

COMP4421 Assignment 1

MOHAMAD, Randitya Setyawan

20316273

`rsmohamad@ust.hk`

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1 Exercises

1. Fourier Transform

- (a) The significant increase across the vertical and horizontal axes in the frequency domain is caused by the abrupt changes in intensity between the image and the black padding. The vertical and horizontal boundary between the image and the black padding have a large gradient with respect to the y and x axes respectively. These large changes contribute to the vertical and horizontal axes in the frequency domain representation.
- (b) The significant increase in the low frequency region is caused by the black padding which does not change intensity across a large area. This contributes to the low frequency components in the frequency domain representation.

2 Programming Tasks

1. Spatial Linear Filtering

(a) Average filter



(c) Sobel Y



(b) Sobel X



(d) Laplacian filter

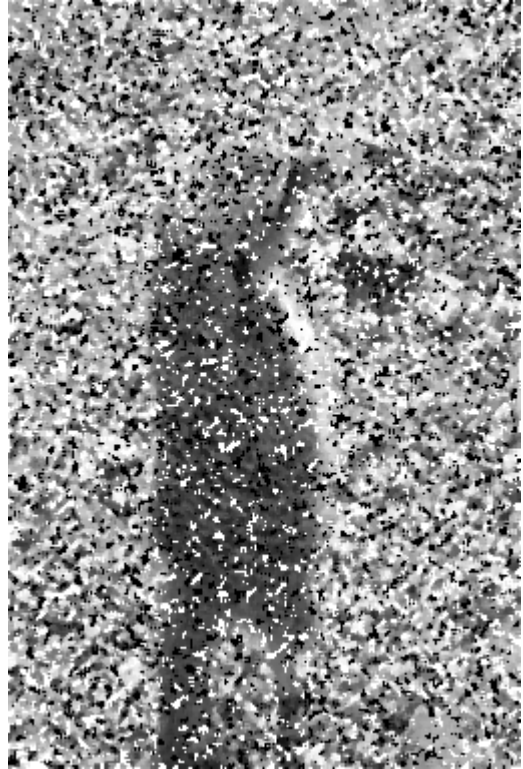


2. Spatial Non-linear Filtering

(a) Gaussian noise

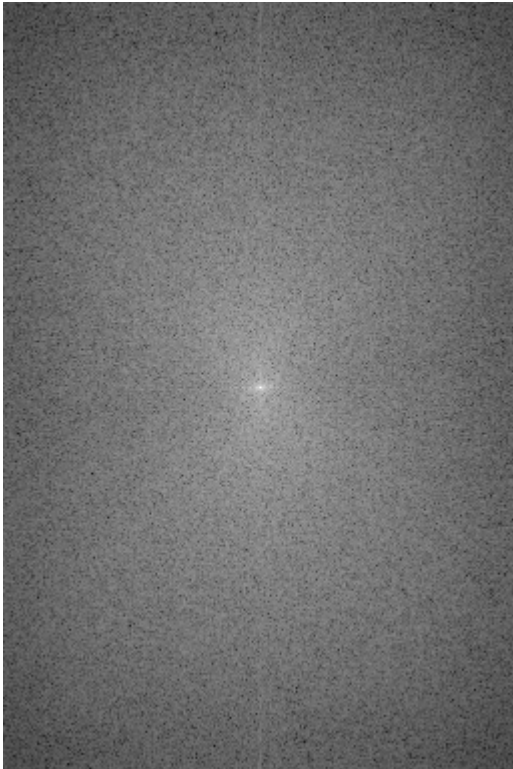


(b) Salt and pepper noise



3. Discrete Fourier Transform

(a) Frequency spectrum



(b) Inverse DFT real component

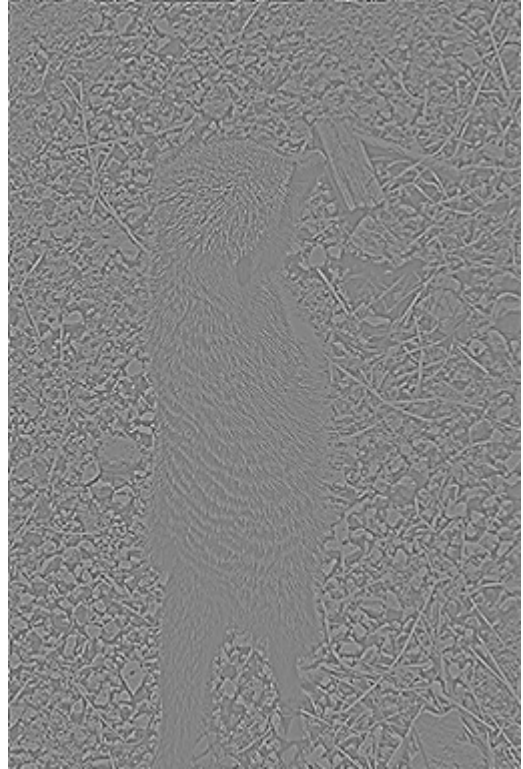


4. Filtering in the Frequency Domain

(a) Average filter



(b) Laplacian filter



5. High-Frequency Emphasis ($a = 0.1$, $b = 0.9$)

(a) Butterworth



(b) Gaussian

