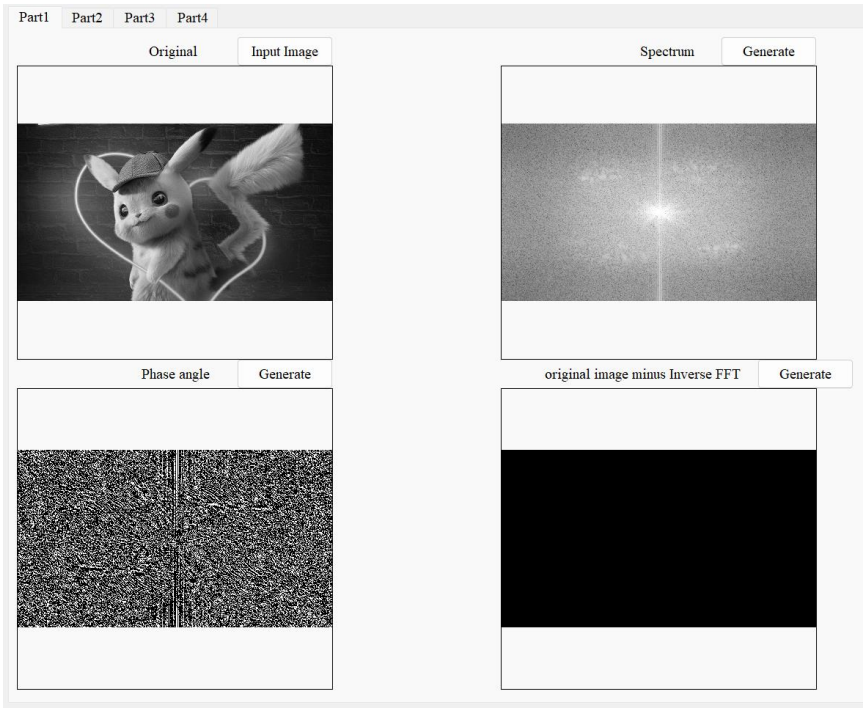
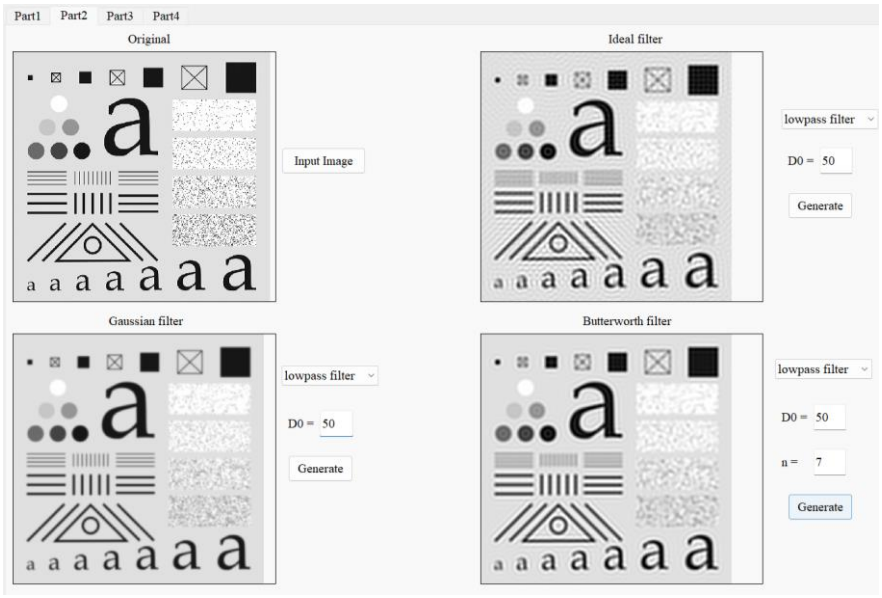
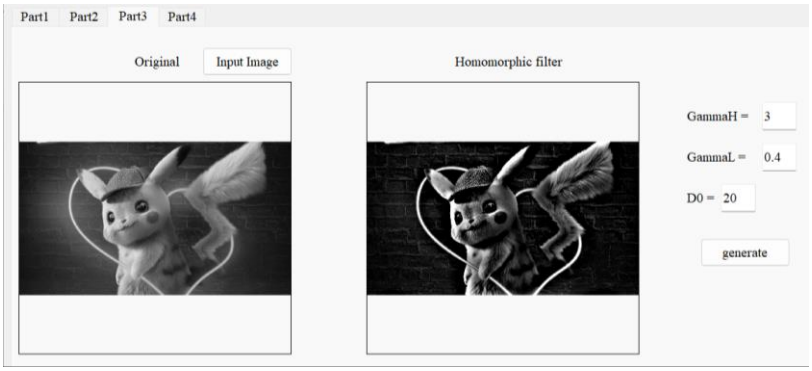
HW4 r12631001 許喬淇

