Practical No. 4

Aim :

Read any image. Display the outputs of contrast stretching, intensity level slicing.

Objective :

To Study Various Methods for Image Enhancement using Spatial and Frequency Domain.

Theory:

Image enhancement –

The principal objective of enhancement is to process an image so that the resultis more suitable than the original image for a specific application. Image enhancement approaches fall into two broad categories: spatial domain methods and frequency domain methods. The term spatial domain refers to the image plane itself, and approaches in this category are based on direct manipulation of pixels in an image. Frequency domain processing techniques are based on modifying the Fourier transform of an image. Image enhancement is the process of adjusting digital images so that the results are more suitable for display or further image analysis. For example, you can remove noise, sharpen, or brighten an image, making it easier to identify key features.

Contrast Stretching:

One of the simplest piecewise linear functions (function whose pieces are linear) is a contrast stretching transformation. The form of the piece wise function can be arbitrary complex.
A practical implementation of some important transformation can be formulated only as piece wise function. It increases the dynamic range of the gray levels in the image being processed. Low contrast images are resulted from poor illumination, lack of dynamic range in the imaging sensor, or even wrong setting of a lens aperture of image acquisition. Transformation function is shown in the graph. Locations of the points (r1, s1) and (r2, s2) used to control the shape of the transformation function. If r1=s1 and r2=s2 transformation is
linear function and produces no changes in the gray level. If r1=r2, s1=0 and s2=L-1, transformation becomes a thresholding function that results a binary image. Intermediate values of (r1, s1) and (r2, s2) produce various degrees of spread in the gray levels of the output image, thus affecting its contrast.

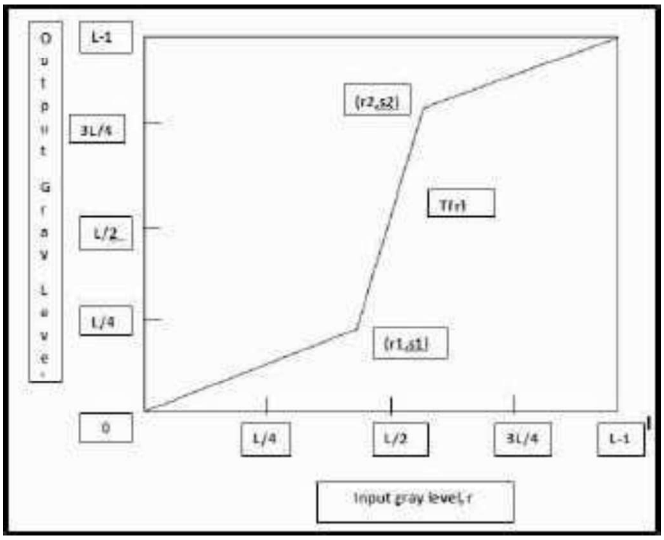
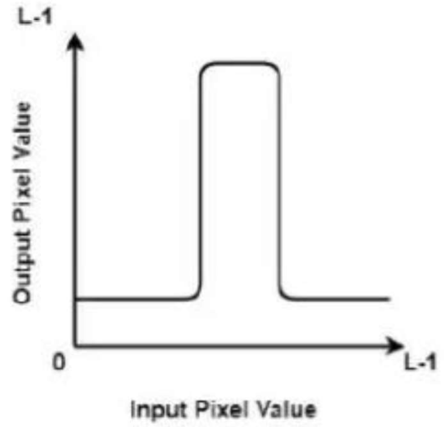


