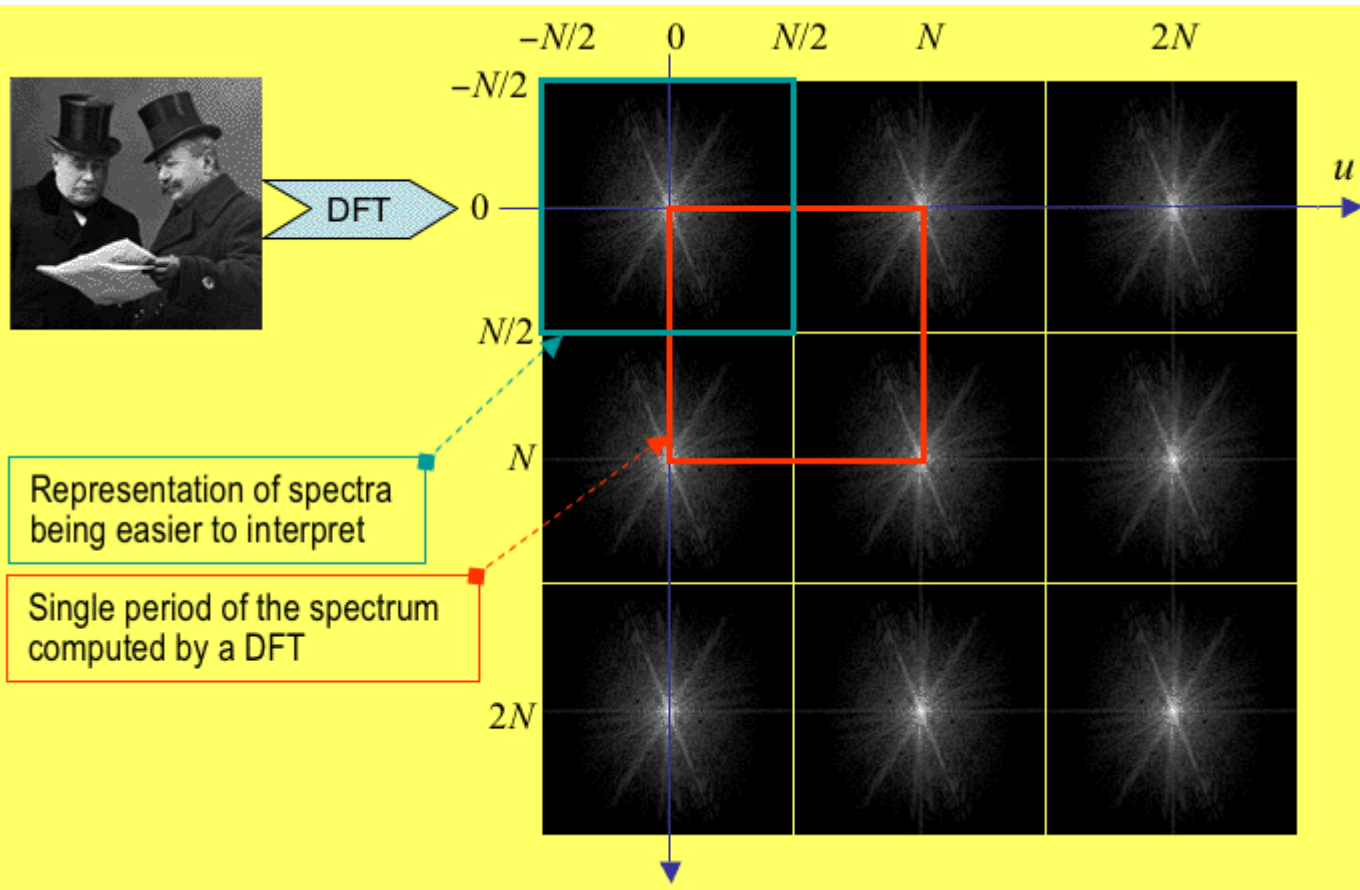
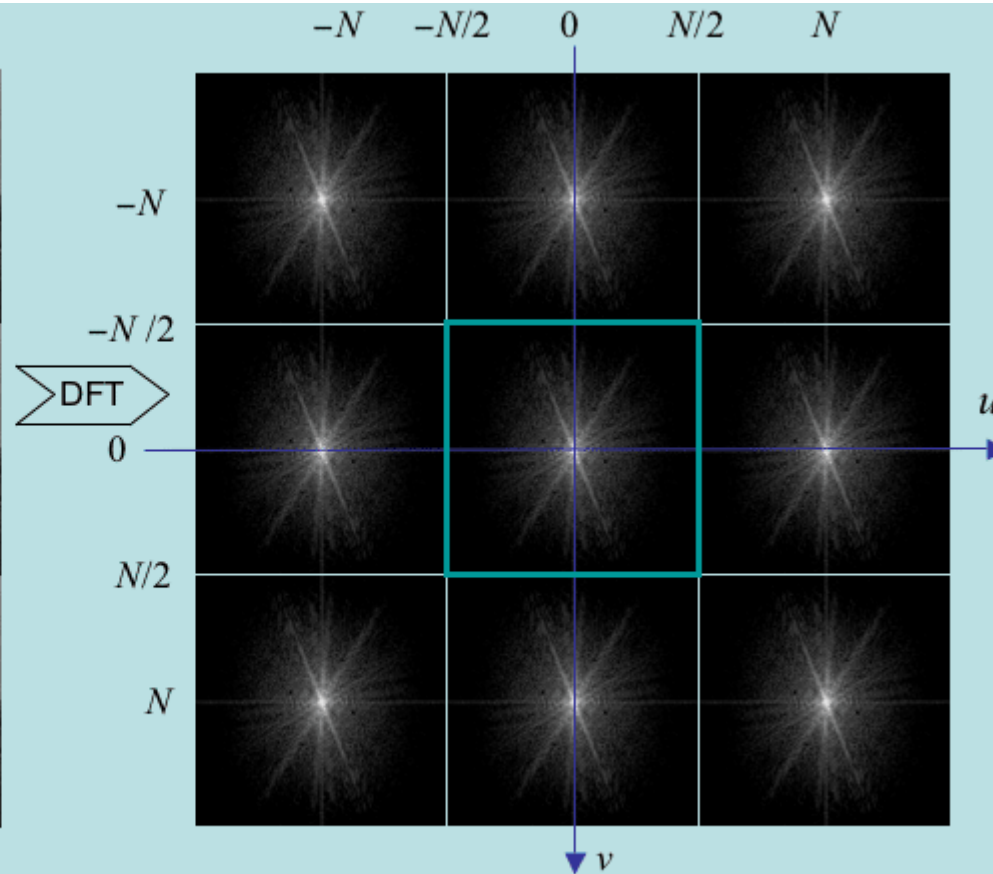


2D DFT



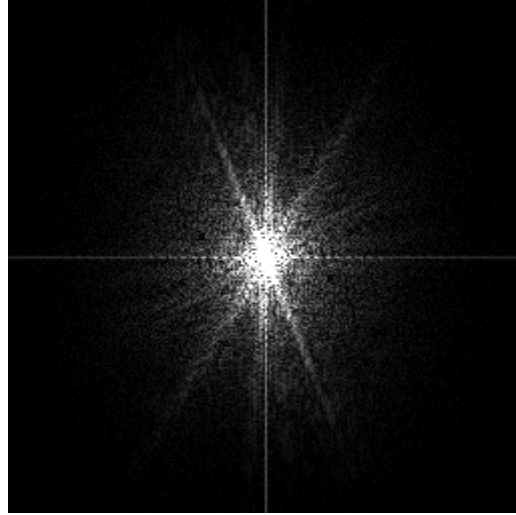


Spatial discontinuities caused by considering an image to be periodic

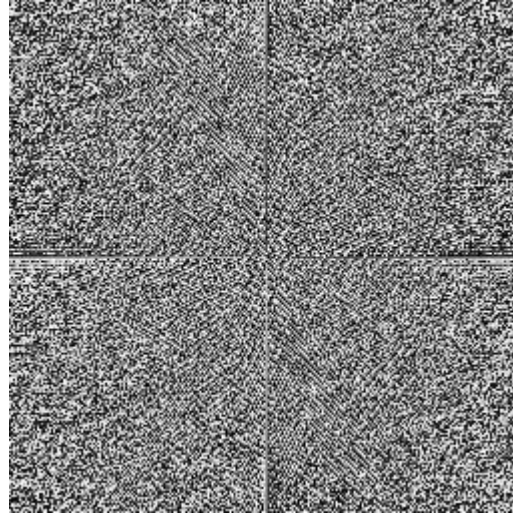




Originál



magnitúdové spektrum



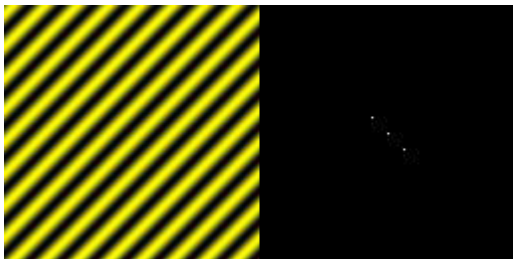
fázové spektrum



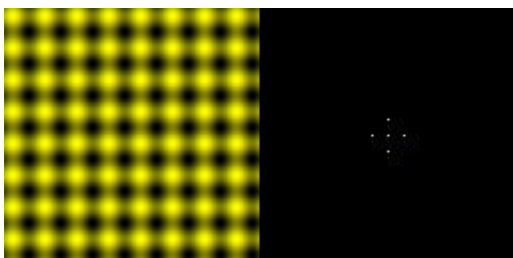
originál, magnitúdové spektrum



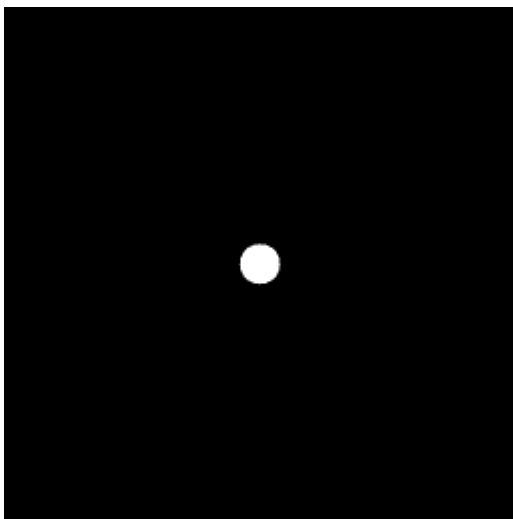
originál, magnitúdové spektrum



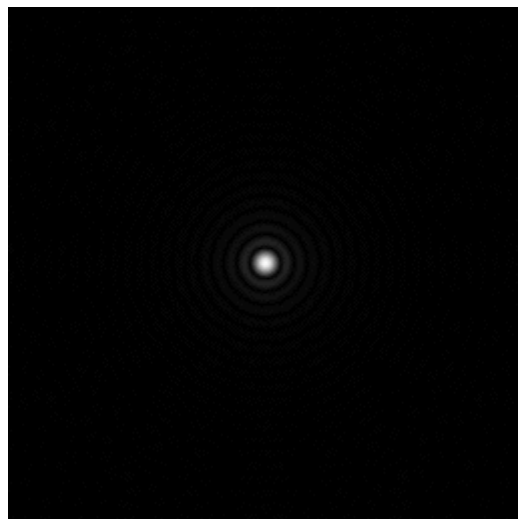
originál, magnitudové spektrum



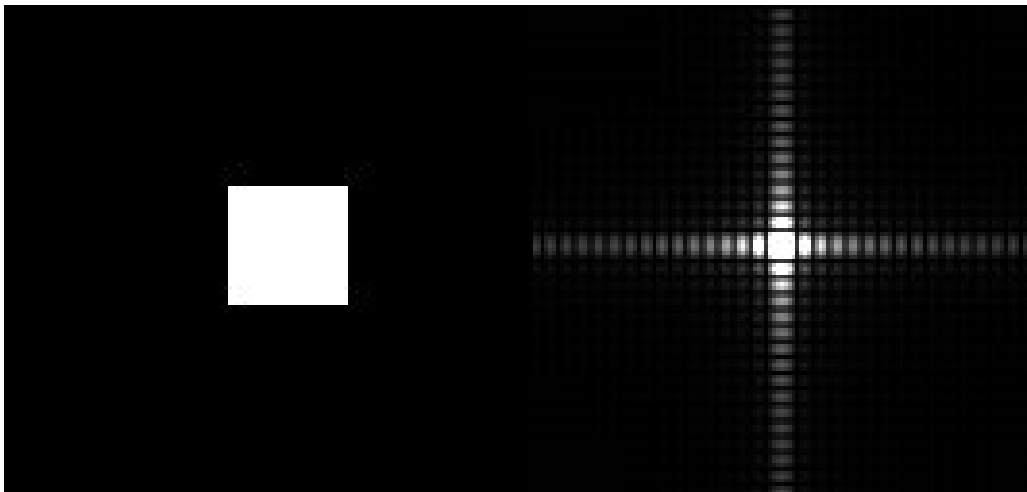
originál, magnitudové spektrum



originál



magnitudové spektrum

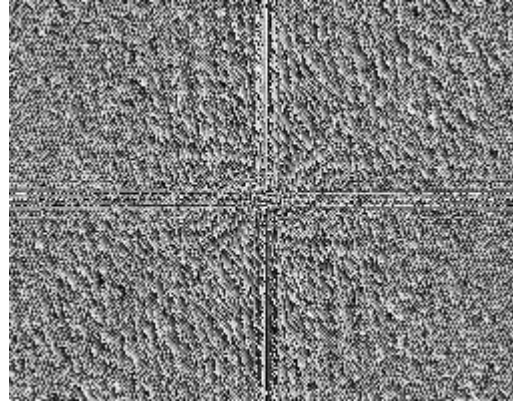
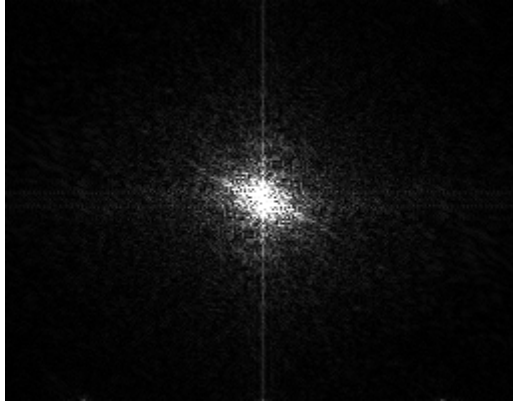


originál

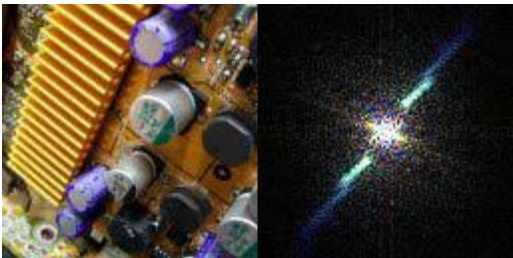
magnitúdové spektrum



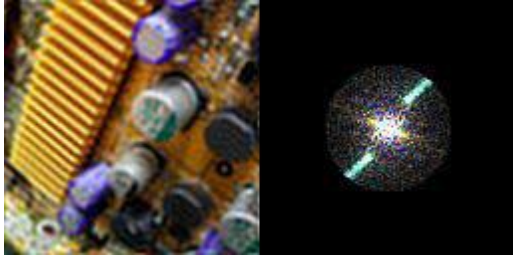
originál, magnitúdové spektrum



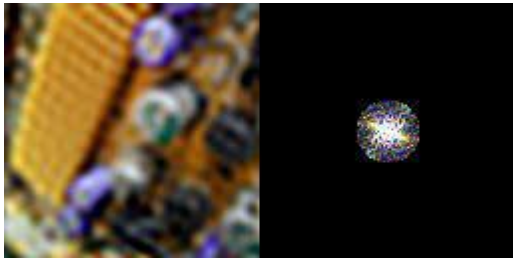
originál, magnitudové spektrum, fázové spektrum, HP, DP



originál, magnitudové spektrum



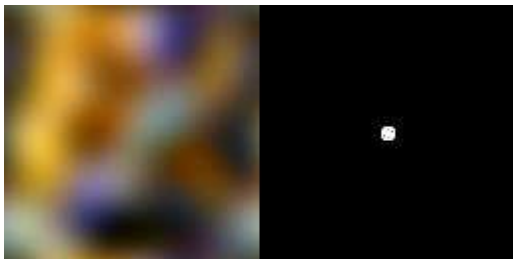
DP, magnitudová prenosová funkcia filtra