UI：

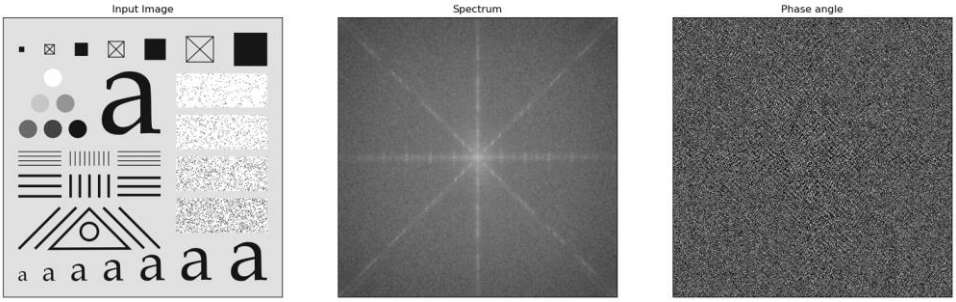






Part1：

button_clicked_input1()取得影像路徑，fft()為快速傅立葉轉換，ifft()為反轉傅立葉轉換。下圖分別為原始影像、頻譜圖和向位角。



將原始影像減去 ifft 觀察差異，發現影像中有許多白點，因此傅立葉轉換前後的影像有差異。

對同一影像分別 resize 為(512, 512)、(1024, 1024)、(2048, 2048)，並計算 FFT 所需時間，發現隨著影像尺寸增加，運算時間也增加。

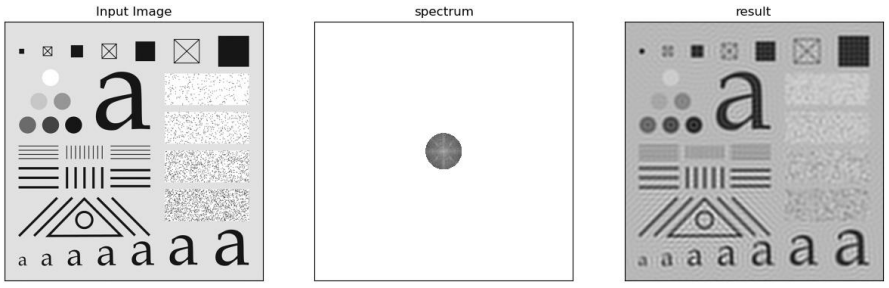
尺寸	(512, 512)	(1024, 1024)	(2048, 2048)
時間	0.0054s	0.0259s	0.1221s

Part2：

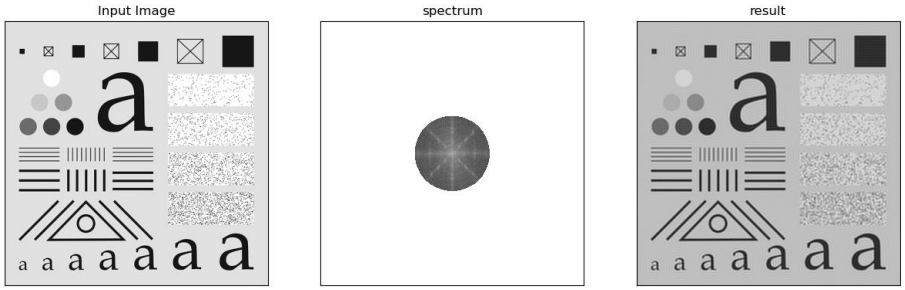
使用 button_clicked_input2()取得影像路徑，影像經 ideal_filter()、gaussian_filter()、butterworth_filter()可得到各遮罩運算後的頻譜圖。

