



# Section 3

## Histogram Equalization, Filtration in Frequency Domain, and Hough Transform

Presentation by *Asem Alaa*

# Histogram Processing: Equalization

- Intensity image (3 bits): [0-7]
- Image size =  $64 \times 64 = 4096$

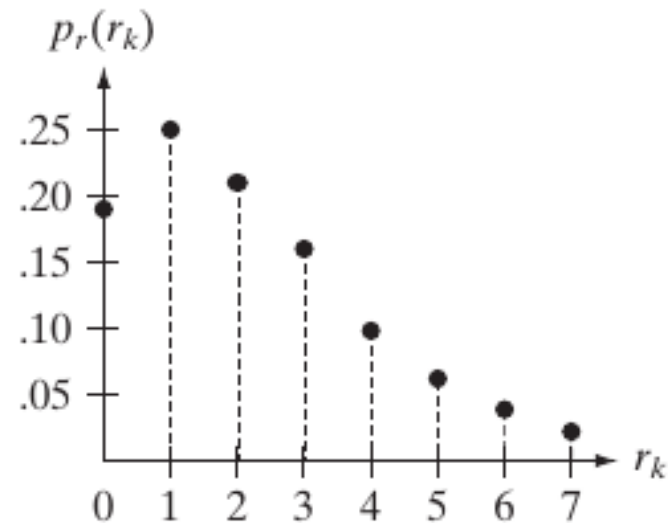
**Step 1: Compute the discrete PDF (histogram)**

# Histogram Processing: Equalization

- Intensity image (3 bits): [0-7]
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## Step 1: Compute the discrete PDF (histogram)

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



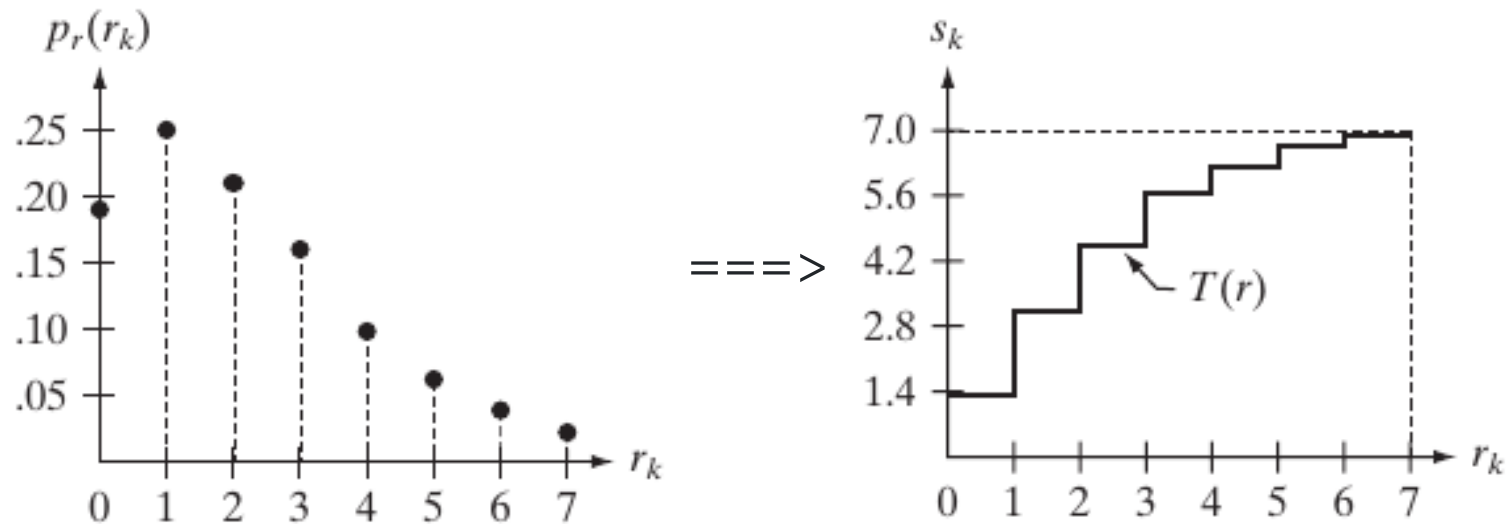
# Histogram Processing: Equalization (cont'd)

