

HOMEWORK 3

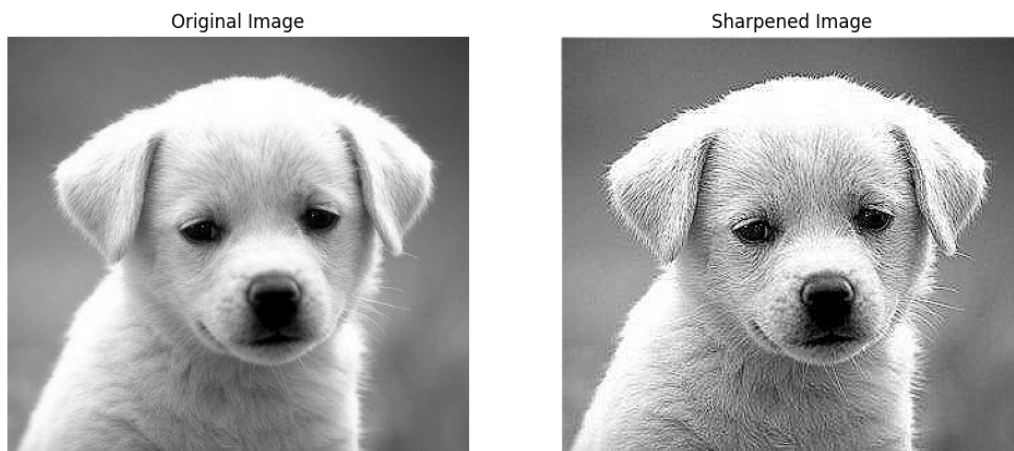
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1. Methods:

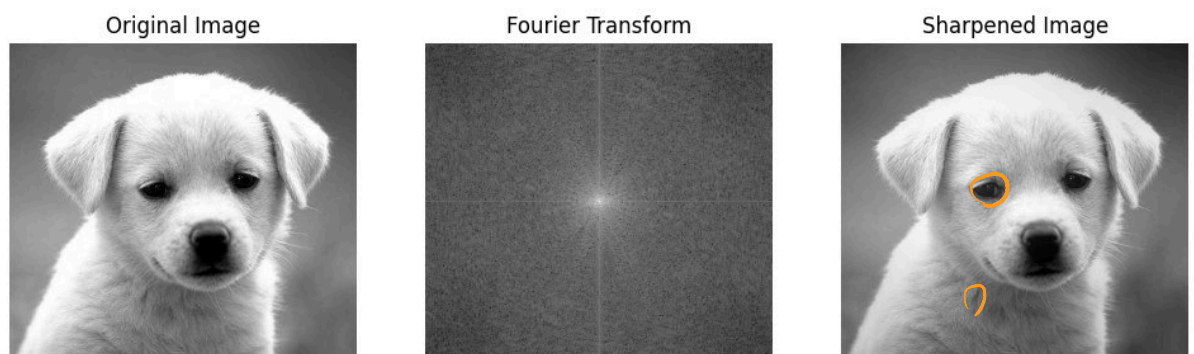
- Laplacian filter in spatial domain sharpening
 1. Convolution Operation : The function `convolution_2d` takes an image and a kernel as inputs.
 2. Laplacian Kernel: The Laplacian kernel used is a simple 3x3 matrix $\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ to highlighting edges.
 3. Applying filter to grayscale image.
 4. Combining the original and filtered image.
- Laplacian filter in frequency domain
 5. Fourier Transform: Convert the image from the spatial domain to the frequency domain using the Fourier Transform (`np.fft.fft2`).
 6. Laplacian filter in the frequency Domain:
 - a. Construct a Laplacian filter to accentuate high-frequency components.
 - b. Normalize the filter to control its overall influence.
 7. Blend the original Fourier-transformed image with the Laplacian-filtered version. Adjusting scaling factor α to adjust the sharpening effect.
 8. Inverse FT using `np.fft.ifft2`

2. Results

- Laplacian filter in spatial domain sharpening



- Laplacian filter in frequency domain



3. Feedback

This Homework is a good practice for Learning the concept of Fourier Transform image sharpening. The chosen in filter and the parameter adjustment bothered me a lot. It's kind of hard without find some online resources.