Histogram

The histogram of an image is a plot of the gray _levels values versus the number of pixels at that value.

A histogram appears as a graph with "brightness" on the horizontal axis from 0 to 255 (for an 8-bit) intensity scale) and "number of pixels "on the vertical axis. For each colored image three histogram are computed, one for each component (RGB, HSL).The histogram gives us a convenient -easy -to -read representation of the concentration of pixels versus brightness of an image, using this graph we able to see immediately:

1 Whether an image is basically dark or light and high or low contrast.

2 Give us our first clues a bout what contrast enhancement would be appropriately applied to make the image more subjectively pleasing to an observer, oreasier to interpret by succeeding image analysis operations.

So the shape of histogram provide us with information about nature of the image or sub image if we considering an object within the image. For example:

1 Very narrow histogram implies a low-contrast image

2 Histogram skewed (مائل) to word the high end implies a bright image

3 Histogram with two major peaks , called bimodal, implies an object that is in contrast with the background

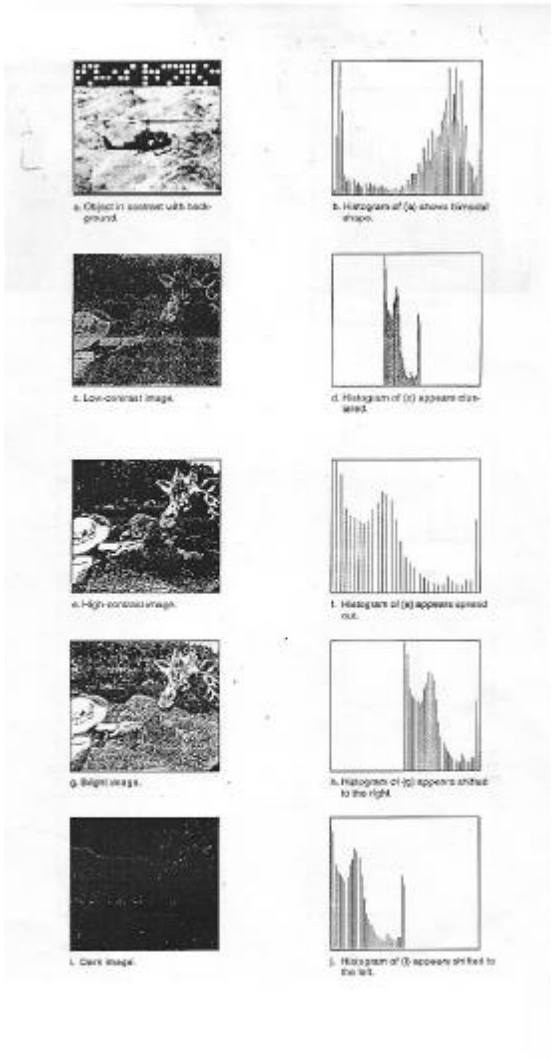


Figure (2-17): Different types of Histogram

Histogram Modifications

The gray level histogram of an image is the distribution of the gray level in an image is the distribution of the gray level in an image. The histogram can be modified by mapping functions, which will stretch, shrink (compress), or slide the histogram. Figure (2-18) illustrates a graphical

representation of histogram stretch, shrink and slide.

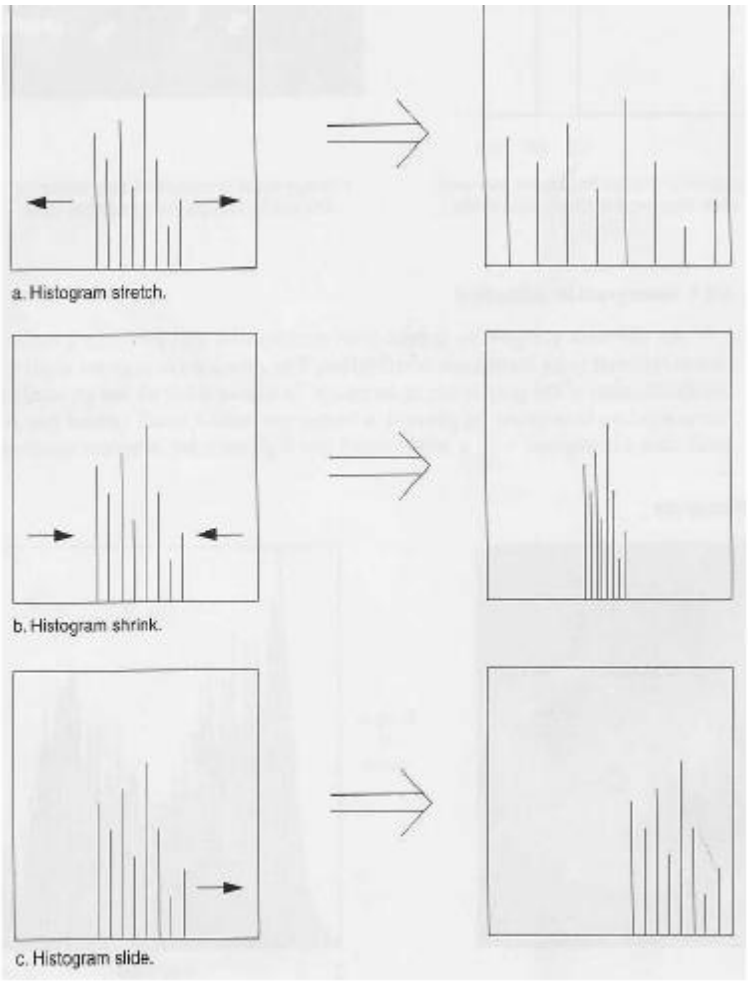


Figure (2-18): Histogram Modifications.

· The mapping function for histogram stretch can be found by the following equation:

$$\text{Stretch (I (r, c))} = \left[\frac{I(r,c) - I(r,c)_{\min}}{I(r,c)_{\max} - I(r,c)_{\min}} \right] [MAX\text{-}MIN] + MIN.$$

Where, $I(r,c)_{max}$ is the largest gray- level in the image I(r,c).

$I(r,c)_{min}$ is the smallest gray- level in the image I(r,c).

MAX and MIN correspond to the maximum and minimum gray –

level values possible (for an 8-bit image these are 255 and 0).

This equation will take an image and stretch the histogram a cross the entire

gray-level range which has the effect of increasing the contrast of a low

contrast image (see figure (2-19) of histogram stretching).

