SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME : 19EC513 – IMAGE PROCESSING AND COMPUTER VISION

III YEAR / V SEMESTER

Unit II- **IMAGE ENHANCEMENT AND RESTORATION**

Topic : Histogram equalization and matching

Applications of Histograms

1. In digital image processing, histograms are used for simple calculations in software.
2. It is used to analyze an image. Properties of an image can be predicted by the detailed study of the histogram.
3. The brightness of the image can be adjusted by having the details of its histogram.
4. The contrast of the image can be adjusted according to the need by having details of the x-axis of a histogram.
5. It is used for image equalization. Gray level intensities are expanded along the x-axis to produce a high contrast image.
6. Histograms are used in thresholding as it improves the appearance of the image.
7. If we have input and output histogram of an image, we can determine which type of transformation is applied in the algorithm.

Histogram Processing Techniques

In Histogram sliding, the complete histogram is shifted towards rightwards or leftwards. When a histogram is shifted towards the right or left, clear changes are seen in the brightness of the image. The brightness of the image is defined by the intensity of light which is emitted by a particular light source.
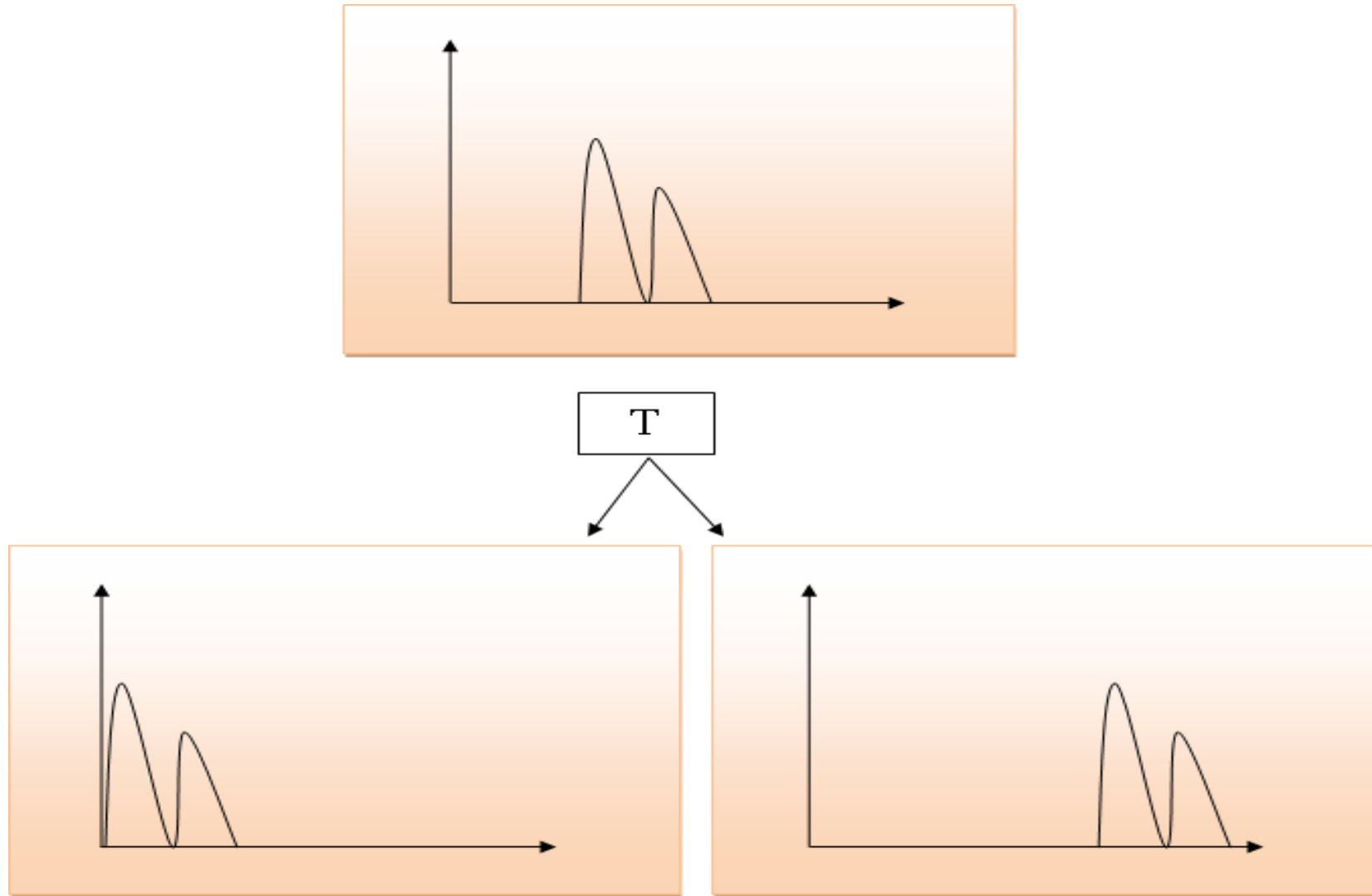
Fig. Histogram Sliding

