

Reprezentace rastrového obrazu

Počítačová grafika

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- *černobílý (B/W) – 1 bit/pixel*
- *v odstínech šedi (gray scale) – 1 byte/pixel*
- *s paletou (palleted) – 1 byte/pixel*
- *plně barevný (color) – 3-4 byte/pixel*
- *s vysokým dynamickým rozsahem (HDR) – 6-12 byte/pixel*

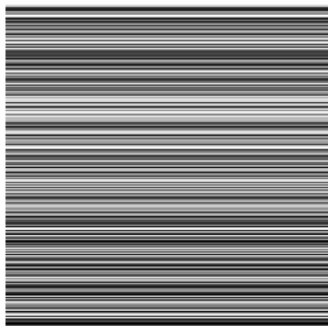
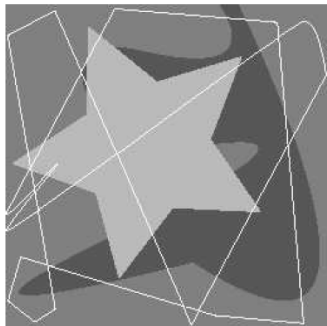


- *Relativní redundance dat*

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

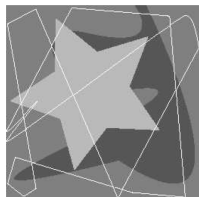
- Kompresní poměr

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



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

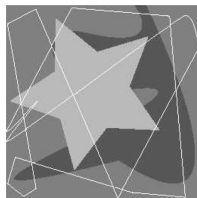
$$L_{avg} = \sum_{k=0}^{L-1} l(r_k) p_r(r_k)$$



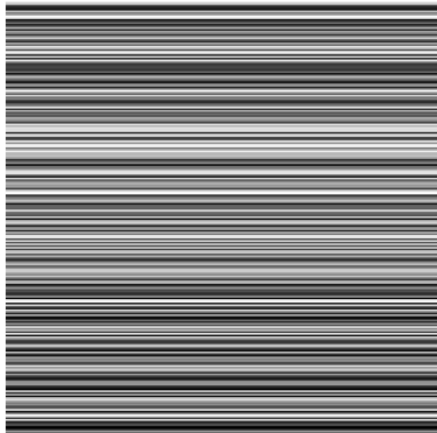
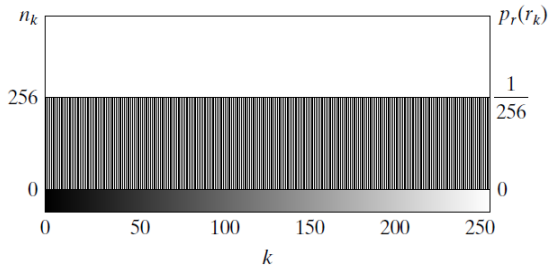
r_k	$p_r(r_k)$	Code 1	$l_1(r_k)$	Code 2	$l_2(r_k)$
$r_{87} = 87$	0.25	01010111	8	01	2
$r_{128} = 128$	0.47	10000000	8	1	1
$r_{186} = 186$	0.25	11000100	8	000	3
$r_{255} = 255$	0.03	11111111	8	001	3
r_k for $k \neq 87, 128, 186, 255$	0	—	8	—	0

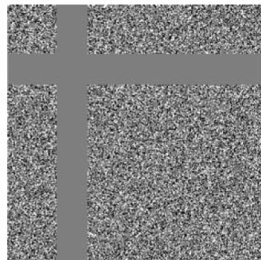
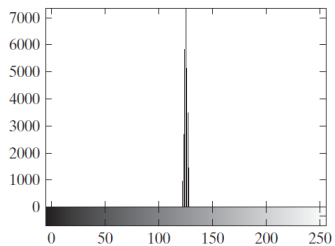
$$p_r(r_k) = \frac{n_k}{MN}, k = 0, 1, \dots, L - 1$$

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Informace

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

Entropie

$$H = -\sum_{j=1}^J P(a_j) \log P(a_j)$$

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

J = entropy(I)