1. Ideal filter：

(a) Lowpass filter：D_0 越小則經遮罩運算之結果影像越模糊，反之越大則越清晰。

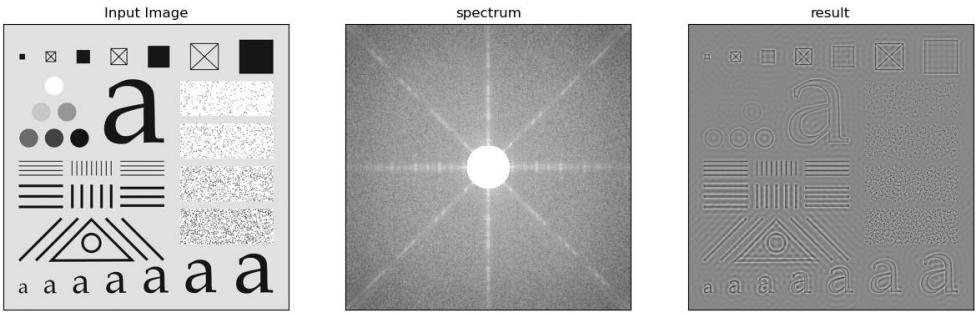


$D_0 = 50$

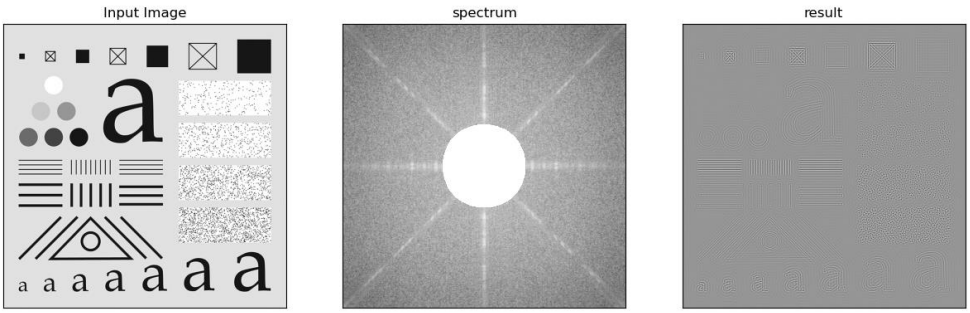


$D_0 = 100$

(b) Highpass filter：D_0 越小則經運算後結果之邊界較清晰，反之則越不清楚。



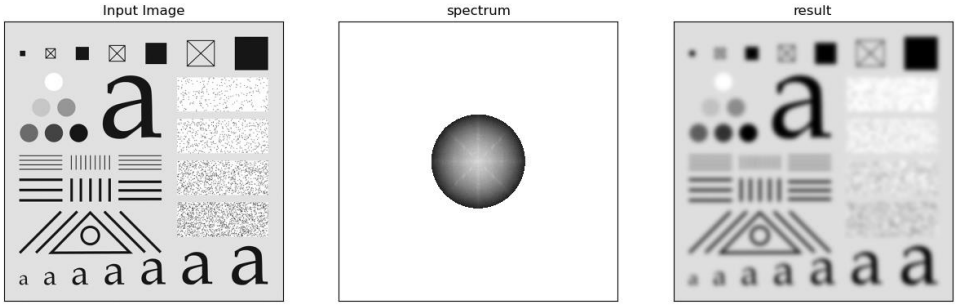
$D_0 = 50$



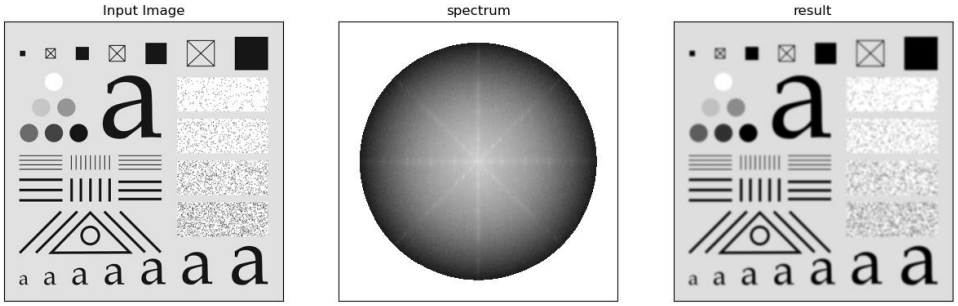
$D_0 = 100$

2. Gaussian filter：

