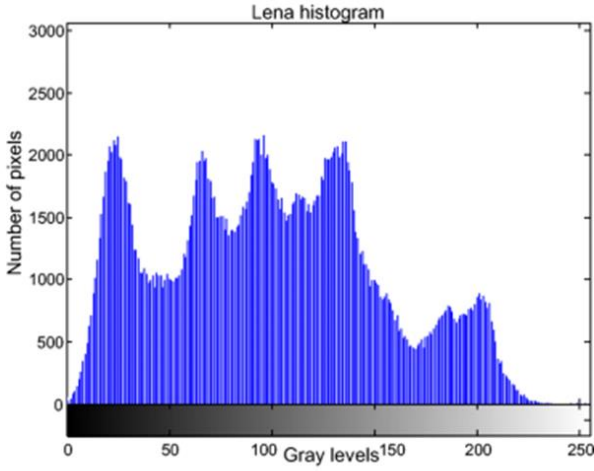
Applications of image histograms

(a)



(b)

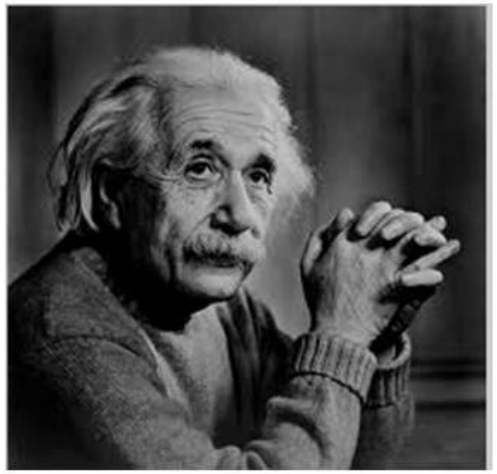
- Histograms are used to analyze image: We can predict the properties of an image by looking at the histogram.
- Histograms can be used to identify image acquisition issues. We can study whether the image is over or under exposure to light.
- The dynamic range of an image can be studied from the histogram.
- The shape of histogram predicts information about the possibility of contrast enhancement.
- Histograms can be used to adjust the contrast of an image.
- Histograms can be used to thresholding an image.

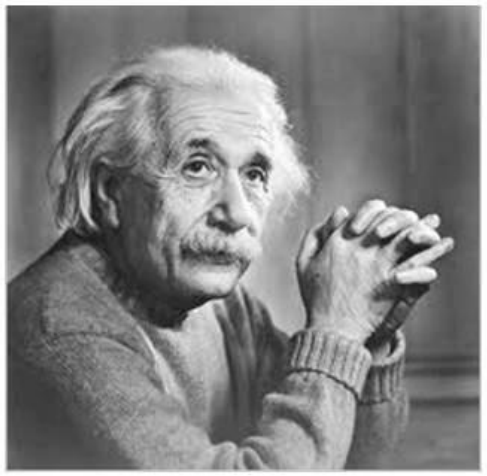
Image Brightness

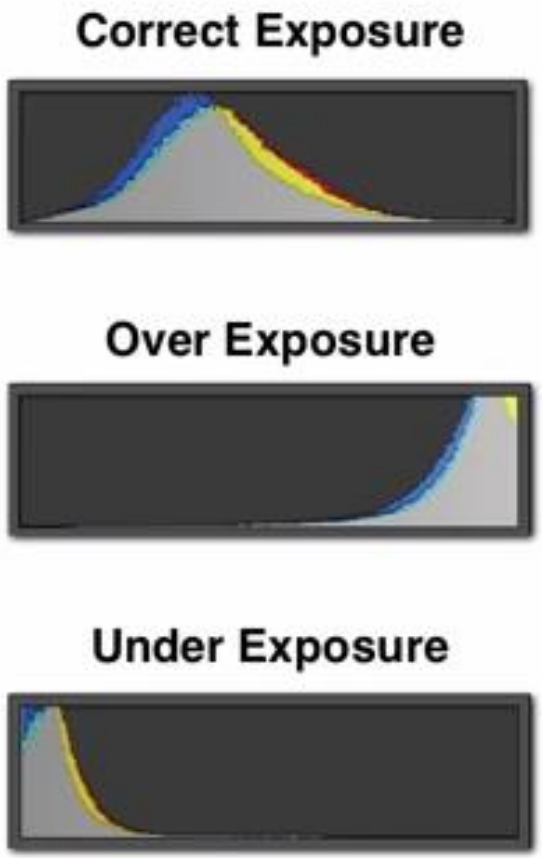
Average image brightness can be calculated as :