Histogram Stretching

In histogram stretching, contrast of an image is increased. The contrast of an image is defined between the maximum and minimum value of pixel intensity.

If we want to increase the contrast of an image, histogram of that image will be fully stretched and covered the dynamic range of the histogram.

From histogram of an image, we can check that the image has low or high contrast.
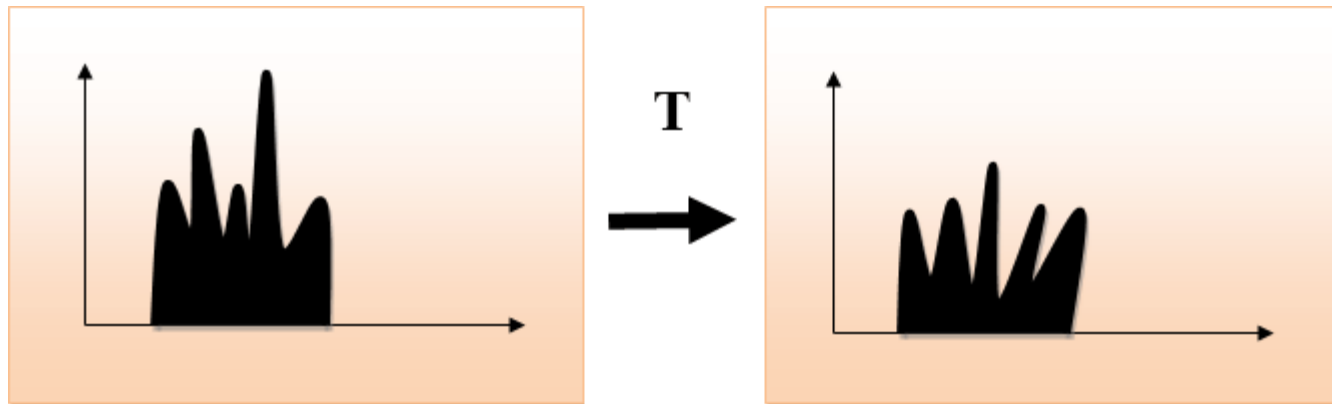
Histogram Equalization

Histogram equalization is used for equalizing all the pixel values of an image. Transformation is done in such a way that uniform flattened histogram is produced.