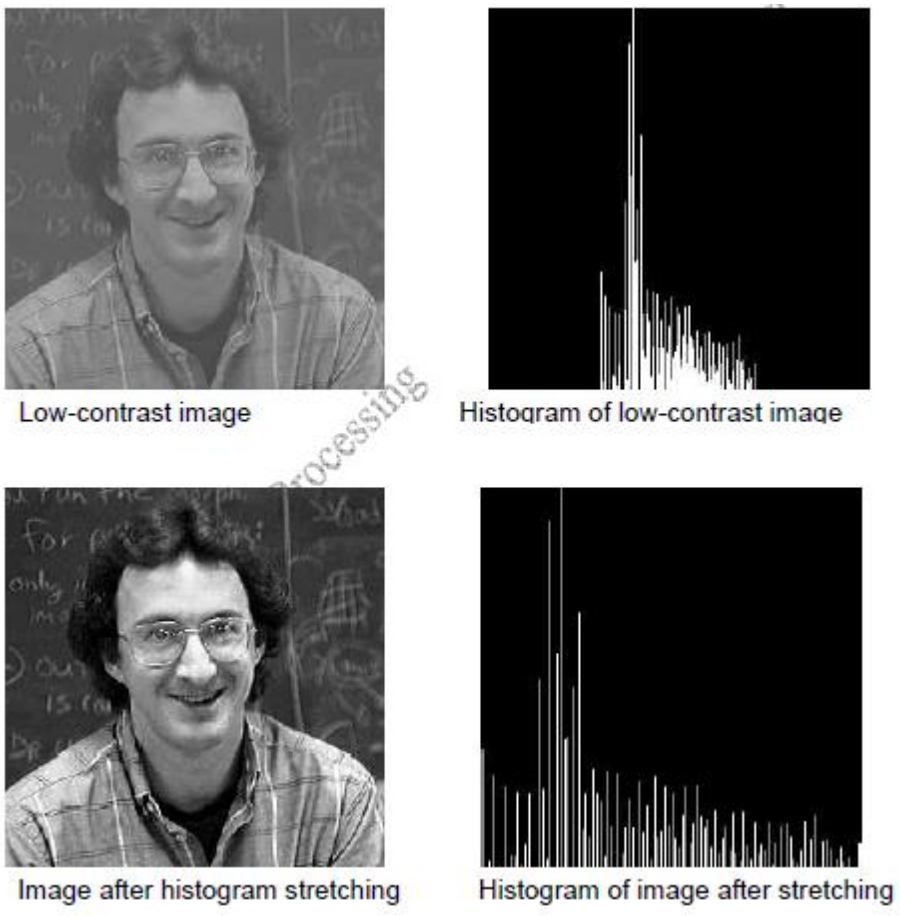
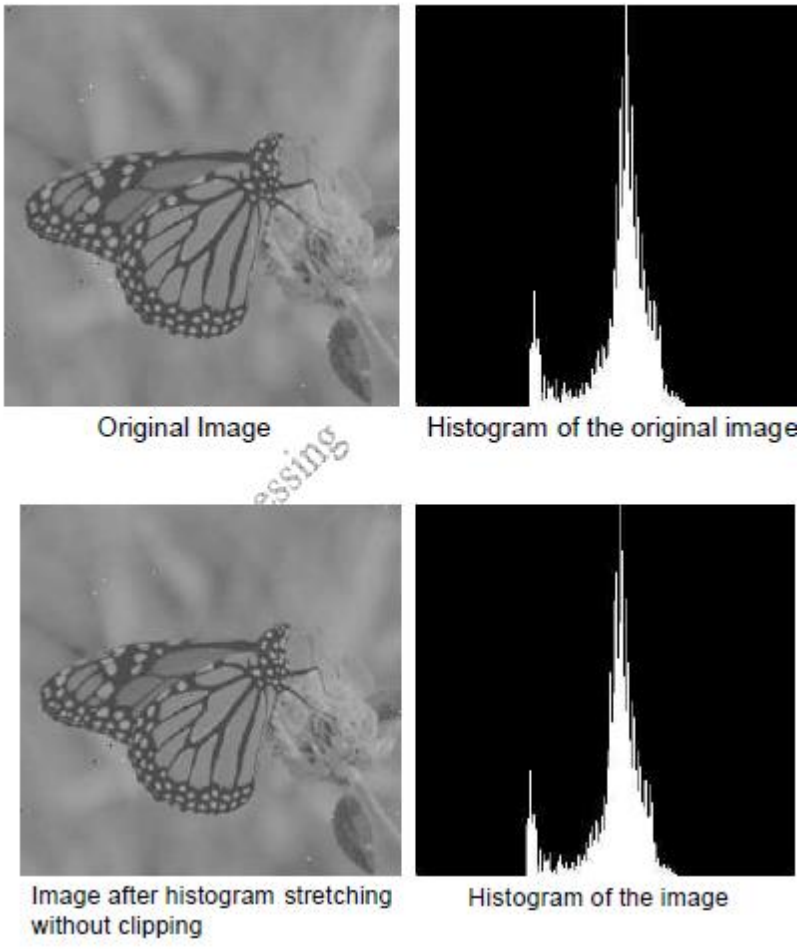
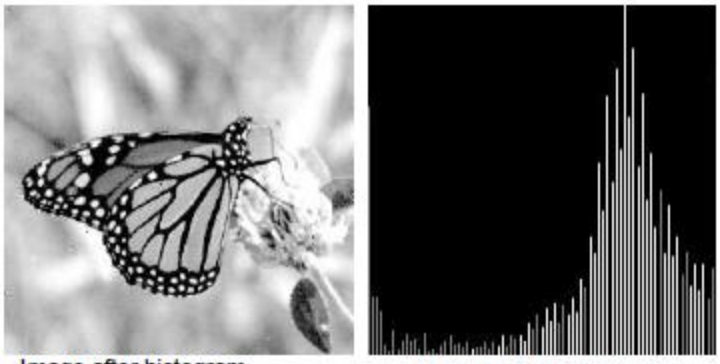


Figure (2-19): Histogram Stretching.

In most of the pixel values in an image fall within small range, but a few

outlines force the histogram to span the entire range, a pure histogram stretch will not improve the image. In this case it is useful to allow a small proceeding of the pixel values to be aliped at the low and high end of the range (for an 8-bit image this means truncating at 0 and 255). See figure (2.20) of stretched and clipped histogram).





