DIP HW2

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1 Enhancement using spatial filters

Figure 1: pirate_a and pirate_b

(a) Download the images 'pirate_a.raw' (Figure.1 left)and 'pirate_b.raw' (Figure.1 right) as shown above (512x512, 256 grayscale). Apply a 3x3 averaging mask to both of the images and make a comparison according to your result.

Figure 2: pirate_a and pirate_b after applying 3x3 averaging mask

(b) Repeat (a), but apply a 3x3 median filter rather than the averaging mask to both of the images. Again, compare these two resultant images and give your explanation.

Figure 3: pirate_a and pirate_b after applying 3x3 median mask

(c) Choose the best-improved image you can obtain from (a) and (b), and apply the Laplacian mask to this image. Display the filtered result and compare it with the original image.

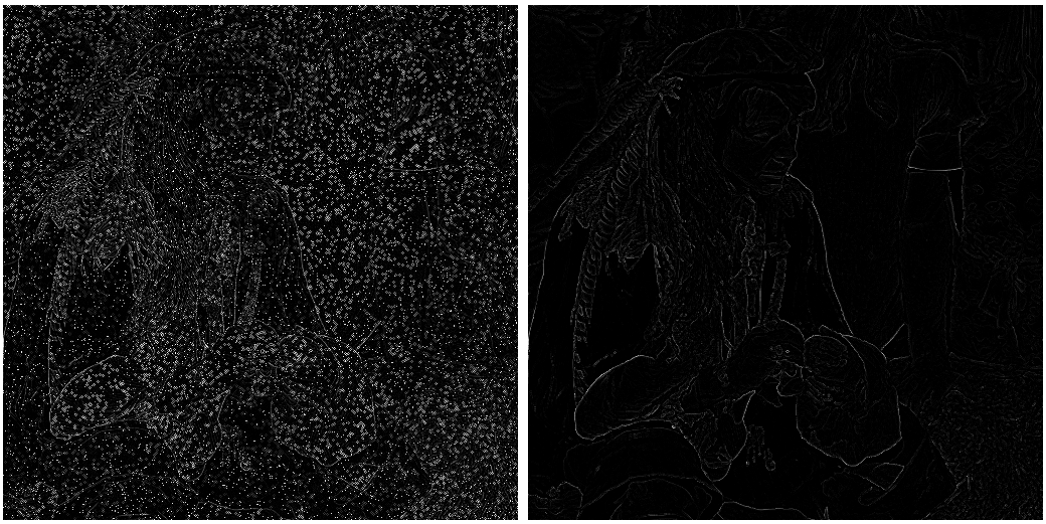


Figure 4: The left panel is the original pirate_a after applying the Laplacian mask; the right panel is the pirate_a after applying a 3x3 median filter and the Laplacian mask

2 Arithmetic mean filter and median filter

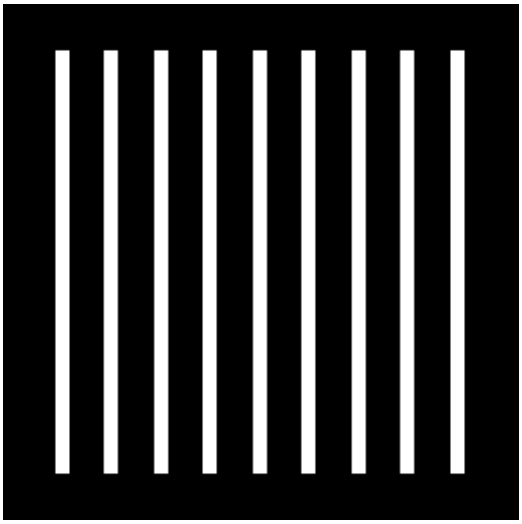


Figure 5: BarTest.tif

- Arithmetic mean filter (7x7 and 3x3)