Histogram equalization increases the dynamic range of pixel values and makes an equal count of pixels at each level which produces a flat histogram with high contrast image.
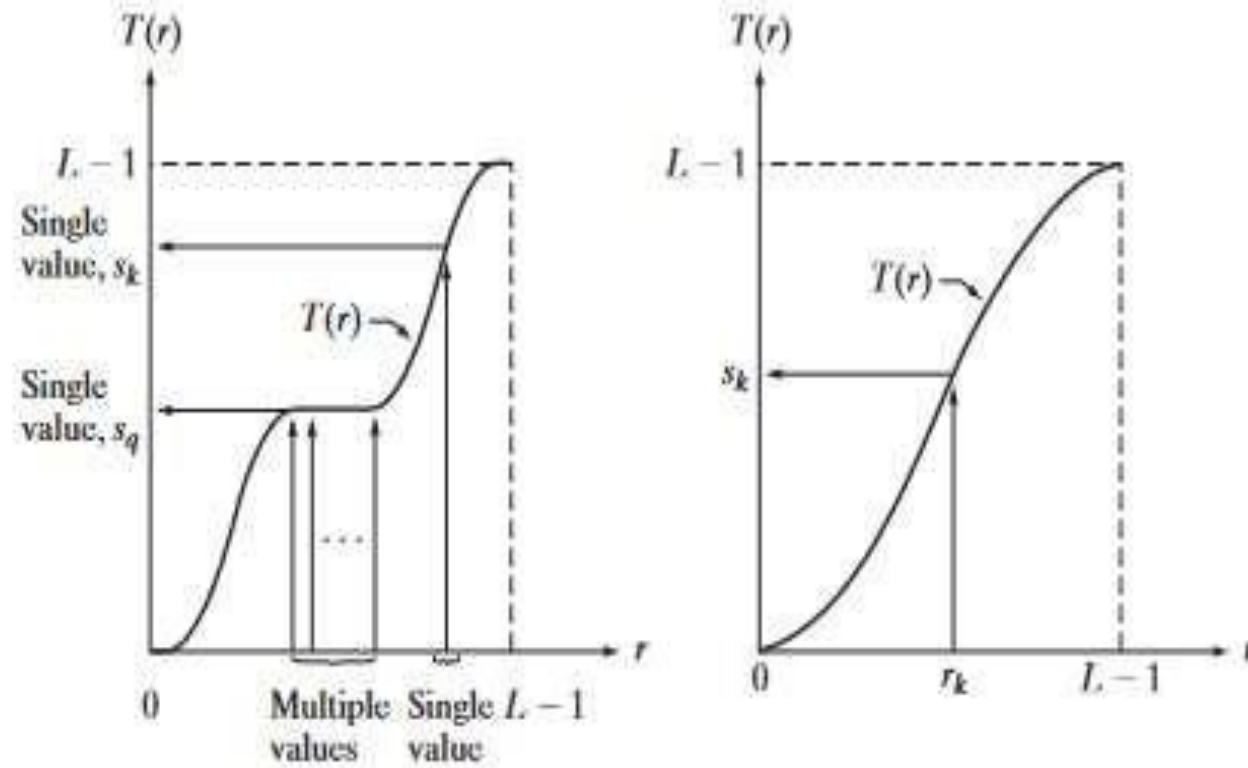
While stretching histogram, the shape of histogram remains the same whereas in Histogram equalization, the shape of histogram changes and it generates only one image.
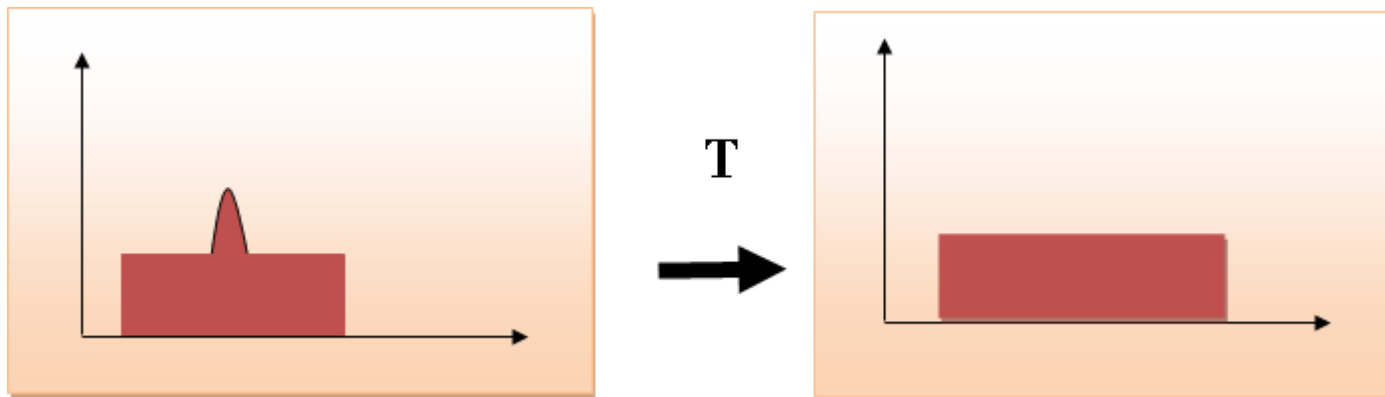
a b

FIGURE 3.17
(a) Monotonically increasing function, showing how multiple values can map to a single value.
(b) Strictly monotonically increasing function. This is a one-to-one mapping, both ways.

†Recall that a function $T(r)$ is *monotonically increasing* if $T(r_2) \geq T(r_1)$ for $r_2 > r_1$. $T(r)$ is a *strictly monotonically increasing* function if $T(r_2) > T(r_1)$ for $r_2 > r_1$. Similar definitions apply to monotonically decreasing functions.