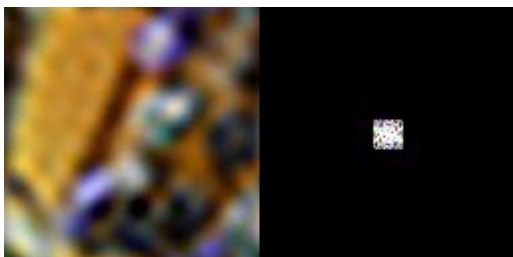
DP, magnitudová prenosová funkcia filtra



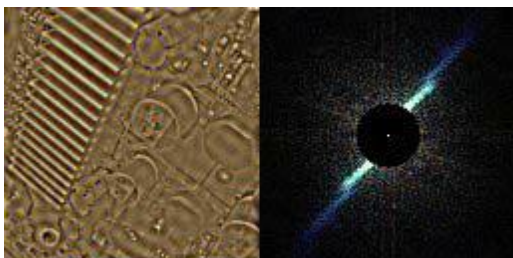
DP, magnitudová prenosová funkcia filtra



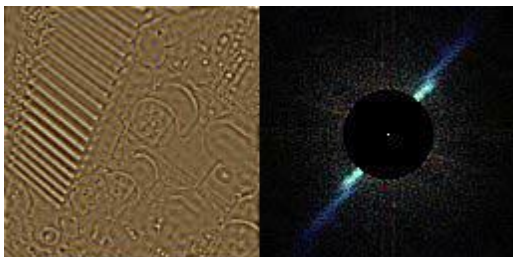
DP, magnitudová prenosová funkcia filtra



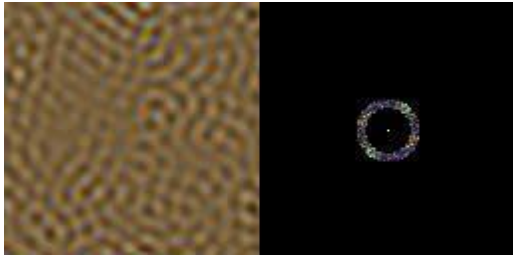
DP, magnitudová prenosová funkcia filtra



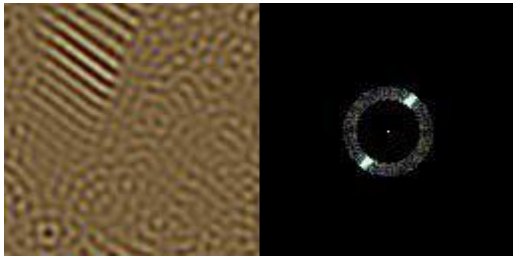
HP, magnitudová prenosová funkcia filtra



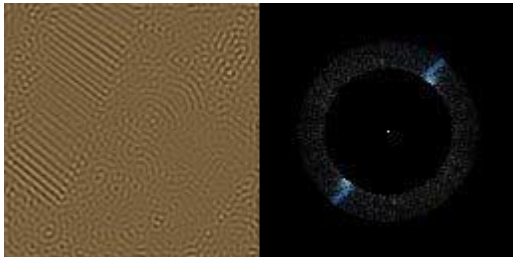
HP, magnitudová prenosová funkcia filtra