$$B(I) = \frac{1}{mn}\sum_{i=1}^{m}\sum_{j=1}^{n} I(i,j)$$

Brightness can be simply increased or decreased by simple addition or subtraction, to the image matrix.





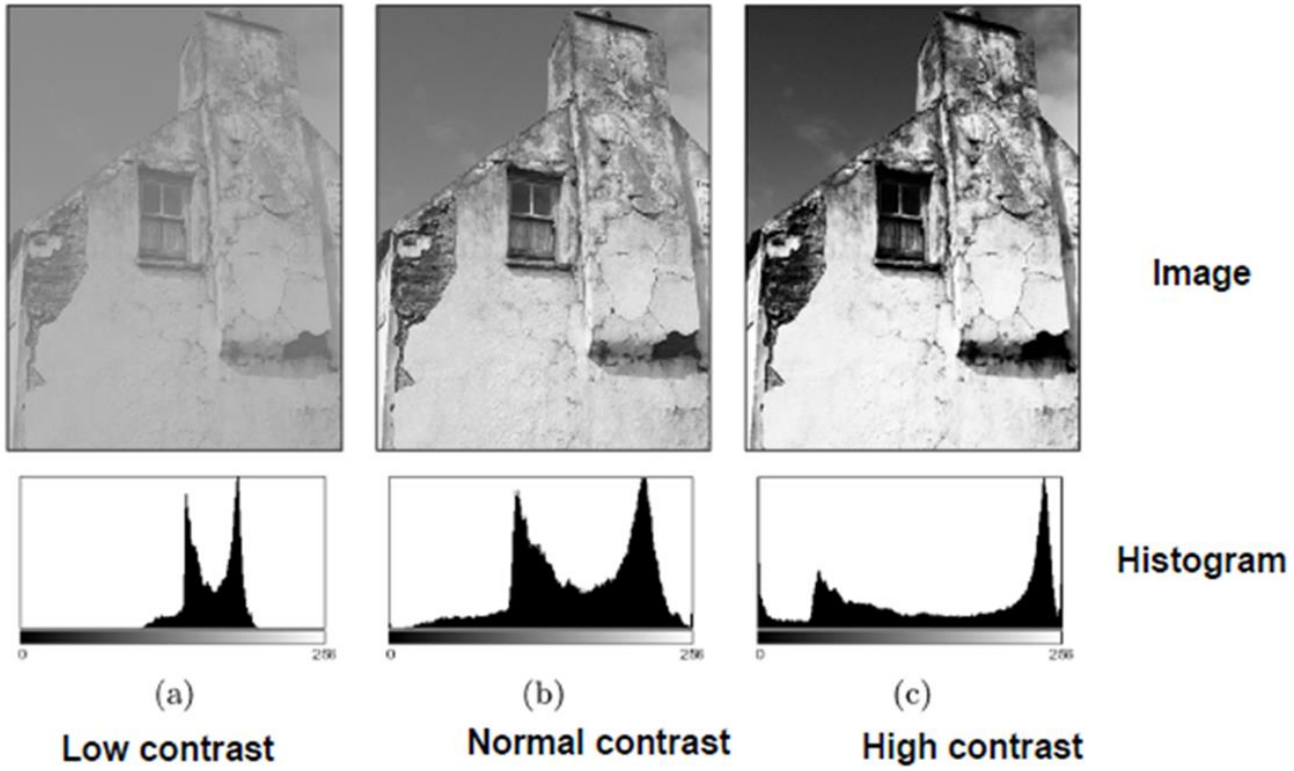

Correct Exposure
Over Exposure
Under Exposure

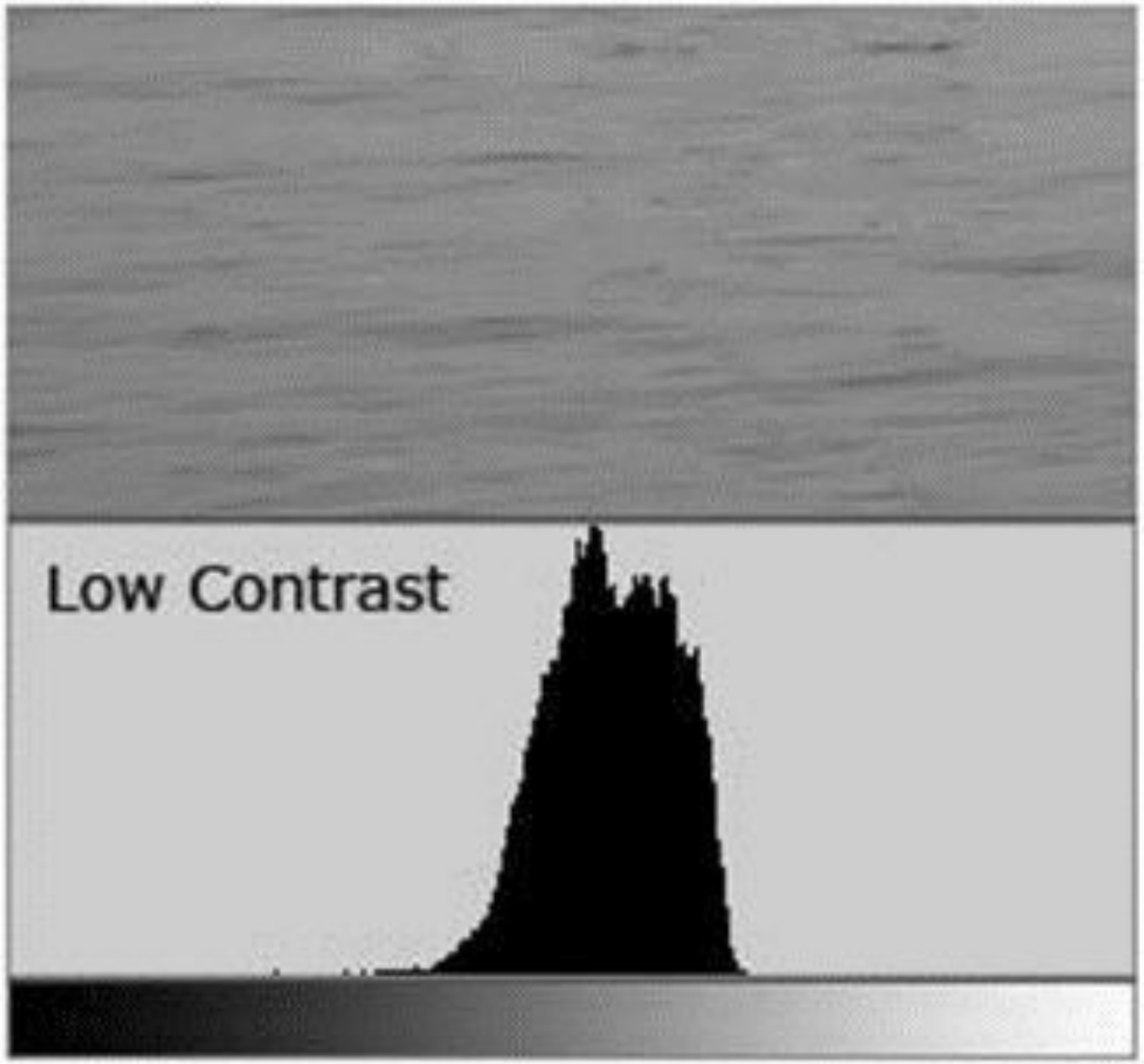

Overexposed
Underexposed
Proper Exposure

