

Histogram Equalization

Enhances the image contrast and light balance by statistical analysis.

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- Calculate CDF
- Multiply CDF value with max value ($2^B - 1$)
- This will be the new value of that particular brightness level
- Replace all values with the new ones.
- Use floor instead of rounding.

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3 bit 4x3 image

$\begin{bmatrix} 6 & 7 & 5 & 6 \\ 7 & 7 & 6 & 5 \\ 4 & 7 & 0 & 6 \end{bmatrix}$

values	Counts	PDF	CDF
0			
1			
2			
3			
4			
5			
6			
7			

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values	Counts	PDF	CDF
0	1	0.08	0.08
1	0	0	0.08
2	0	0	0.08
3	0	0	0.08
4	1	0.08	0.17
5	2	0.17	0.34
6	4	0.33	0.67
7	4	0.33	1

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$\begin{bmatrix} 6 & 7 & 5 & 6 \\ 7 & 7 & 6 & 5 \\ 4 & 7 & 0 & 6 \end{bmatrix}$

values	Counts	PDF	CDF	$\times \text{max}(7)$	floor
0	1	0.08	0.08	0.56	0
1	0	0	0.08	0.56	0
2	0	0	0.08	0.56	0
3	0	0	0.08	0.56	0
4	1	0.08	0.17	1.19	1
5	2	0.17	0.34	2.38	2
6	4	0.33	0.67	4.69	4
7	4	0.33	1	7	7

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0	1	0.08	0.08	0.56	0
1	0	0	0.08	0.56	0
2	0	0	0.08	0.56	0
3	0	0	0.08	0.56	0
4	1	0.08	0.17	1.19	1
5	2	0.17	0.34	2.38	2
6	4	0.33	0.67	4.69	4
7	4	0.33	1	7	7

very dark (4)
to dark

→ mid tones (4)

→ very light (4)

$\begin{bmatrix} 4 & 7 & 2 & 4 \\ 7 & 7 & 4 & 2 \\ 1 & 7 & 0 & 4 \end{bmatrix}$

replace these

with these