PP, magnitudová prenosová funkcia filtra



PP, magnitudová prenosová funkcia filtra



PP, magnitudová prenosová funkcia filtra



originál

hp filter

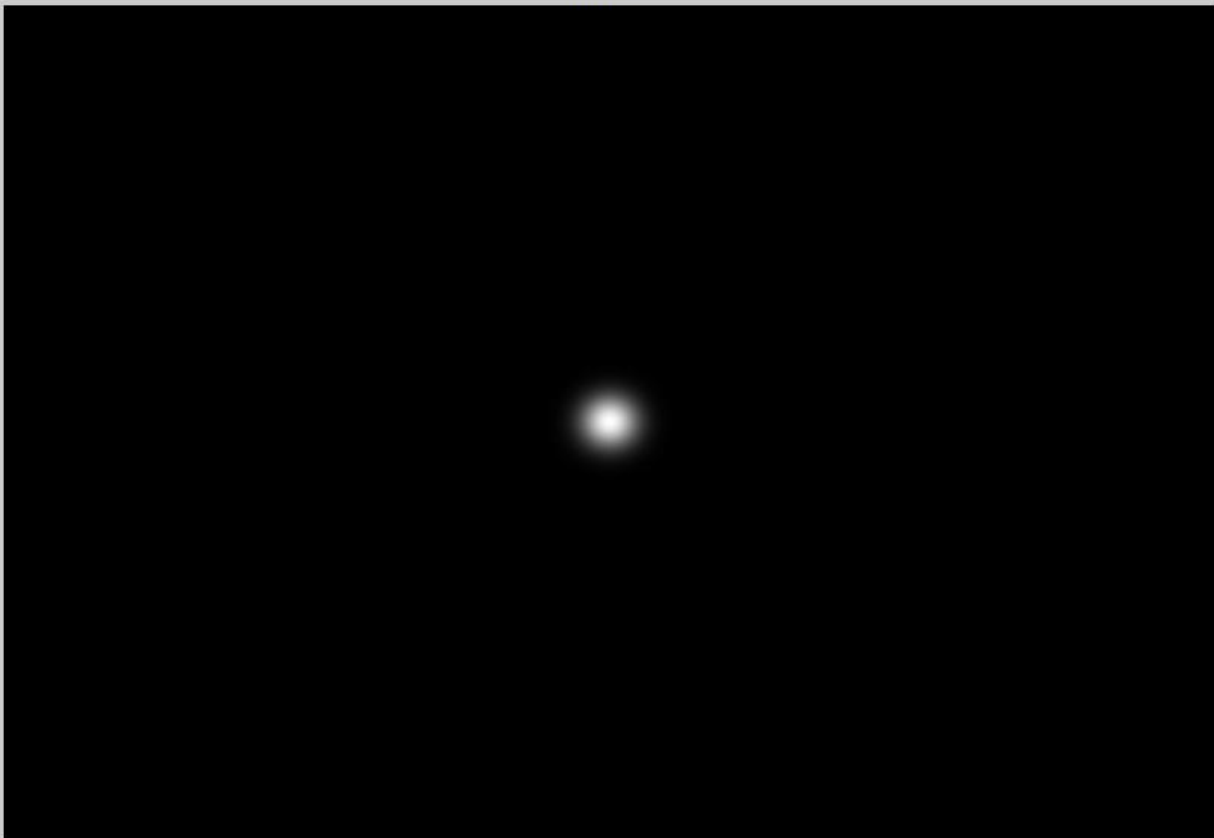


magnitúdová prenosová funkcia filtra

hp filtered image Gaussian Used



lp filter

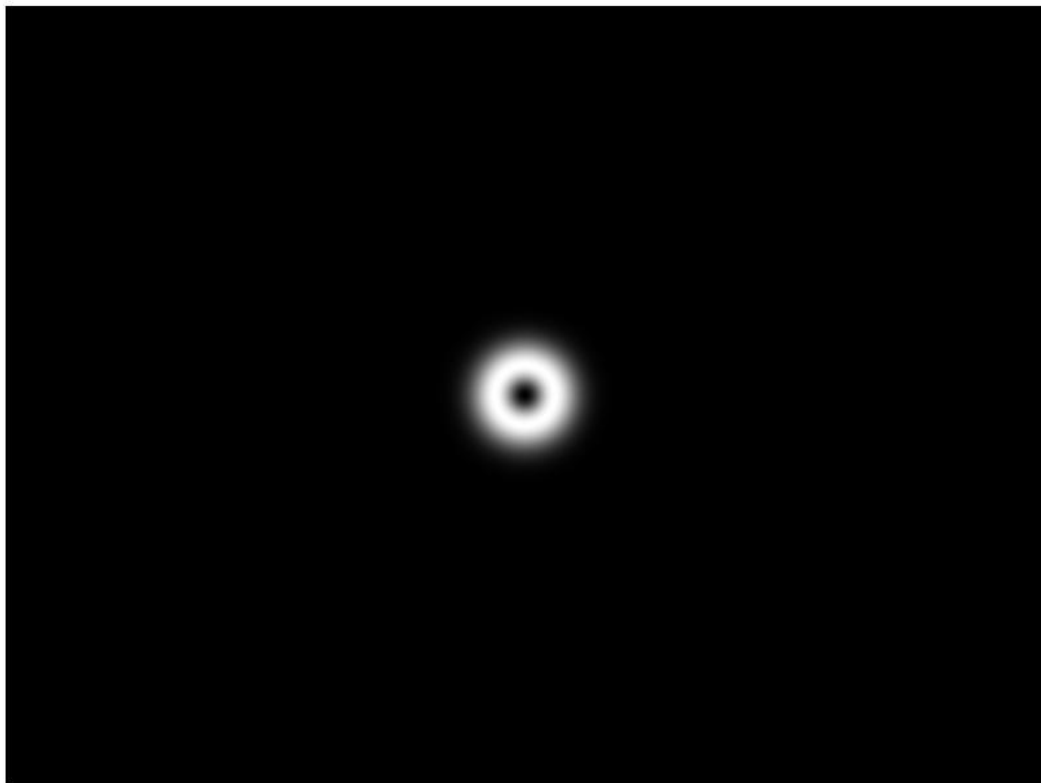


magnitúdová prenosová funkcia filtra

lp filtered image Gaussian Used



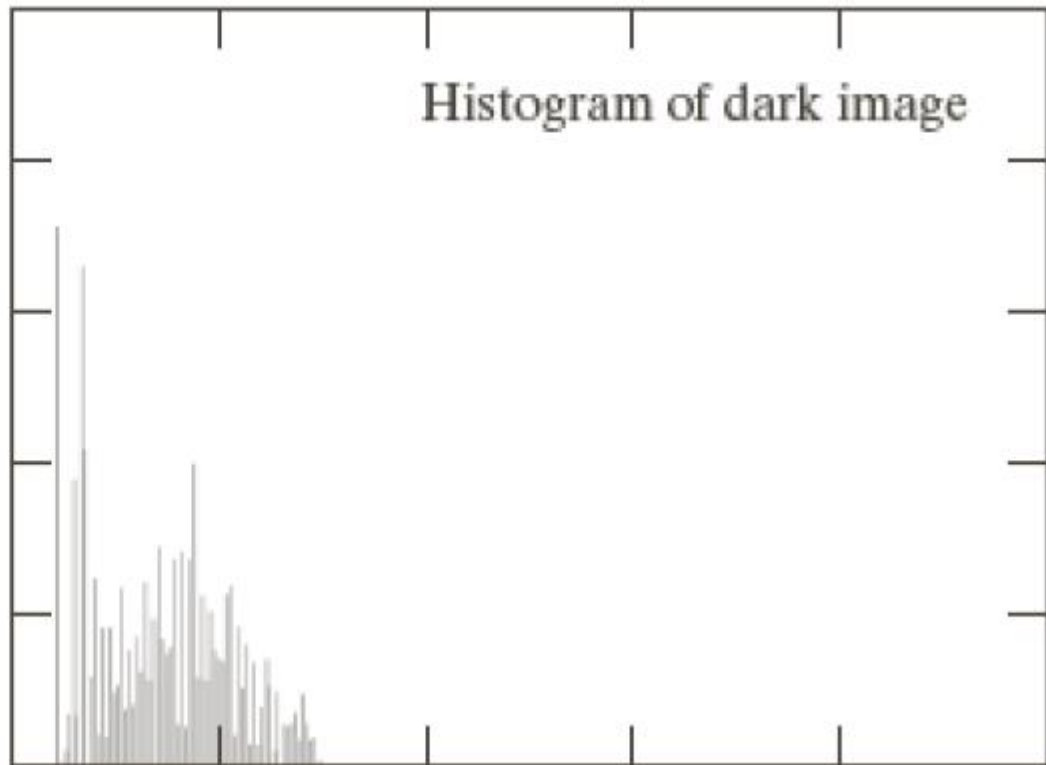
region filter

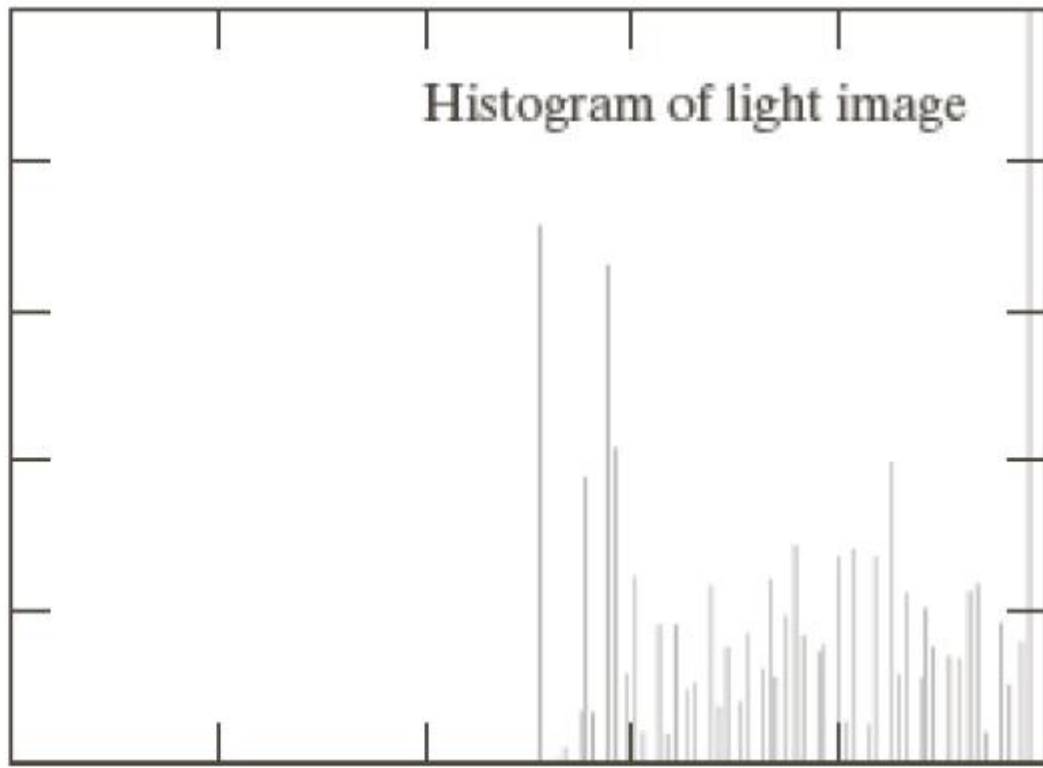


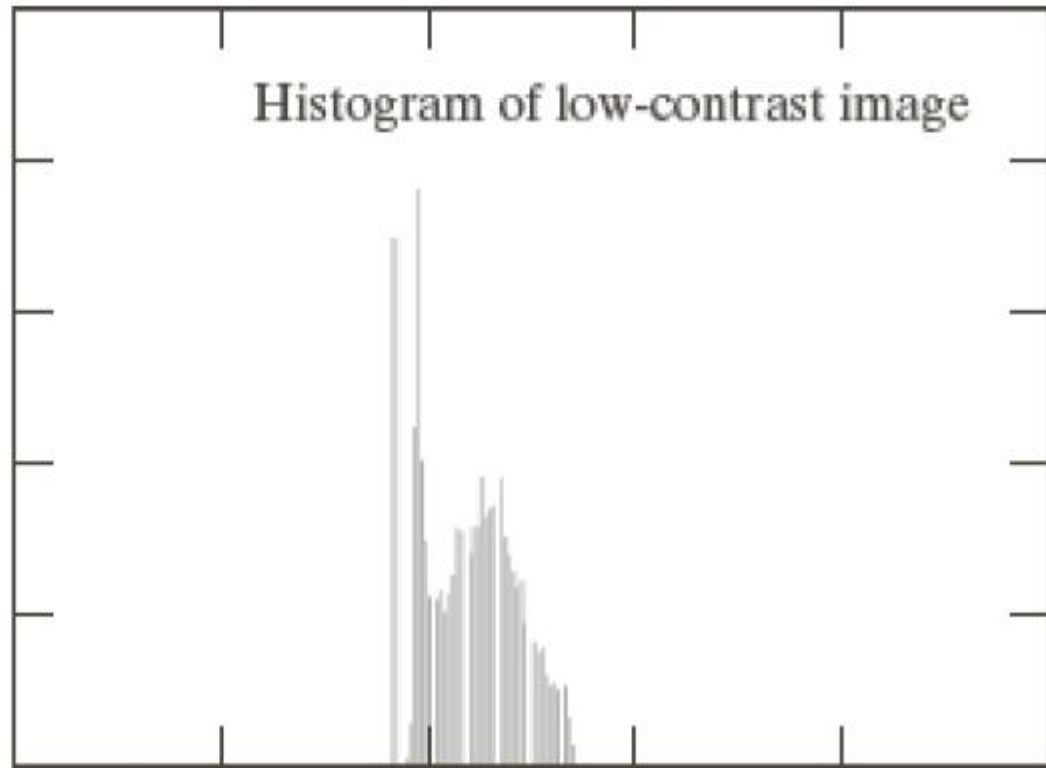
magnitúdová prenosová funkcia filtra

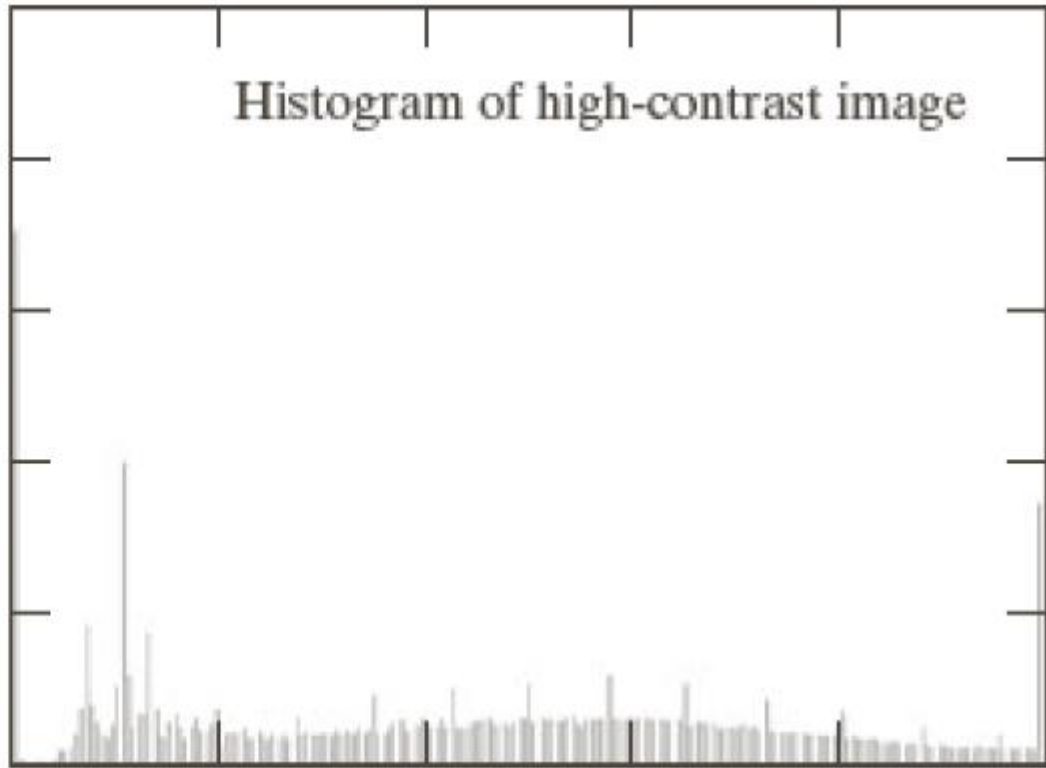
region filtered image Gaussian Used

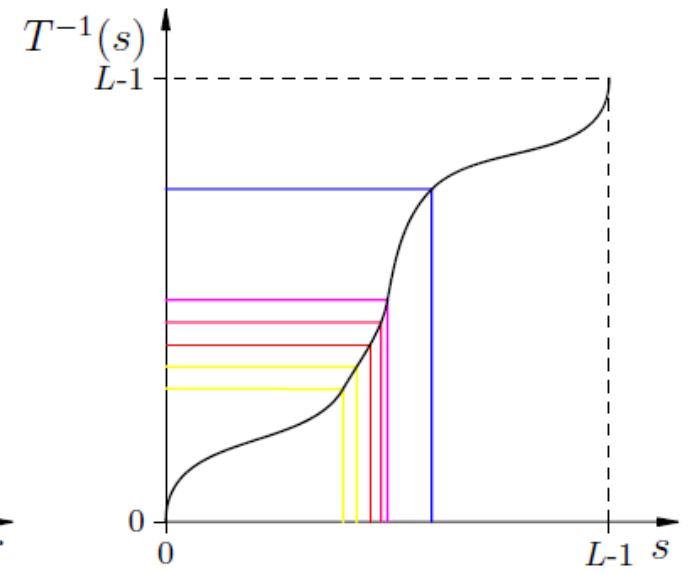
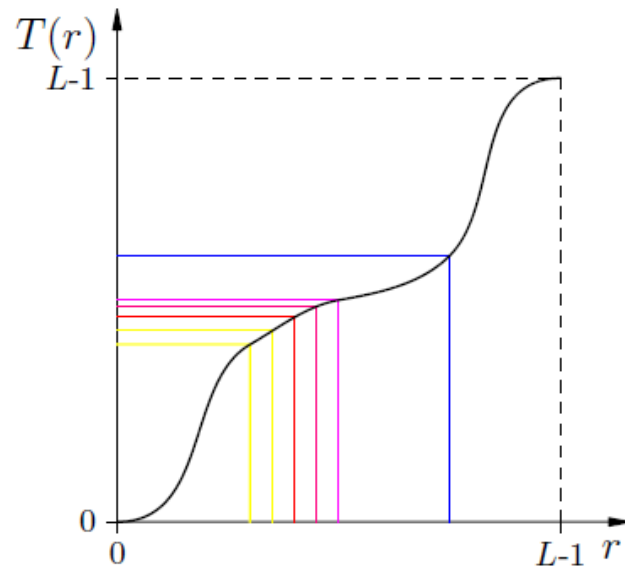
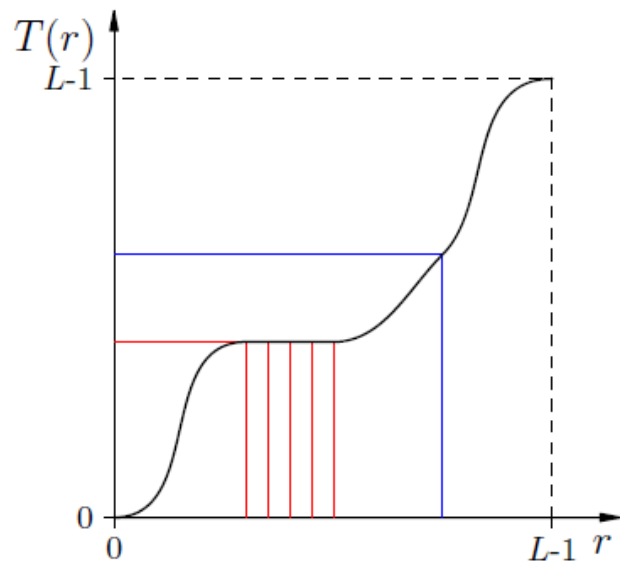




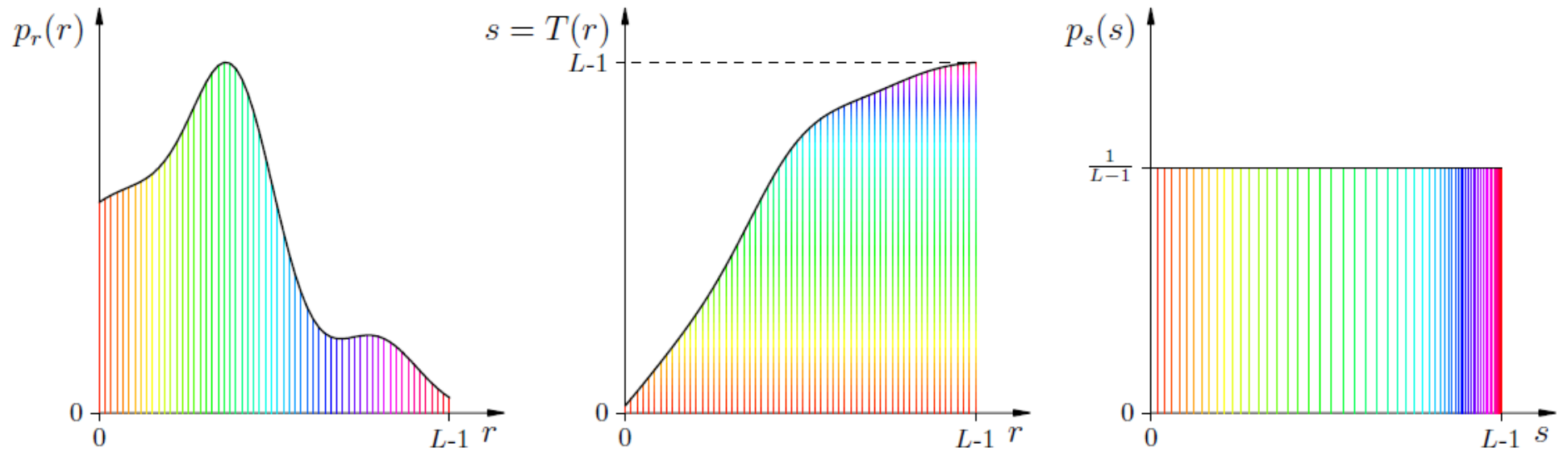








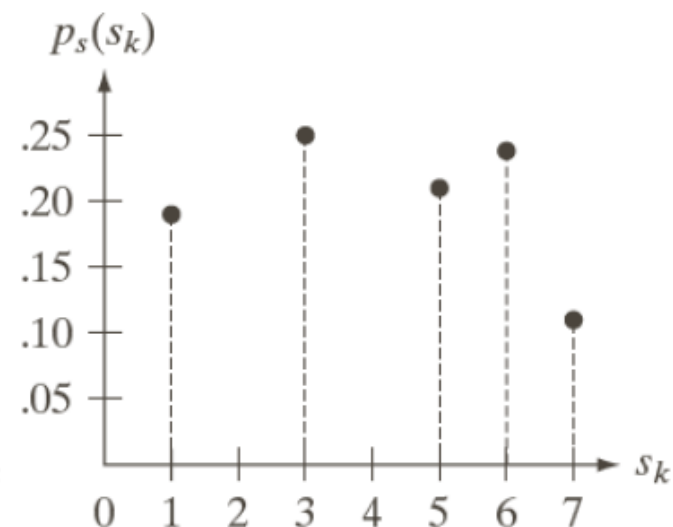
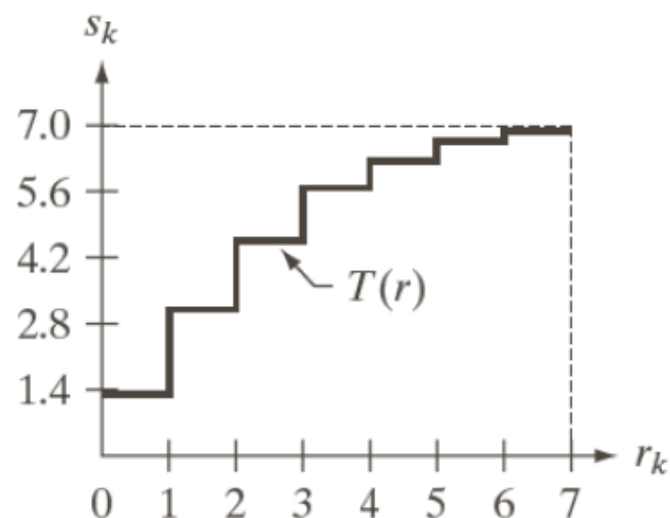
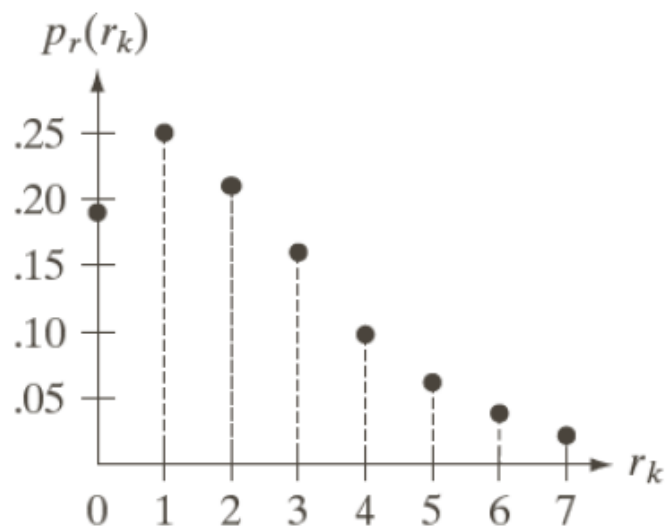
Príklady transformačných funkcií jasu

