

Image Compression



Data Redundancy

Data

Information

Data Redundancy (R)

$$R = 1 - \frac{1}{C}$$

Compression ratio (C)

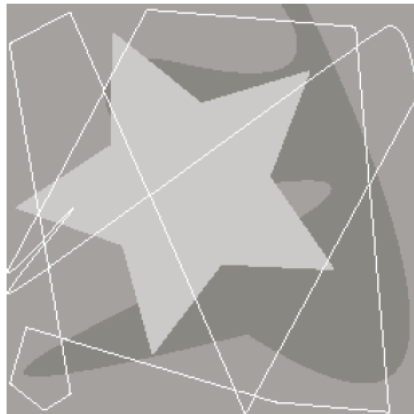
$$C = \frac{b}{b'}$$

Data Redundancy

Coding redundancy

Spatial & Temporal redundancy

Irrelevant information



Coding Redundancy

Fixed length coding

Variable length coding

$$p_r(r_k) = \frac{n_k}{MN} \quad k = 0, 1, 2, \dots, L - 1$$

$$L_{\text{avg}} = \sum_{k=0}^{L-1} l(r_k) p_r(r_k)$$

$$MNL_{\text{avg}}.$$

Coding Redundancy

r_k	$p_r(r_k)$	Code 1	$l_1(r_k)$	Code 2	$l_2(r_k)$
$r_{87} = 87$	0.25	01010111	8	01	2
$r_{128} = 128$	0.47	10000000	8	1	1
$r_{186} = 186$	0.25	11000100	8	000	3
$r_{255} = 255$	0.03	11111111	8	001	3
r_k for $k \neq 87, 128, 186, 255$	0	—	8	—	0

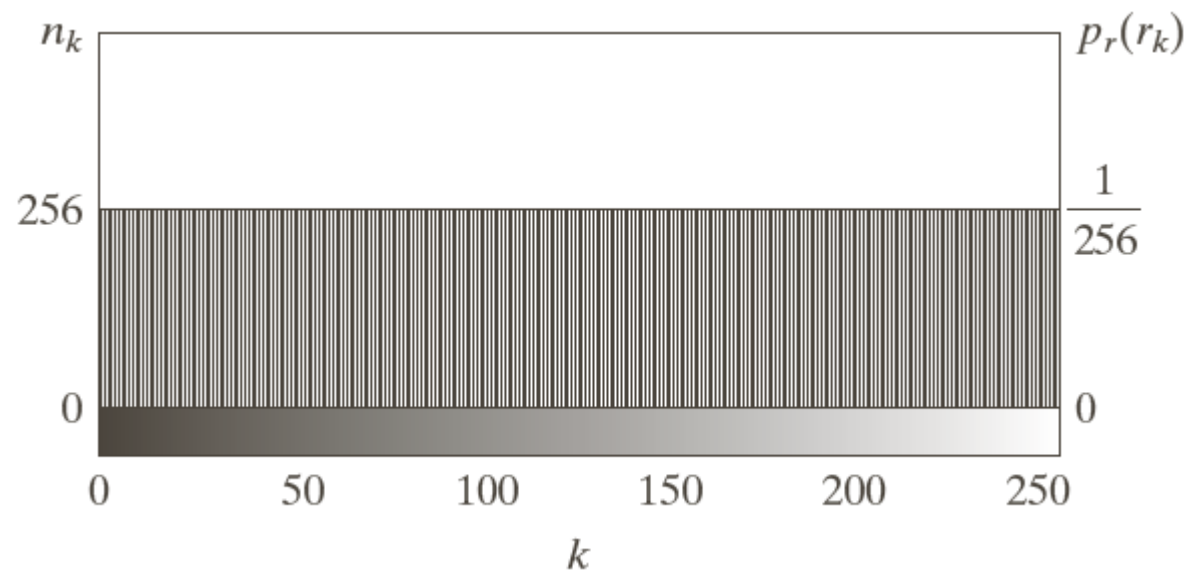
Coding Redundancy

$$L_{\text{avg}} = 0.25(2) + 0.47(1) + 0.25(3) + 0.03(3) = 1.81 \text{ bits}$$

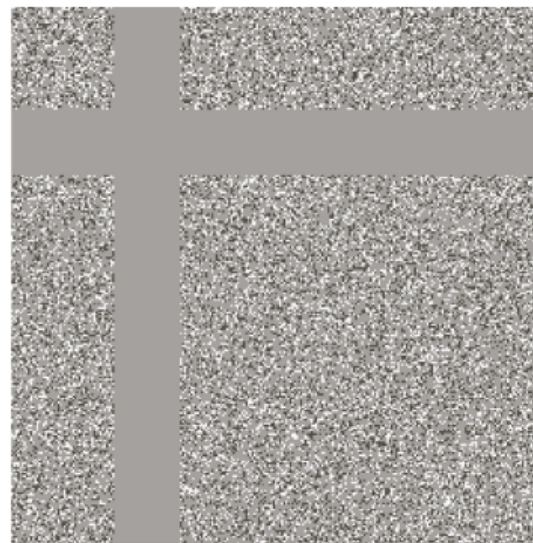
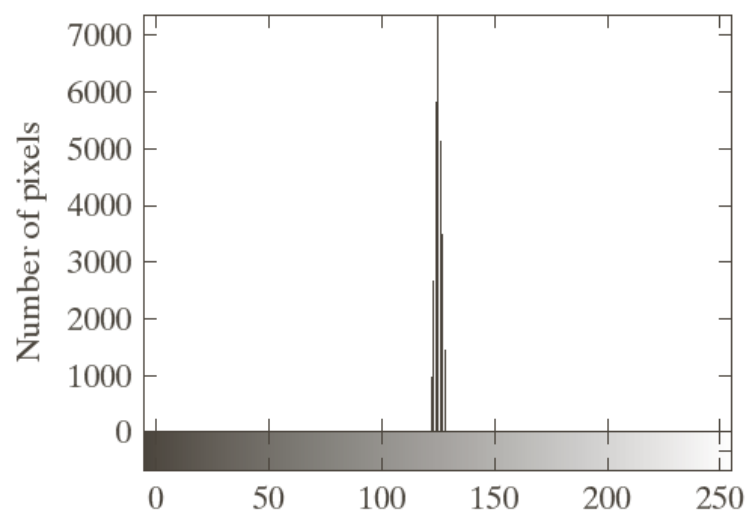
$$C = \frac{256 \times 256 \times 8}{118,621} = \frac{8}{1.81} \approx 4.42$$

$$R = 1 - \frac{1}{4.42} = 0.774$$

Spatial & Temporal redundancy



Irrelevant Information



Entropy :-

$$I(E) = \log \frac{1}{P(E)} = -\log P(E)$$

$$H = - \sum_{n=1}^j P(a_n) \log_2 P(a_n)$$

$$\tilde{H} = - \sum_{k=0}^{L-1} P_r(r_k) \log_2 [P_r(r_k)]$$

Fidelity Criteria

$$e(x, y) = \hat{f}(x, y) - f(x, y)$$

$$\sum_{x=0}^{M-1} \sum_{y=0}^{N-1} \hat{f}(x, y) - f(x, y)$$

$$e_{rms} = \left[\frac{1}{MN} \left[\sum_{x=0}^{M-1} \sum_{y=0}^{N-1} (\hat{f}(x, y) - f(x, y))^2 \right] \right]^{1/2}$$

$$SNR_{rms} = \frac{\sum_{x=0}^{M-1} \sum_{y=0}^{N-1} \hat{f}(x, y)^2}{\sum_{x=0}^{M-1} \sum_{y=0}^{N-1} [\hat{f}(x, y) - f(x, y)]^2}$$