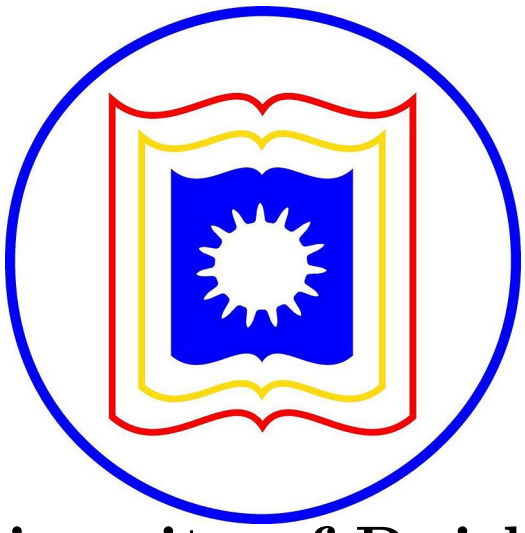

University of Rajshahi

Department of Computer Science & Engineering

CSE4182 - Digital Image Processing Lab

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Abstract

This is a notebook for Digital Image Processing Lab. This will contain all the assignments and their explanations.

Contents

Chapter 1

Assignment 9
Morphological Transformations Implementation

1.1 Introduction

In our last assignment-8, we learned about morphological operations like Erosion, Dilation, Opening, Closing. We implemented these operations with built-in OpenCV functions. Now we will create our custom functions to perform these operation and will compare the output of our implemented functions with the output of the OpenCV's built-in functions.

1.1.1 Sample Image

Morphological transformations are normally performed on binary images. It needs two inputs, one is our original image :

Figure 1.1: Sample image

1.1.2 Structuring Element

Second one is called structuring element or kernel which decides the nature of operation. We are using a 5*5 matrix as our structuring element which is with full of ones :

$$\begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

1.2 Operations

1.2.1 Erosion

Erosion erodes away the boundaries of foreground object.The structuring element slides through the image as in 2D convolution. A pixel in the original image (either 1 or 0) will be considered 1 only if all the pixels under the kernel is 1, otherwise it is eroded (made to zero).

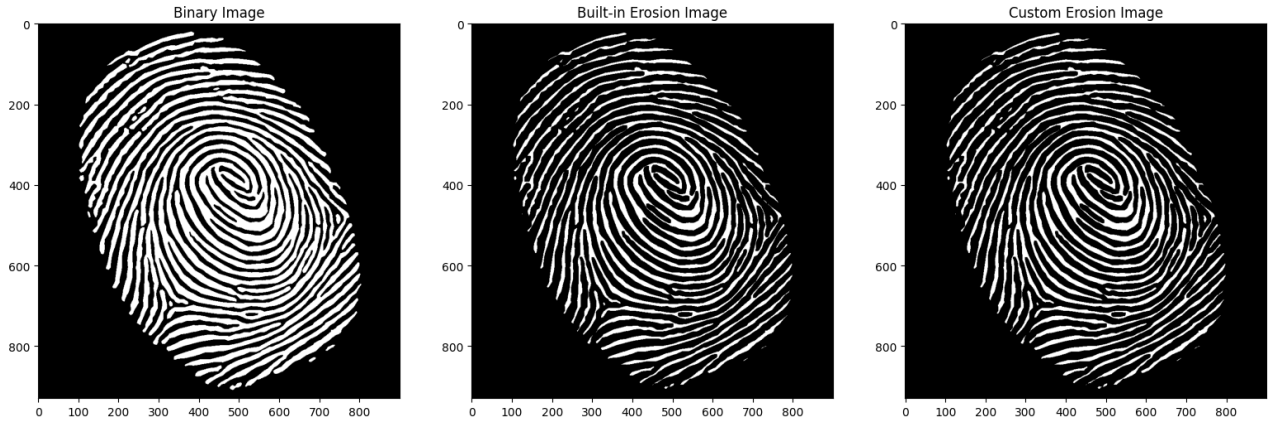


Figure 1.2: Built-in vs Custom Erosion Image

Here, we can see that the the output is similar for both. The White region are shrunken.

1.2.2 Dilation

It is just opposite of erosion. Here, a pixel element is '1' if atleast one pixel under the kernel is '1'. So it increases the white region in the image or size of foreground object increases.

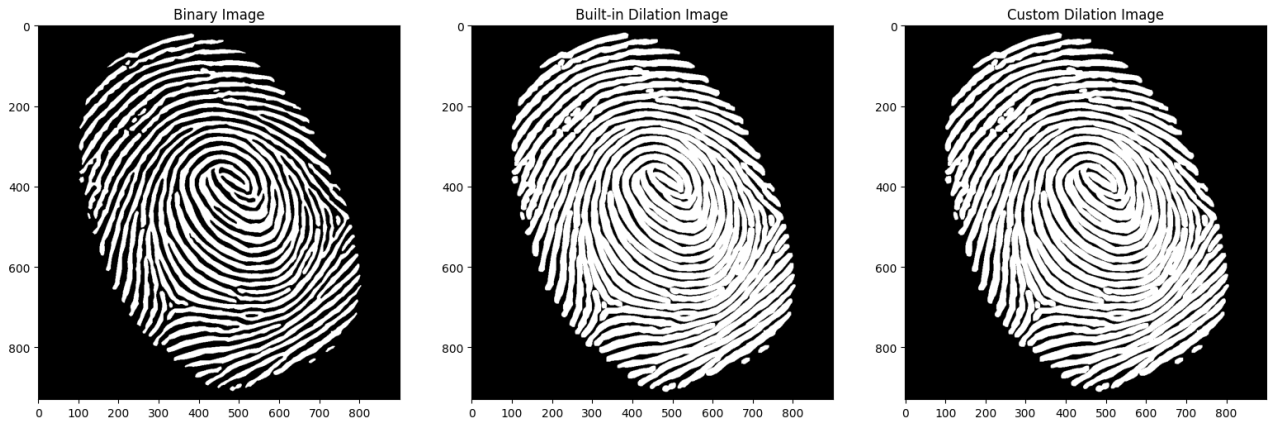


Figure 1.3: Built-in vs Custom Dilation Image

Here, we can see that the the output is similar for both.Here our object area increases.

1.2.3 Opening

Opening is just Erosion followed by Dilation. It is useful in removing noise. We added some white noise to check this.

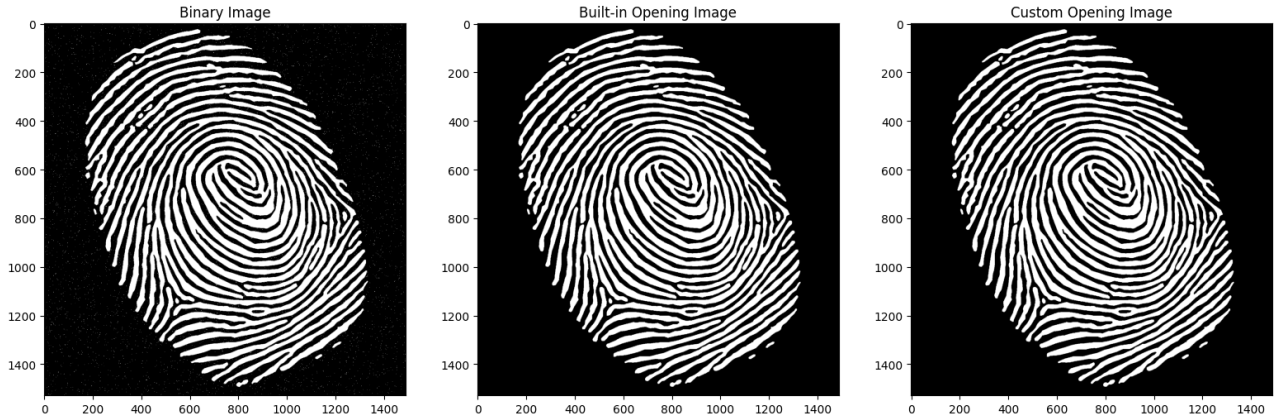


Figure 1.4: Built-in vs Custom Opening Image

Here, we can see that the the output is similar for both functions. The noise are removed.

1.2.4 Closing

Closing is reverse of Opening, Dilation followed by Erosion. It is useful in closing small holes inside the foreground objects, or small black points on the object. Here we created some black noise or holes in our picture.

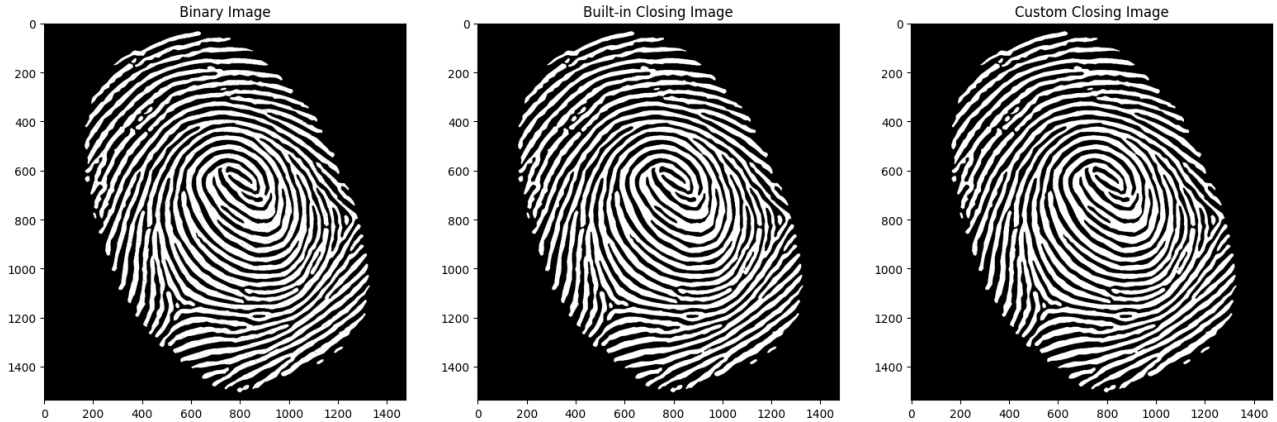


Figure 1.5: Built-in vs Custom Closing Image

Here, we can see that the the output is similar for both. The holes are removed from the picture after operation.

1.3 Discussion

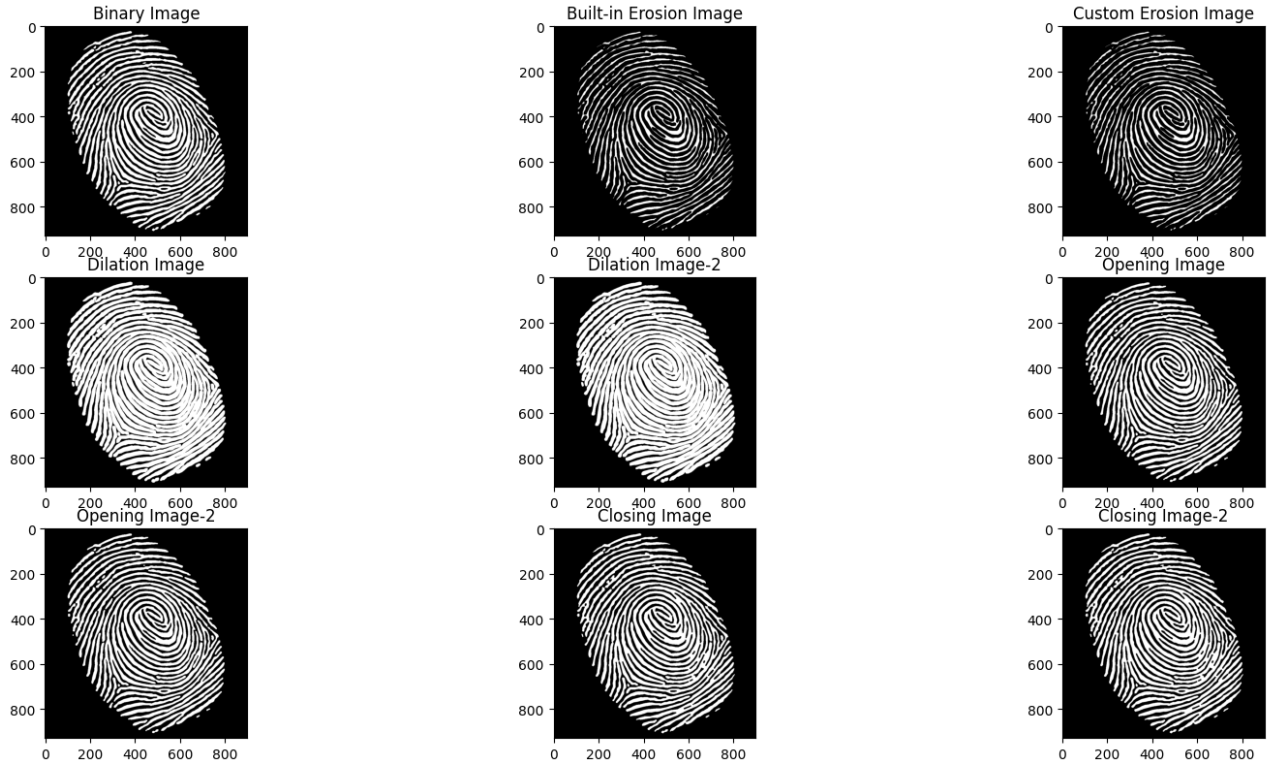


Figure 1.6: Built-in vs Custom function output Image

The outputs are similar for both custom and built-in functions. Hence, we can say that our built-in functions are producing correct image.

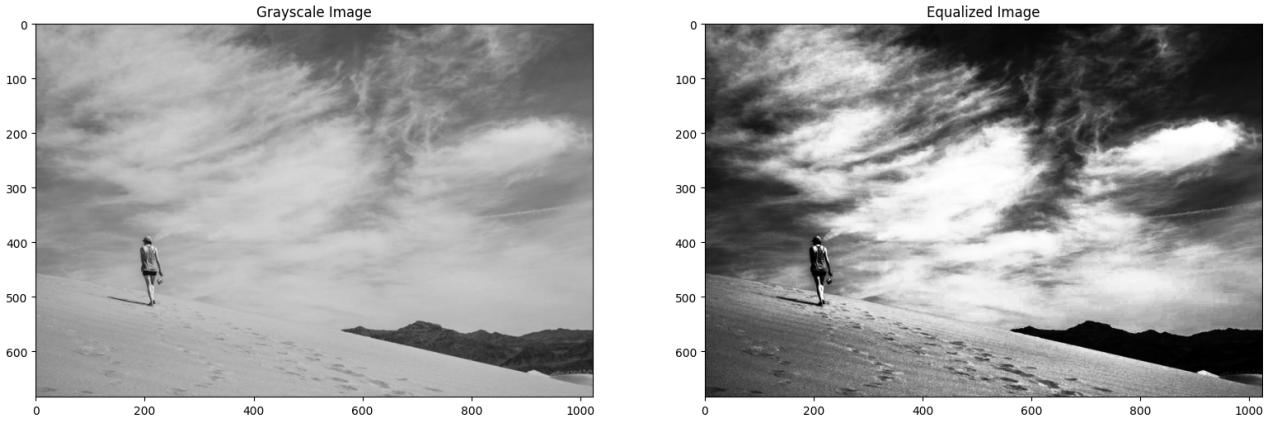
Chapter 2

Assignment 10

2.1 Histogram Equalization

Histogram Equalization is an image processing technique that adjusts the contrast of an image by using its histogram. To enhance the image's contrast, it spreads out the most frequent pixel intensity values or stretches out the intensity range of the image.

2.1.1 Equalized Image vs Pre-processed Image



If you compare the two images above, you will find that the histogram equalized image has better contrast. It has areas that are darker as well as brighter than the original image.

2.1.2 Histogram Equalization Implementation

We are using cv2.equalizeHist() built-in function to equalize our image. It takes an initial image and returns the equalized image.

```
image = cv2.equalizeHist(initialImg)
```

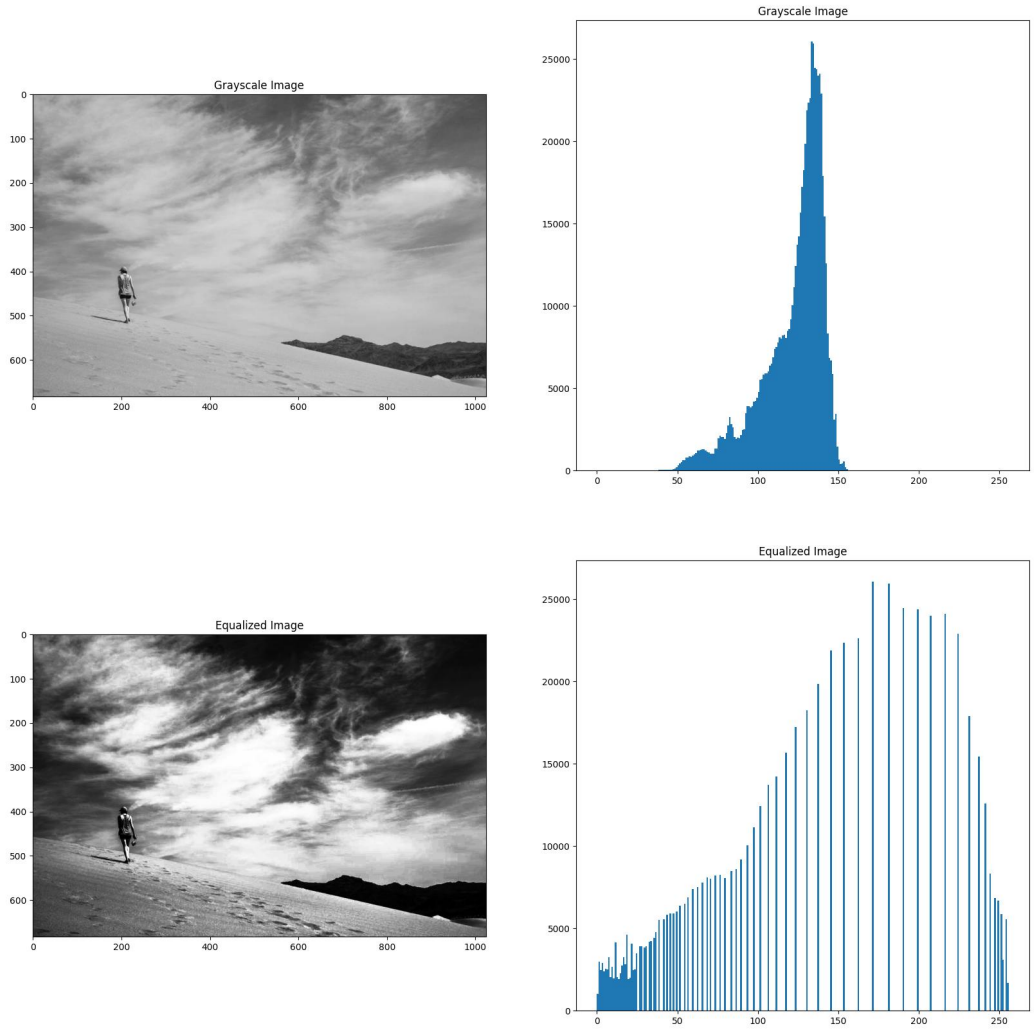


Figure 2.1: Histogram comparison between equalized and normal image

Unlike the original image histogram, the pixel intensity values now range from 0 to 255 on the X-axis for the equalized image. As a result, the image is now looking better than before.