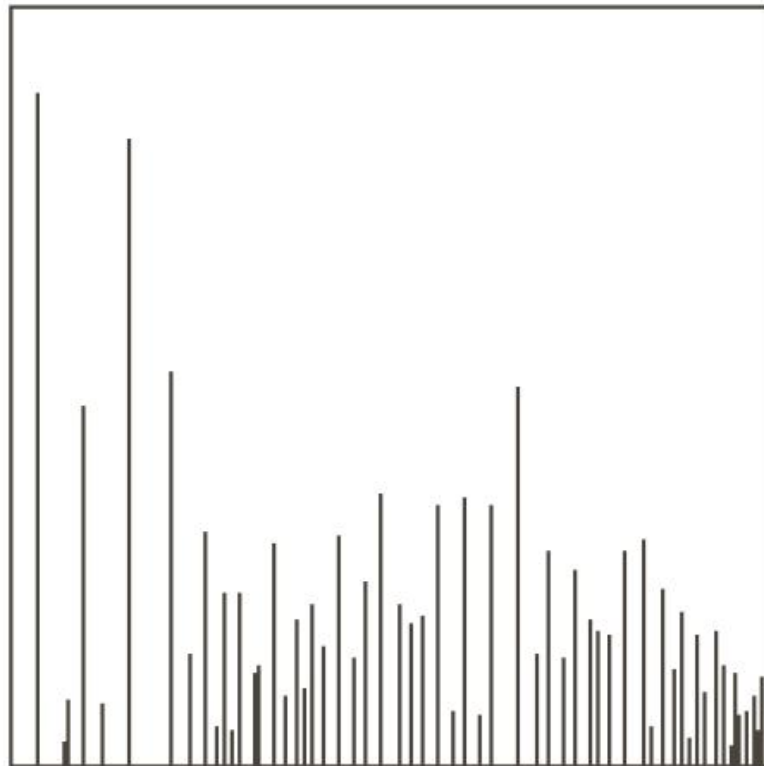
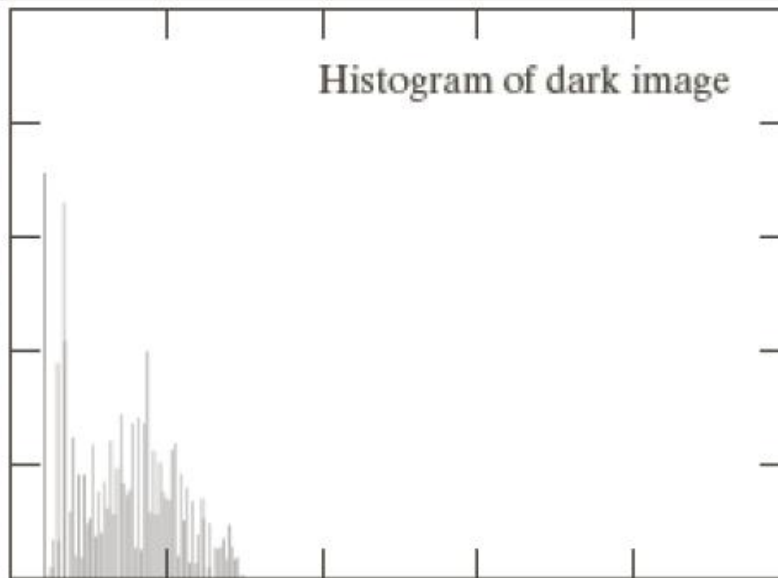


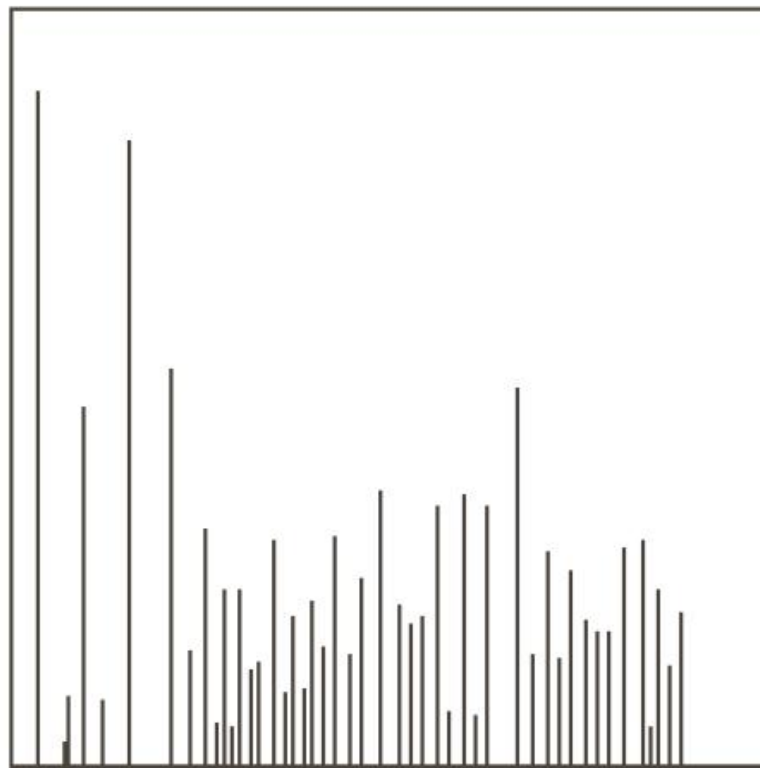
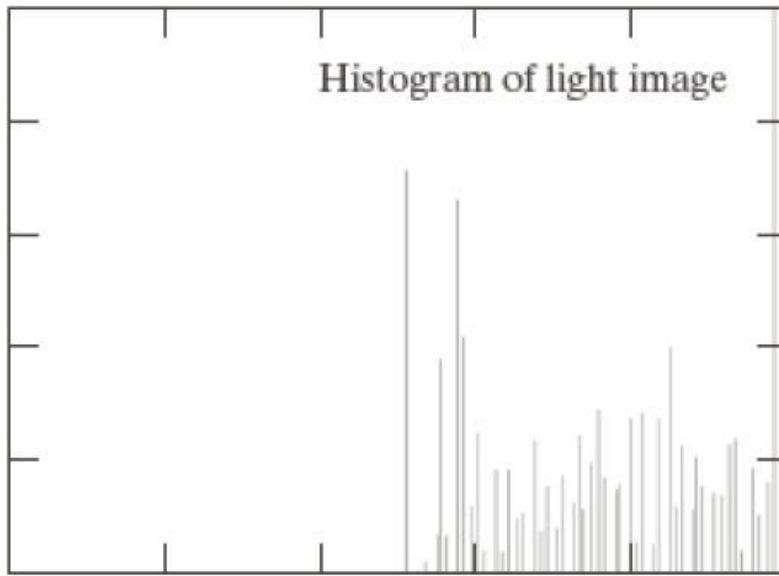
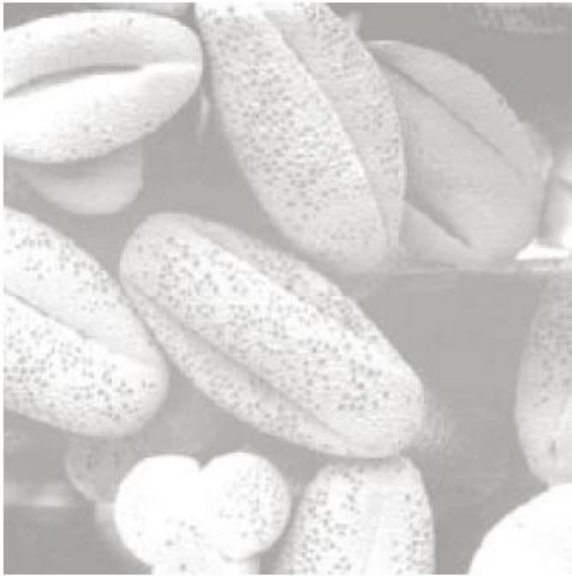
Ekvalizácia histogramu

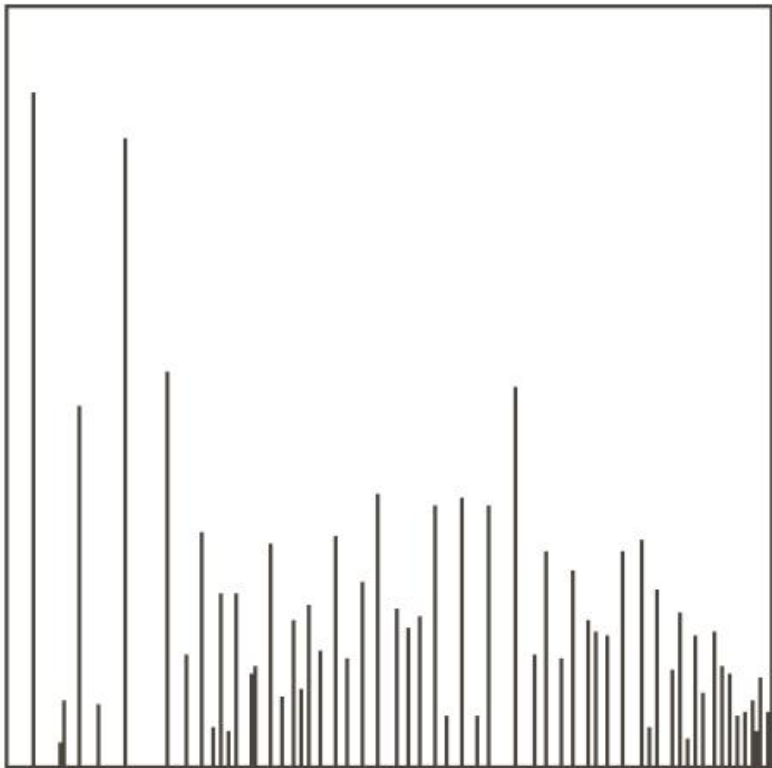
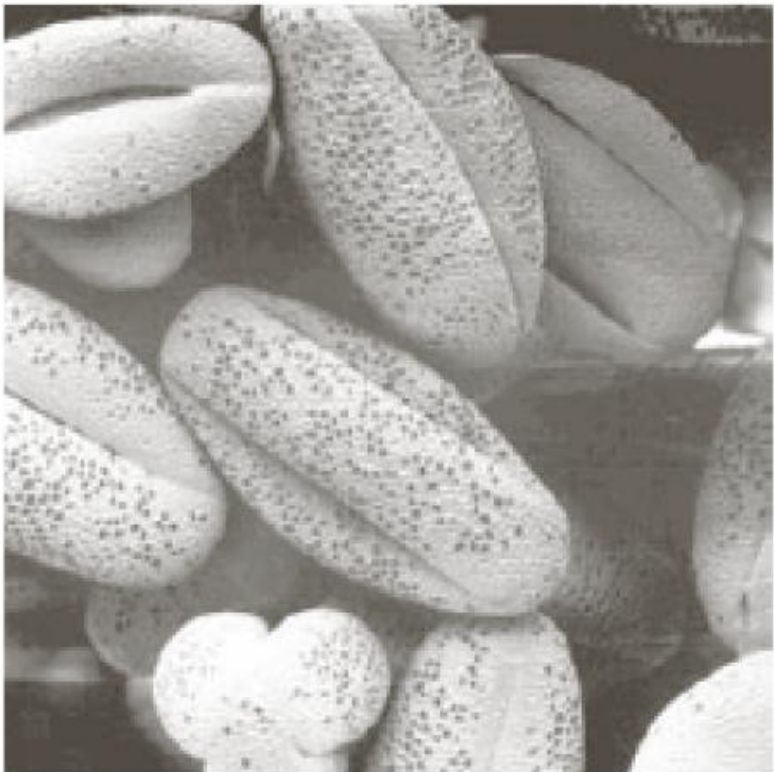
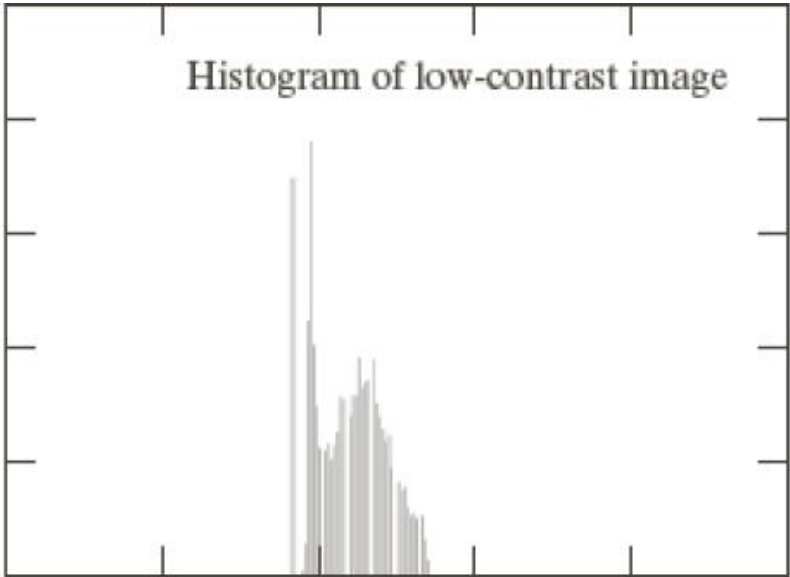
- ▶ r_k is the intensity level in $0, \dots, L - 1$
 - ▶ $p_r(r_k) = \frac{n_k}{MN}, \quad k = 0, 1, \dots, L - 1$
- ▶ p_r can be equalized by assigning the intensity s_k to those pixels having intensity r_k :
 - ▶ $s_k = T(r_k) = (L - 1) \sum_{j=0}^k p_r(r_j)$
 $= \frac{L-1}{MN} \sum_{j=0}^k n_j, \quad k = 0, 1, \dots, L - 1$

