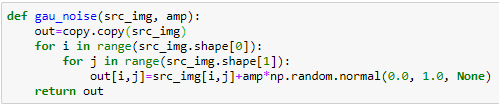
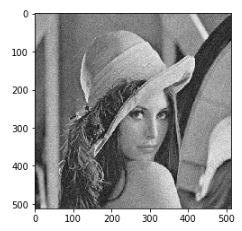
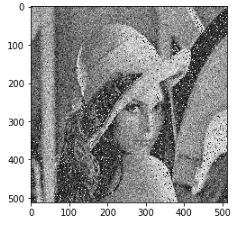
Homework 8. Noise Removal 學號: R06944023 姓名: 吳尚真

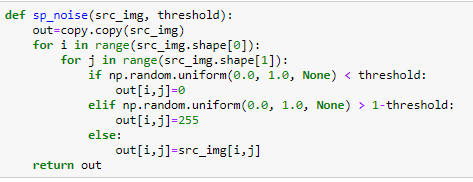
### 使用Python Jupyter Notebook 來實作

1. Generate 4 Noise images

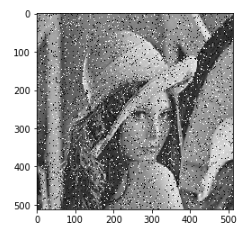
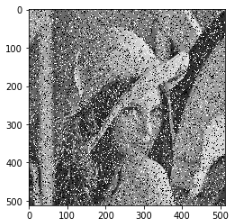
1) Gaussian noise: 在原image上，加上Gaussian normal distribution



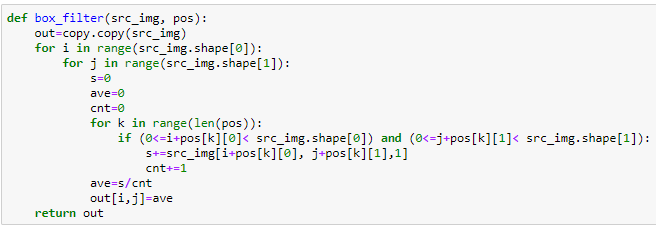
左: amplitude =10，SNR=-7.99 右: amplitude =30，SNR=-6.88  
 

2) salt and pepper : 用threshold 決定pixel value  


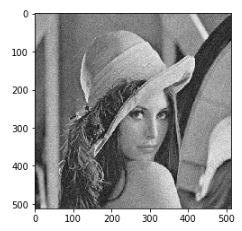
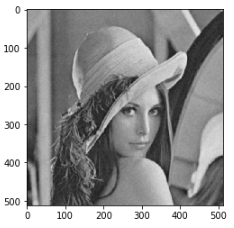
左: probability=0.05，SNR=1.137 右: probability =0.1，SNR=-1.304

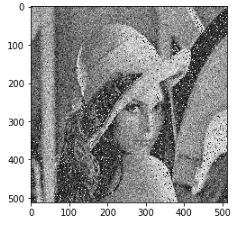
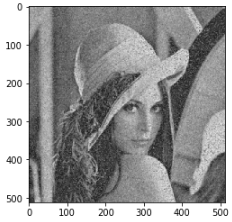
2. 做box filter: 給定一個box的position，可以是3x3、5x5 …等，將box範圍內所有點的pixel value相加，取平均，再assign給中間的點



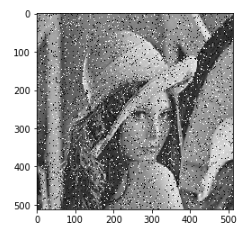
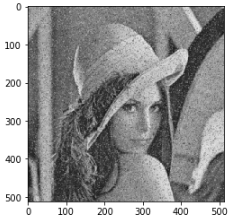
左: Gaussian 10 noise image 右: 做3x3 box filter的結果

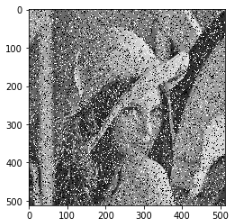
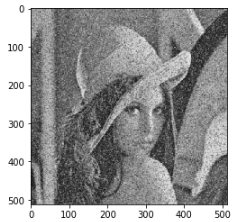
左: Gaussian 30 noise image 右: 做3x3 box filter的結果

