

# Computer Vision

## Home Work 8

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Project – Noise Removal.

Language and library used: Python, Pillow, Numpy, OpenCV.



Original Image

Gaussian Noise



Amplitude =10 Median Filter 3\*3



Amplitude = 10 Median Filter 5\*5



Amplitude = 30 Median filter 3\*3



Amplitude = 30 Median filter 5\*5



Amplitude 10 (No Filter)



Amplitude = 10 Opening and Closing



Amplitude = 30 Opening and closing



Amplitude = 10 Closing and Opening



Amplitude=30 Closing and Opening



Amplitude=30 Box Filter = 0.5



Amplitude = 10 Box Filter = 0.5



Amplitude = 30 Box Filter = 0.3



Amplitude = 10 Box Filter 0.3



Amplitude = 30

## Salt and Pepper



Probability = 0.1



Probability = 0.05



Probability=0.1 Close and Open



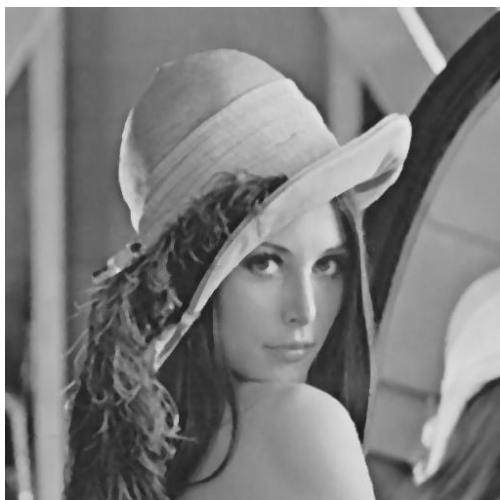
Probability = 0.1 Open and Close



Probability=0.5 Close and Open



Probability = 0.5 Median Filter 3\*3



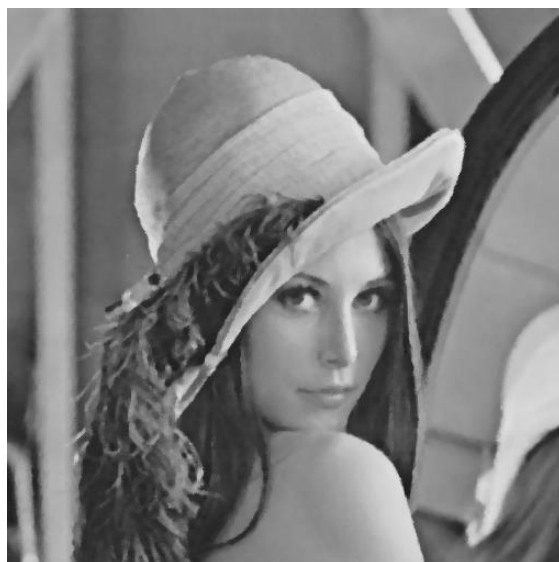
Probability = 0.5 Median Filter 5\*5



Probability = 0.5 Opening and Closing



Probability = 10 Median Filter = 3\*3



Probability = 10 Median Filter = 5\*5



Probability = 0.1 Box Filter = 0.5



Probability = 0.5 Box Filter = 0.5

Probability = 0.1 Box Filter 0.3



Probability = 0.1 Box Filter = 0.3

#### Signal to Noise Ratio

gaussianNoise\_10\_SNR: 13.56472572763004  
gaussianNoise\_30\_SNR: 2.855710211625561  
saltAndPepper\_0\_01\_SNR: -2.0692220349467356  
saltAndPepper\_0\_05\_SNR: 0.8946181758374777  
gaussianNoise\_10\_box\_3x3\_SNR: 11.945595165008083  
gaussianNoise\_30\_box\_3x3\_SNR: 9.105011019172704  
saltAndPepper\_0\_01\_box\_3x3\_SNR: 5.7170171766633535  
saltAndPepper\_0\_05\_box\_3x3\_SNR: 8.06888513213883  
gaussianNoise\_10\_box\_5x5\_SNR: 8.770590583732563  
gaussianNoise\_30\_box\_5x5\_SNR: 8.770590583732563  
saltAndPepper\_0\_01\_box\_5x5\_SNR: 6.612741837558412  
saltAndPepper\_0\_05\_box\_5x5\_SNR: 7.780470930040363  
gaussianNoise\_10\_median\_3x3\_SNR: 11.364133042804124  
gaussianNoise\_30\_median\_3x3\_SNR: 8.93732310574696  
saltAndPepper\_0\_01\_median\_3x3\_SNR: 10.545323853402879  
saltAndPepper\_0\_05\_median\_3x3\_SNR: 11.529784457382487  
gaussianNoise\_10\_median\_5x5\_SNR: 8.217005502424739  
gaussianNoise\_30\_median\_5x5\_SNR: 7.96552096230371  
saltAndPepper\_0\_01\_median\_5x5\_SNR: 8.070445225896359  
saltAndPepper\_0\_05\_median\_5x5\_SNR: 8.108491398465018  
gaussianNoise\_10\_openingThenClosing\_SNR: 4.667682741102726  
gaussianNoise\_30\_openingThenClosing\_SNR: 4.362648856902253  
saltAndPepper\_0\_01\_openingThenClosing\_SNR: 2.9001756300225914  
saltAndPepper\_0\_05\_openingThenClosing\_SNR: 3.7148050492782754  
gaussianNoise\_10\_closingThenOpening\_SNR: 5.008969164812753

gaussianNoise\_30\_closingThenOpening\_SNR: 4.226989722495777

saltAndPepper\_0\_01\_closingThenOpening\_SNR: 3.548940585879159

saltAndPepper\_0\_05\_closingThenOpening\_SNR: 4.316030140089023