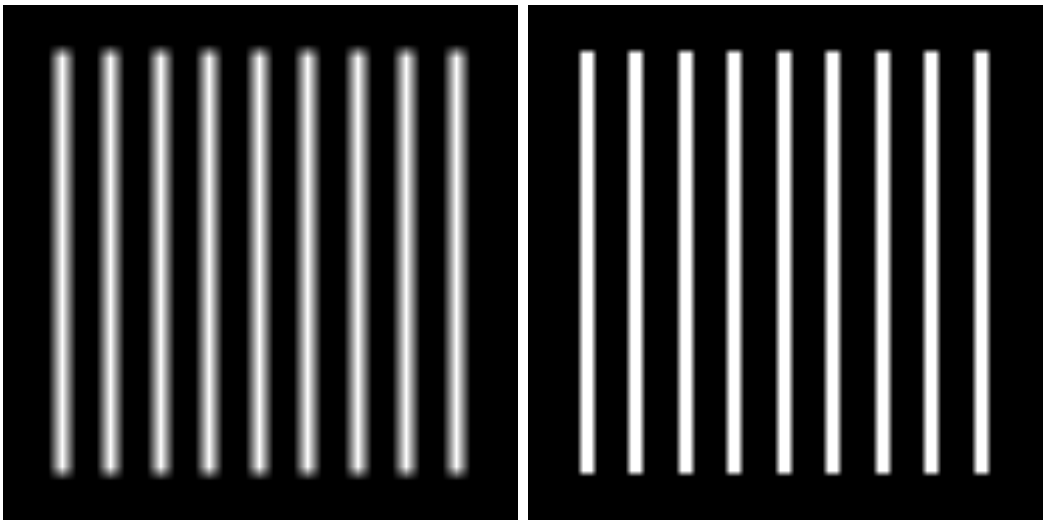


Figure 6: BarTest.tif after applying an arithmetic mean filter of 7x7 (left) and 3x3 (right)

- Median filter (7x7 and 3x3)

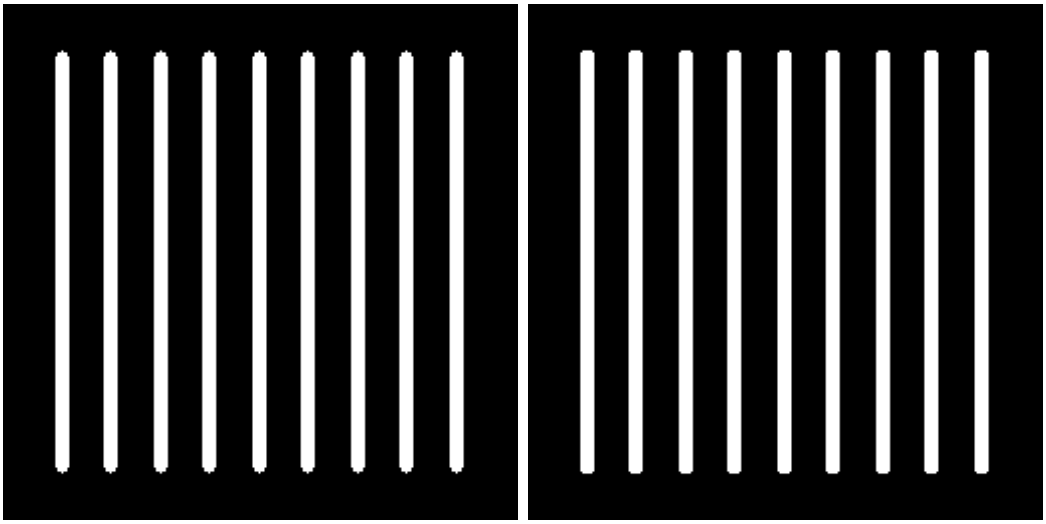


Figure 7: BarTest.tif after applying an arithmetic median filter of 7x7 (left) and 3x3 (right)

3 2D-FFT of "Lenna"

Figure 8: Lenna.tif

(a) Obtain the 2D-FFT of the image "Lenna.tif" (Figure.8), and display the spectrum image of $log|F(u,v)|$.

