ASSIGNMENT 1 : Computer Vision
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Q1. Increasing the filter size increases the blurring effect of the filter as the weightage of neighbouring pixels increases

Input Image

Filter_Size = (3,3)

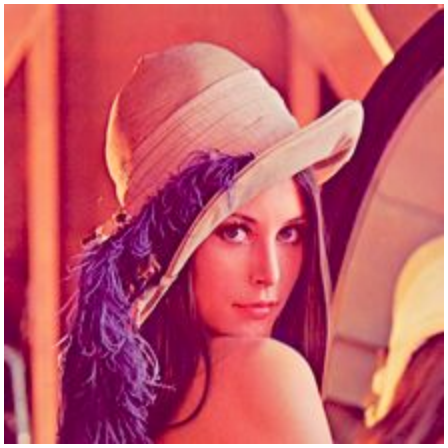
Filter Size = (5,5)

Filter Size = (11,11)

Filter Size = (15,15)

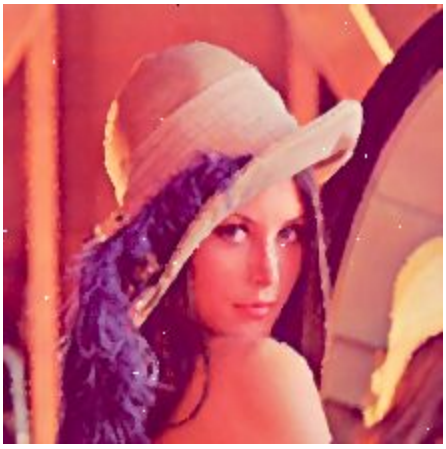
Q2. Increasing the filter size increases the effectiveness of the filter in reducing noise as the median is taken from a larger kernel size (set of values). However, increases it further leads to a blurring effect as the bordering pixel values isn't considered as the median value. Filter of size (3,3) isn't able to reduce the effect of 20% noise completely in all the locations. There are traces of noise in some (even tho it is very few) locations.

Noise Level = 10%

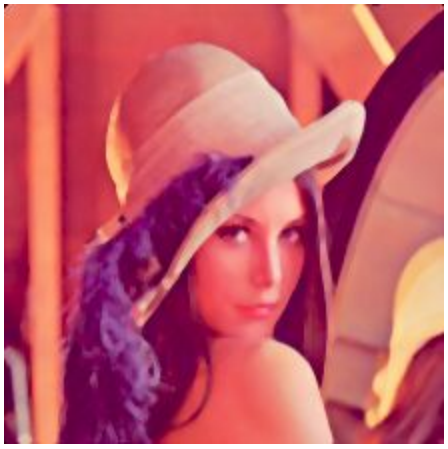


Input Image

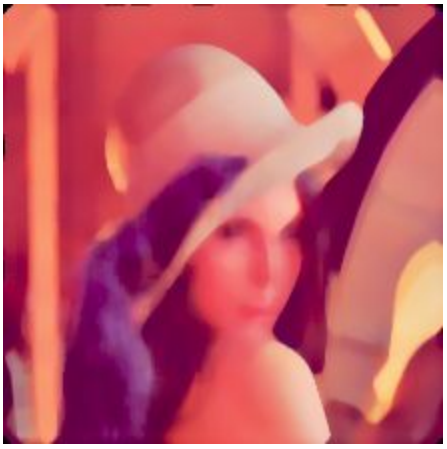
Noise Image (10%)



Kernel Size: (3,3)

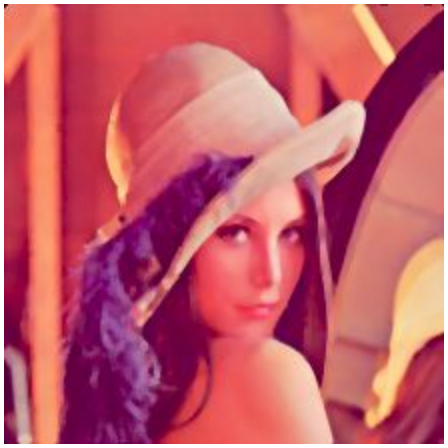
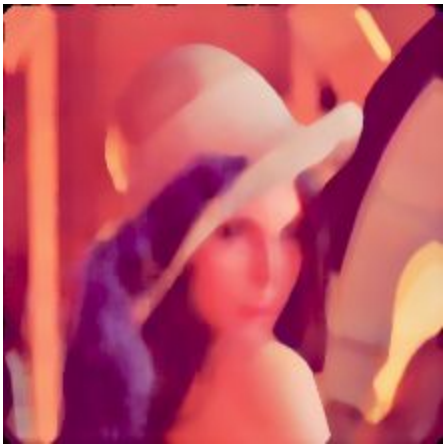


Kernel Size: (5,5)



Kernel Size: (11,11)

Noise level: 20%

Kernel Size: (3,3) Kernel Size: (5,5) Kernel Size: (11,11)

Q3. Increasing the kernel size increasing the blurring effect and increasing the sigma value also leads to further increase in blurring.

Sigma = 20




Kernel Size: 3,3 Kernel Size: 5,5 Kernel Size: 11,11 Kernel Size: 15,15

Changing the Sigma Value for filter size: 11,11




Sigma : 1 Sigma: 10 Sigma: 40 Sigma: 100

Q4. Using Bilinear Interpolation for image resizing.