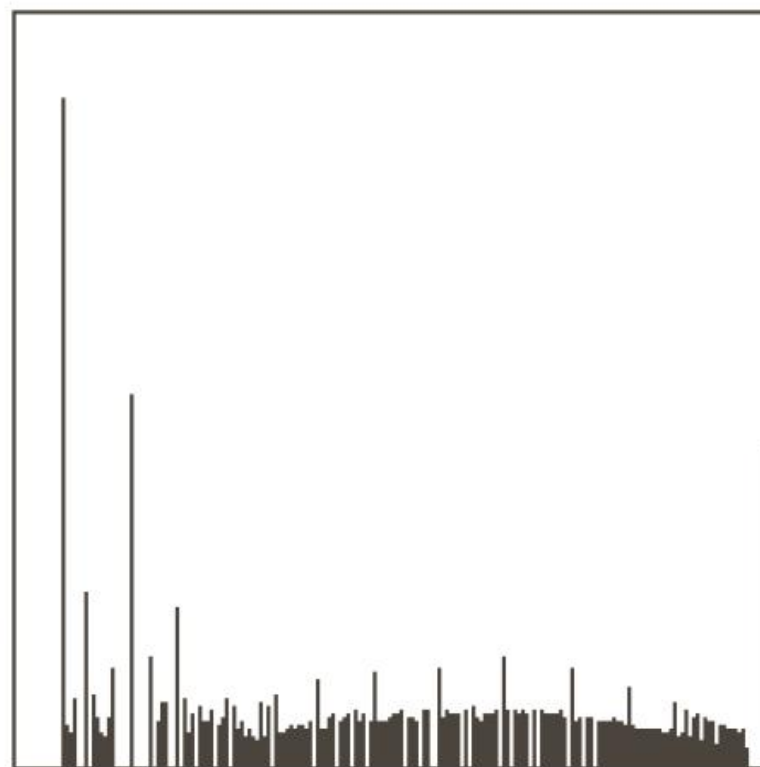
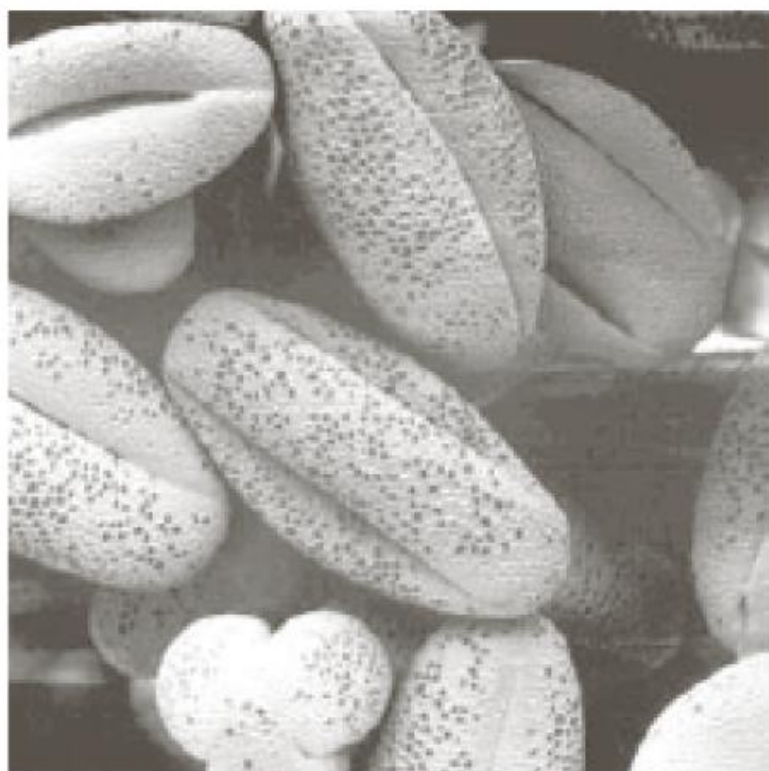
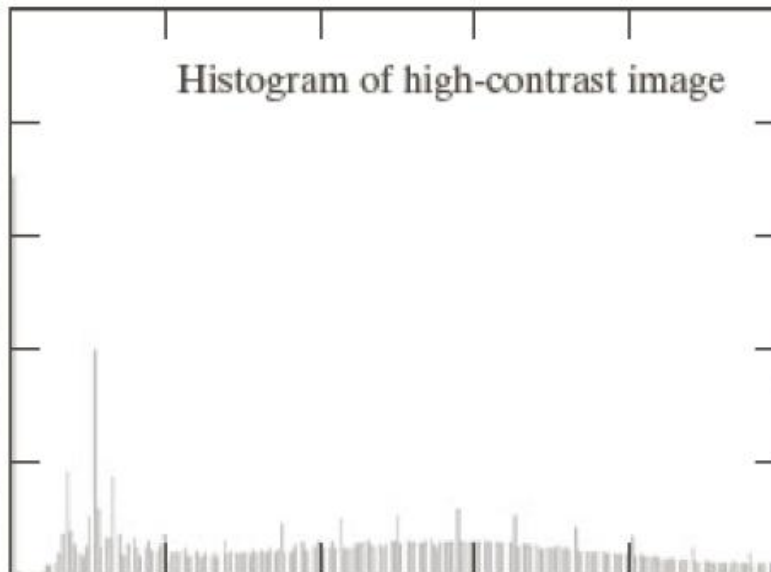
r_k	n_k	$p_r(r_k)$	$T(r_k)$	s_k	$p_s(s_k)$
$r_0 = 0$	790	0.19	1.33	1	0.19
$r_1 = 1$	1023	0.25	3.08	3	0.25
$r_2 = 2$	850	0.21	4.55	5	0.21
$r_3 = 3$	656	0.16	5.67	6	0.24
$r_4 = 4$	329	0.08	6.23	6	
$r_5 = 5$	245	0.06	6.65	7	0.11
$r_6 = 6$	122	0.03	6.86	7	
$r_7 = 7$	81	0.02	7.00	7	