**Step 2: Compute the discrete CDF (cumulative histogram)**

<b>i</b>	<b>accumulative</b>	<b>accumulative x 7</b>	<b>rounded</b>
<b>s0</b>	0.19	1.33	1
<b>s1</b>	0.44	3.08	3
<b>s2</b>	0.65	4.55	5
<b>s3</b>	0.81	5.67	6
<b>s4</b>	0.89	6.23	6
<b>s5</b>	0.95	6.65	7
<b>s6</b>	0.98	6.86	7
<b>s7</b>	1.00	7.00	7

# Histogram Processing: Equalization (cont'd)

**Step 2: Compute the discrete CDF (cumulative histogram)**



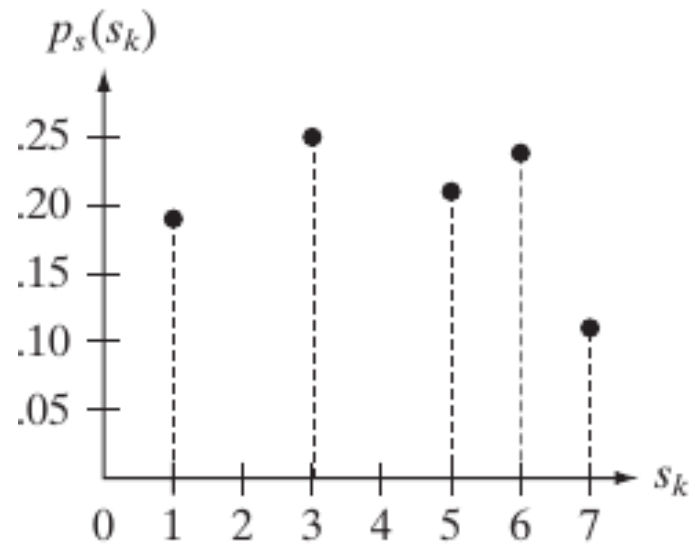
# **Histogram Processing: Equalization**

## **(cont'd)**

**Step 3: Use the previous table to map the pixels values**

# Histogram Processing: Equalization (cont'd)

**Step 3: Use the previous table to map the pixels values**



# Histogram Processing: Matching

- Intensity image (3 bits): [0-7]
- Image size =  $64 \times 64 = 4096$

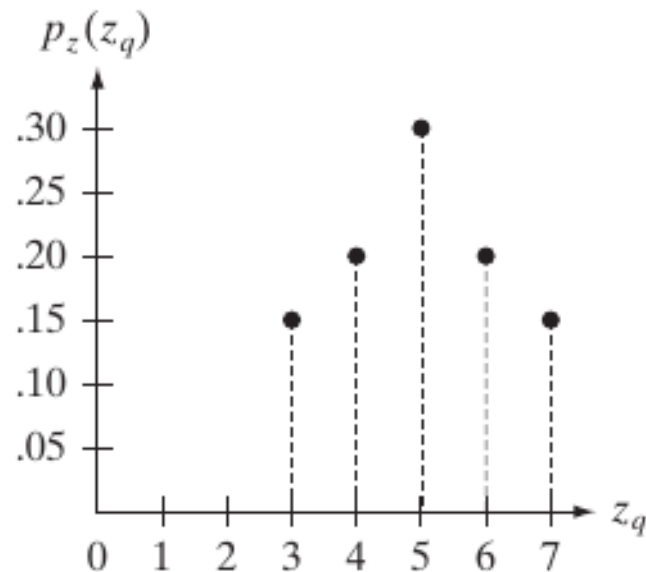


# Histogram Processing: Matching

- Intensity image (3 bits): [0-7]
- Image size =  $64 \times 64 = 4096$
- Obtain an image with an **arbitrary distribution** instead of a uniform distribution

# Histogram Processing: Matching

- Intensity image (3 bits): [0-7]
- Image size =  $64 \times 64 = 4096$
- Obtain an image with an **arbitrary distribution** instead of a uniform distribution
- Target distribution



# Histogram Processing: Matching (cont'd)

**Step 1: Obtain the scaled histogram equalized values (previous example)**

- $s_0 = 1$   $s_1 = 3$   $s_2 = 5$   $s_3 = 6$
- $s_4 = 7$   $s_5 = 7$   $s_6 = 7$   $s_7 = 7$

