**LAB 3**

**I. Convolution: based on class lecture**

**- Main point: when we use convolution without padding, the output image will lose some pixels in the boundaries.**

**II. Apply Convolution**

**3. Filter an image using average filtering.**

Explain the algorithm:

* Example for 3x3 kernel, and we can infer for nxn kernel

Text, letter

Description automatically generated

* We can call it as Low Pass filtering: It is also known as the smoothing filter. It removes the high-frequency content from the image. It is also used to blur an image.

Running code:

Open folder contains exe file in cmd, and write the following command:

Graphical user interface, text

Description automatically generated

A screenshot of a computer

Description automatically generated with low confidence

Command: LAB3.exe -avg 3 3 img.jpg avg.jpg

A collage of a dog

Description automatically generated with medium confidence

**4. Filter an image using median filtering.**

Explain the algorithm:

Running code:

Open folder contains exe file in cmd, and write the following command:

Text

Description automatically generated

Background pattern

Description automatically generated with low confidence



Command: LAB3.exe -med 5 5 img.jpg med.jpg

A picture containing dog, indoor, sitting, white

Description automatically generated

**5. Filter an image using Gaussian filtering.**

Explain the algorithm:

From Wikipedia and stack over flow

Destination image will lose some pixels in the boundaries because of convolution

Graphical user interface, text

Description automatically generated

Running code:

Open folder contains exe file in cmd, and write the following command:

Text

Description automatically generated



Command: LAB3.exe -gau 5 5 img.jpg gau.jpg

A picture containing dog, indoor, sitting, white

Description automatically generated

**6. Detect edges using Sobel operator.**

Explain the algorithm:

From wikipedia

Graphical user interface, text, application

Description automatically generated

Text

Description automatically generated

Running code:

Open folder contains exe file in cmd, and write the following command:

Text

Description automatically generated



Command: LAB3.exe -sobel img.jpg sobel.jpg

A collage of a dog

Description automatically generated with medium confidence

**7.** **Detect edges using Prewitt operator.**

Explain the algorithm:

From Wikipedia

Graphical user interface, text, application, email

Description automatically generated

Running code:

Open folder contains exe file in cmd, and write the following command:

Text

Description automatically generated



Command: LAB3.exe -prew img.jpg prew.jpg

A collage of a dog

Description automatically generated with medium confidence

**8. Detect edges using Laplace operator.**

Explain the algorithm:

A picture containing table

Description automatically generated

Running code:

Text

Description automatically generated



Command: LAB3.exe -lap img.jpg lap.jpg

A collage of a dog

Description automatically generated with medium confidence

**III. References**

1. <https://www.geeksforgeeks.org/spatial-filters-averaging-filter-and-median-filter-in-image-processing/>
2. <https://en.wikipedia.org/wiki/Sobel_operator>
3. <https://en.wikipedia.org/wiki/Prewitt_operator>
4. <https://github.com/kimnamlhn/Digital-Image-Processing/blob/main/Lab3/EdgeDetector.cpp>
5. <https://www.geeksforgeeks.org/laplacian-filter-using-matlab/>
6. <https://stackoverflow.com/questions/8204645/implementing-gaussian-blur-how-to-calculate-convolution-matrix-kernel>
7. <https://en.wikipedia.org/wiki/Gaussian_blur>