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IMAGE PROCESSING

Labwork 2: Image Filtering

Part 1. Use a pen and paper to do the following tasks:

Task 1: Given the following image I:

23	12	34	22
89	35	25	78
67	34	21	98
57	76	36	54

And the following kernel K:

$1/37 *$

23	12	34
89	35	25
67	34	21

- Filter image I using the kernel K and the 0-padding technique.
- Filter image I using the median filter of size 3x3 and the 0-padding technique.

Task 2: Given the following image J:

123	127	128	119	115	130
140	145	148	153	167	172
133	154	183	192	194	191
194	199	207	210	198	195
164	170	175	162	173	151

- Smooth image J using the averaging filter of size 3x3 and the 0-padding technique.
- Sharpen image J using the Laplacian filter of size 3x3 and the 0-padding technique.

- Sharpen image J using the Sobel filter of size 3x3 and the 0-padding technique.

Part 2. Use OpenCV and Python to do the following tasks:

- Download from the Internet some greyscale images ***(preferred ultrasound images or X-ray images)*** for your work.

Task 1: Load an image, then display it and its histogram on the screen.

Task 2: Apply the averaging filter using the function: $cv2.blur()$, Gaussian filter using the function $cv2.GaussianBlur()$ and Median filter using the function $cv2.medianBlur()$ on the loaded image to blur it. Display the filtered images and compare the difference with the original image.

Task 3: Add Gaussian noise, Salt and Pepper noise and Periodic noise to the loaded image, then display the noisy images with their corresponding histogram.

Task 4: Apply the averaging filter, Gaussian filter, and Median filter to the three noisy images to remove noise. Display the noisy images and the noise removal images to see the difference.

Task 5: Transform the periodic noisy image from spatial domain to frequency domain using Fourier transform, then: (1) Perform noise removal on the transformed image using frequency filtering, (2) Perform Inverse Fourier Transform to convert the image from frequency domain back to spatial domain, finally (3) Display the periodic noisy image and the filtered image together for comparison.

***Note**:* you are required to upload the captured photos and the source codes of your labworks to the google drive folder of the DIP course.