Histogram matching

Histogram equalization automatically determines a transformation function that seeks to produce an output image that has a uniform histogram.

When automatic enhancement is desired, this is a good approach because the results from this technique are predictable and the method is simple to implement.

We show in this section that there are applications in which attempting to base enhancement on a uniform histogram is not the best approach. In particular, it is useful some times to be able to specify the shape of the histogram that we wish the processed image to have. The method used to generate a processed image that has a specified histogram is called histogram matching or histogram
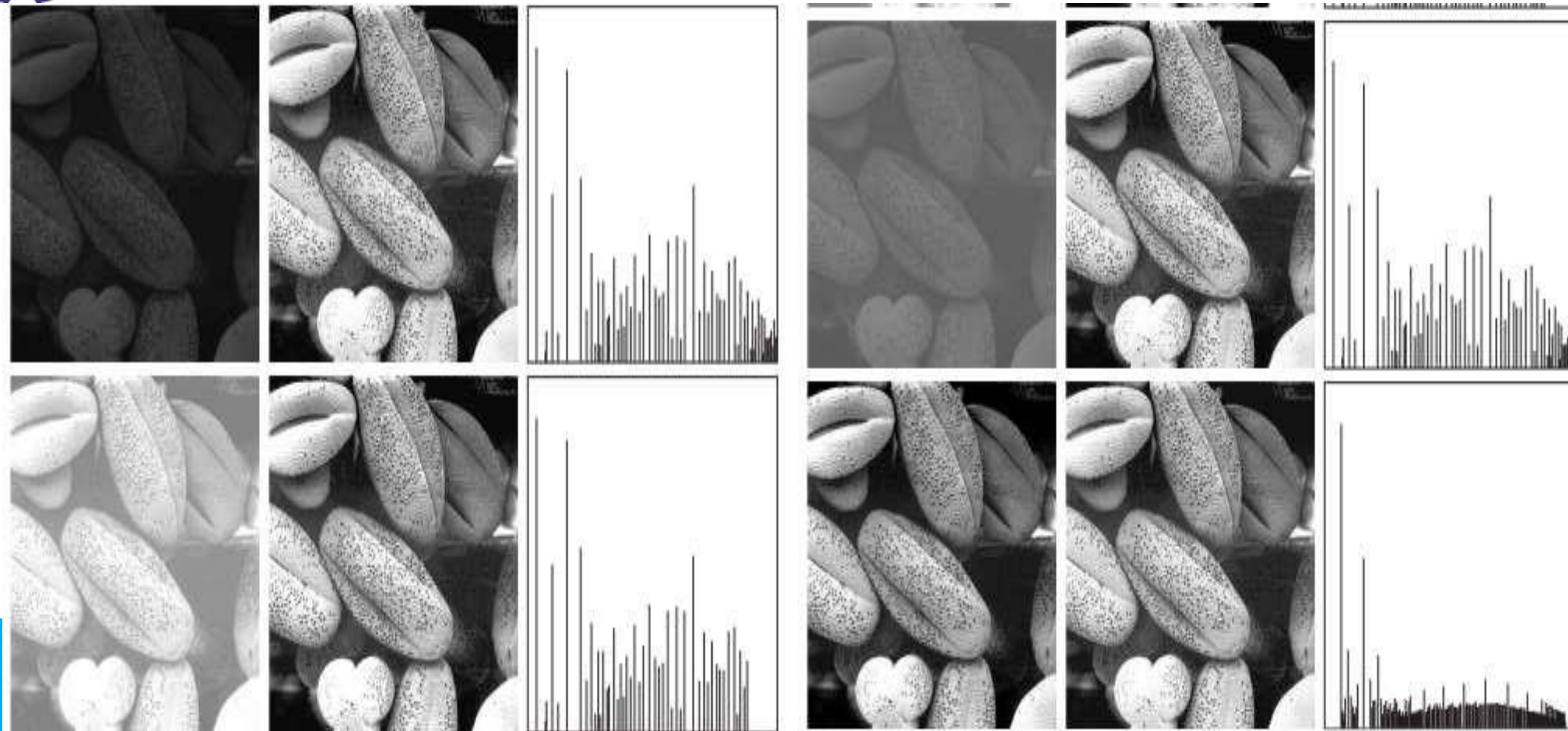
FIGURE 3.20 Left column: images from Fig. 3.16. Center column: corresponding histogram-equalized images. Right column: histograms of the images in the center column.

Any Query????

Thank you……