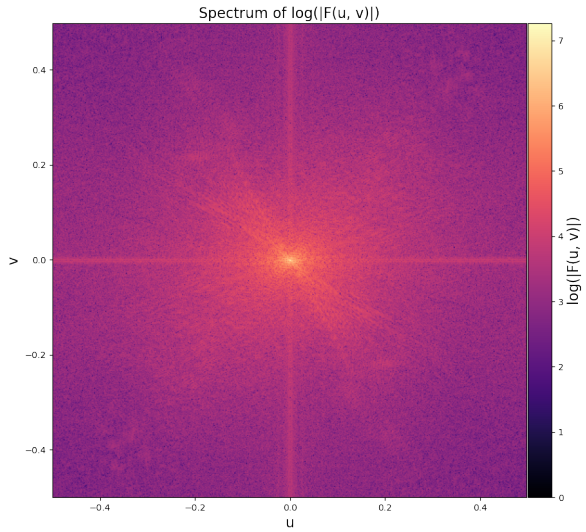


Figure 9: Spectrum image of $log|F(u,v)|$ of Lenna.tif

(b) Magnitude and Phase images: Do 2D-FFT to obtain the magnitude and phase of the image. Display its "magnitude-only image" and "phase-only image" by applying inverse 2D FFT.

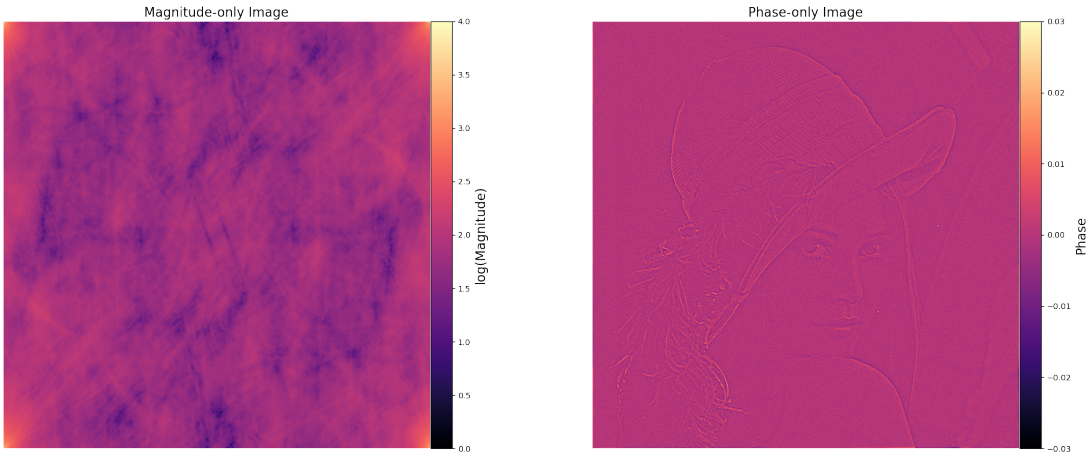
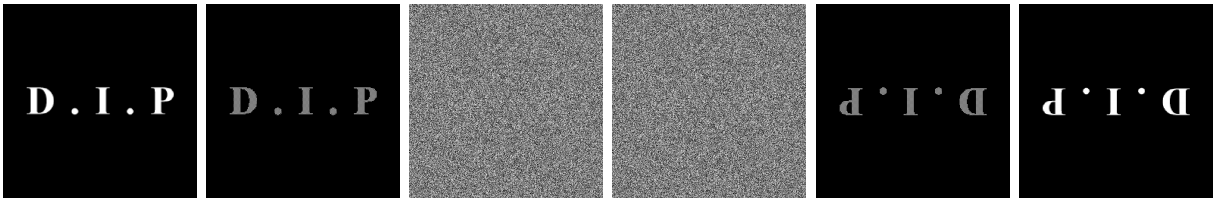


Figure 10: The left and right panels are the "magnitude-only image" and "phase-only image" of Lenna.tif, respectively

4 DFT

Figure 11: DIP_image.tif

(a) What would the processed image look like? Show the processed images from each step. (Results of each step are shown by panels from left to right)



(1) original DIP_image.tif

(2) multiplying the image by $(-1)^{x+y}$

(3) computing the DFT

(4) taking the complex conjugate of the transform

(4) computing the inverse DFT

(6) multiplying the real part of the result by $(-1)^{x+y}$

(b) Explain mathematically why it appears as it does.

The mathematical reason for the final image's appearance is related to the effects of conjugation and phase shifting in the Fourier domain. When taking the conjugate in the frequency domain (Step 4), the effect is similar to flipping the image spatially when the inverse transform is applied.