執行環境: python3, numpy, PIL

檔案:

圖檔

	Gauss		Salt Pepper	
	10	30	0.05	0.1
Noise picture	gauss_10.bmp	gauss_30.bmp	SandP_05.bmp	SandP_10.bmp
Box filter 3	*box_3.bmp	*box_3.bmp	*box_3.bmp	*box_3.bmp
Box filter 5	*box_5.bmp	*box_5.bmp	*box_5.bmp	*box_5.bmp
Median 3	*median_3.bmp	*median_3.bmp	*median_3.bmp	*median_3.bmp
Median 5	*median_5.bmp	*median_5.bmp	*median_5.bmp	*median_5.bmp
Open then close	*open-close.bmp	*open-close.bmp	*open-close.bmp	*open-close.bmp
Close then open	*close-open.bmp	*close-open.bmp	*close-open.bmp	*close-open.bmp

程式

noise.py remove.py SNR.py

其他

report.pdf

說明:

noise.py

```
18 def generateImage(name, method, arg):
19     tmparr = np.zeros((R,C), dtype=np.uint8)
20     for r in range(R):
21         for c in range(C):
22             tmparr[r][c] = method(arr[r][c], arg)
23     Image.fromarray(tmparr).save(name)
```

name 是新圖檔的名字，arg 是用以傳給 method 的參數 tuple

method 是生成 noise 的方法種類，為一 f(a,b)形式的函數，

接收一亮度值 a 與參數 b， 並回傳此方法下新的亮度值。

```
 9 def gauss(val, arg):
10     return toInt(val + arg[0]*np.random.normal(0,1))
11
12 def SandP(val, arg):
13     x = np.random.uniform(0, 1)
14     if x < arg[0]: return 0
15     elif x > arg[1]: return 255
16     return val
```

gauss 和 SandP 是兩種 method 的函式

```
4 def toInt(a):
5     if a >= 255: return 255
6     elif a <= 0: return 0
7     return round(a)
```

toInt 用以將浮點數轉為 unsigned 8-bit integer

最後 noise.py 生成 4 個 noise 圖檔:

gauss_10.bmp gauss_30.bmp SandP_05.bmp SandP_10.bmp

remove.py

```
def getNeighbors(Arr, r, c, n):
    ret, n = [], n//2
    for dr in range(-n, n+1):
        for dc in range(-n, n+1):
            new_r, new_c = r+dr, c+dc
            if new_r>=0 and new_c>=0 and new_r<R and new_c<C:
                ret += [Arr[new_r][new_c]]
    return ret
```

getNeighbors 回傳二維陣列 Arr 中，

包括自己的所有非界外 4-connected nXn neighbor pixel 的值(一個 list)，

```
def dilate(arr):
    height, width = len(arr), len(arr[0])
    ret = np.zeros((height, width), dtype=np.uint8)
    for r in range(height):
        for c in range(width):
            for r2,c2 in kernel:
                try: ret[r][c] = max(ret[r][c], arr[r-r2][c-c2])
                except IndexError: continue
    return ret
def erose(arr):
    height, width = len(arr), len(arr[0])
    ret = np.full((height, width), 255, dtype=np.uint8)
    for r in range(height):
        for c in range(width):
            for r2,c2 in kernel:
                try: ret[r][c] = min(arr[r+r2][c+c2], ret[r][c])
                except IndexError: continue
    return ret

def opening(arr):
    return dilate(erose(arr))

def closing(arr):
    return erose(dilate(arr))
```

dilate, erose, opening, closing 皆沿用 hw5 的函式

最後生成 24 個圖檔，分別是用六種 noise cleaning 方法對四種 noise picture 操作的結果

SNR.py

```
def SNR(narr, arr):
    return 10*np.log10(np.var(arr)/np.var(np.subtract(narr,arr)))
```

arr 是原圖 lena.bmp 的資料陣列，narr 是要比對的新圖之資料陣列

最後印出所有圖對 lena.bmp 的比對結果

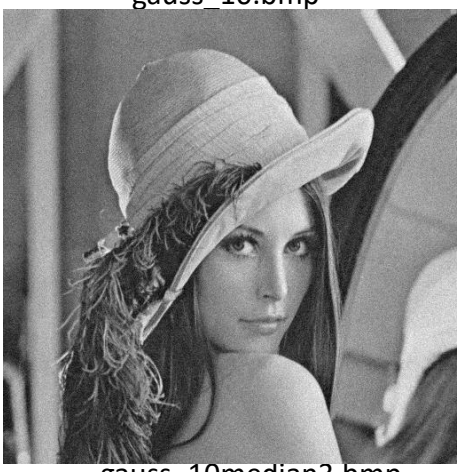
結果:

SNR

```
gauss_10.bmp
    unmodified -7.989946148870191
    box3 -8.206656315427
    box5 -8.147989865078218
    median3 -8.19857177419445
    median5 -8.178092497036477
    open-close -2.190899153244647
    close-open -1.498677979671269
SandP_05.bmp
    unmodified 1.0775012998096594
    box3 -7.7338800526169855
    box5 -7.858438302564743
    median3 -7.921870998343219
    median5 -8.099158619423788
    open-close -6.290662077999852
    close-open -2.589358265396714
```

```
gauss_30.bmp
    unmodified -6.885086965701015
    box3 -7.931106709759861
    box5 -8.029692042895073
    median3 -7.8113674329966996
    median5 -7.982680550845897
    open-close 4.788999209580781
    close-open 4.044259162574532
SandP_10.bmp
    unmodified -1.4941169065722024
    box3 -7.336488135119268
    box5 -7.587195206650446
    median3 -7.95738220462805
    median5 -8.099861875634705
    open-close -4.709980618772129
    close-open -3.3762440246890746
```

gauss_10.bmp



gauss_10box3.bmp

gauss_10box5.bmp

gauss_10median3.bmp

gauss_10median5.bmp

gauss_10open-close.bmp

gauss_10close-open.bmp

gauss_30.bmp

gauss_30box3.bmp

gauss_30box5.bmp

gauss_30median3.bmp

gauss_30median5.bmp

gauss_30open-close.bmp

gauss_30close-open.bmp

SandP_05.bmp

SandP_05box3.bmp

SandP_05box5.bmp

SandP_05median3.bmp

SandP_05median5.bmp

SandP_05open-close.bmp

SandP_05close-open.bmp

SandP_10.bmp

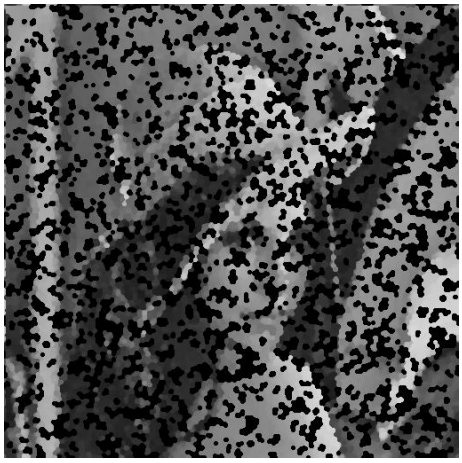
SandP_10box3.bmp

SandP_10box5.bmp

SandP_10median3.bmp

SandP_10median5.bmp

SandP_10open-close.bmp



SandP_10close-open.bmp