LAB 3

Digital Image Processing

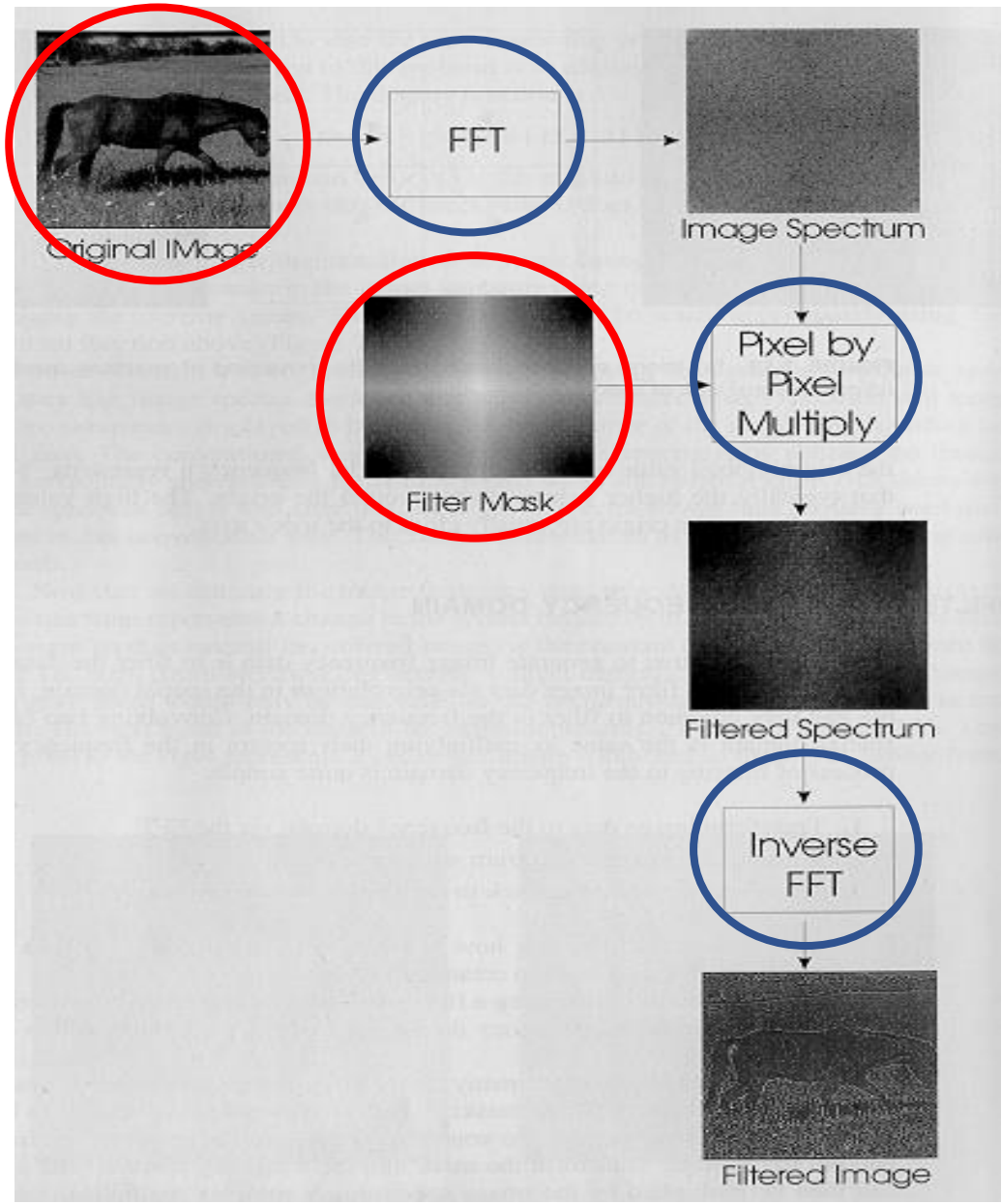
Image Enhancement - Apply Frequency Domain Filtering

Image Enhancement – Histogram Specification

Spring 2024

1. Image Enhancement - Apply Frequency Domain Filtering

a. Read the lena.jpg image and convert the image to grayscale.
b. Apply a 2D Fourier Transform by computing the magnitude of the Discrete Fourier Transform of the grayscale image. Observe that the image spectrum has 2 channels, **explain** why.
c. Shift the zero-frequency component of the Fourier Transform to center the image spectrum
d. Display the original image, grayscale image(a), magnitude spectrum(b) and centered image spectrum(c)
e. Create an Ideal Low Pass filter with a Do of 50pixels and apply the mask by multiplying with the centered spectrum.
f. Apply inverse-shift and calculate the magnitude of the inverse DFT to restore the image back to the spatial domain.
g. Display the images from (e) and (f)
h. Create an Ideal High Pass filter with a Do of 50pixels and apply the mask by multiplying with the centered spectrum.
i. Apply inverse-shift and calculate the magnitude of the inverse DFT to restore the image back to the spatial domain.
j. Display the images from (h) and (i)
k. Are there any differences observed in the restored images (f and i)? If Yes|No **explain** why.



2. Image Enhancement – Histogram Specification

Histogram specification is the transformation of an image so that its histogram matches a specified histogram. Match the source image below to the reference image:

a. Read the source image (aspens_in_fall.jpg) and the reference image (forest.jpg)
b. Match the histograms of the source image to the reference image
c. Use the mask(mask.jpg) provided to mask the matched image from (b).
d. Display the source image, reference image, the matched image, and masked-matched image
e. Plot and compare the histograms and cumulative distribution functions (CDFs) for each image

Source image

Reference image

References:

- Frequency Domain Filtering: https://docs.opencv.org/4.x/de/dbc/tutorial_py_fourier_transform.html
- Image histogram: https://docs.opencv.org/3.4/d8/dc8/tutorial_histogram_comparison.html