Gaussian: Level 0

Gaussian: Level 1

Gaussian:Level 2

Gaussian: Level 2

Laplacian Level 0

Laplacian Level 1

Laplacian Level 2

Lap: Level 3

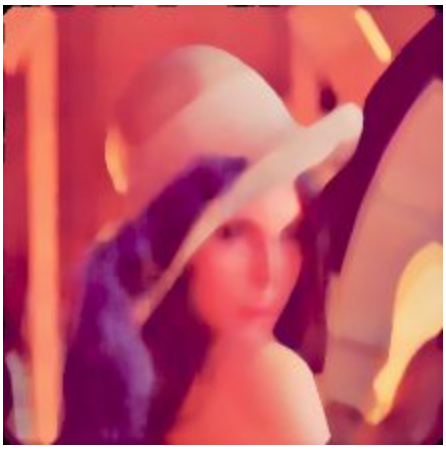
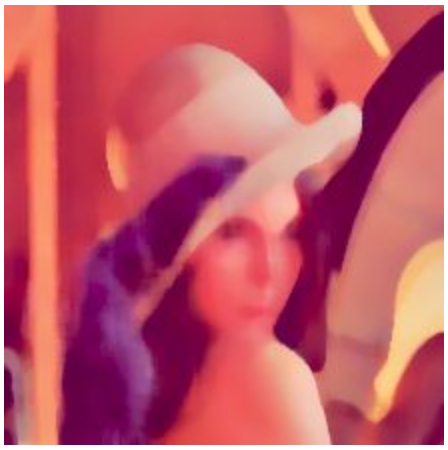
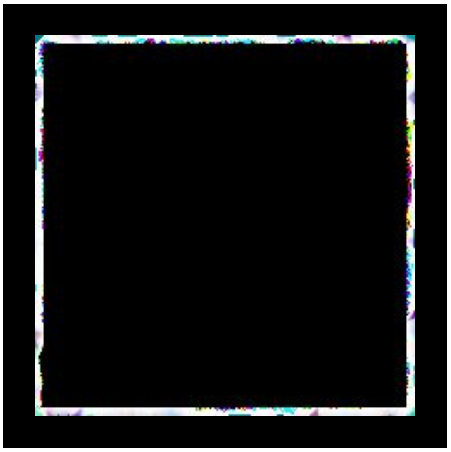
Q5. Using OpenCV functions: The difference in the images for arise due to the difference in the image padding. In OpenCV functions the images are padded using a mirror approach while implementing it myself I used zero padding. (There is a extra border on the both the outputs. **A black border has been added to made this visible**)

Averaging Filter: Kernel Size - 15,15 - and image difference between self implemented and OpenCV functions



Self: A OpenCV: B A-B

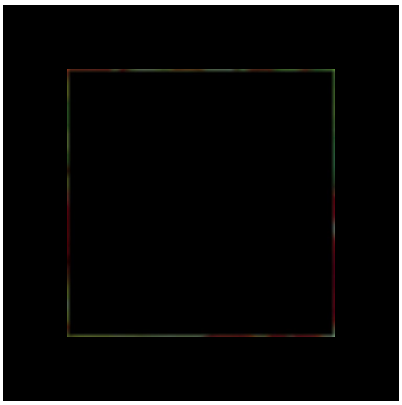
Median Filter: Kernel Size - 11,11 - and image difference between self implemented and OpenCV functions.

Self: A OpenCV: B A-B

Gaussian Filter: Kernel Size - 15,15, Sigma = 20- and image difference between self implemented and OpenCV

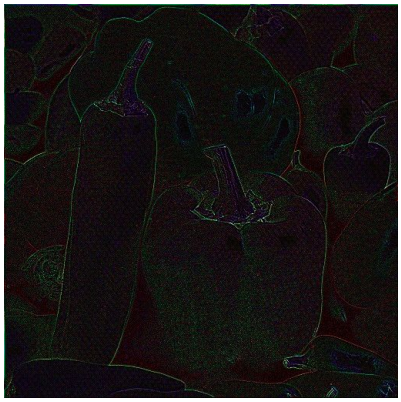




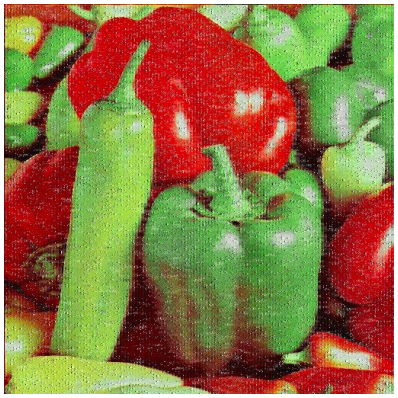
Self: A OpenCV - B A-B

Q6. Performed Thresholding on the LH, HL, HH subbands and median filtering on the LL subband of the second order DWT.


I+SP


L(I)


I+SP+L(I)


Output

Q7. Embedded a watermark of size 1/8th the original image size in the LL subband of second order DWT. The same image was used for the watermarking operation. Implemented this research paper for performing the task.


Watermarked Image


Retrieved Watermark