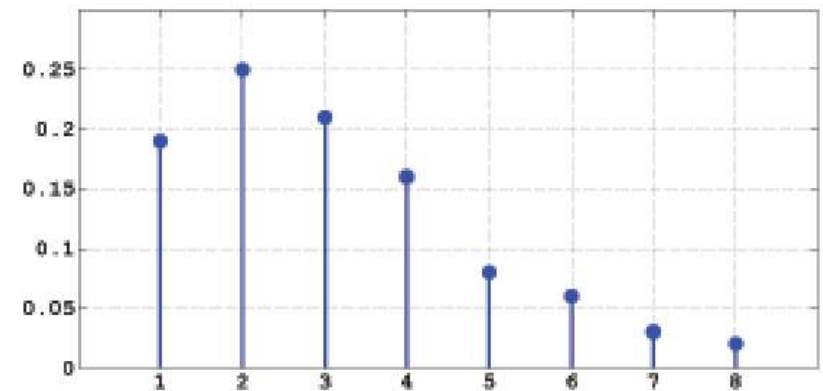


# Recap: Histogram Equalization

Example.  $64 \times 64$  input image.

- $M \times N = 64 \times 64 = 4096$ .
- 3 bits/pixel.
- Gray levels range from 0 to  $L - 1$ , where  $L = 2^3 = 8$ .

| $r_k$     | $n_k$ | $p_r(r_k) = n_k/MN$ |
|-----------|-------|---------------------|
| $r_0 = 0$ | 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                |



# Recap: Histogram Equalization

Example.  $64 \times 64$  input image.

- $M \times N = 64 \times 64 = 4096$ .
- 3 bits/pixel.
- gray levels range from 0 to  $L - 1$ , where  $L = 2^3 = 8$ .

|           |       | Normalized H | CDF        | $s_r = T_r = (L-1) * P_c(r_k)$ |
|-----------|-------|--------------|------------|--------------------------------|
| $r_k$     | $n_k$ | $p_r(r_k)$   | $P_c(r_k)$ | $T(r)$                         |
| $r_0 = 0$ | 790   | 0.19         | 0.19       | 1                              |
| $r_1 = 1$ | 1023  | 0.25         | 0.44       | 3                              |
| $r_2 = 2$ | 850   | 0.21         | 0.65       | 5                              |
| $r_3 = 3$ | 656   | 0.16         | 0.81       | 6                              |
| $r_4 = 4$ | 329   | 0.08         | 0.89       | 6                              |
| $r_5 = 5$ | 245   | 0.06         | 0.95       | 7                              |
| $r_6 = 6$ | 122   | 0.03         | 0.98       | 7                              |
| $r_7 = 7$ | 81    | 0.02         | 1.00       | 7                              |

# Recap: Histogram Equalization

- To calculate hist. of transformed image  $H_s(s)$ ;
  - for each value of  $s$ ,
  - find values of  $r$  where  $s = T(r)$
  - sum  $H_r(r)$  for those values
- Example. Take  $s = T(r) = 6$ 
  - $T(r) = 6$  for  $r = 3, 4$
  - $H_s(6) = H_r(3) + H_r(4) = 656 + 329 = 985$

| $r_k$     | $n_k$ | $p_r(r_k)$ | $P_c(r_k)$ | $T(r)$ |
|-----------|-------|------------|------------|--------|
| $r_0 = 0$ | 790   | 0.19       | 0.19       | 1      |
| $r_1 = 1$ | 1023  | 0.25       | 0.44       | 3      |
| $r_2 = 2$ | 850   | 0.21       | 0.65       | 5      |
| $r_3 = 3$ | 656   | 0.16       | 0.81       | 6      |
| $r_4 = 4$ | 329   | 0.08       | 0.89       | 6      |
| $r_5 = 5$ | 245   | 0.06       | 0.95       | 7      |
| $r_6 = 6$ | 122   | 0.03       | 0.98       | 7      |
| $r_7 = 7$ | 81    | 0.02       | 1.00       | 7      |

| $s_k$     | $H_s(s)$ |
|-----------|----------|
| $s_0 = 0$ | 0        |
| $s_1 = 1$ | 790      |
| $s_2 = 2$ | 0        |
| $s_3 = 3$ | 1023     |
| $s_4 = 4$ | 0        |
| $s_5 = 5$ | 850      |
| $s_6 = 6$ | 985      |
| $s_7 = 7$ | 448      |