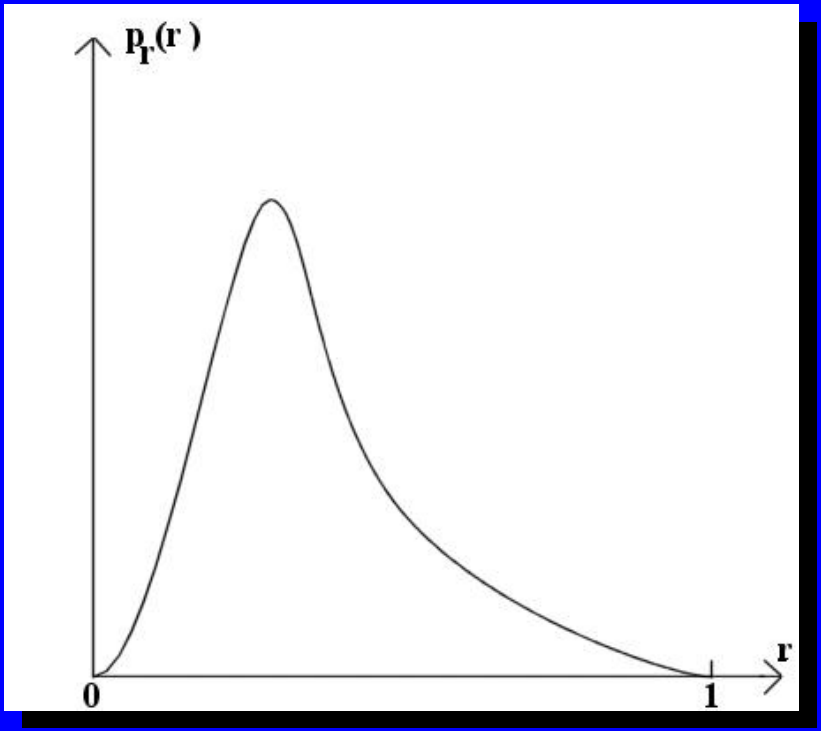
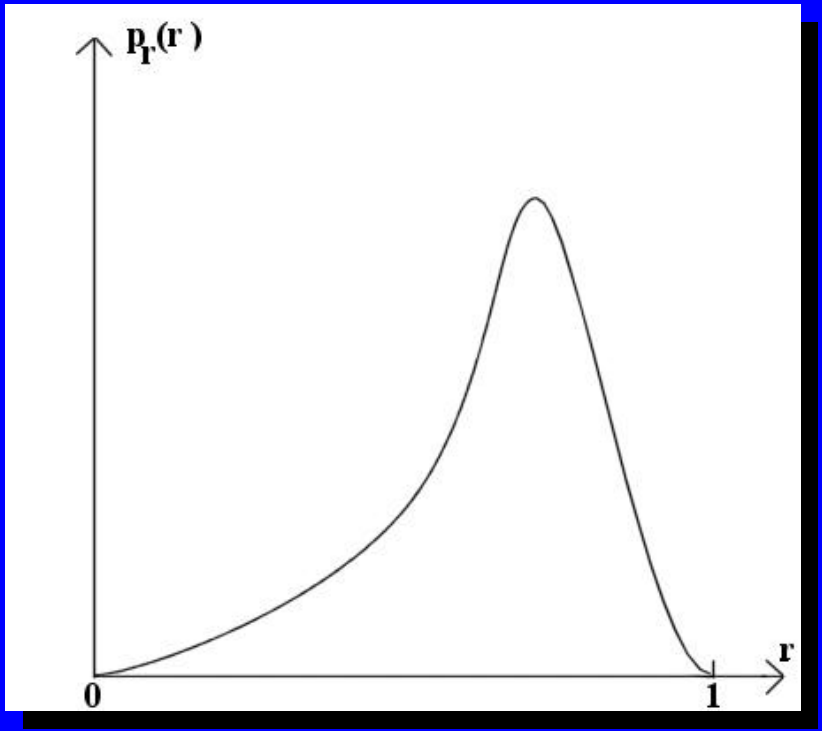
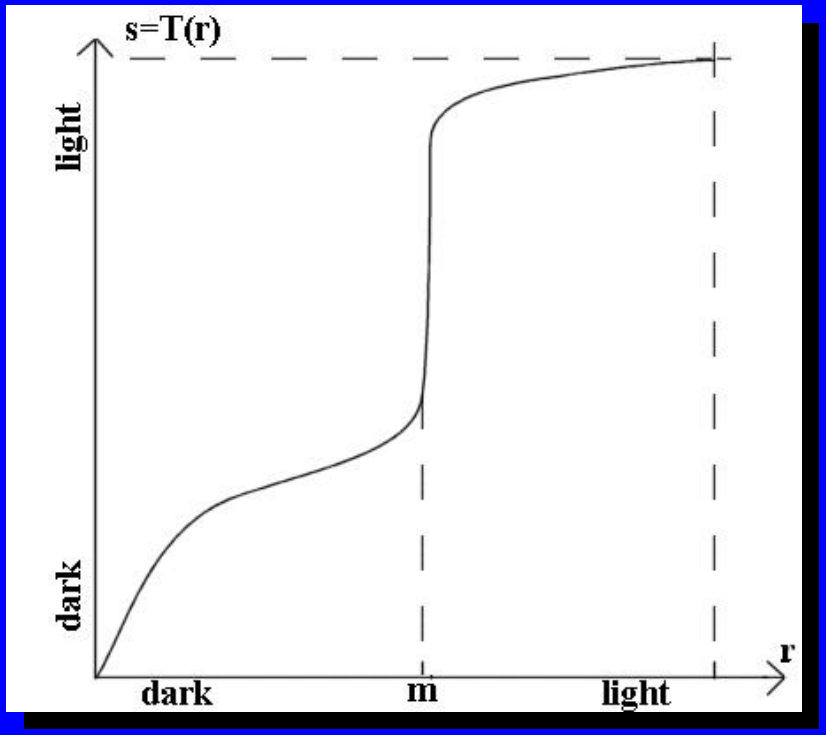
HISTOGRAM TRANSFORMATION

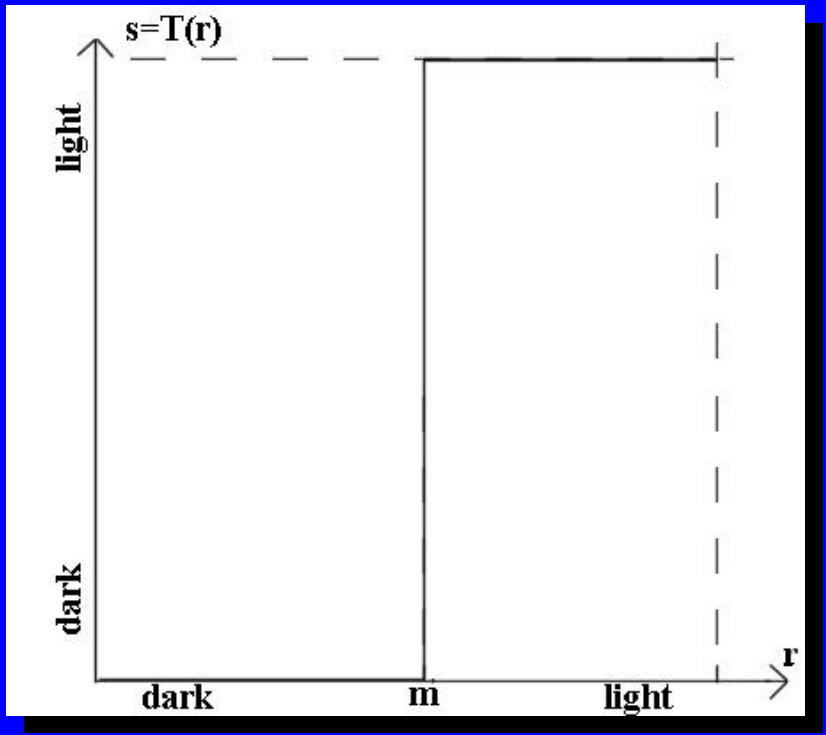
HISTOGRAM EXAMPLES





HISTOGRAM STRETCHING





HISTOGRAM EQUALIZATION

Let the variable r represent the gray level. For any r in the interval [0,1] (with r=0 representing black, and r=1 representing white), consider the transformation:

$$s=T(r) \qquad (1)$$

It is assumed that T satisfies the conditions:

- T(r) is singel valued and monotonically increasing in the interval $0 \le r \le 1$
- $0 \le T(r) \le 1$ for $0 \le r \le 1$

Condition a) preserves the order from black to white, whereas condition b) guaranties a mapping that is consistant with the allowed range of pixel values.

Let the original and transformed gray levels be considered random quantities in the interval [0,1] with probability density functions $p_r(r)$ and $p_s(s)$, respectively.

Then,

$$p_s(s) = \left[p_r(r) \frac{dr}{ds} \right] \qquad (2)$$

Consider the transformation function:

$$s = T(r) = \int_0^r p_r(w)dw \quad 0 \le r \le 1 \tag{3}$$

From (3) we get:

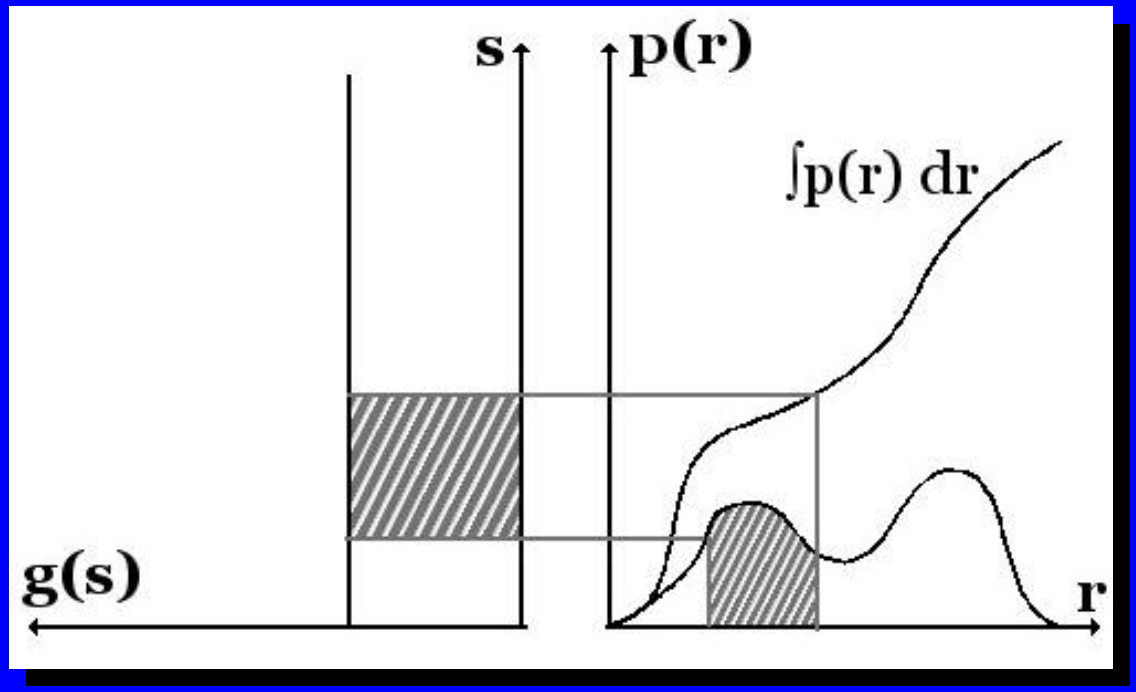
$$\frac{ds}{dr} = p_r(r) \tag{4}$$

Substituting in (2) gives:

$$p_s(s) = \left[p_r(r) \frac{1}{p_r(r)} \right] = 1 \qquad 0 \le s \le 1 \tag{5}$$

Equalisation

- s=T(r), where
  - r=old grayscale
  - s=new grayscale
  - T=transformation



Equalisation: choose $T(r) = \int_0^r p_r(w)dw$

•keeps the order between the values. A dark area will remain dark.

•increases contrast between pixels with similar graylevels.

When should you use it?