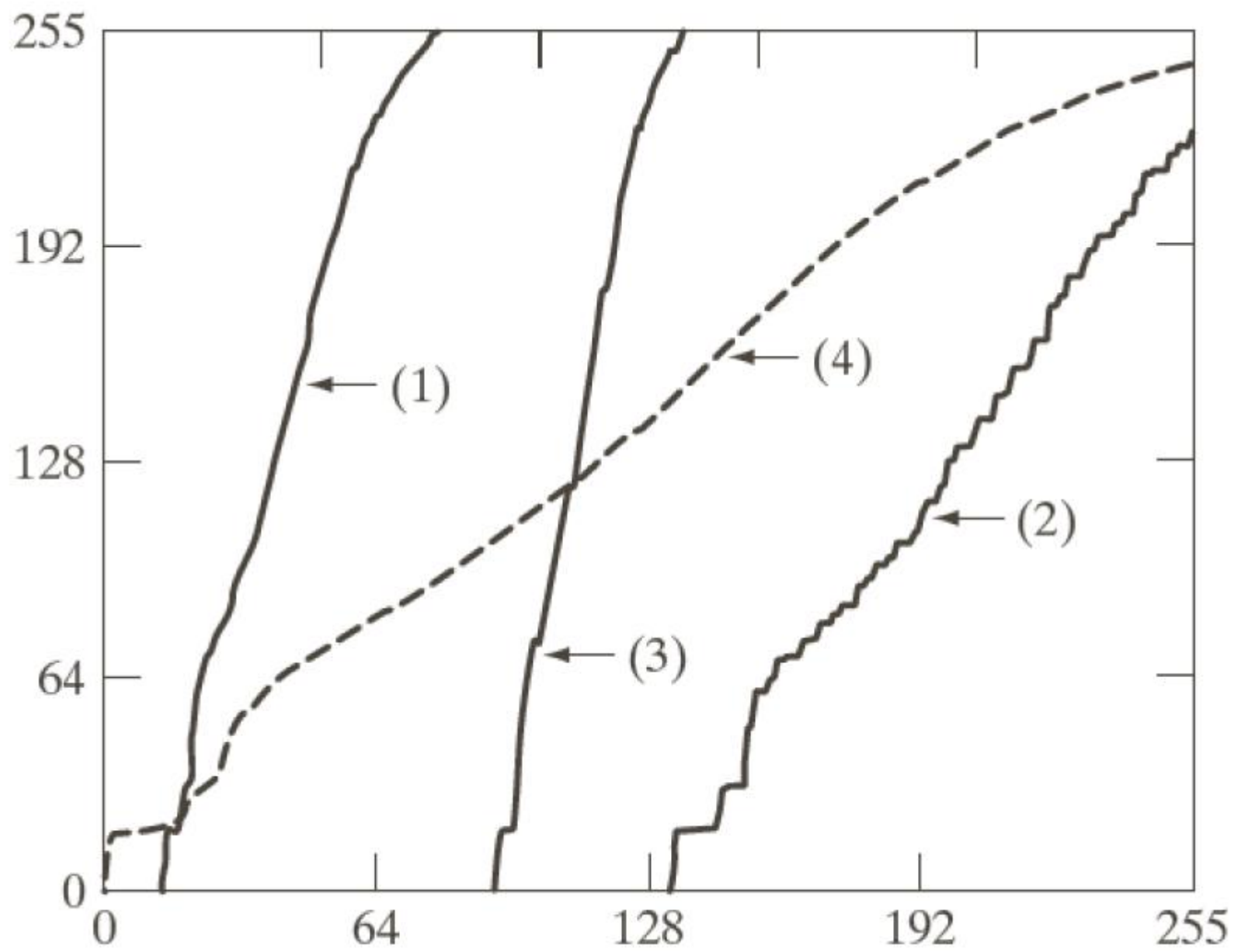




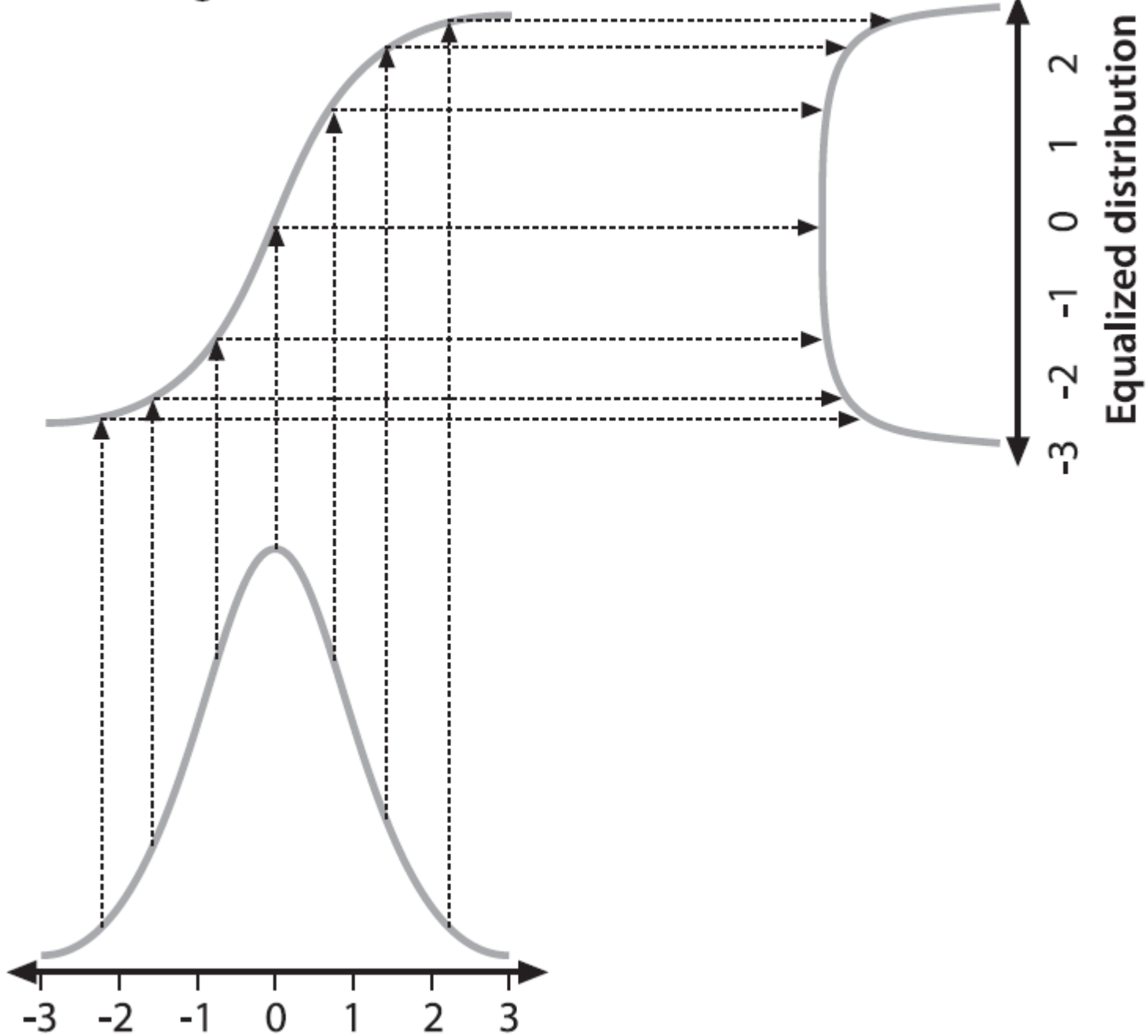








Cumulative gaussian distribution

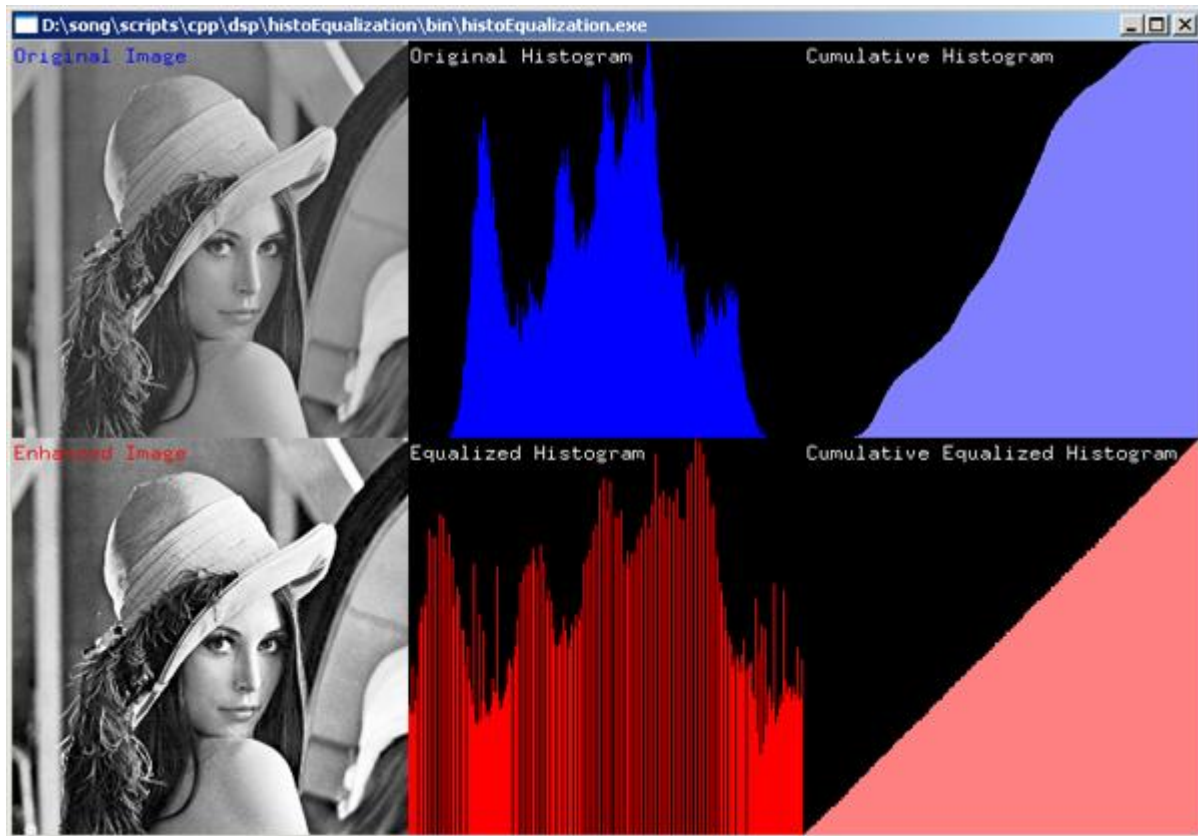


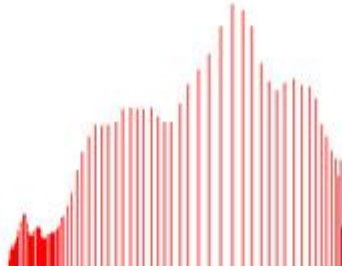
-3 -2 -1 0 1 2 3

Gaussian distribution

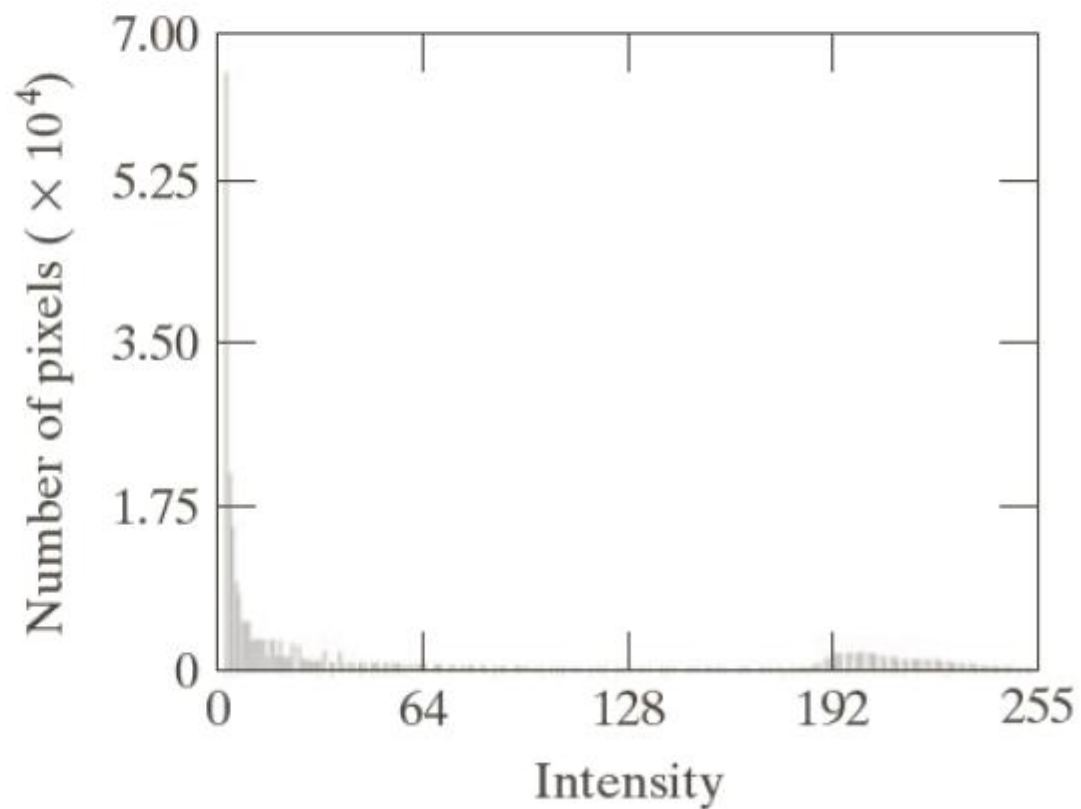
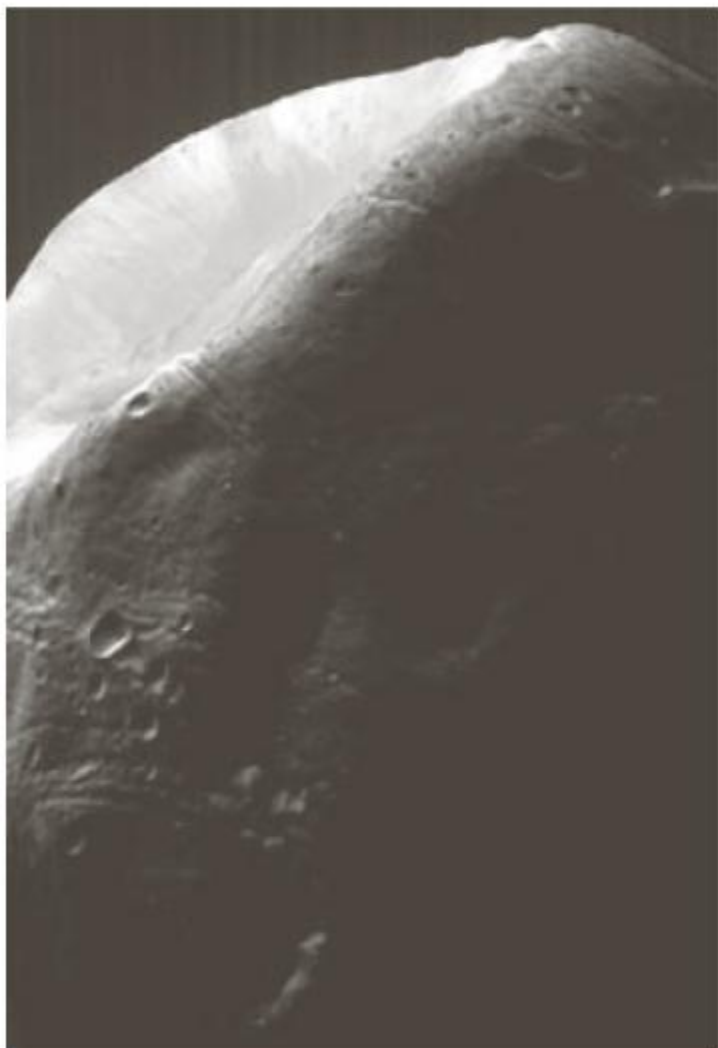
-3 -2 -1 0 1 2 3

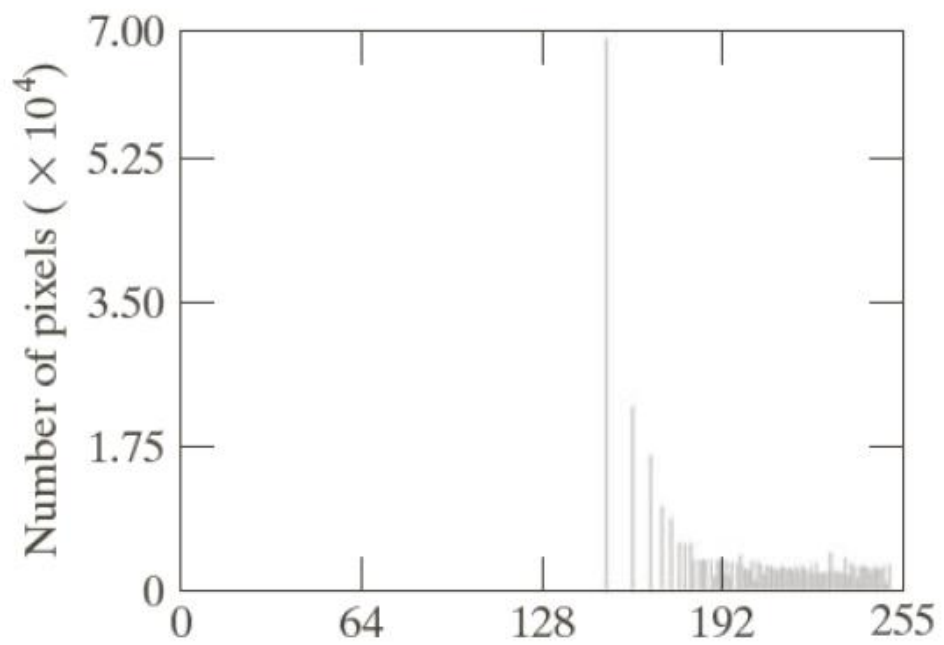
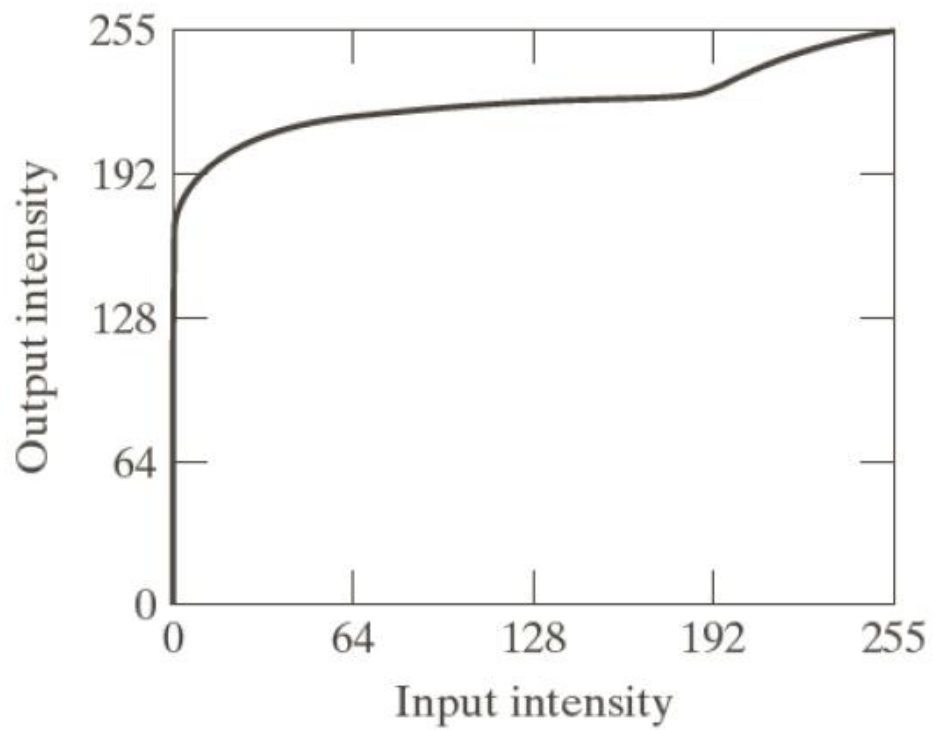
Equalized distribution

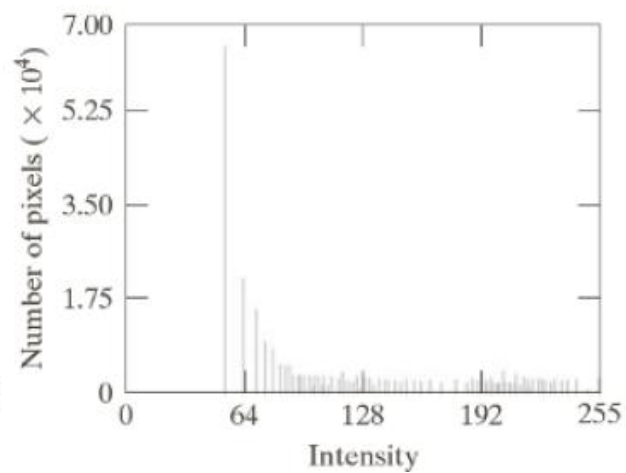
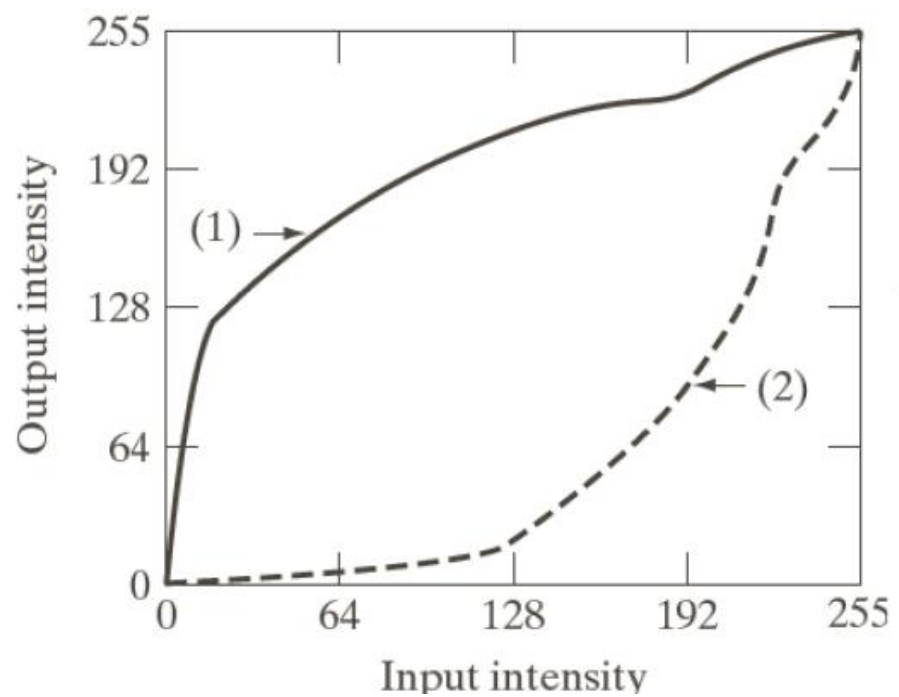
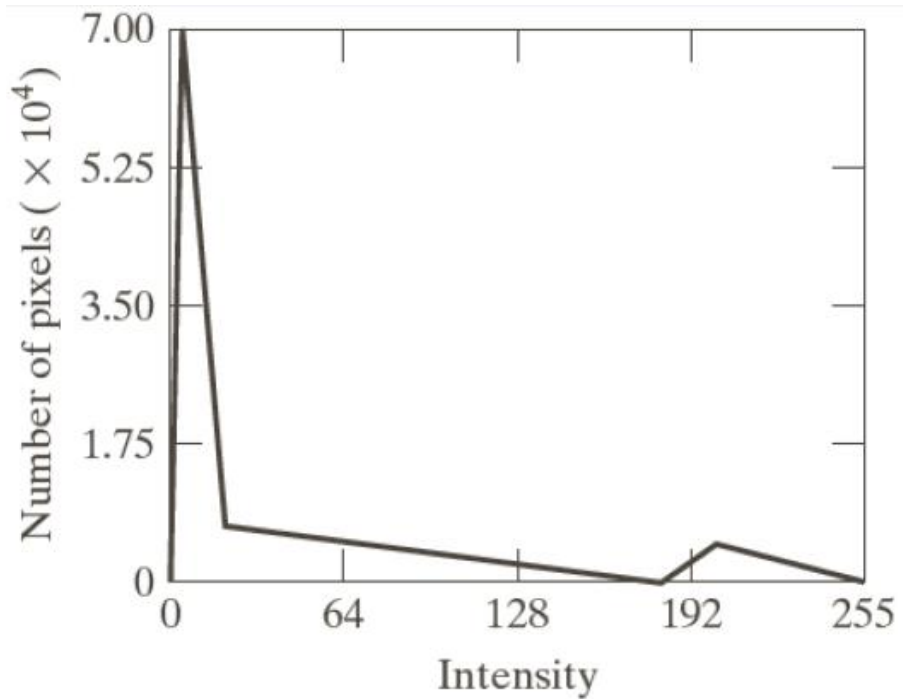




