Department of
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Subject Name & Code: Image Processing: ADUA31205(B)

Title of Assignment: Perform linear and non-linear noise smoothing for a noisy image.

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ASSIGNMENT NO. 2

IP Assignment 2

Tittle : Perform linear & non linear noise smoothing for a noisy image.

linear objective :

1) To learn what is noisy image.
2) To learn what is linear & non linear noise smoothing.
3) To learn python commands in opencv to perform these operation.

Theory :

When we are dealing with image at some point the image will be crisper & sharper which we need to smoothen or blur to get a clear image, or sometimes the image will be with a bad edge which also we need to smooth it down to make the image usable. In opencv, we got more than one method to smooth or blur an image.

A) **Linear noise smoothing :→**

These are good filter for remaining gaussian noise & is most cases the other types of noise as well

B) **Non linear noise smoothing :→**

It takes into account that non linear signal will form curved structure in delay space.

Types of smoothing filter :→

Also known as blurring filter, are a types of image filter that are commonly used in image processing to reduce noise & remove small details from an image. There are several types of smoothing filters, ~~including~~ excluding mean filter, median filter, gaussian filter & bilateral filter

A) **Means filter :→**

The mean filter is a type of linear smoothing filter that replaces each pixel image with the average of neighbouring pixels. The size of neighbouring pixels is defined by filter kernel or masic.

B) **Median filter :→**

The median filter is a type of ~~linear smoothing~~ non linear smoothing filter that replaces each pixel in the image with the median value of its neighbouring pixels. Neighbour size is also defined by filter kernel.

c) **Gaussian filter :→**

It is a type of linear smoothing filter that is based on gaussian distribution. It work by convolving image with gaussian kernel.

D) **Bilateral filter :→**

It is a type of non linear smoothing filter that uses a combination of spatial and range filtering. spatial is similar to gaussian, while range is based on difference in pixel intensities

formula:

$\longrightarrow$ range weight.

$$BF(I)_p = \frac{1}{W_p} \sum_{q \in s} G_{\sigma_s}(\|p-q\|) \, G_{\sigma_r}(|I_p - I_q'|) \, I_q$$

$\longrightarrow$ normalization factor

$\longrightarrow$ space weight

Conclusion: Thus we implemented image smoothing using various types of filter. We used opencv library in Python to perform these operations.

Software requirement: VS code.

Program Code:

```python
import cv2

img = cv2.imread("D:\MY FILES\COLLEGE MATERIAL\ASSIGNMENTS\images.jpg")
cv2.imshow("Noisy Image",img)

# Linear Smoothing

avg_blur = cv2.blur(img,(5,5))
cv2.imshow('Average Blurring',avg_blur)

gaussian_blur = cv2.GaussianBlur(img,(7,7),0) cv2.imshow('Gaussian
Blurring',gaussian_blur)

# Non-linear smoothing

median_blur = cv2.medianBlur(img,5)
cv2.imshow('Median Blurring',median_blur)

bilateral_blur = cv2.bilateralFilter(img,9,60,15) cv2.imshow('Bilateral
Blurring',bilateral_blur)

cv2.waitKey(0)
```

Output: