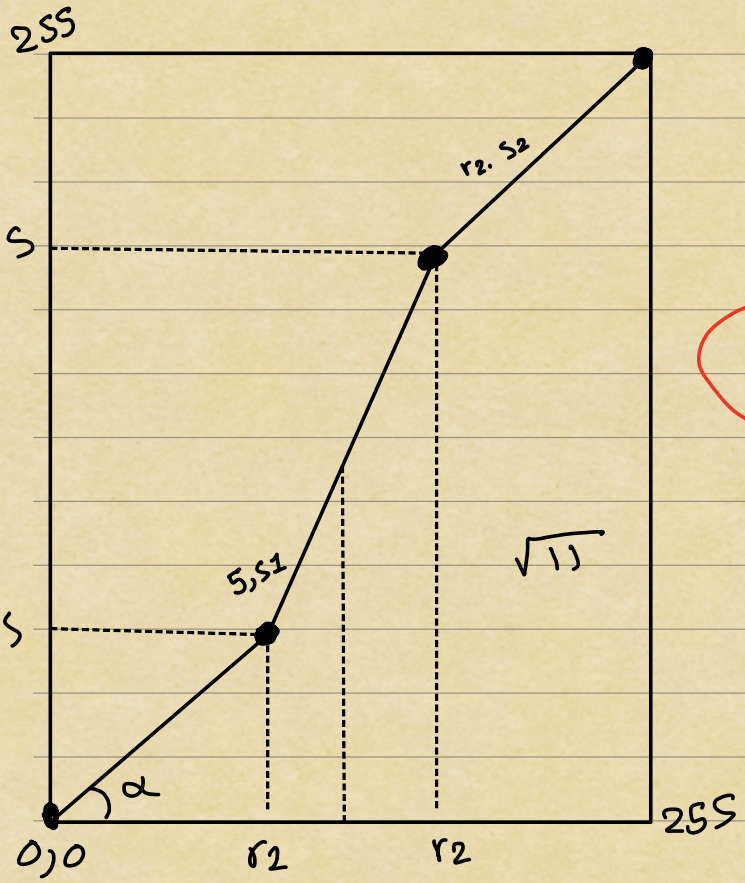
Histogram Equalization



$r_1 - r_2 \Rightarrow s =$

$$\frac{r - r_1}{r_2 - r_1} = \frac{s - s_1}{s_2 - s_1}$$

$$s = \frac{(r - r_1)(s_2 - s_1)}{r_2 - r_1} + s_1$$

$r_2 - r_2 = 7$

EX

Example: Histogram Equalization

Suppose that a 3-bit image (L=8) of size 64 × 64 pixels (MN = 4096) has the intensity distribution shown in following table.
Get the histogram equalization transformation function and give the $p_s(s_k)$ for each s_k.

r_k	n_k	$p_r(r_k) = n_k/MN$
$r_0 = 0$	790	0.19
$r_1 = 1$	1023	0.25
$r_2 = 2$	850	0.21
$r_3 = 3$	656	0.16
$r_4 = 4$	329	0.08
$r_5 = 5$	245	0.06
$r_6 = 6$	122	0.03
$r_7 = 7$	81	0.02

TABLE 3.1 Intensity distribution and histogram values for a 3-bit, 64 × 64 digital image.

Example: Histogram Equalization

r_k	n_k	$p_r(r_k) = n_k/MN$
$r_0 = 0$	790	0.19
$r_1 = 1$	1023	0.25
$r_2 = 2$	850	0.21
$r_3 = 3$	656	0.16
$r_4 = 4$	329	0.08
$r_5 = 5$	245	0.06
$r_6 = 6$	122	0.03
$r_7 = 7$	81	0.02

$$s_0 = T(r_0) = 7\sum_{j=0}^{0} p_r(r_j) = 7 \times 0.19 = 1.33 \rightarrow 1$$

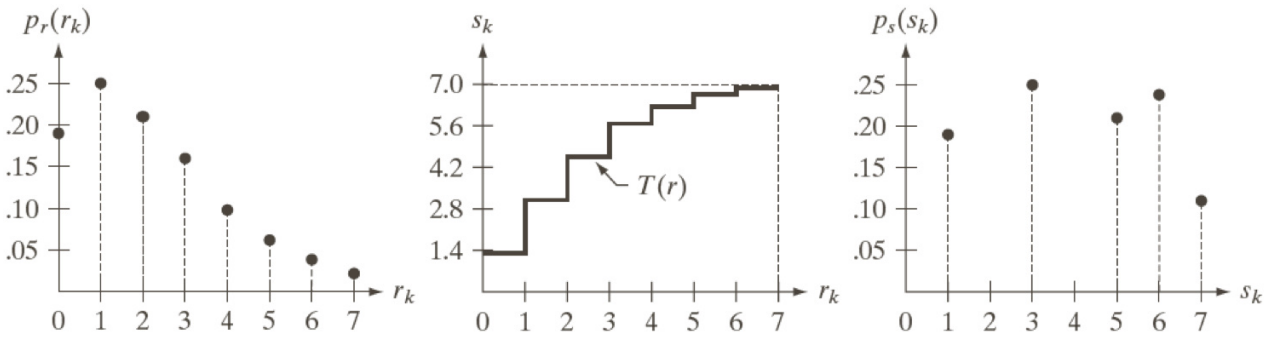
$$s_1 = T(r_1) = 7\sum_{j=0}^{1} p_r(r_j) = 7 \times (0.19 + 0.25) = 3.08 \rightarrow 3$$

$$s_2 = 4.55 \rightarrow 5 \qquad s_3 = 5.67 \rightarrow 6$$

$$s_4 = 6.23 \rightarrow 6 \qquad s_5 = 6.65 \rightarrow 7$$

$$s_6 = 6.86 \rightarrow 7 \qquad s_7 = 7.00 \rightarrow 7$$

Example: Histogram Equalization



a b c

FIGURE 3.19 Illustration of histogram equalization of a 3-bit (8 intensity levels) image. (a) Original histogram. (b) Transformation function. (c) Equalized histogram.

Keep in mind the Following

2-bit = 4
3-bit = 7

Ex-1

Suppose that a 3-bit image (L=8) of size 64 × 64 pixels (MN = 4096) has the intensity distribution shown in following table.
Get the histogram equalization transformation function and give the ps (sk) for each sk

r_k	n_k	$Pr=(r_k/MN)$
$r_0 = 0$	790	0.19
$r_1 = 1$	1023	0.25
$r_2 = 2$	850	0.21
$r_3 = 3$	656	0.16
$r_4 = 4$	329	0.08
$r_5 = 5$	245	0.06
$r_6 = 6$	122	0.03
$r_7 = 7$	81	0.02

Step-1 Finding SK

$$SK = T(rk) = (L-1)\sum_{J=0}^{K} Pr(rj) \quad K=0,1,2,\dots L-1$$

$S_0 = 7(0.19) = 1.33 \Rightarrow 1$

$S_1 = 7(0.19+0.25) = 3.08 \Rightarrow 3$

$S_2 = 7(0.19+0.25+0.21) = 4.55 \Rightarrow 5$

$S3 = 7(0.19 + 0.25 + 0.21 + 0.16) = 5.67 = 6$

$S4 = 7(0.19 + 0.25 + 0.21 + 0.16 + 0.08) = 6.23 \Rightarrow 6$

$S5 = 7(0.19 + 0.25 + 0.21 + 0.16 + 0.08 + 0.06) = 6.65 \Rightarrow 7$

$S6 = 7(0.19 + 0.25 + 0.21 + 0.16 + 0.08 + 0.06 + 0.03) = 6.86 \Rightarrow 7$

$S7 = (0.19 + 0.25 + 0.21 + 0.16 + 0.08 + 0.06 + 0.03 + 0.02) = 7.00 \Rightarrow 7$

Step-2 Finding SK

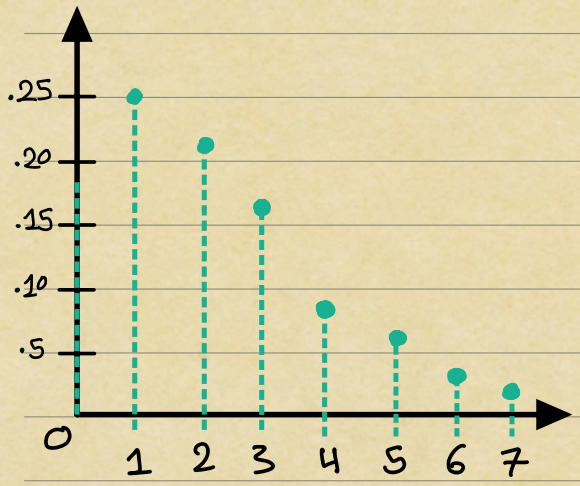
we need to Find the PS(SK) Value

We will add the similer Value of the SK result

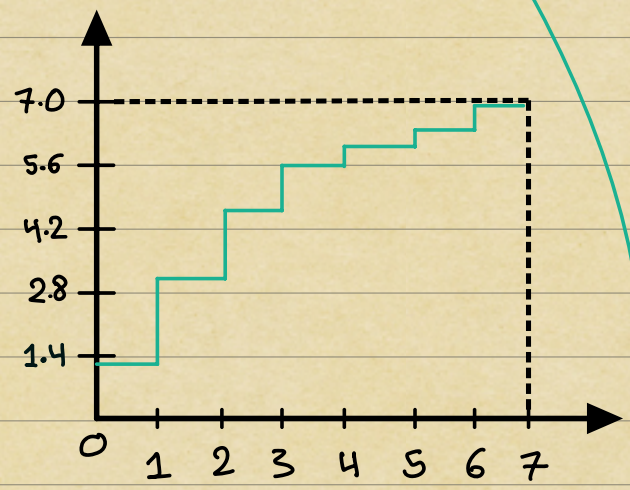
$r0 = 0.19$
$r1 = 0.25$
$r2 = 0.21$
$r3 = 0.24$
$r5 = 0.11$

Step-3 The greph

Pr(rk)



Sk



Ps(sk)