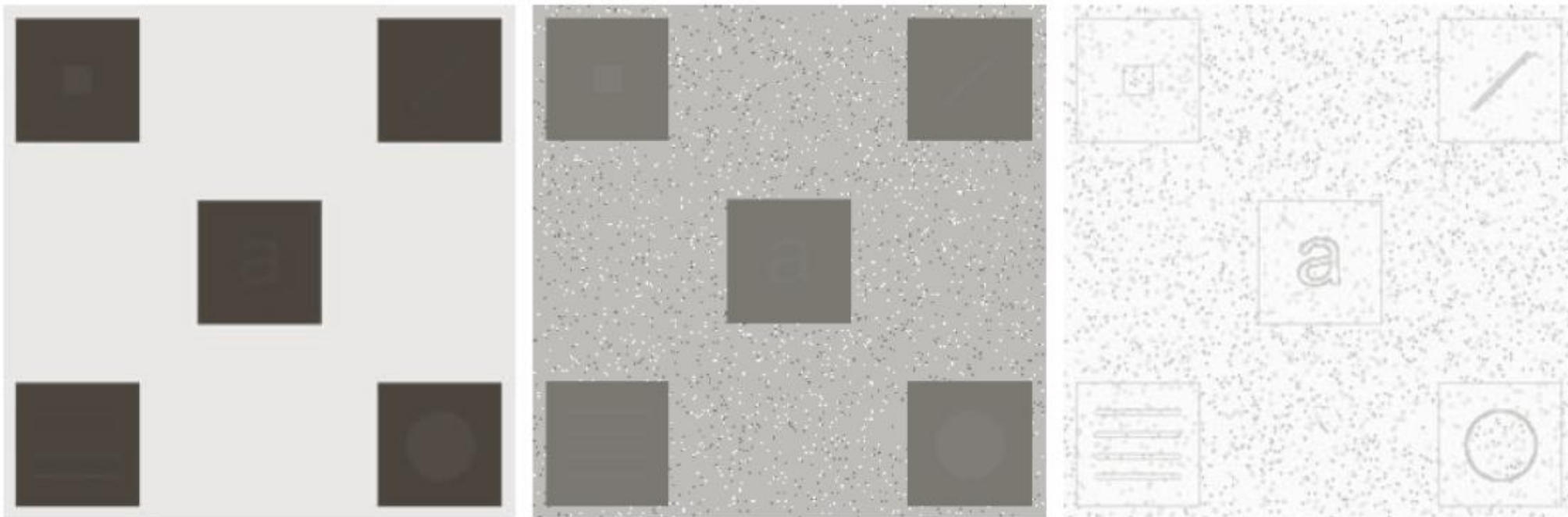
Príklady špecifikácie histogramu









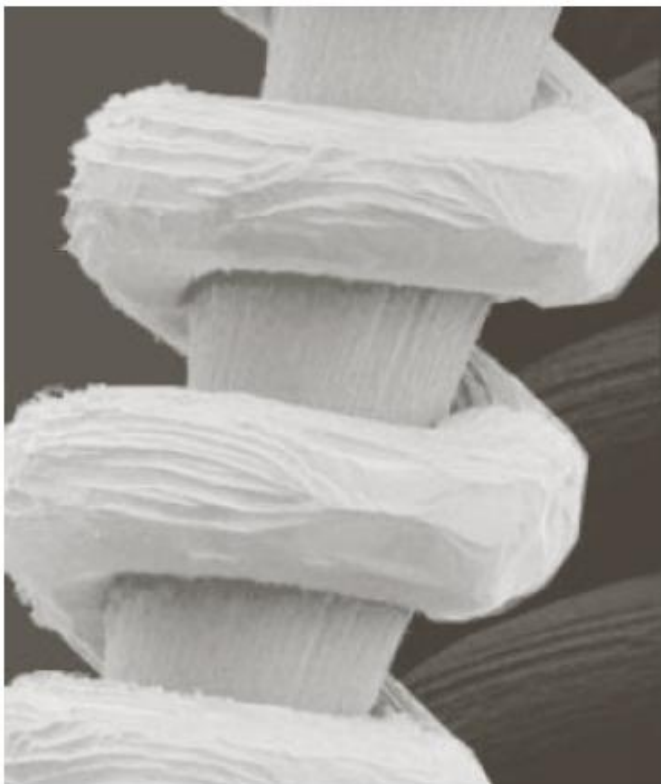


Adaptívna ekvalizácia histogramu po prekrývajúcich sa blokoch 7x7

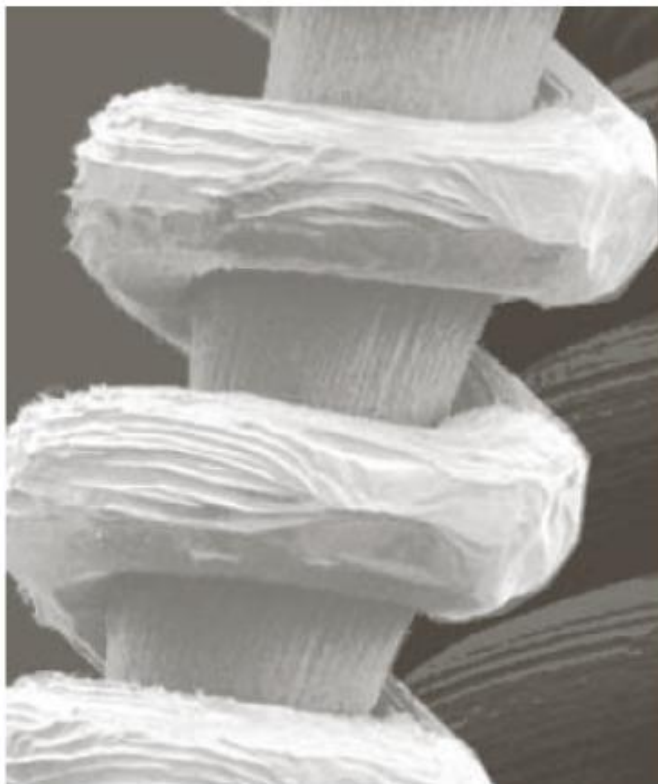
- ▶ Only dark regions need to be enhanced
 - ▶ $m_{S_{xy}} \leq k_0 m_G$
- ▶ Uniform region have to be preserved
 - ▶ $\sigma_{S_{xy}} \leq k_1 \sigma_G$
- ▶ Low contrasted regions have to be enhanced
 - ▶ $\sigma_{S_{xy}} \leq k_2 \sigma_G$

$$g(x, y) = \begin{cases} E \cdot f(x, y) & \text{if } m_{S_{xy}} \leq k_0 m_G \\ & \text{AND } k_1 \sigma_G < \sigma_{S_{xy}} \leq k_2 \sigma_G \\ f(x, y) & \text{otherwise} \end{cases}$$

$$E = 4, k_0 = 0.4, k_1 = 0.02, k_2 = 0.4.$$



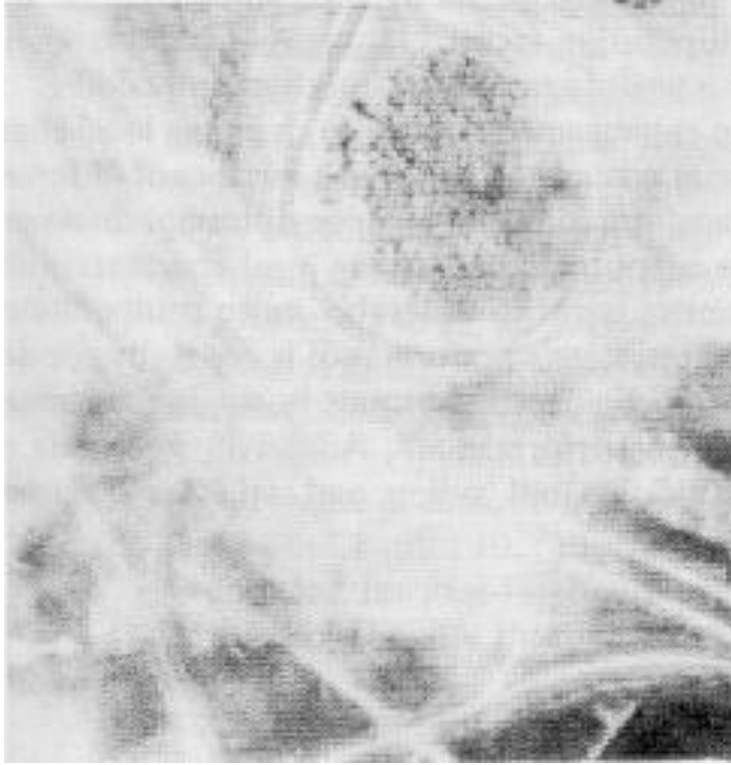
originál



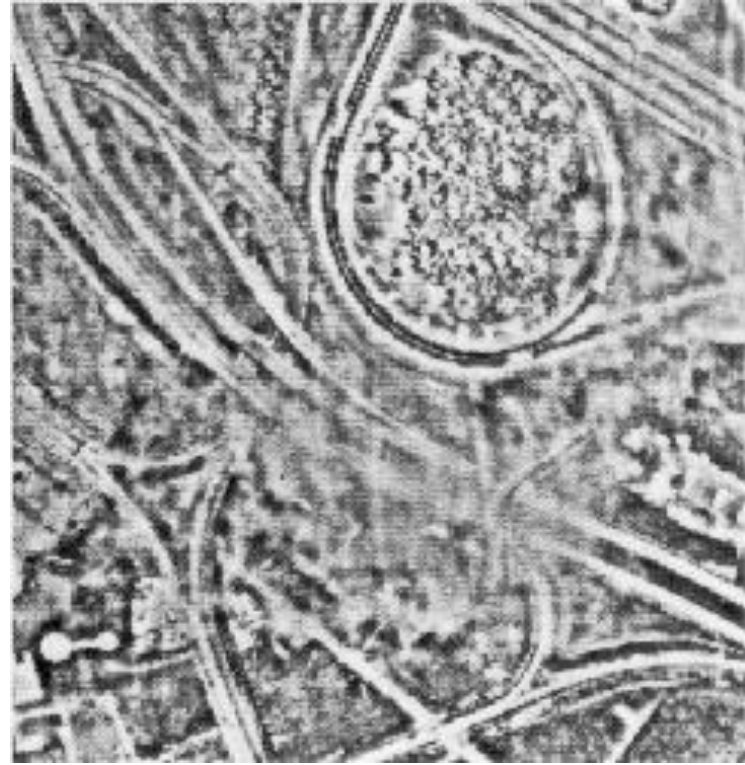
ekvalizácia na základe celého obrazu



ekvalizácia na základe lokálnych charakteristík

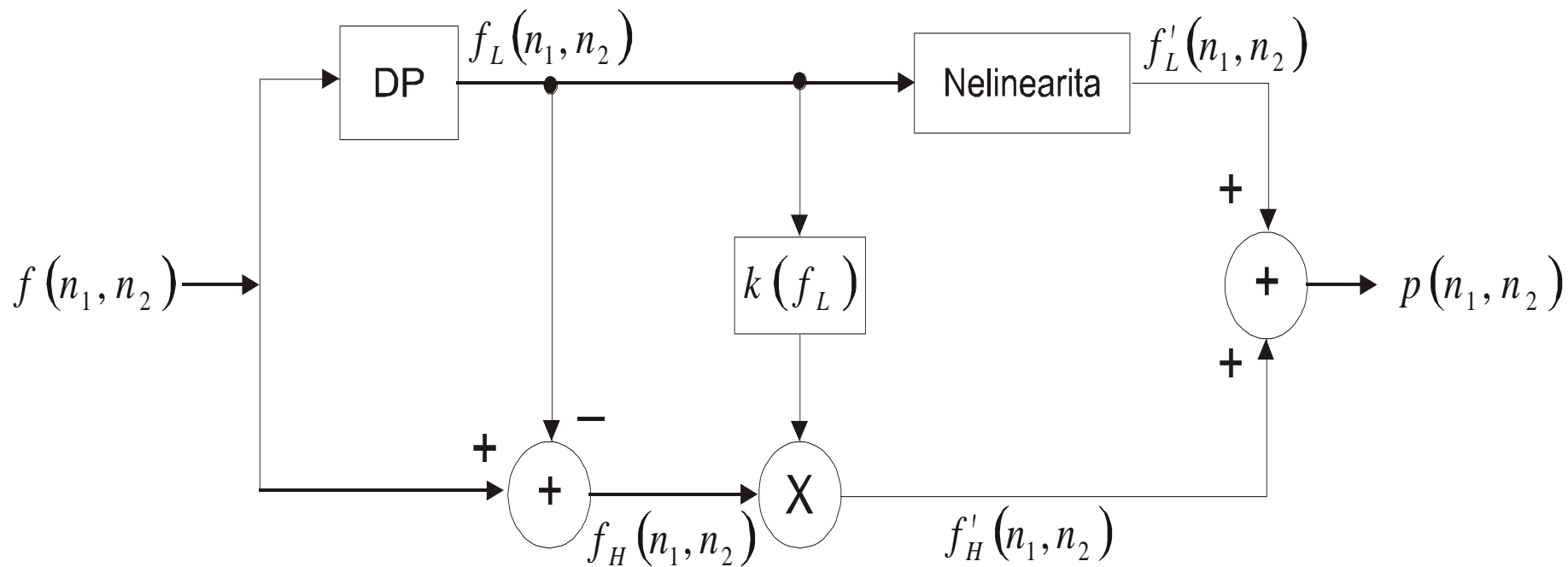


(a)



(b)

Iný príklad adaptívnej zmeny kontrastu (pozri skriptá)



$f(n_1, n_2)$ – vstupný obraz

$f_L(n_1, n_2)$ – priemerný lokálny jas

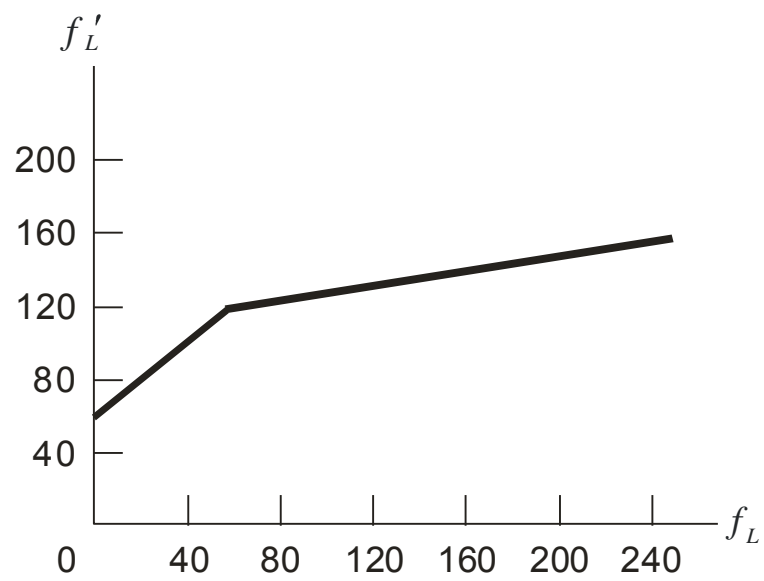
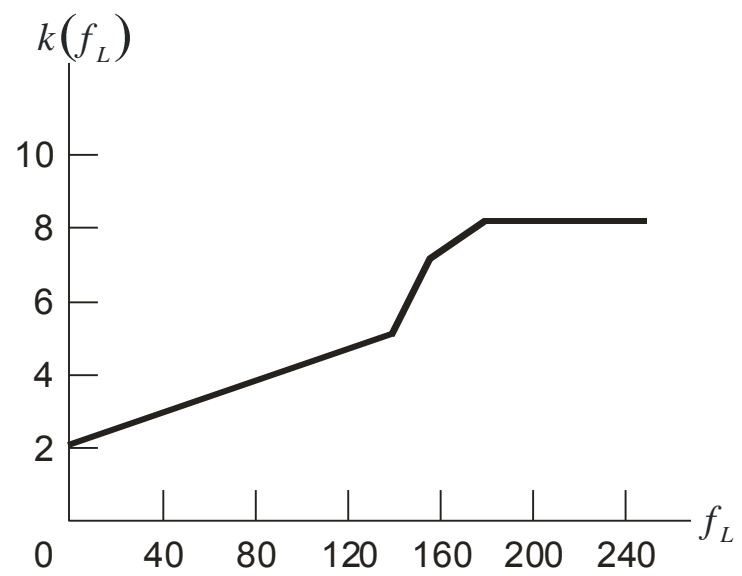
$f_H(n_1, n_2)$ – lokálny kontrast

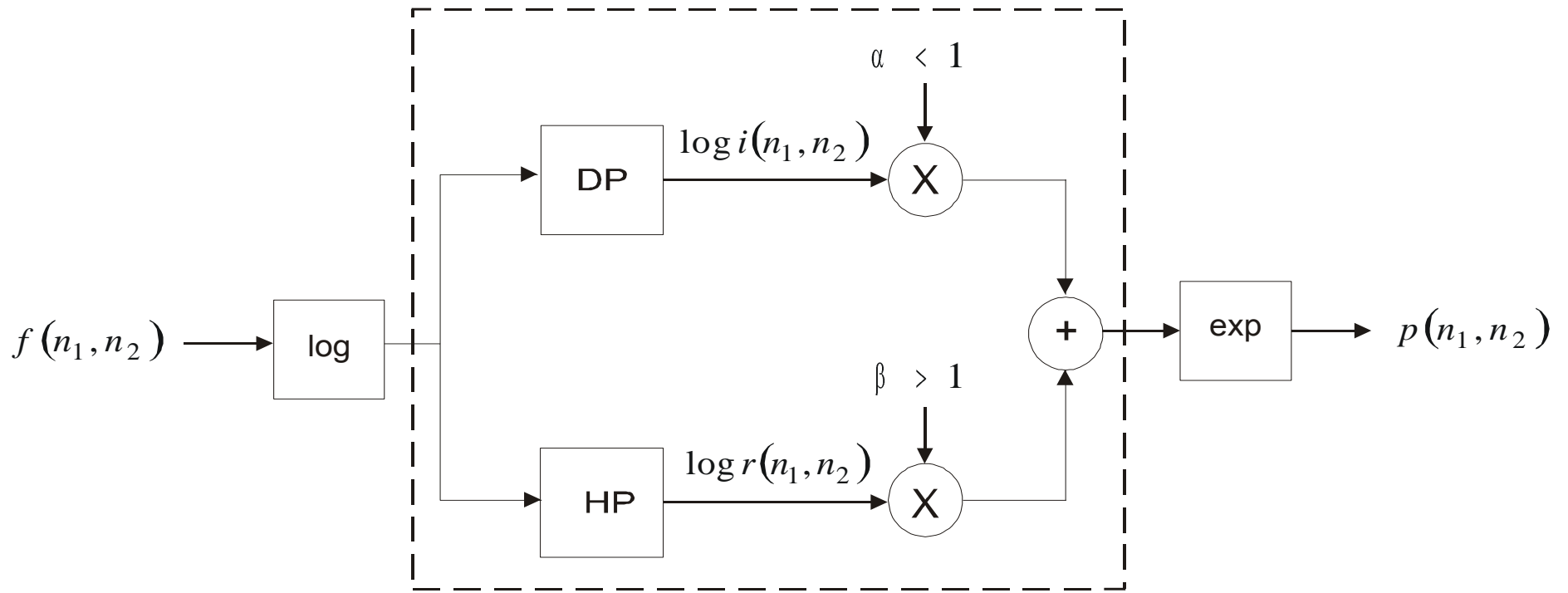
$k(f_L)$ – skalár – závisí od priemerného lokálneho jasu $f_L(n_1, n_2)$