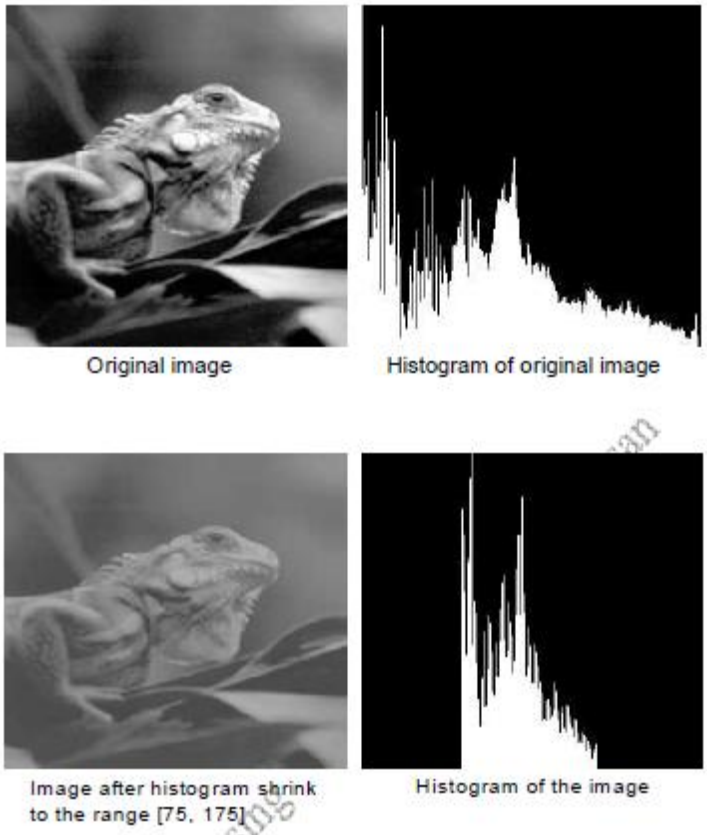
Figurer (2-20): Histogram Stretching (Clipping).

· The opposite of a histogram stretch is a histogram shrink, which will decrease image contrast by compressing the gray levels. The mapping function for a histogram shrinking can be found by the following equation:

$$\text{Shrink (I(r,c))} = \left[\frac{Shrink_{\max} - Shrink_{\min}}{I(r,c)_{\max} - I(r,c)_{\min}} \right] [\, I(r,c) - I(r,c)_{min}] + Shrink_{min}$$

$Shrink_{max}$ and $shrink_{min}$ correspond to the maximum and minimum desired in the compressed histogram. In general, this process produces an image of reduced contrast and may not seem to be useful an image enhancement (see figure (2-21) of shrink histogram).

Histogram



Figurer (2.20): Histogram Shrinking.

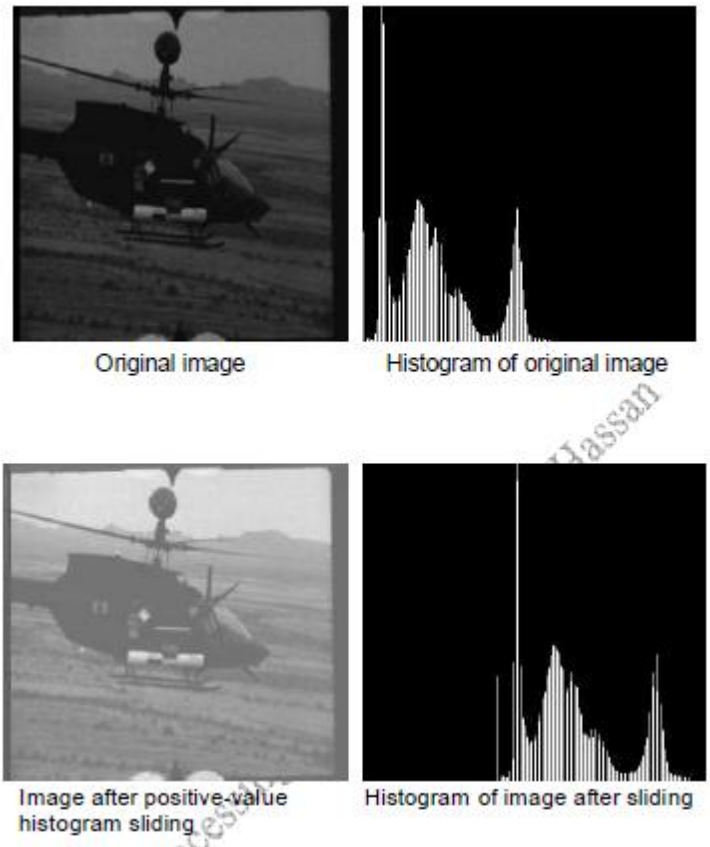
· The histogram slide techniques can be used to make an image either darker or lighter but retain the relationship between gray-level values. This can be a accomplished by simply adding or subtracting a fixed number for all the gray-level values, as follows:

Slide (I(r,c)) = I (r,c)+ OFFSET.

Where OFFSET values is the amount to slide the histogram.

In this equation, a positive OFFSET value will increase the overall brightness; where as a negative OFFSET will create a darker image, figure

(2-22) shows histogram sliding.



Figurer (2.21): Histogram Sliding.