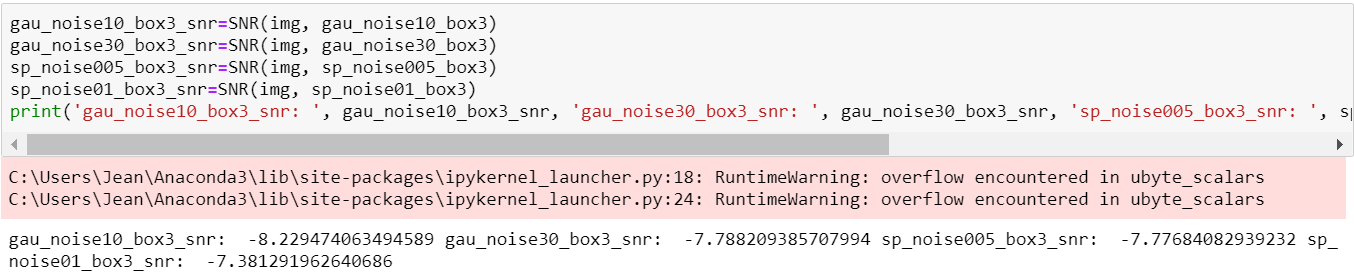
左: salt and pepper 0.05 noise image 右: 做3x3 box filter的結果

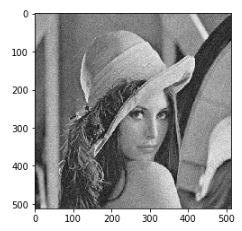
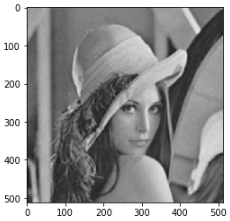
左: salt and pepper 0.1 noise image 右: 做3x3 box filter的結果

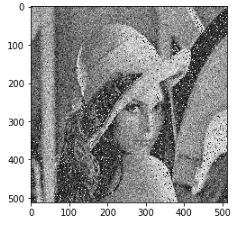
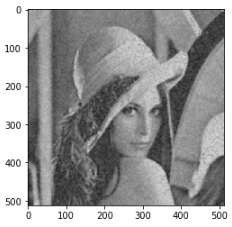
SNR結果:



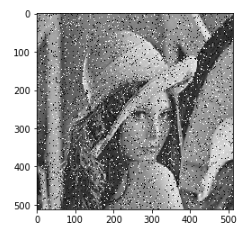
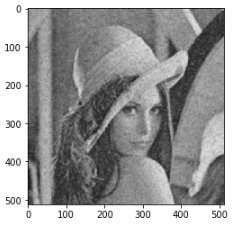
左: Gaussian 10 noise image 右: 做5x5 box filter的結果

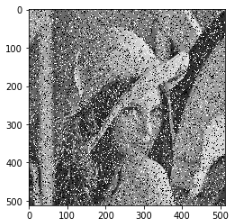
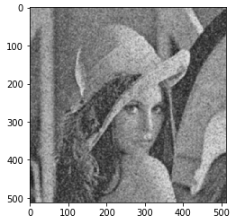
左: Gaussian 30 noise image 右: 做5x5 box filter的結果

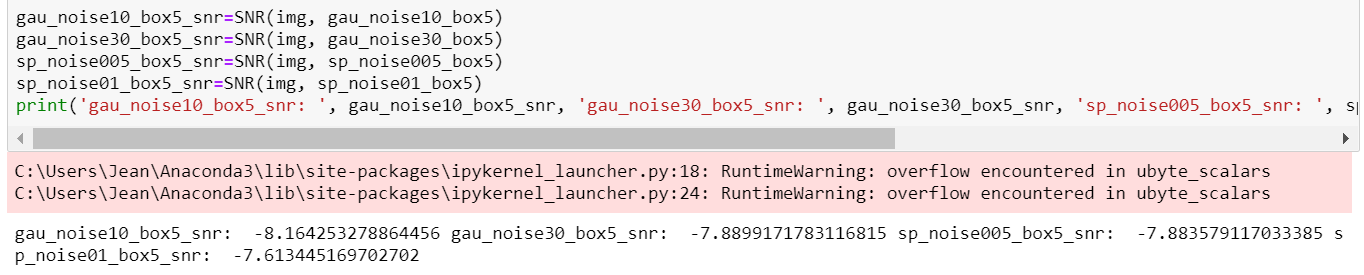
左: salt and pepper 0.05 noise image 右: 做5x5 box filter的結果