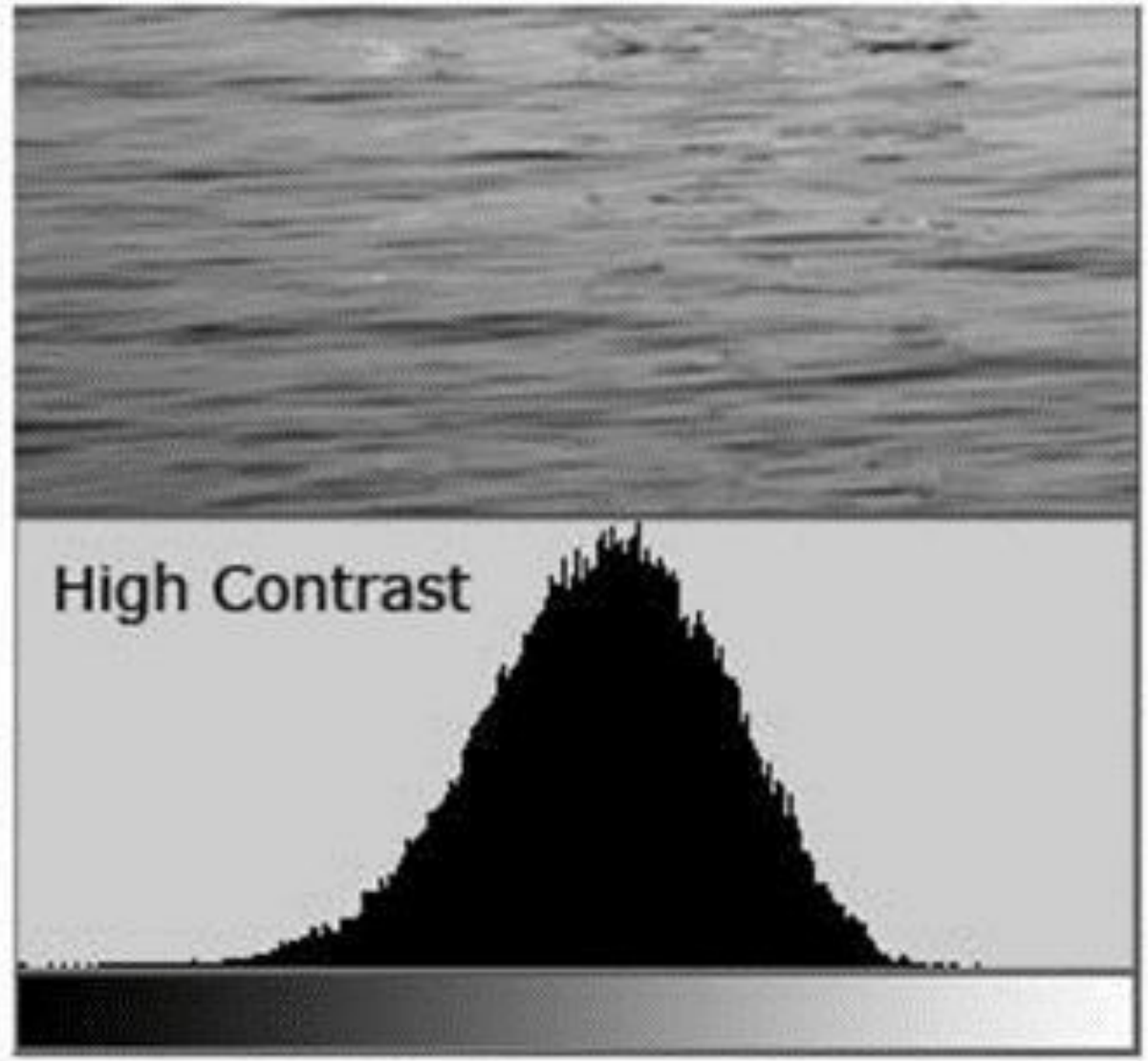
Image Contrast

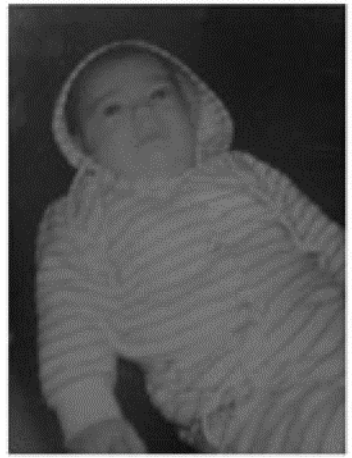
The contrast of a grayscale image indicates how easily objects in an image can be distinguished.

In a high contrast image there will be many distinct intensity values. But in low contrast image there will be only few intensity values.

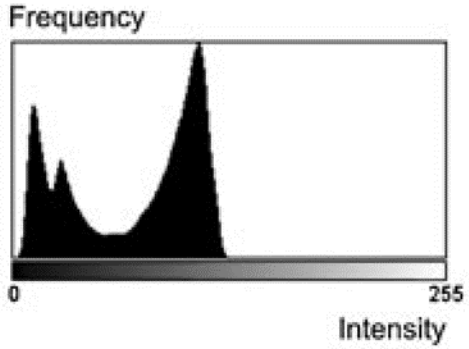


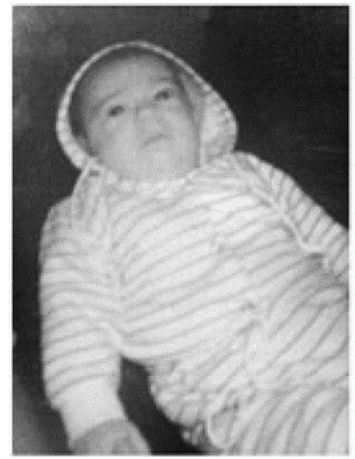

Low Contrast


High Contrast

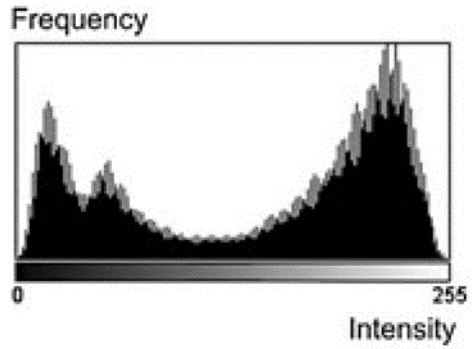


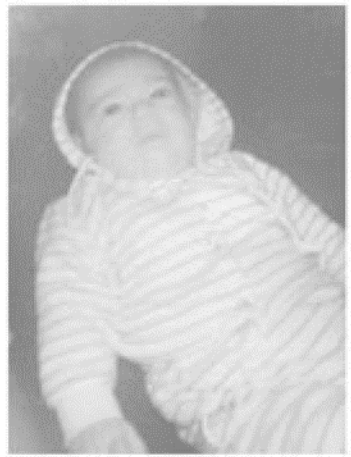
Dark image



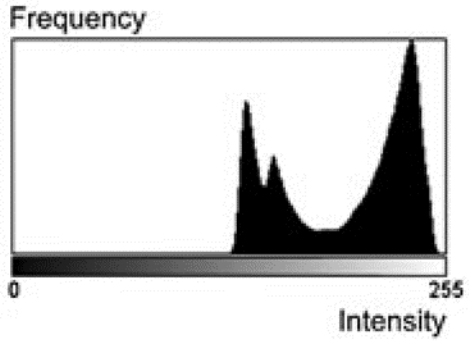


High contrast image

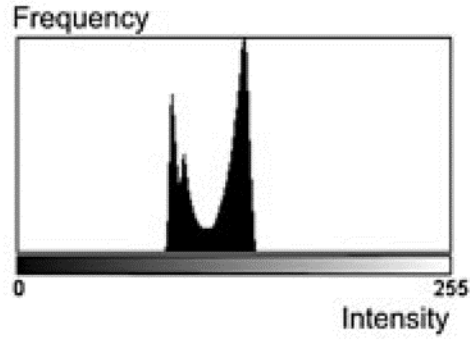




Bright image



Low contrast image



Contrast Equation ?

Different equations for contrast exists. For eg :

$$C\ (I) = \frac{\max(I) - \min(I)}{maz(I) + \min(I)}$$

- This equation work well for simple images with 2 luminances (uniform foreground and background)
- Does not work well for complex scenes with many luminances