(a) Lowpass filter：D_0 越小則經遮罩運算之結果影像越模糊，反之越大則越清晰。

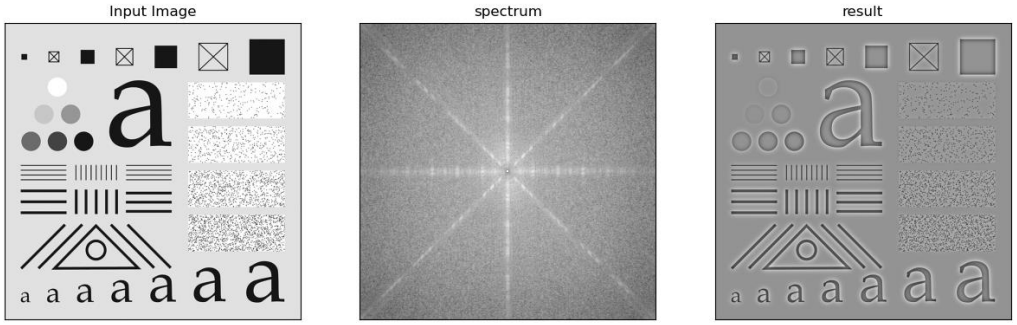


$D_0 = 20$

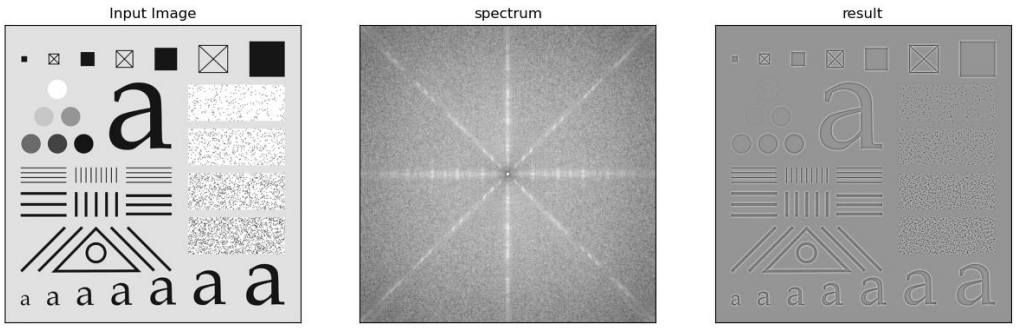


$D_0 = 50$

(b) Highpass filter：D_0 越小則遮罩運算結果的圖案較清楚，反之則較不清楚。



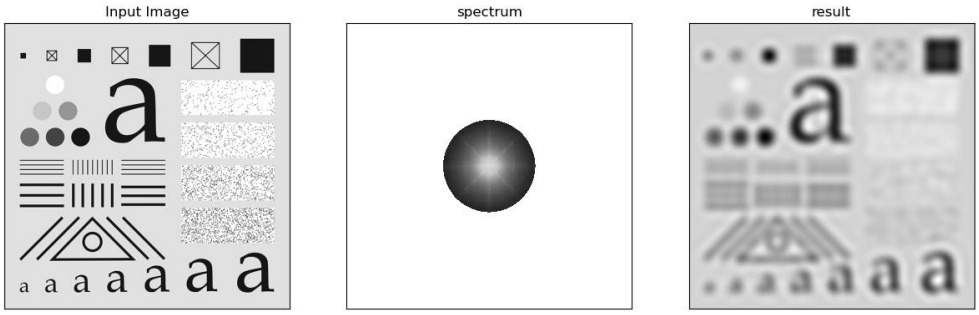
$D_0 = 20$



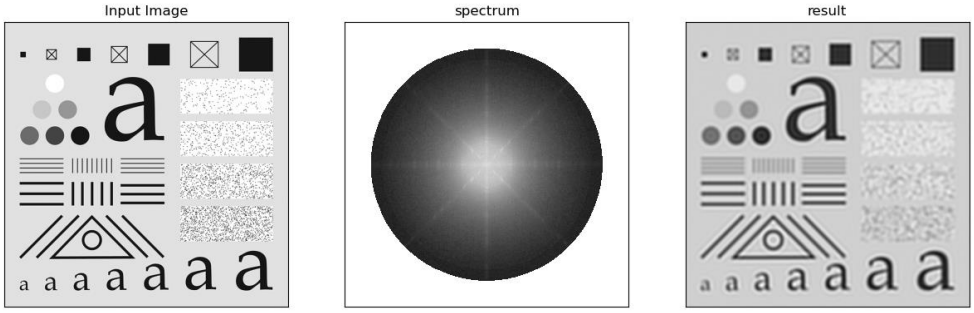
$D_0 = 50$

3. Butterworth filter：

(a) Lowpass filter：D_0 越小則經遮罩運算之結果影像越模糊，反之越大則越清晰。

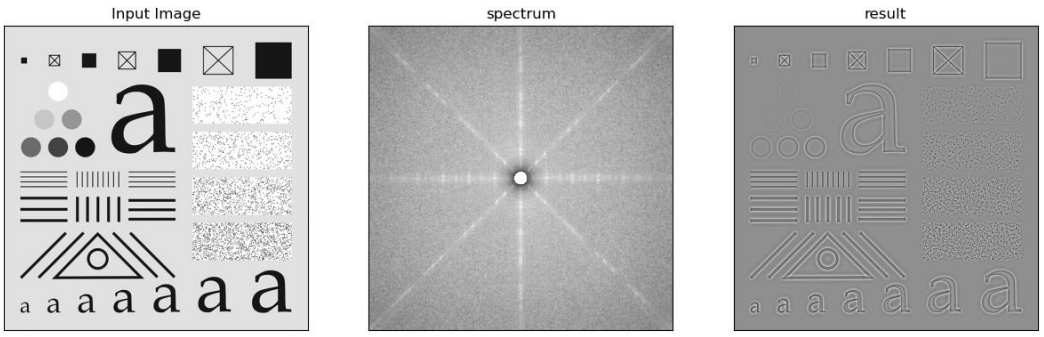


$D_0 = 20$

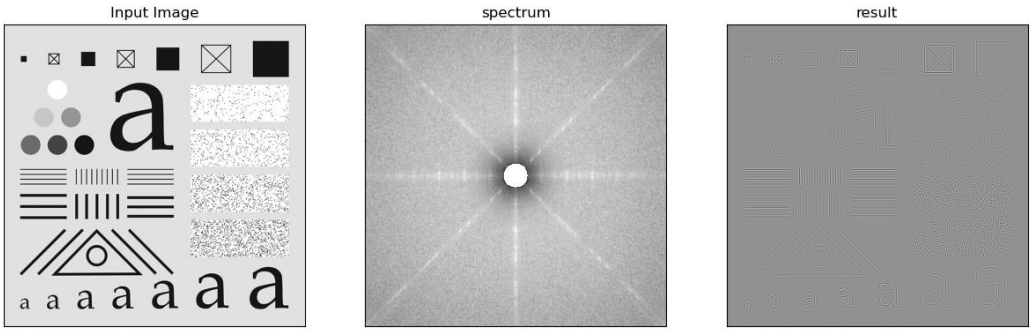


$D_0 = 50$

(c) Highpass filter：D_0 越小則遮罩運算結果的圖案輪廓較清楚，反之則較不清楚。



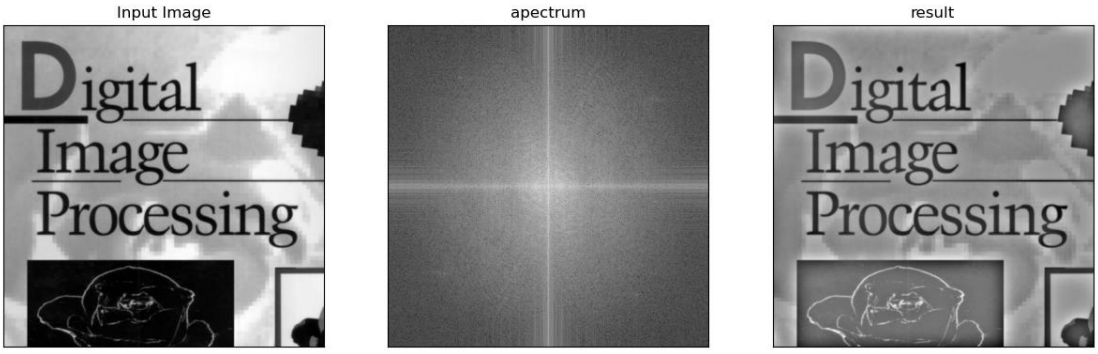
$D_0 = 50$



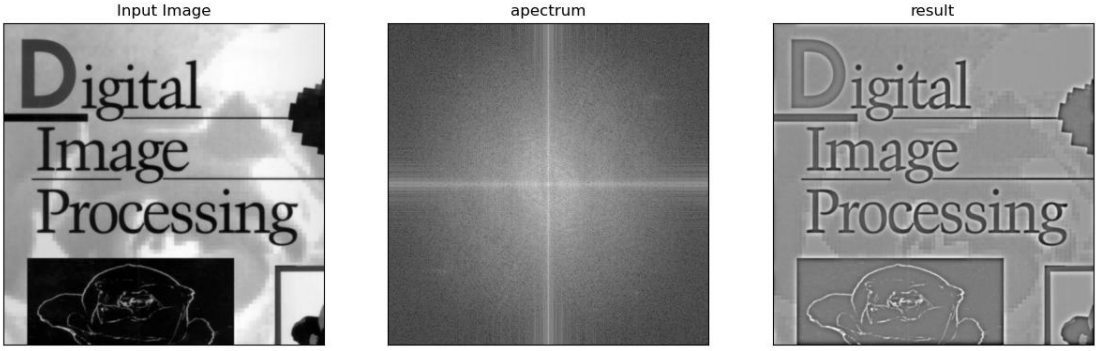
$D_0 = 100$

Part3：

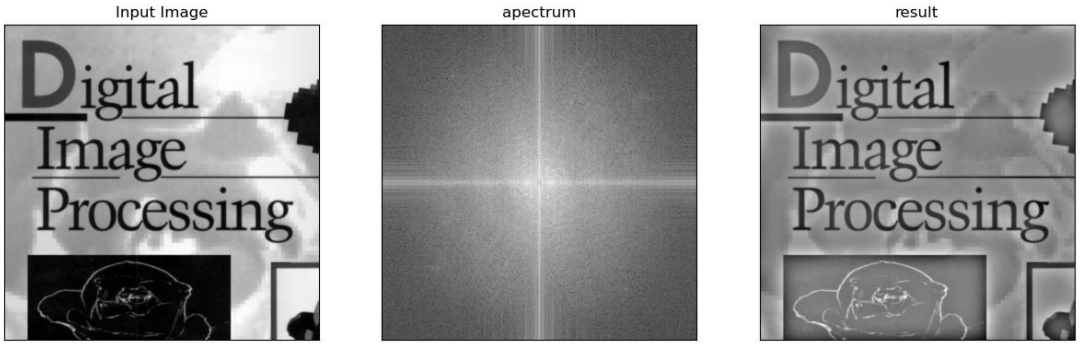
