Image Processing Project2 Answer Sheet

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1.

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| Explain how you implement FFT by DFT  N為偶數時，先將N點的DFT分解為兩個N/2點的DFT，使複數乘法減少一半：再將每個N/2點的DFT分解成N/4點的DFT，使複數乘又減少一半，繼續進行分解可以大大減少計算量。最小變換的點數稱為基數，對於基數為2的FFT算法，它的最小變換是2點DFT。  首先將n = 2^N個輸入點列按二進位進行編號，然後對各個編號按位倒置並按此重新排序。例如，對於一個8點變換，001倒置以後變成 100倒置後的編號為{0,4,2,6,1,5,3,7}。  010 → 010  011 → 110  100 → 001  101 → 101  110 → 011  111 → 111  然後將這n個點列作為輸入傳送到[蝶形結](https://zh.wikipedia.org/wiki/%E8%9D%B6%E5%BD%A2%E7%BB%93" \o "蝶形結)網路中，將因子WN^K{\displaystyle W\_{N}^{k}}逐層加入到蝶形網路中。 |
| Explain how you implement inverse FFT from FFT  先將輸入的序列做排序，排序的方式是先將索引轉成2進制然後反轉，再轉回十進制。 接著產生新的索引序列，再依照公式做利用規則與對稱性做運算。 |
| Show the result of problem1.txt after FFT  data =  9.0000 7.0000 5.0000 3.0000  1.0000 -2.0000 3.0000 -4.0000  8.0000 6.0000 9.0000 7.0000  0.6000 7.0000 5.0000 6.0000 |

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| image with noise |
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| image with noise after FFT |
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| Explain what kind of the noise is (are) in the image |
| 同時有兩種雜訊在圖內   1. 胡椒鹽雜訊 2. 週期性(脈衝)雜訊 |
| The filter(s) you use to process the image |
| (Hint: you need to show the filter parameter)  **D = 30;** v\_k = **300**; u\_k = **300**; v\_k = **500**; u\_k = **100**;  v\_k = **-200**; u\_k = **200**; v\_k = **100**; u\_k = **500**; |
| The result of image with noise after \_\_\_Butterworth Notch\_\_filter |
| Without noise after median filter |
| Summary and discussion:   1. 使用FFT轉換後, 再取log(1+abs(fft\_img)), 發現有週期性的脈衝 2. 使用Butterworth Notch filter將各個亮點給遮住, 衰減週期性脈衝 3. 與原圖相比, 經過butterworth notch filter後, 背景格狀圖樣被移除 4. 使用中值濾波, 將亮、暗點的胡椒雜訊給移除 |

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| problem3\_4a.bmp | |
|  | 1.Noise type: 白鹽式雜訊  2.Noise mean: 0.3  3.Noise deviation: 0.3 |
| Histogram of noise:  C:\Users\Admin\Documents\NCTU\Digital_Image_Processing\Project2(在職)\Project2\題目原檔\第三題\p3_4a_hist.jpg |
| How do you get the noise type?  產生pdf distribution後, 畫出分佈圖 | |
| Result of problem3\_4a.bmp after filtering | |
| C:\Users\Admin\Documents\NCTU\Digital_Image_Processing\Project2(在職)\Project2\題目原檔\第三題\p3_4a.jpg | |
| What filter is more suitable to problem3\_1.bmp? why?   1. 算術平均濾波器 2. 因為可以使影像變平滑, 使雜訊變模糊 | |

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| problem3\_4b.bmp | |
|  | 1.Noise type: 胡椒鹽及白鹽  2.Noise mean: <0.2  3.Noise deviation: <0.2 |
| Histogram of noise:  C:\Users\Admin\Documents\NCTU\Digital_Image_Processing\Project2(在職)\Project2\題目原檔\第三題\p3_4b_hist.jpg |
| How do you get the noise type?  產生pdf distribution後, 畫出分佈圖 | |
| Result of problem3\_4b.bmp after filtering | |
| C:\Users\Admin\Documents\NCTU\Digital_Image_Processing\Project2(在職)\Project2\題目原檔\第三題\p3_4b.jpg | |
| What filter is more suitable to problem3\_2.bmp? why?   1. 自適中值濾波器 2. 可以將P< 0.2的胡椒鹽及白鹽式雜訊過濾 | |

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| problem3\_4c.bmp | |
|  | 1.Noise type: 胡椒鹽及白鹽  2.Noise mean: <0.2  3.Noise deviation: <0.2 |
| Histogram of noise:  C:\Users\Admin\Documents\NCTU\Digital_Image_Processing\Project2(在職)\Project2\題目原檔\第三題\p3_4c_hist.jpg |
| How do you get the noise type?  產生pdf distribution後, 畫出分佈圖 | |
| Result of problem3\_4c.bmp after filtering | |
| C:\Users\Admin\Documents\NCTU\Digital_Image_Processing\Project2(在職)\Project2\題目原檔\第三題\p3_4c.jpg | |
| What filter is more suitable to problem3\_3.bmp? why?   1. 自適中值濾波器+幾何平均濾波器 2. 可以將P< 0.2的胡椒鹽及白鹽式雜訊過濾, 再用算術平均將影像做平滑處理 | |

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| problem3\_4d.bmp | |
|  | 1.Noise type: 胡椒鹽  2.Noise mean: 0.3  3.Noise deviation: 0.3 |
| Histogram of noise:  C:\Users\Admin\Documents\NCTU\Digital_Image_Processing\Project2(在職)\Project2\題目原檔\第三題\p3_4_hist.jpg |
| How do you get the noise type?  產生pdf distribution後, 畫出分佈圖 | |
| Result of problem3\_4d.bmp after filtering | |
| C:\Users\Admin\Documents\NCTU\Digital_Image_Processing\Project2(在職)\Project2\題目原檔\第三題\p3_4d.jpg | |
| What filter is more suitable to problem3\_4.bmp? why?   1. 自適中值濾波器 \* 2 (第一次filter\_size=5, 第二次filter\_size=3) 2. 可以將P> 0.2的胡椒鹽及白鹽式雜訊過濾後, 還有部分雜訊沒被過濾, 再用filter\_size=3的自適中值濾波器過濾 (因為第二次filter\_size=5時, 會造成影像比較模糊, filter\_size=3可以保留比較多細節 | |

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| problem3\_4e.bmp | |
|  | 1.Noise type: 高斯雜訊  2.Noise mean: 0.2  3.Noise deviation: 0.2 |
| Histogram of noise:  C:\Users\Admin\Documents\NCTU\Digital_Image_Processing\Project2(在職)\Project2\題目原檔\第三題\p3_4e_hist.jpg |
| How do you get the noise type?  產生pdf distribution後, 畫出分佈圖 | |
| Result of problem3\_4e.bmp after filtering | |
| C:\Users\Admin\Documents\NCTU\Digital_Image_Processing\Project2(在職)\Project2\題目原檔\第三題\p3_4e.jpg | |
| What filter is more suitable to problem3\_5.bmp? why?   1. 算術平均濾波器 2. 因為可以使影像變平滑, 使雜訊變模糊 | |