT we have (compared by original image):

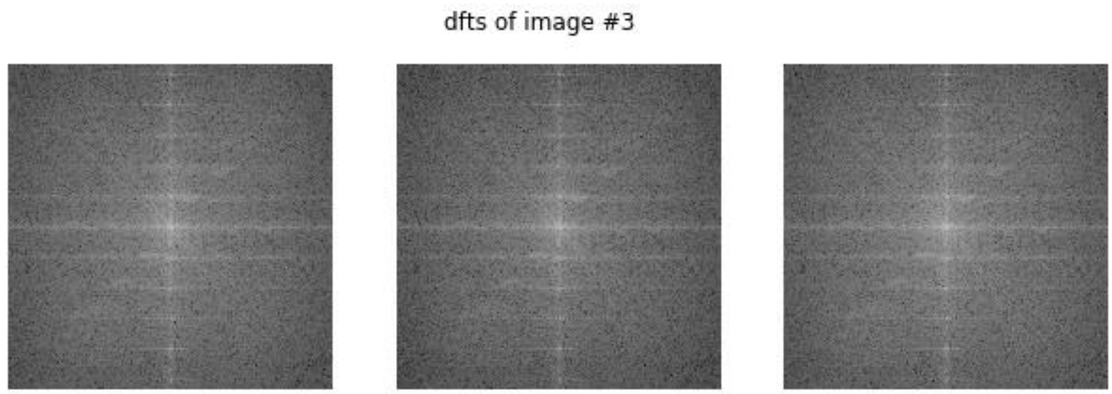
original

frequency notch filter

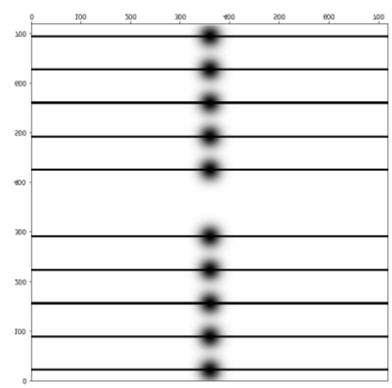
c.

By filtering in frequency domain, following result will be obtained:

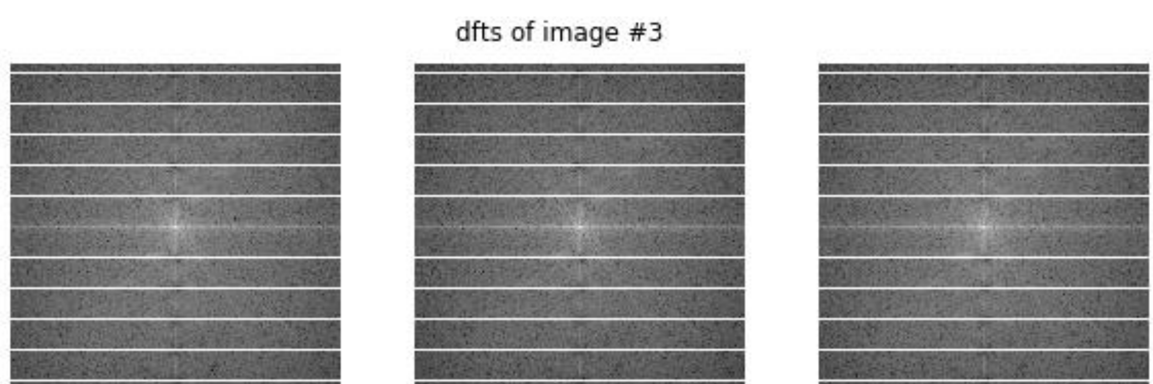
DFT of original image:



Implementing following filter:



Results in the following DFT:



Taking reverse DFT we have (compared by original image):

original

frequency notch filter

d.

???

6.

a.

Multiplicative noise is a type of noise which is multiplied to the original image in the frequency domain. In contrast, additive noise is a type of noise which is added to the original image in the frequency domain.

“Salt and pepper” noise is an additive noise.

b.

One directional spatial filtering will be used in the mentioned situation (for example, vertical, horizontal or diagonal spatial filters will be used).

As frequency of periodic noise increases, kernel size should be decreased.

c.

???

d.

???

e.

???