CMPG-767 Image processing and Analysis
Course Project 3

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Goals: To learn how to simulate and filter impulse noise

1. Design the following Matlab functions:

a) A function for simulation of impulse noise (random impulse noise with the [0, 255] range and salt-and-pepper impulse noise), which should be used to corrupt an image artificially). The function shall accept a clear image (matrix), a type of noise (random or salt-and-pepper), and a corruption rate as parameters and return a corrupted image (matrix).

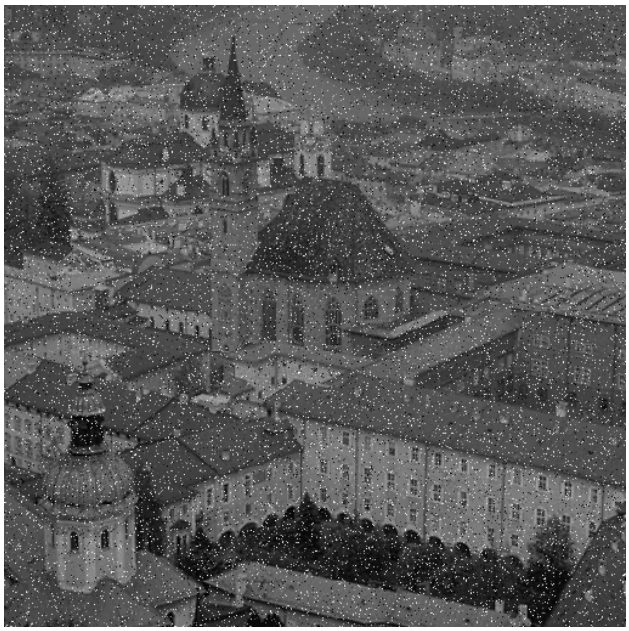
b) A function utilizing **differential rank impulse detector** followed by median filtering **only of those pixels**, which were detected as noisy. Do not forget to take care of boundary effect and to extend an image over its boundaries using mirroring. The function shall accept an image (matrix), the length of a rank interval ***r***, and threshold ***s*** (see slides 15-23 of Lecture-6) as parameters and return a filtered image (matrix).

2. Choose an image $f(x, y)$

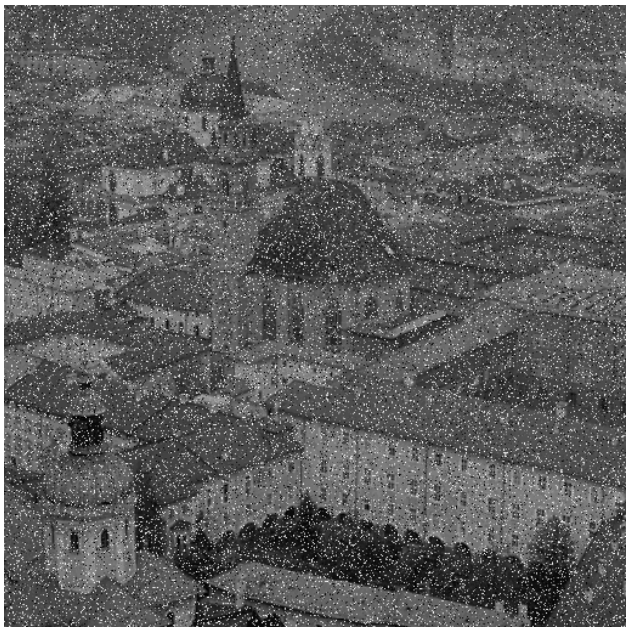
3.1. Generate random impulse noise $\eta(x, y)$ with the corruption rate 0.1 and 0.2 using the function, which you designed, corrupt your image $f(x, y)$, and save noisy pictures

RANDOM IMPULSE NOISE

CR 0.1



CR 0.2



3.2. Generate salt and pepper noise with the corruption rate 0.1 and 0.2 using the function, which you designed, corrupt your image $f(x, y)$, and save noisy pictures

SALT & PEPPER NOISE

CR 0.1

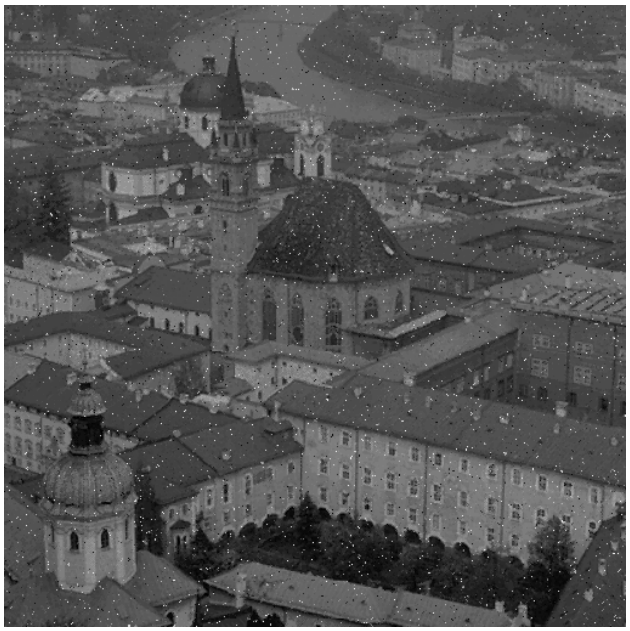
CR 0.2

4. Filter your noisy image using the median filter with the differential rank impulse detector. Use the function, which you designed. You may apply this filter more than 1 time, if necessary. Try different values of interval r, and s and find the values giving the best filtering result in terms of RMSE/PSNR.

MEDIAN FILTER ON RANDOM IMPULSE

CR 0.1; r = 6; s = 15

CR 0.2; r = 6; s = 15



CR 0.1; r = 2; s = 5

CR 0.2; r = 2; s = 5

5. Find RMSE/PSNR for your filtered images (use functions designed in Project 2).

Measured PSNR and RMSE between original and filtered images:

CR	0.1		0.2	
r/s	6/15	2/5	6/15	2/5
PSNR	3.069394e+01	3.238254e+01	2.573766e+01	2.866551e+01
RMSE	7.444634e+00	6.129336e+00	1.317217e+01	9.402959e+00

MEDIAN FILTER ON SALT AND PEPPER

CR 0.1; r = 6; s = 15

CR 0.2; r = 6; s = 15

CR 0.1; r = 2; s = 5

CR 0.2; r = 2; s = 5

CR	0.1		0.2	
r/s	6/15	2/5	6/15	2/5
PSNR	2.674098e+01	2.648725e+01	2.091619e+01	2.142915e+01
RMSE	1.173521e+01	1.208309e+01	2.294724e+01	2.163129e+01