$f'_H(n_1, n_2)$ – upravený kontrast; $k(f_L) > 1$ – kontrast sa zvyšuje, $k(f_L) < 1$ – kontrast sa znižuje

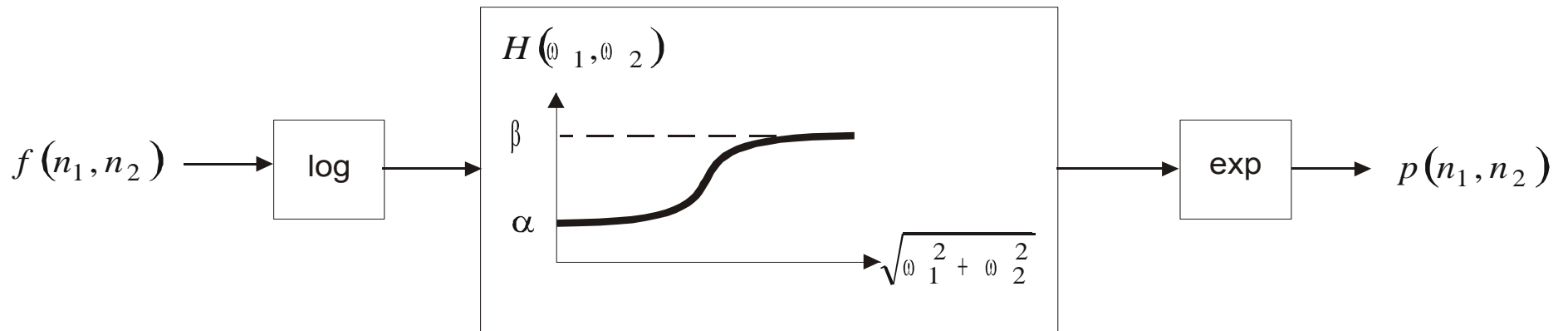
$f'_L(n_1, n_2)$ priemerný lokálny jas modifikovaný bodovou nelinearitou

$p(n_1, n_2)$ – výsledný spracovaný obraz

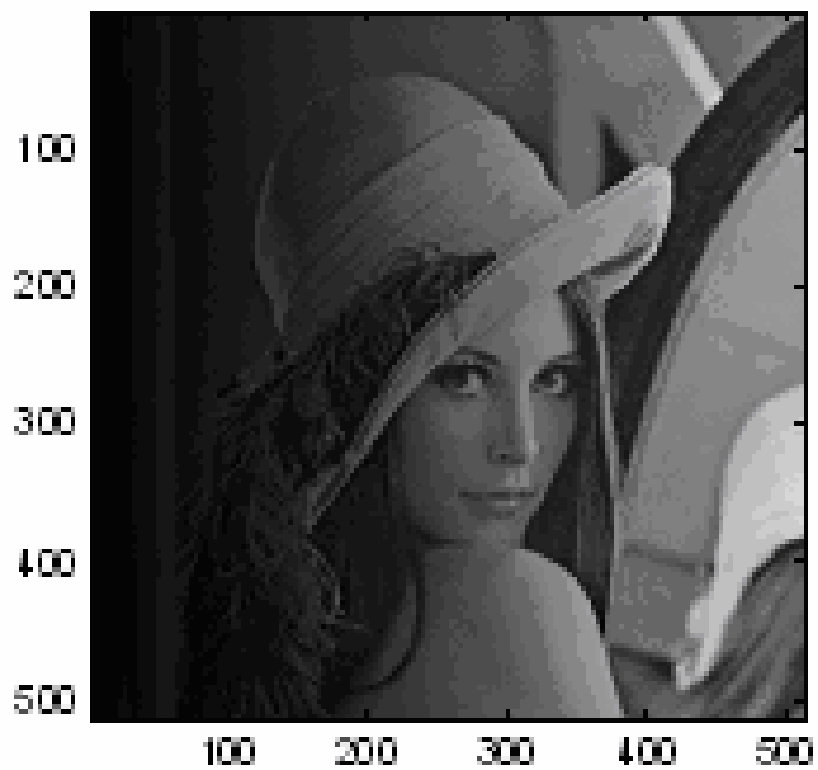




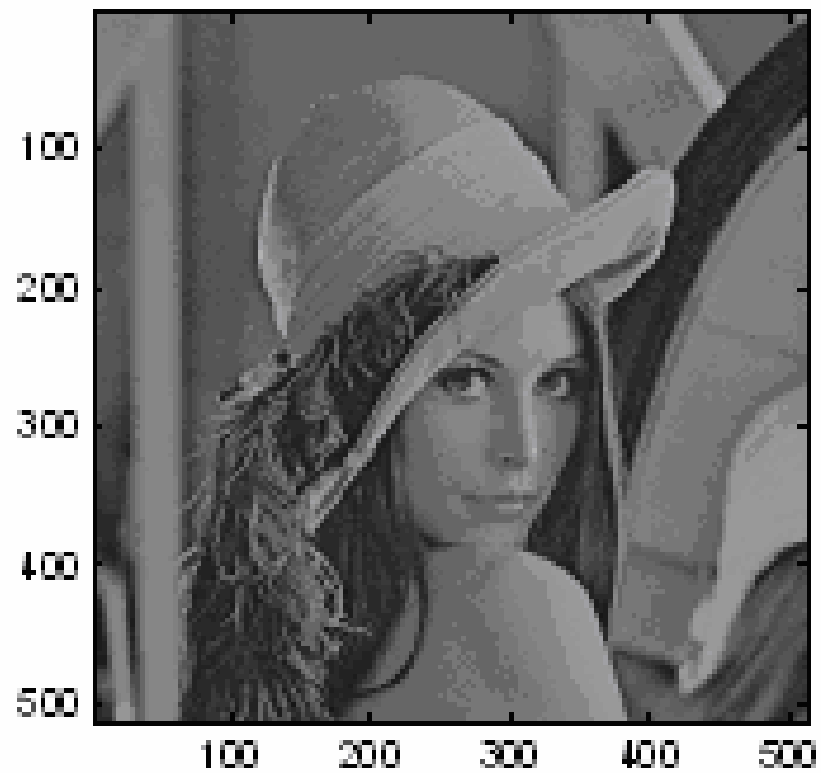
(a)



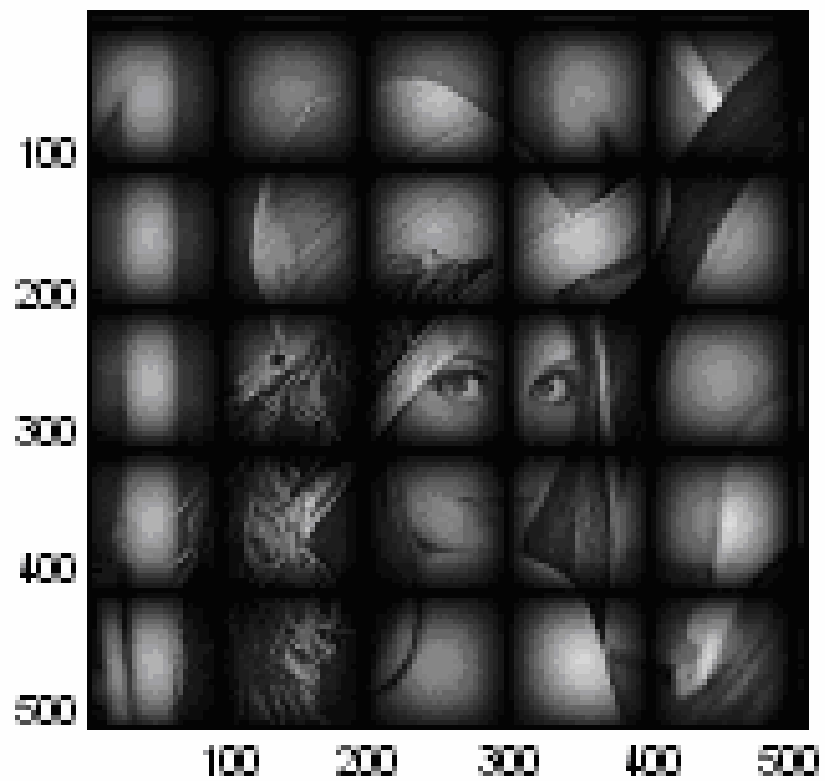
(b)



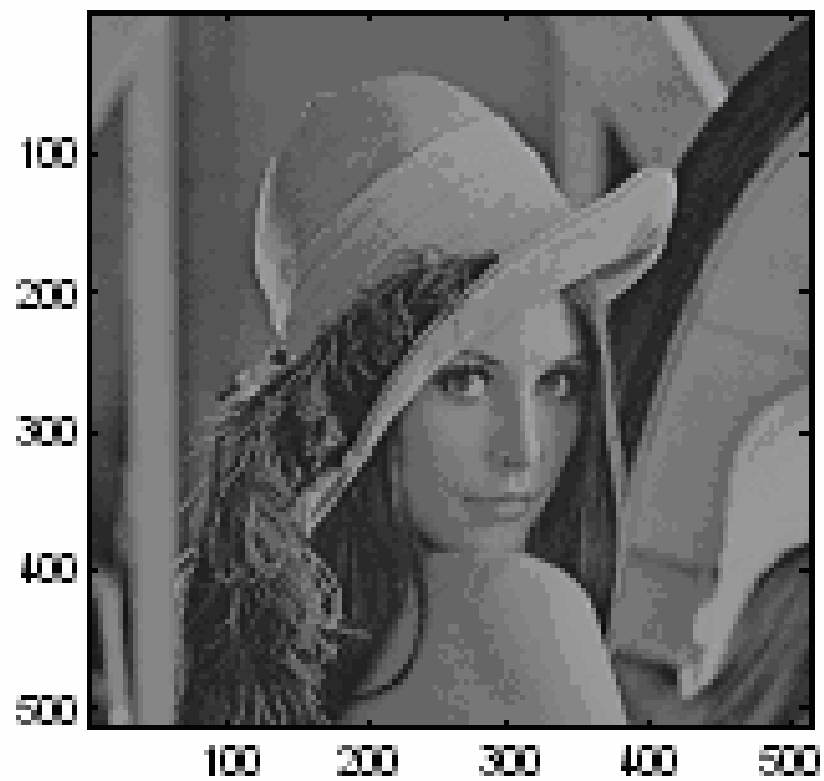
originál



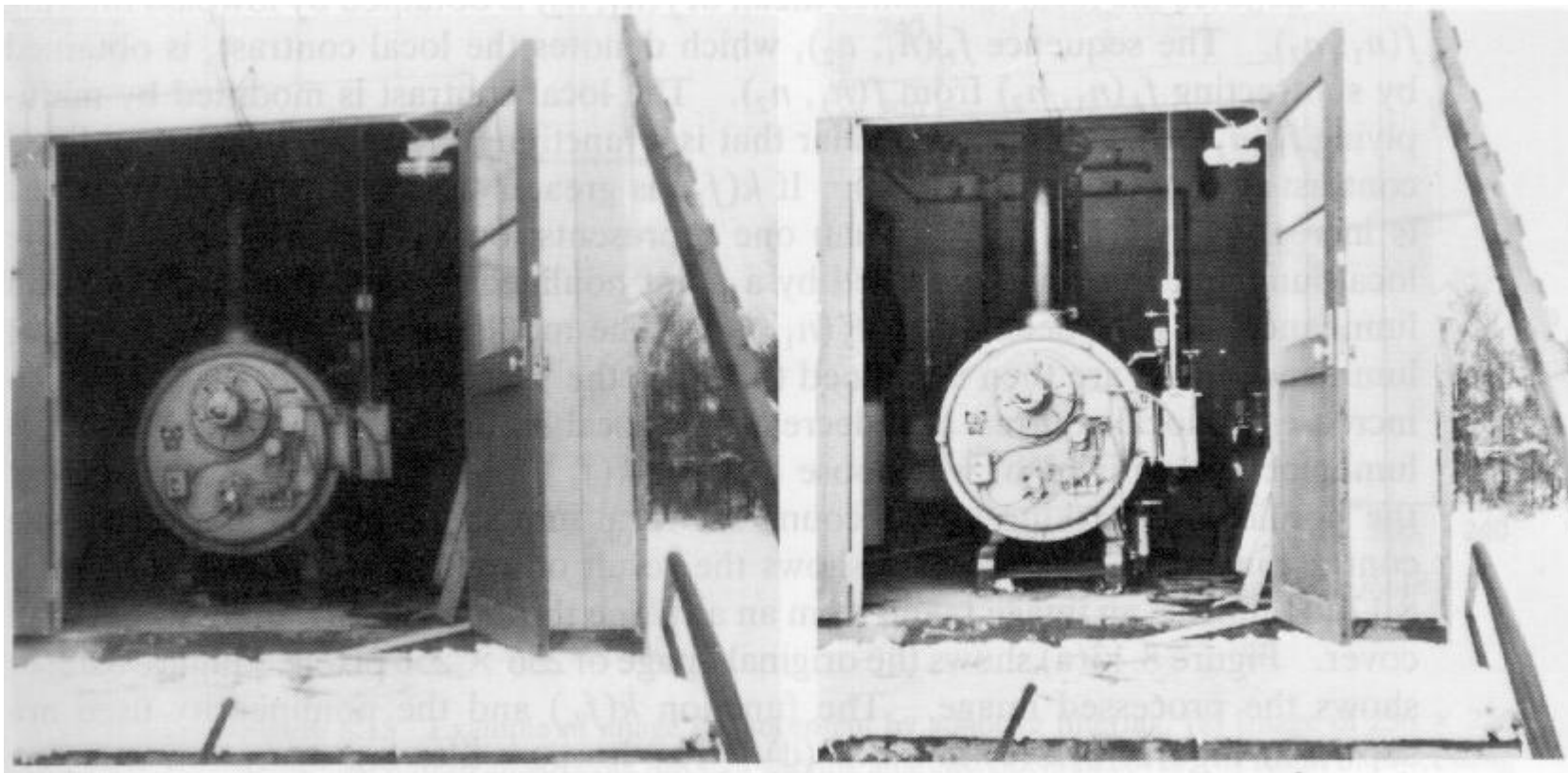
po homomorfnej filtrácii



originál



po homomorfnej filtrácii



originál

po homomorfnej filtrácii

