Report: Computer Vision (CSL462) Assignment-1

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Figure 1: Orignal Image For Edge Detection

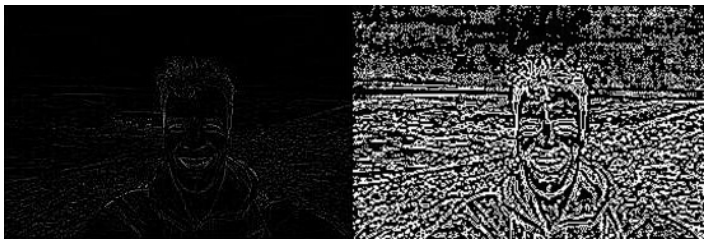

Figure 2: Edge detection a) With Edge Magnitude b) Binary Image

1 Objective

To adaptive blur on image based on edge/color/template information. Foreground should be highlighted and the background should be blurred.

2 Second Order Edge Detection

The **Marr-Hildreth algorithm** is applied for edge detection. It is a method of detecting edges in digital images, that is, continuous curves where there are strong and rapid variations in image brightness. The Marr-Hildreth edge detection method is simple and operates by convolving the image first with the Gaussian filter and then the Laplacian filter.Then, zero crossings are detected in the filtered result to obtain the edges. Outputs images are shown in Figure-2.

Gaussian Operator:

$$g(x,y) = \frac{1}{2\pi\sigma^2} e^{-(x^2+y^2)/2\sigma^2} \tag{1}$$

Laplacian Operator:

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix} \tag{2}$$

3 Adaptive Blur Computation

Foreground and background are distinguished based on the local average edge density. Following Steps are used to blur the image:

1. Edge detection done using above given method with $\sigma = 0.2$ and output is taken with edge magnitudes.

2. Average of pixel values calculated.

Figure 3: Adaptive Blur Step-3 Output

Figure 4: Adaptive Blur Output Image-1

3. Then image is made binary using:

$$\begin{cases} 1 & \text{if pixel value >= 3xAverage} \\ 0 & \text{otherwise} \end{cases}$$

   Image shown in Figure 3, which almost distinguished foreground and background.

4. Let MxN be size of the image. Now, a window of size of M/10xN/10 is moved on the image and window is blurred using the σ which is calculated using the **Extract Statistics** function which is discussed in the next section.

5. Then, finally background blurred image is created.

   Output Images are shown in Figure-4,5

4 Extract Statistics

This function calculates σ for a image portion(window) (say I1) based on binary edge detected image (say I) of Adaptive Blur Step-3. Let A be the average pixel value of the I and A1 be the average pixel value of the I1. Then,

$$\sigma = \begin{cases} \text{min(5,(min(4,A/2)-A1)} & \text{if A1<min(4,A/2)} \\ 2 & \text{if A1<=A/2} \\ 0 & \text{otherwise} \end{cases}$$

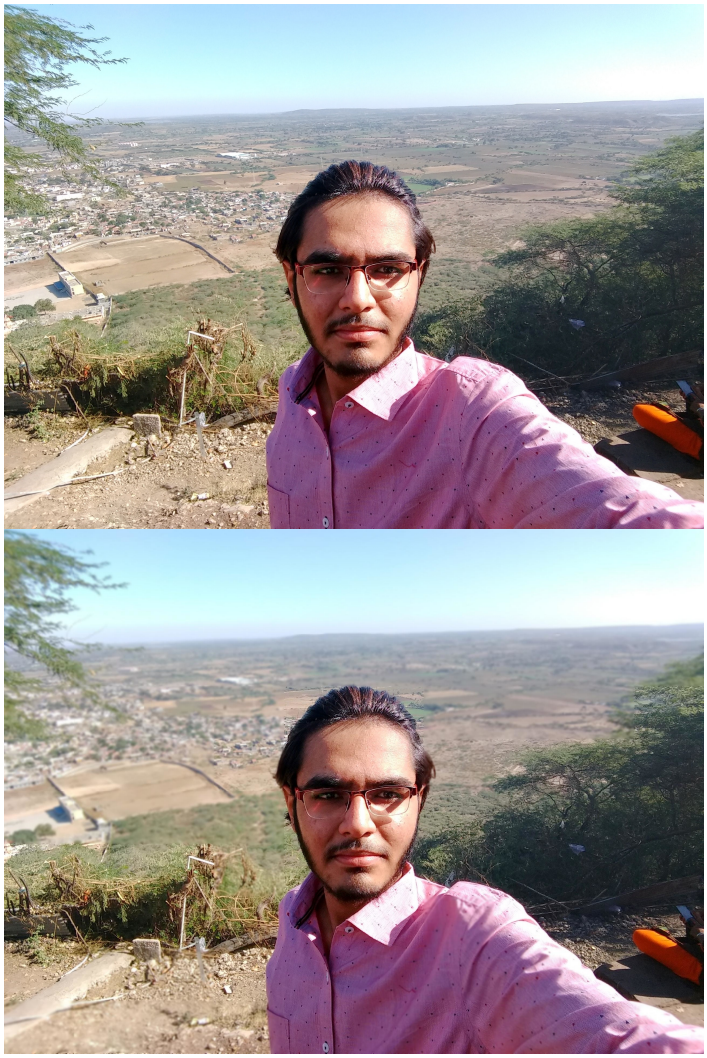

Figure 5: Adaptive Blur Output Image-2

5 References

1. Marr-Hildreth Algorithm-Wikipedia
2. Gauss Filter-Wikipedia
3. Image Source-Google

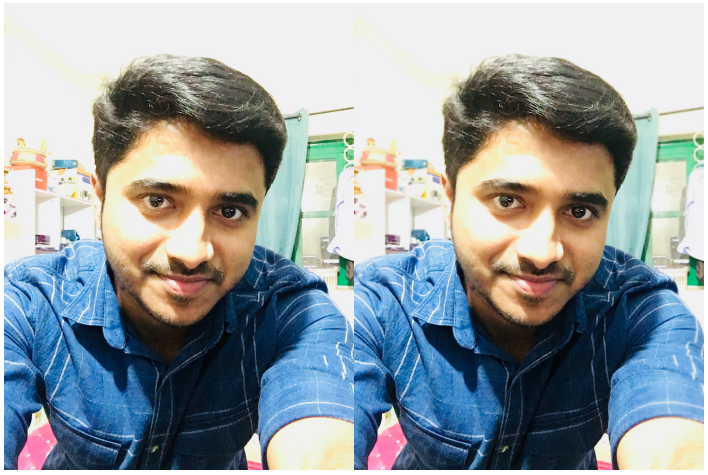

Figure 6: Adaptive Blur Output Image-3