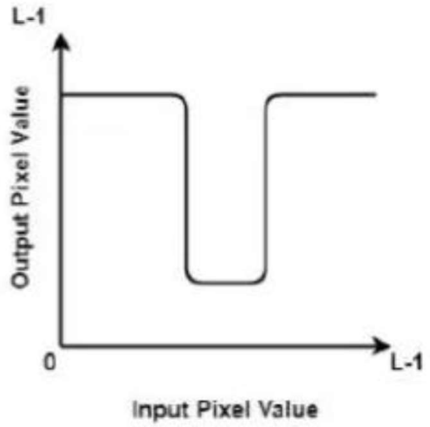
Fig : Contrast Stretching

Intensity level slicing-

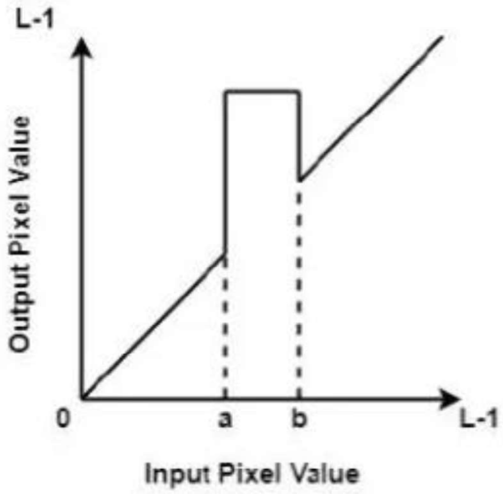
Intensity level slicing means highlighting a specific range of intensities in an image. In other words, we segment certain gray level regions from the rest of the image. Suppose in an image, your region of interest always take value between say 80 to 150, So, intensity level slicing highlights this range and now instead of looking at the whole image, one can now focus on the
highlighted region of interest. Since, one can think of it as piecewise linear transformation function so this can be implemented in several ways. Here, we will discuss the two basic type of slicing that is more often used.

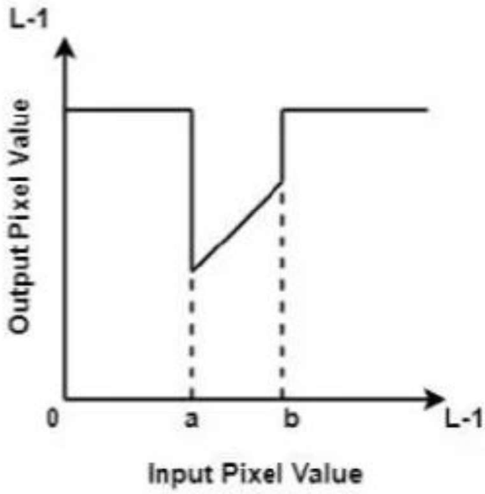
In the first type, we display the desired range of intensities in white and suppress all other intensities to black or vice versa. This results in a binary image. The transformation function for both the cases is shown below.





In the second type. we brighten or darken the desired range of intensities(a to b as shown below) and leave other inten- sities unchanged or vice versa. The transformation function for both the cases, first where the desired range is changed and second where it is unchanged, is shown below.





Procedure:

a) Contrast Stretching -

Applying contrast stretching to the input image:

1.Read and load the input RGB image.

2. Split the R, G, B channels of the image.

3.For each channel:

•Initialise the stretch factors.

•Determine the min and max values in each channel (max_val, min_val).

•Calculate the stretch factor for each channel using the following formula:

•stretch_factor_1 = (stretch_max - stretch_min) / (max_val - min_val)

•stretch_factor_2 = stretch_min - stretch_factor_1 * min_val

4. Initialize the stretched image with zeroes.

5. Obtain the three stretched channels one by one using cv2.convertScaleAbs() function by passingthe above calculated stretch factors to it.

6. Store the stretched channels as parts of the stretched image.

7. Display the contrast stretched image using cv2 library.

b) Intensity level Slicing

Applying intensity level slicing to the input image:

1. Read and load the input RGB image.
2. Convert the image to grayscale using the cv2.cvtColor() function.
3. Set the lower and upper intensity levels.
4. Create a mask with the intensity range using the intensity levels set above and the obtained gray scale image.
5. Apply this mask to the original image by performing a bitwise AND toobtain the intensity sliced image.
6. Display the intensity sliced image using the cv2 library.

Conclusion:

We have successfully read the image and display the outputs of contrast stretching,intensity level slicing.