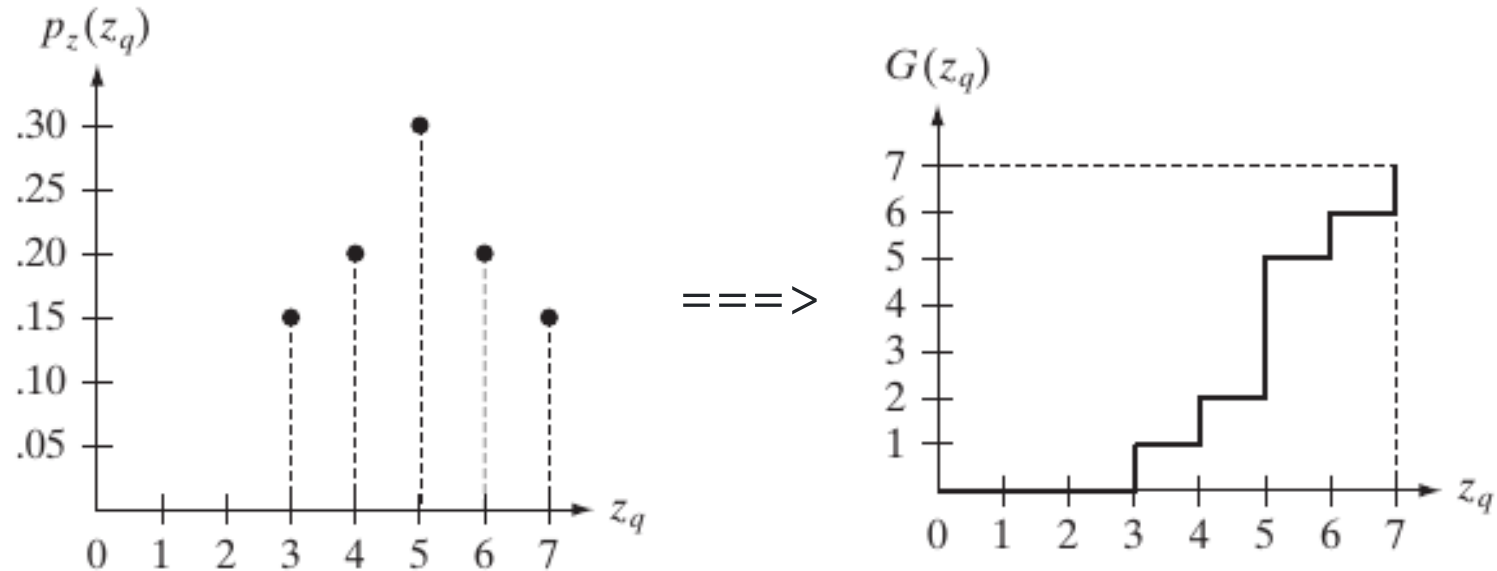
# Histogram Processing: Matching (cont'd)

**Step 2: compute the discrete CDF of the target distribution**

<b>i</b>	<b>accumulative x 7</b>	<b>rounded</b>
<b>z0</b>	0.00	0
<b>z1</b>	0.00	0
<b>z2</b>	0.00	0
<b>z3</b>	1.05	1
<b>z4</b>	2.45	2
<b>z5</b>	4.55	5
<b>z6</b>	5.95	6
<b>z7</b>	7.00	7

# Histogram Processing: Matching

**Step 2: compute the discrete CDF of the target distribution**

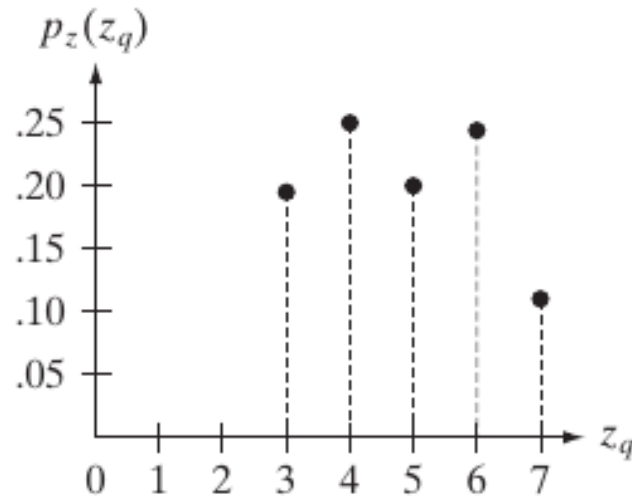


# Histogram Processing: Matching

**Step 3: use the previous table to map the pixels values**

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# Histogram Processing: Demo



{histograms.ipnyb}



# Filtration in Frequency Domain: Demo



{frequency\_filter.ipnyb}