

CO543 – Image Processing

Lab 04

Sharpening Spatial Filtering

Task 1

1) Use of Second Derivative for Image Enhancement: The Laplacian

- Write a program to implement “The Laplacian” and note the effects on the given image.

$$\nabla^2 f = [f(x+1, y) + f(x-1, y) + f(x, y+1) + f(x, y-1)] - 4f(x, y).$$

$$g(x, y) = \begin{cases} f(x, y) - \nabla^2 f(x, y) & \text{if the center coefficient of the Laplacian mask is negative} \\ f(x, y) + \nabla^2 f(x, y) & \text{if the center coefficient of the Laplacian mask is positive.} \end{cases}$$

2) Use of First Derivative for Image Enhancement: The Gradient

- Write a program to implement “Robert Cross Gradient Operator” and observe the changes in the image.

z_1	z_2	z_3
z_4	z_5	z_6
z_7	z_8	z_9

$$\nabla f \approx |z_9 - z_5| + |z_8 - z_6|.$$

- Write a program to implement “Sobel Operators” and observe the changes on the image.

$$\nabla f \approx |(z_7 + 2z_8 + z_9) - (z_1 + 2z_2 + z_3)| \\ + |(z_3 + 2z_6 + z_9) - (z_1 + 2z_4 + z_7)|.$$

Task 2

1. Read a given image.
2. Take the Laplacian of the image using the Second Derivative.
3. Sharpen image by adding original image and laplacian image.
4. Take the Sobel gradient of the image using the First Derivative.
5. Smooth Sobel image using 5×5 averaging filter.
6. Mask the laplacian image using smooth Sobel image.
7. Add product image with the original image.
8. For better result apply power law transformation
(<http://www.pyimagesearch.com/2015/10/05/opencv-gamma-correction/>)

Submission

1. You need to submit **all python files** containing the relevant programs and functions named according to the relevant question names or as indicated in the lab sheet, along with the **main function** to run them and display your outputs. Make sure to include the **input images** you used to run the codes as well.
2. You need to submit a **PDF file (e15XXXresults.pdf)** displaying all **results** from your code (your **input and output images** under each section after performing the required functions).

You can submit a **single ZIP file** as **e15XXXlab04.zip** including all:

- **Python source codes**
- **All Input and output images**
- **A PDF file with results**

Note: XXX indicates your registration number in all cases.