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

Celková chyba

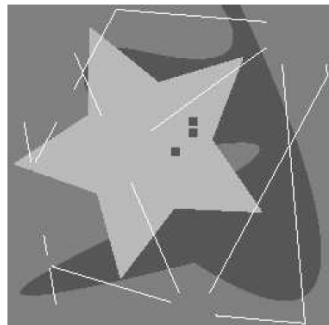
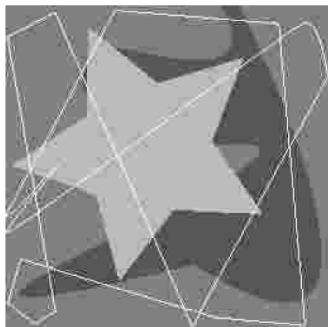
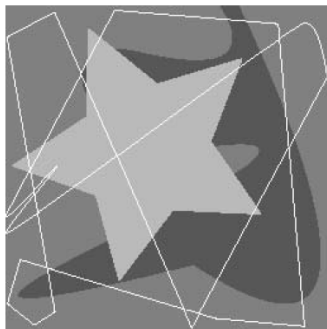
$$\sum_{x=0}^{M-1} \sum_{y=0}^{N-1} \hat{f}(x, y) - f(x, y)$$

root-mean-square error

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

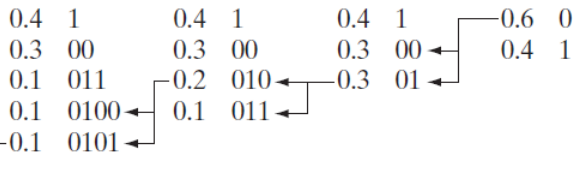
mean-square signal-to-noise ratio

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



Original source		Source reduction			
Symbol	Probability	1	2	3	4
a_2	0.4	0.4	0.4	0.4	0.6 0.4
a_6	0.3	0.3	0.3	0.3	
a_1	0.1	0.1	0.2	0.3	
a_4	0.1	0.1			
a_3	0.06	0.1	0.1		
a_5	0.04				

Original source			Source reduction			
Symbol	Probability	Code	1	2	3	4
a_2	0.4	1	0.4	1	0.4	1
a_6	0.3	00	0.3	00	0.3	00
a_1	0.1	011	0.1	011	0.2	010
a_4	0.1	0100	0.1	0100	0.1	011
a_3	0.06	01010	0.1	0101		
a_5	0.04	01011				



Vstupní data

139	144	149	153	155	155	155	155
144	151	153	156	159	156	156	156
150	155	160	163	158	156	156	156
159	161	162	160	160	159	159	159
159	160	161	162	162	155	155	155
161	161	161	161	160	157	157	157
162	162	161	163	162	157	157	157
162	162	161	161	163	158	158	158

Koeficienty po DCT

1259.6	-1.0	-12.1	-5.2	2.1	-1.7	-2.7	1.3
-22.6	-17.5	-6.2	-3.2	-2.9	-0.1	0.4	-1.2
-10.9	-9.3	-1.6	1.5	0.2	-0.9	-0.6	-0.1
-7.1	-1.9	0.2	1.5	0.9	-0.1	-0.0	0.3
-0.6	-0.8	1.5	1.6	-0.1	-0.7	0.6	1.3
1.8	-0.2	1.6	-0.3	-0.8	1.5	1.0	-1.0
-1.3	-0.4	-0.3	-1.5	-0.5	1.7	1.1	-0.8
-2.6	1.6	-3.8	-1.8	1.9	1.2	-0.6	-0.4

Kvantizační tabulka

16	11	10	16	24	40	51	61
12	12	14	19	26	58	60	55
14	13	16	24	40	57	69	56
14	17	22	29	51	87	80	61
18	22	37	56	68	109	103	77
24	35	55	64	81	104	113	92
49	64	78	87	103	121	120	101
72	92	95	98	112	100	103	99

Kvantované koeficienty

79	0	-1	0	0	0	0	0
-2	-1	0	0	0	0	0	0
-1	-1	0	0	0	0	0	0
-1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Expandované koeficienty před IDCT

1264	0	-10	0	0	0	0	0
-24	-12	0	0	0	0	0	0
-14	-13	0	0	0	0	0	0
-14	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Rekonstruovaná data

142	144	147	150	152	153	154	154
149	150	153	155	156	157	156	156
157	158	159	161	161	160	159	158
162	162	163	163	162	160	158	157
162	162	162	162	161	158	156	155
160	161	161	161	160	158	156	154
160	160	161	162	161	160	158	157
160	161	163	164	164	163	161	160