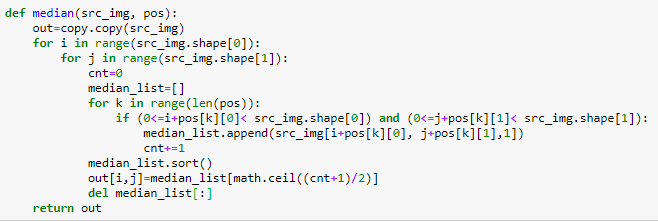
左: salt and pepper 0.1 noise image 右: 做3x3 box filter的結果

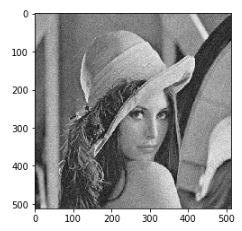
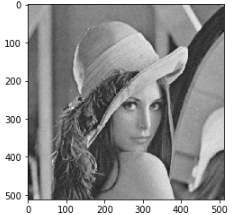
SNR結果:



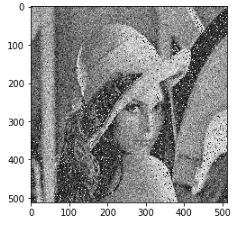
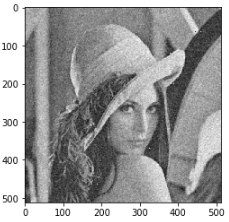
3. 做median filter: 給定一個filter的position，可以是3x3、5x5 …等，將範圍內所有點的pixel value放入list做排序，取list裡中間的值assign給中間的點



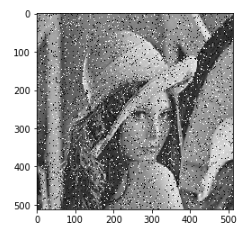
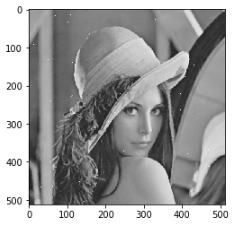
左: Gaussian 10 noise image 右: 做3x3 median filter的結果

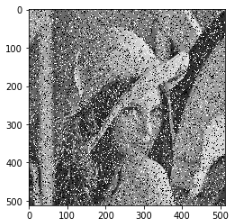
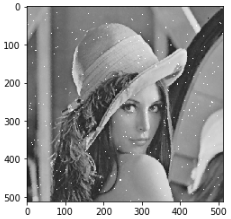
左: Gaussian 30 noise image 右: 做3x3 median filter的結果

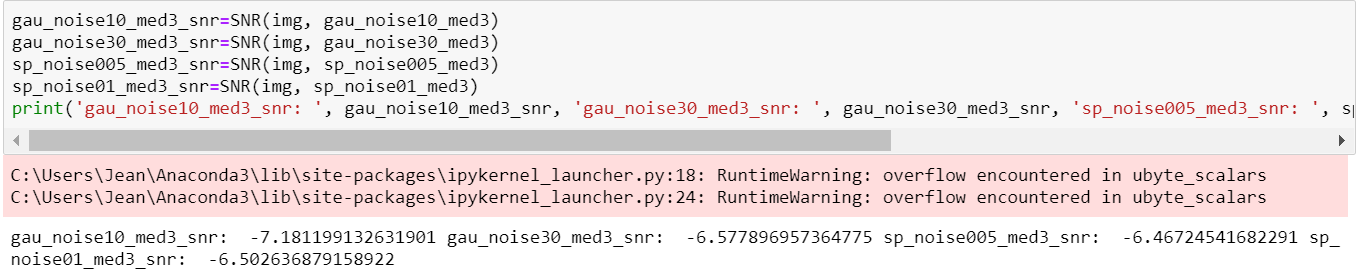
左: salt and pepper 0.05 noise image 右: 做3x3 median filter的結果