使用 button_clicked_input3()取得影像路徑，原始影像經 homomorphic_filter()可得遮罩運算後頻譜圖。而參數 D_0 增加時影像對比度增加，反之減少；γ_H 的增減只有些微的亮度差異；γ_H 增加時則有似光暈的效果。



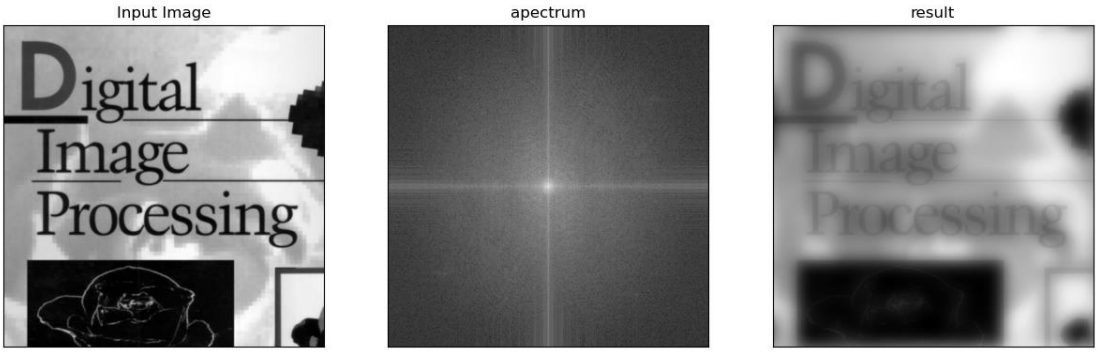
D_0 = 20, γ_H = 3, γ_H = 0.4



D_0 = 60, γ_H = 3, γ_H = 0.4



D_0 = 20, γ_H = 100, γ_H = 0.4



D_0 = 20, γ_H = 3, γ_H = 40

Part4：

對於 motion blurred 之影像，wiener 有較清晰的 de-blurring 結果。