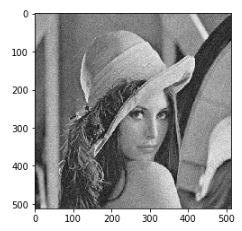
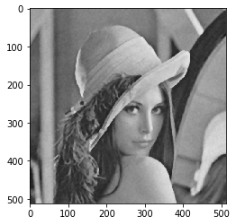
左: salt and pepper 0.1 noise image 右: 做3x3 median filter的結果

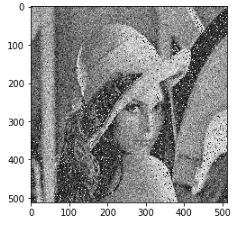
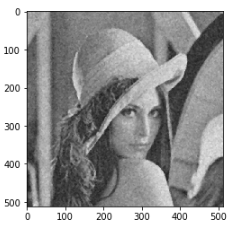
SNR結果:



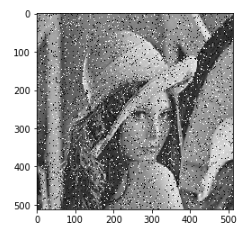
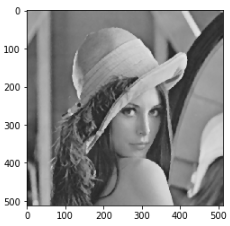
左: Gaussian 10 noise image 右: 做5x5 median filter的結果

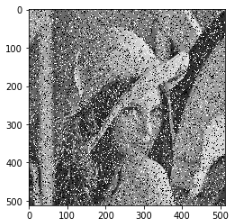
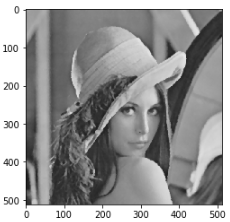
左: Gaussian 30 noise image 右: 做5x5 median filter的結果

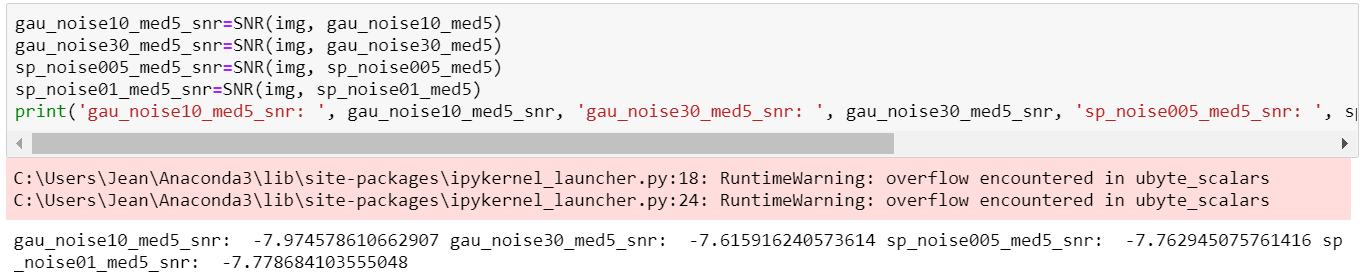
左: salt and pepper 0.05 noise image 右: 做5x5 median filter的結果

左: salt and pepper 0.1 noise image 右: 做5x5 median filter的結果

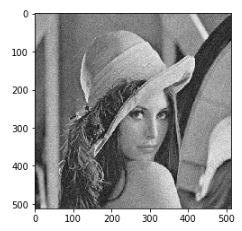
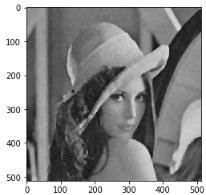
SNR結果:



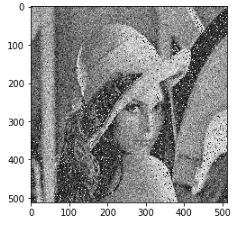
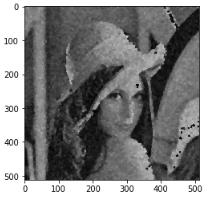
4. 做opening then closing: 使用3-5-5-5-3的kernel，同HW5的方法做opening and closing



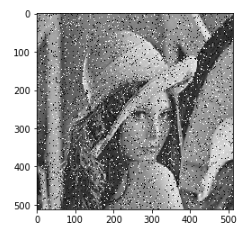
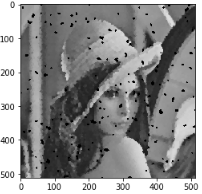
左: Gaussian 10 noise image 右: 做opening then closing的結果

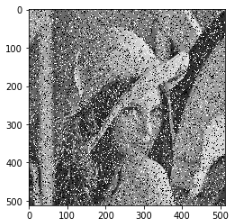
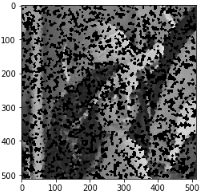
左: Gaussian 30 noise image 右: 做opening then closing的結果

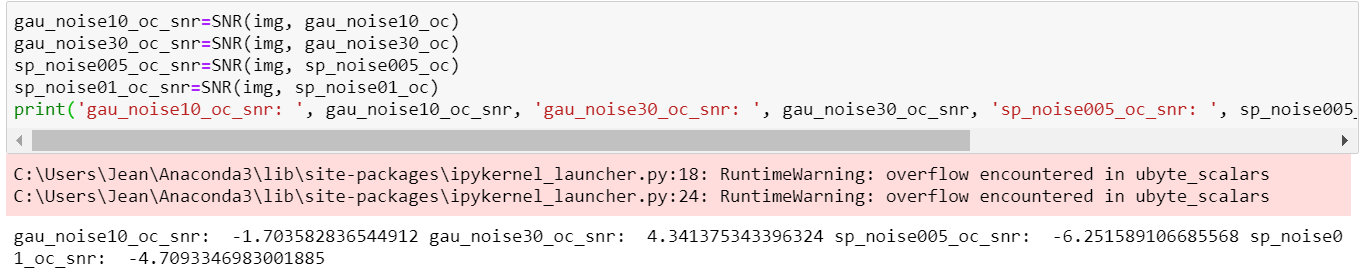
左: salt and pepper 0.05 noise image 右: 做opening then closing的結果

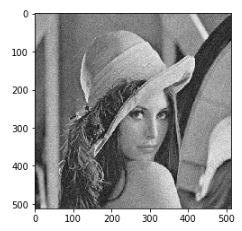
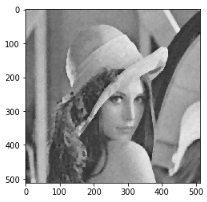
左: salt and pepper 0.1 noise image 右: 做opening then closing的結果

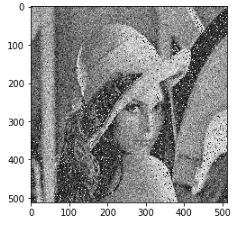
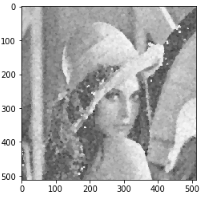
SNR結果:



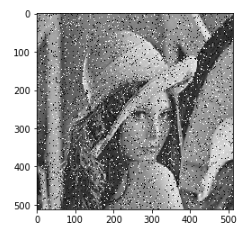
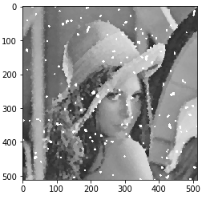
左: Gaussian 10 noise image 右: 做closing then opening的結果

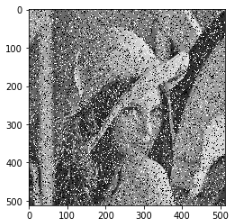
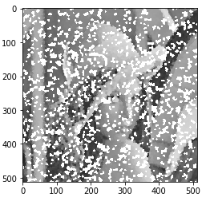
左: Gaussian 30 noise image 右: 做closing then opening的結果

左: salt and pepper 0.05 noise image 右: 做closing then opening的結果

左: salt and pepper 0.1 noise image 右: 做closing then opening的結果

SNR結果:

