



flusser@utia.cas.cz

Prof. Ing. Jan Flusser, DrSc.

Digitální zpracování obrazu

Lecture 3

Digitální zpracování obrazu

- Digitalizace (vzorkování, kvantování)
- Předzpracování (změny kontrastu a jasu, potlačení šumu, zaostření, ...)
- Analýza obrazu (detekce a rozpoznávání objektů)
- Kódování (komprese)

Předzpracování obrazu

- **Image enhancement**
- **Image restoration**

Image enhancement

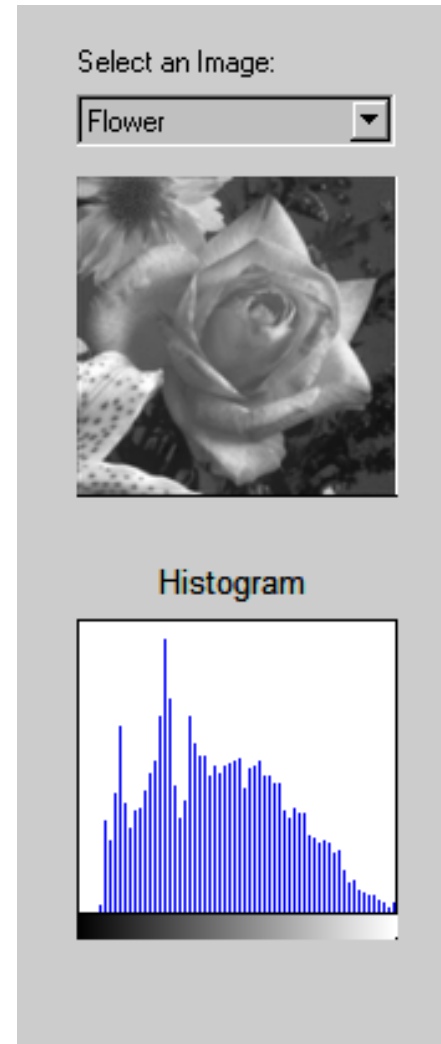
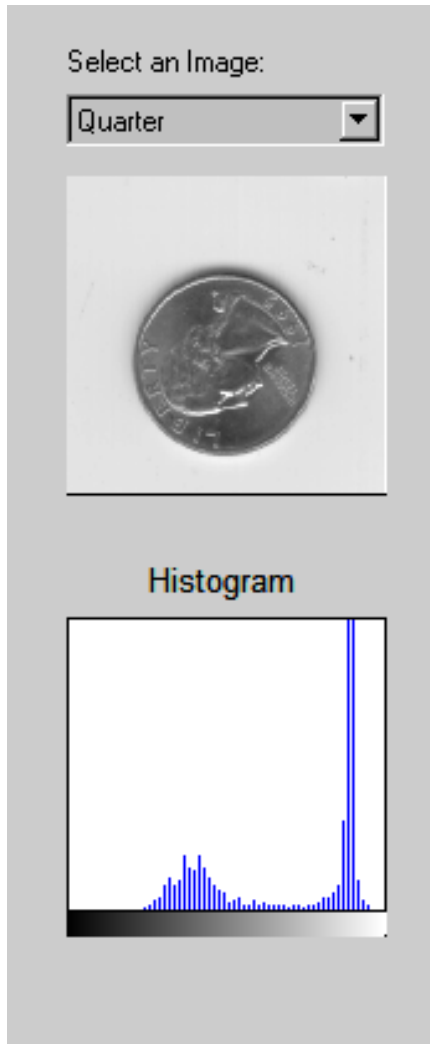
- **Změny kontrastu a jasu**
- **Potlačení šumu**
- **Detekce a zvýraznění hran**



Změny kontrastu a jasu

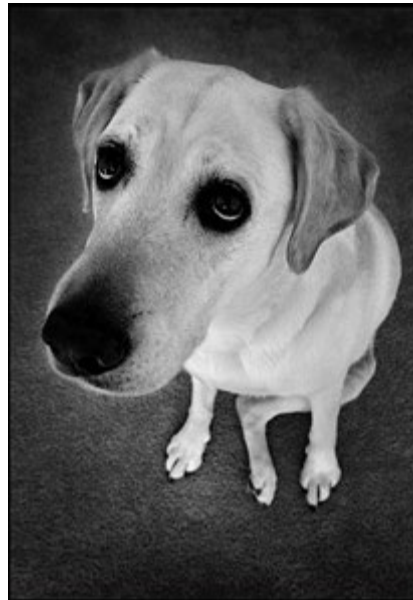
- **Histogram**
- **Lineární změny kontrastu a jasu**
- **Nelineární změny kontrastu a jasu, ekvalizace**
- **Lokální operace**

Histogram

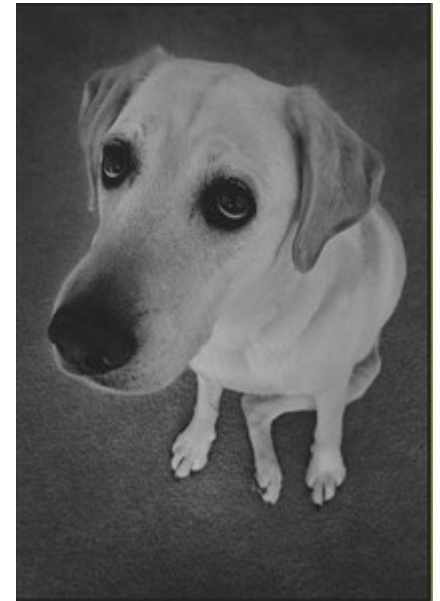




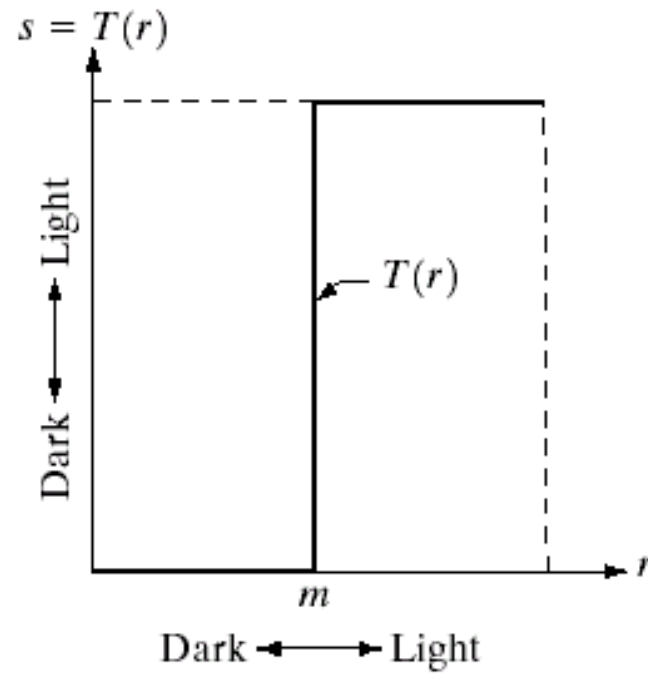
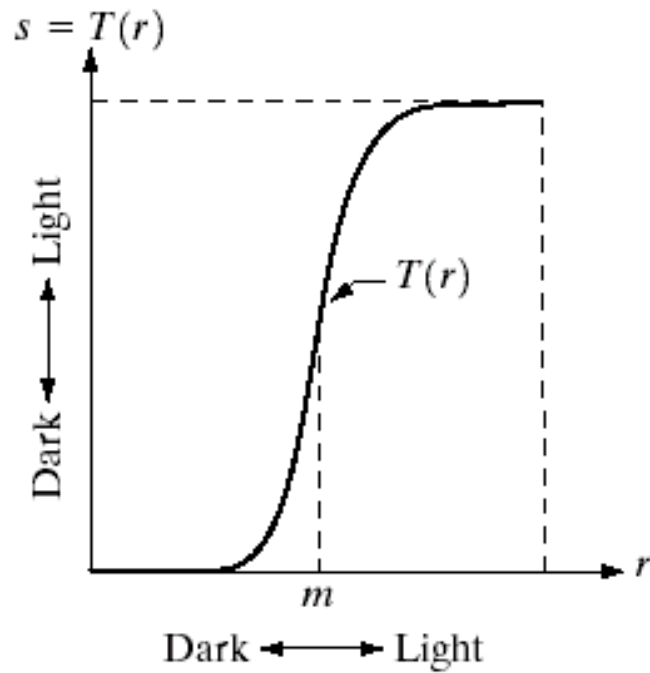
jas



kontrast

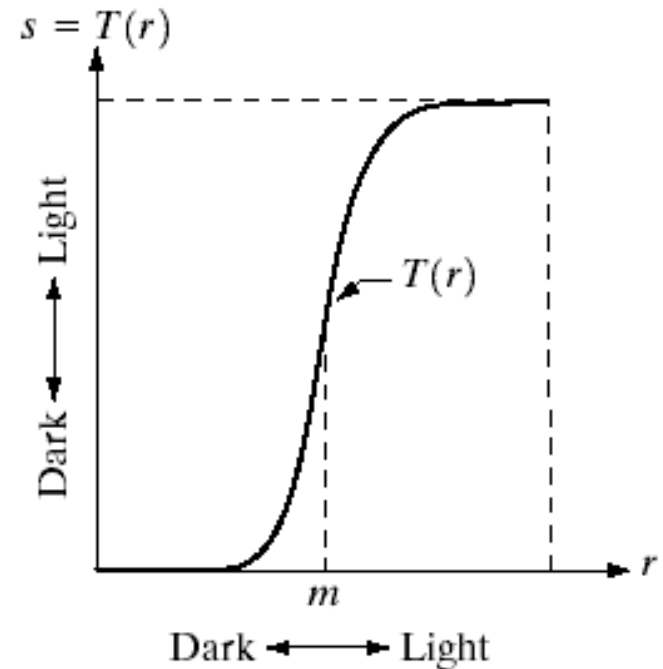


Změny kontrastu a jasu



Categories of illumination changes

- Point-wise transforms



- Global x local
- Linear x nonlinear



Illumination changes



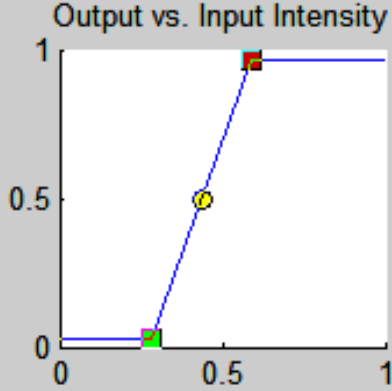
Změny kontrastu a jasu – lineární

Select an Image:
Pout

Adjusted Image

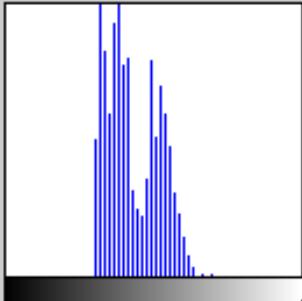


Output vs. Input Intensity

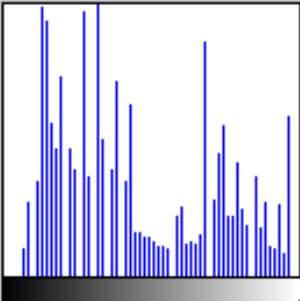


Gamma: 1

Histogram



Histogram



Operations:

Intensity Adjustment

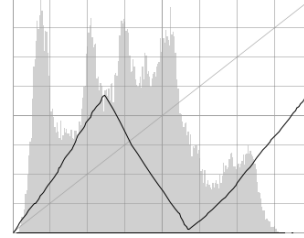
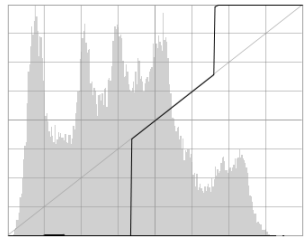
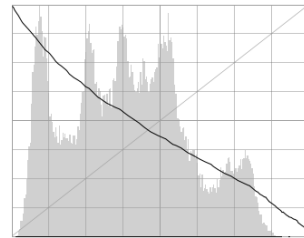
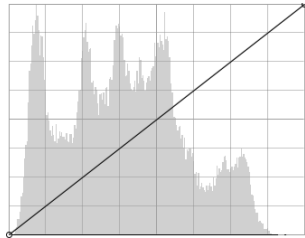
+ Brightness - Brightness

+ Contrast - Contrast

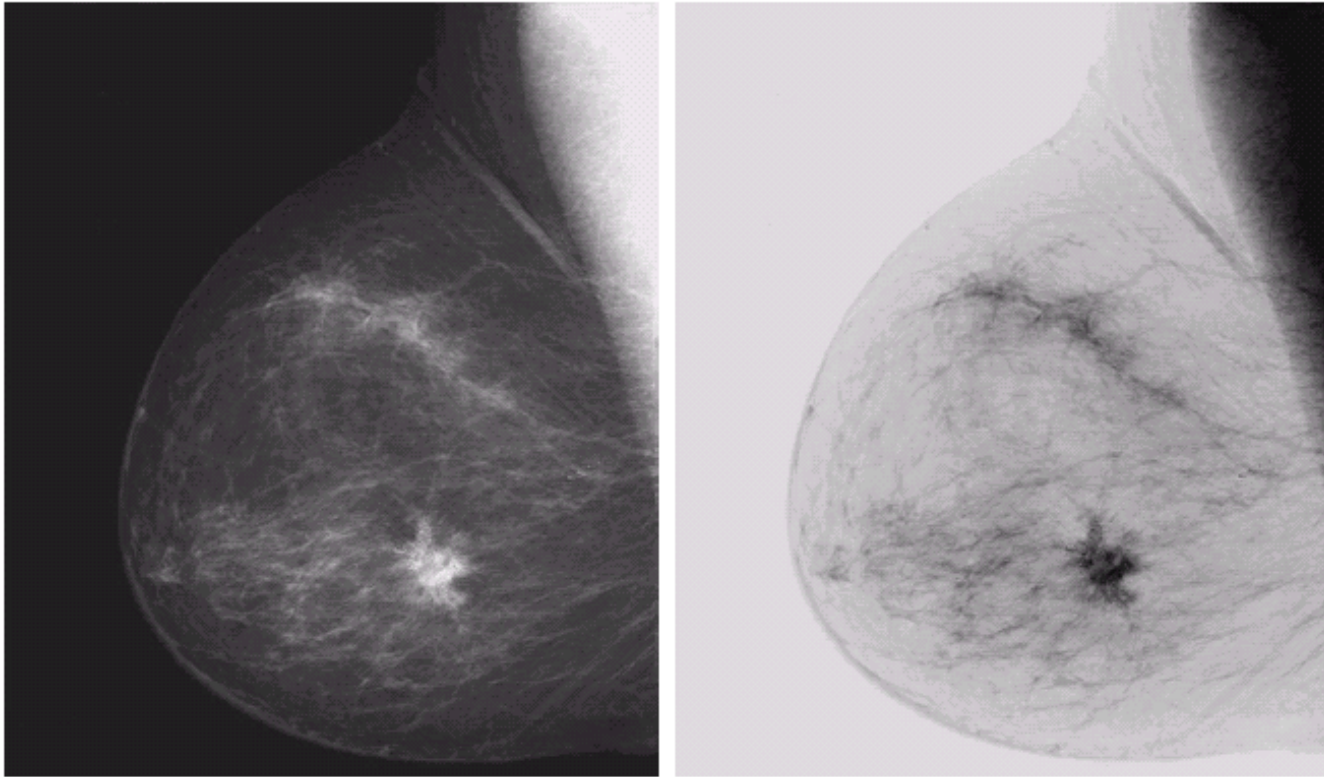
+ Gamma - Gamma

Info Close



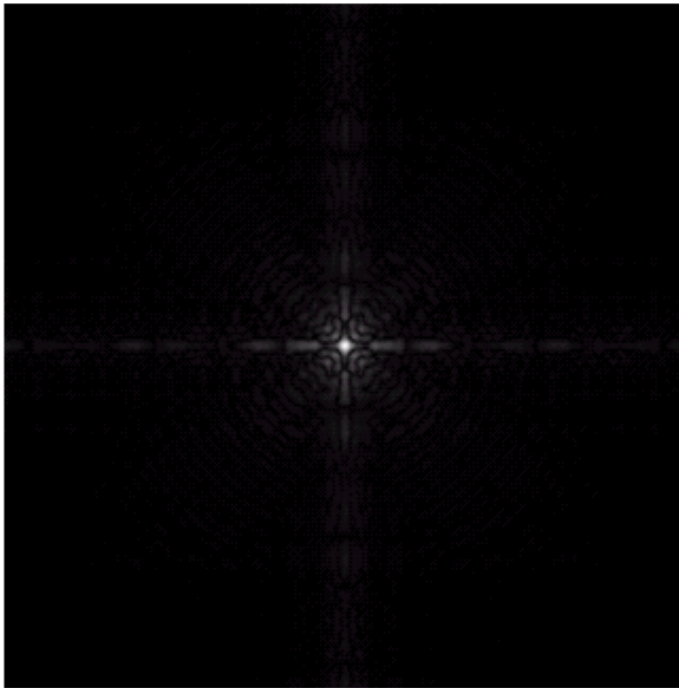


Negativ

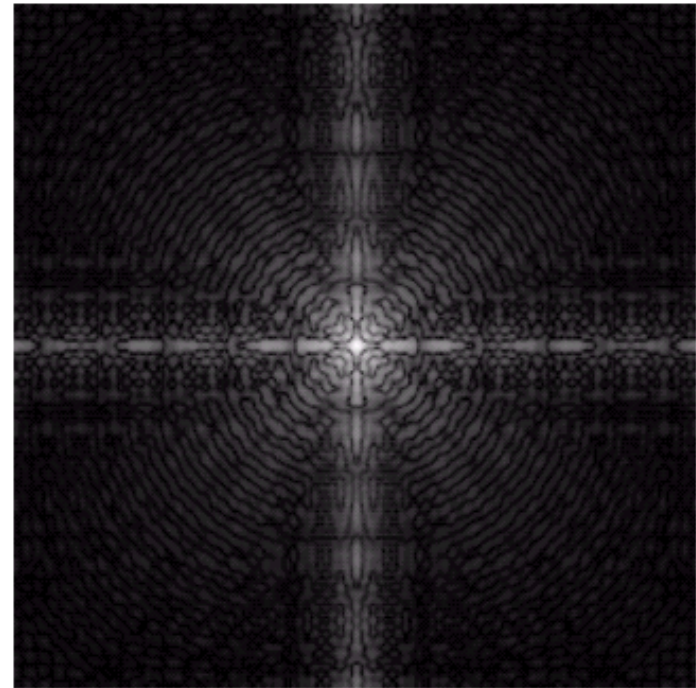


Mamogram

Nelineární transformace šedi



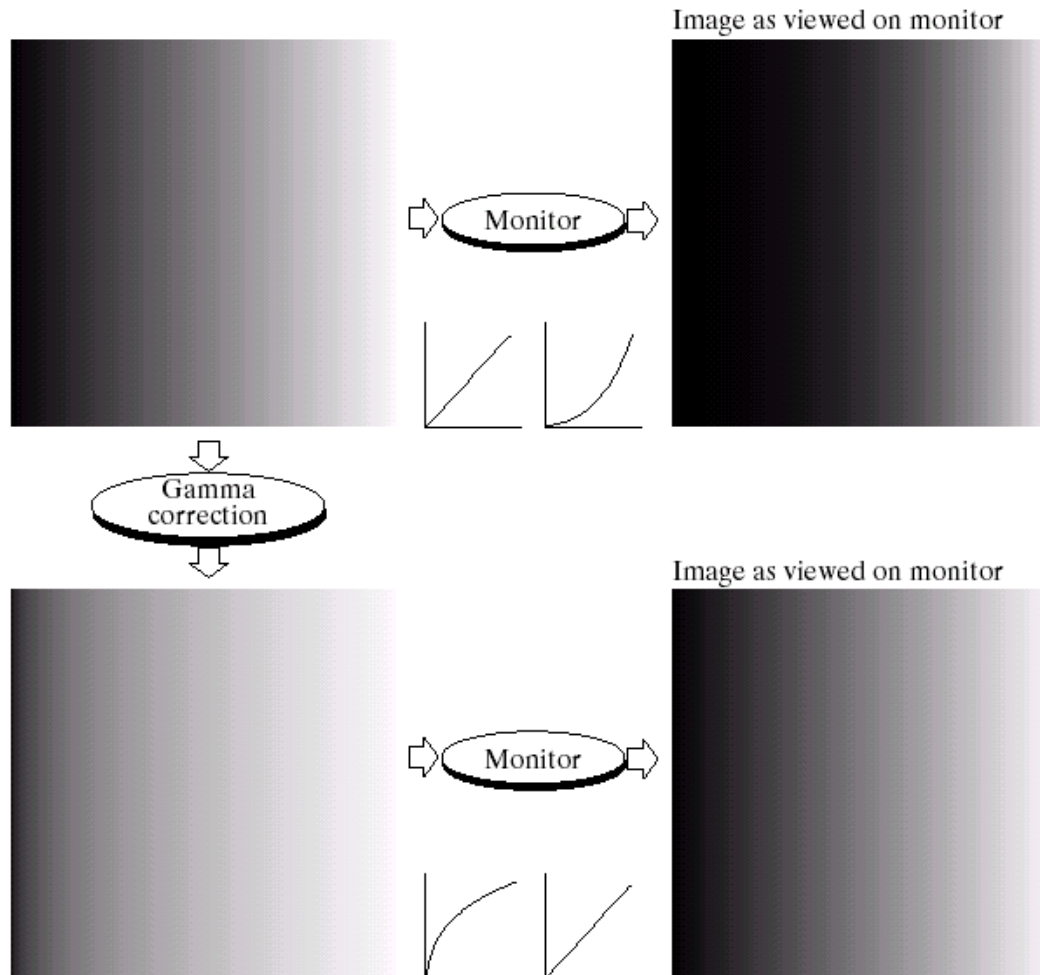
ampl



$\log(\text{ampl} + 1)$

Gama korekce

$$\text{Output} = c (\text{input})^{\text{gama}}$$



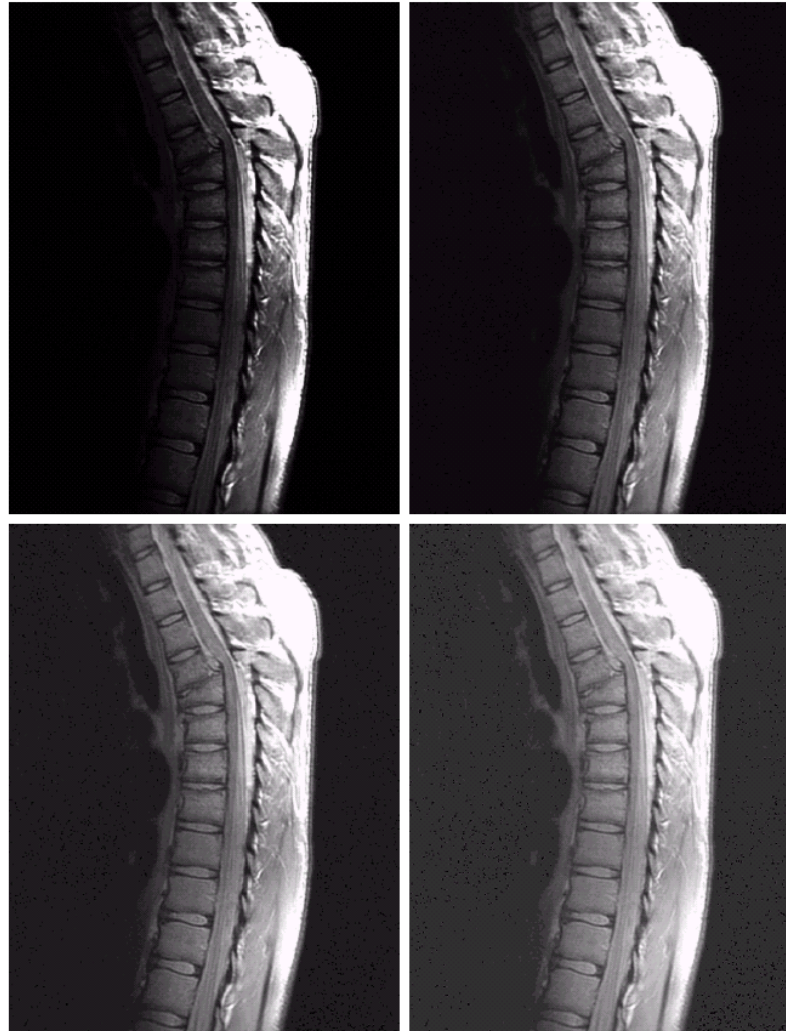
Gama korekce

Output = (input)^{gama} gama = 3, 4, 5



Gama korekce

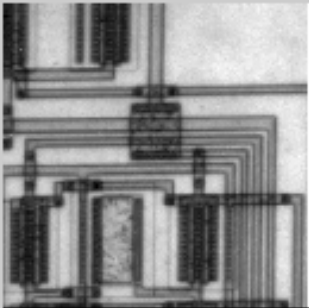
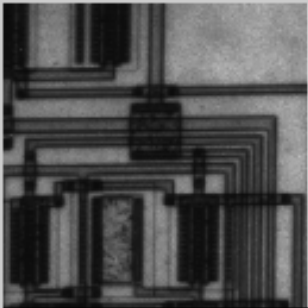
Output = (input)^{gama} gama = 0.6, 0.4, 0.3



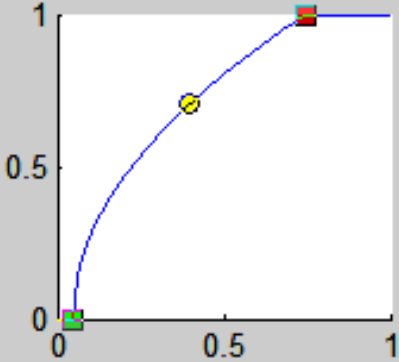
Gama korekce

Select an Image:
Circuit

Adjusted Image

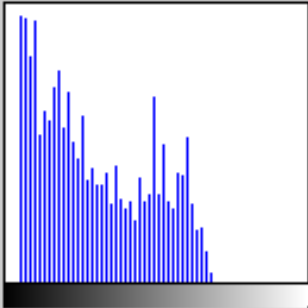


Output vs. Input Intensity

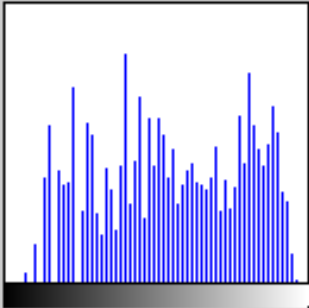


Gamma: 0.50493

Histogram



Histogram



Operations:
Intensity Adjustment

+ Brightness - Brightness

+ Contrast - Contrast

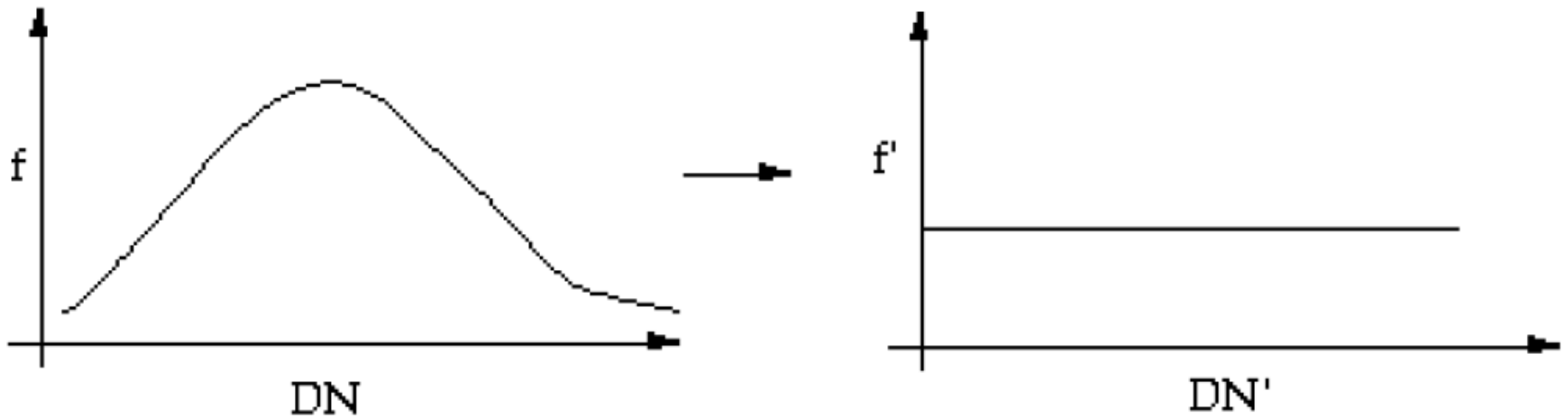
+ Gamma - Gamma

Info Close

Gama korekce

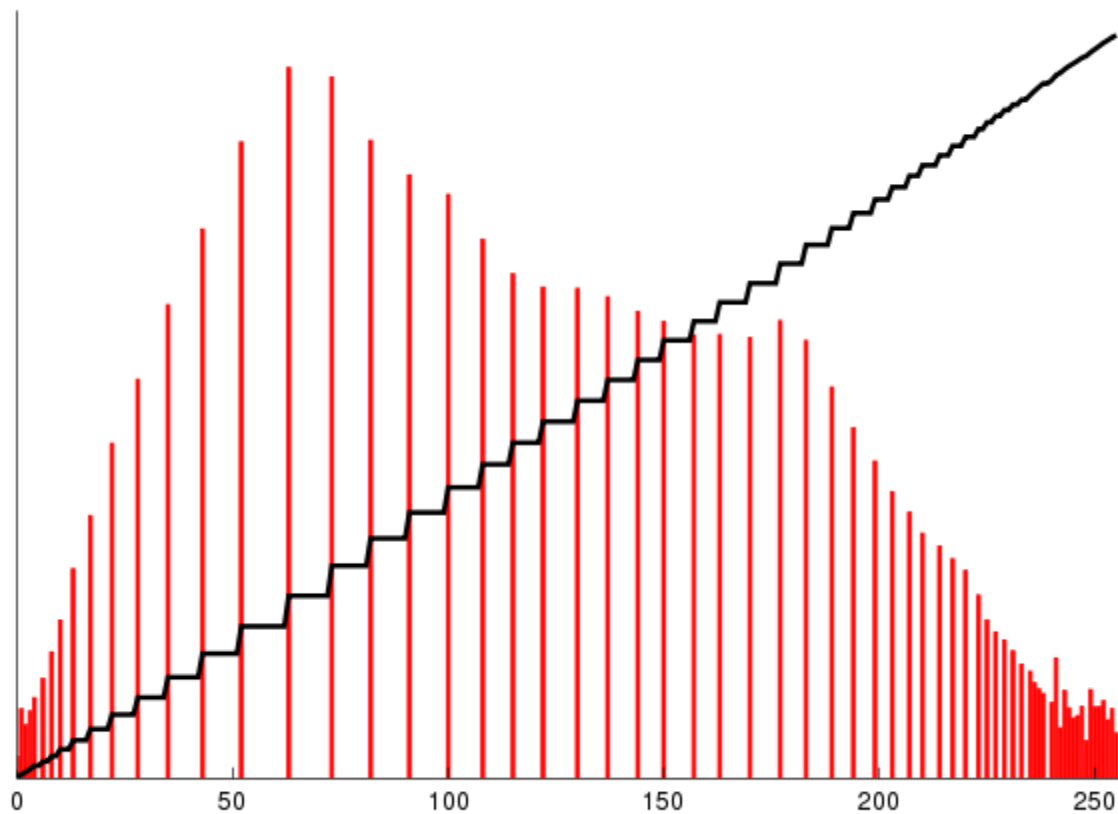


Ekvalizace histogramu



řešení -> kumulativní histogram



Ekvalizace histogramu



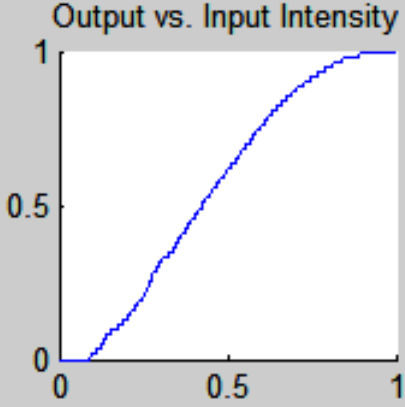
Ekvalizace histogramu

Select an Image:
Flower

Equalized Image

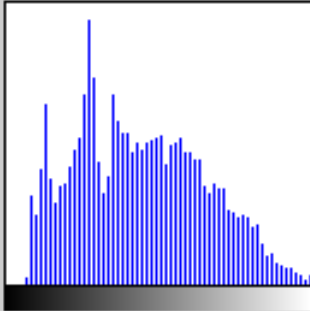


Output vs. Input Intensity

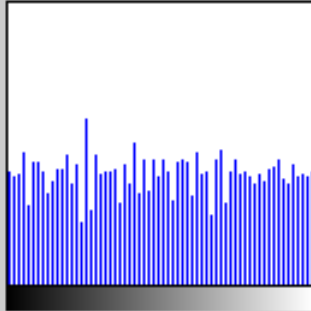


Gamma: 1

Histogram



Histogram



Operations:

Histogram Equalization

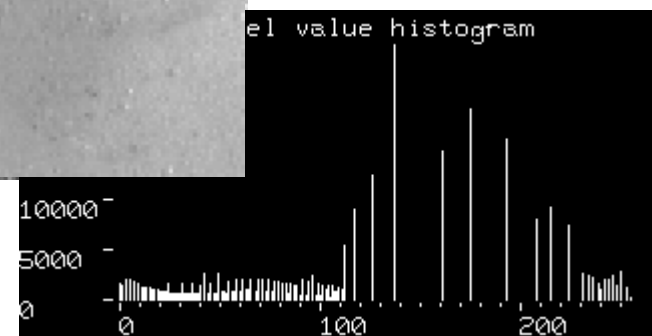
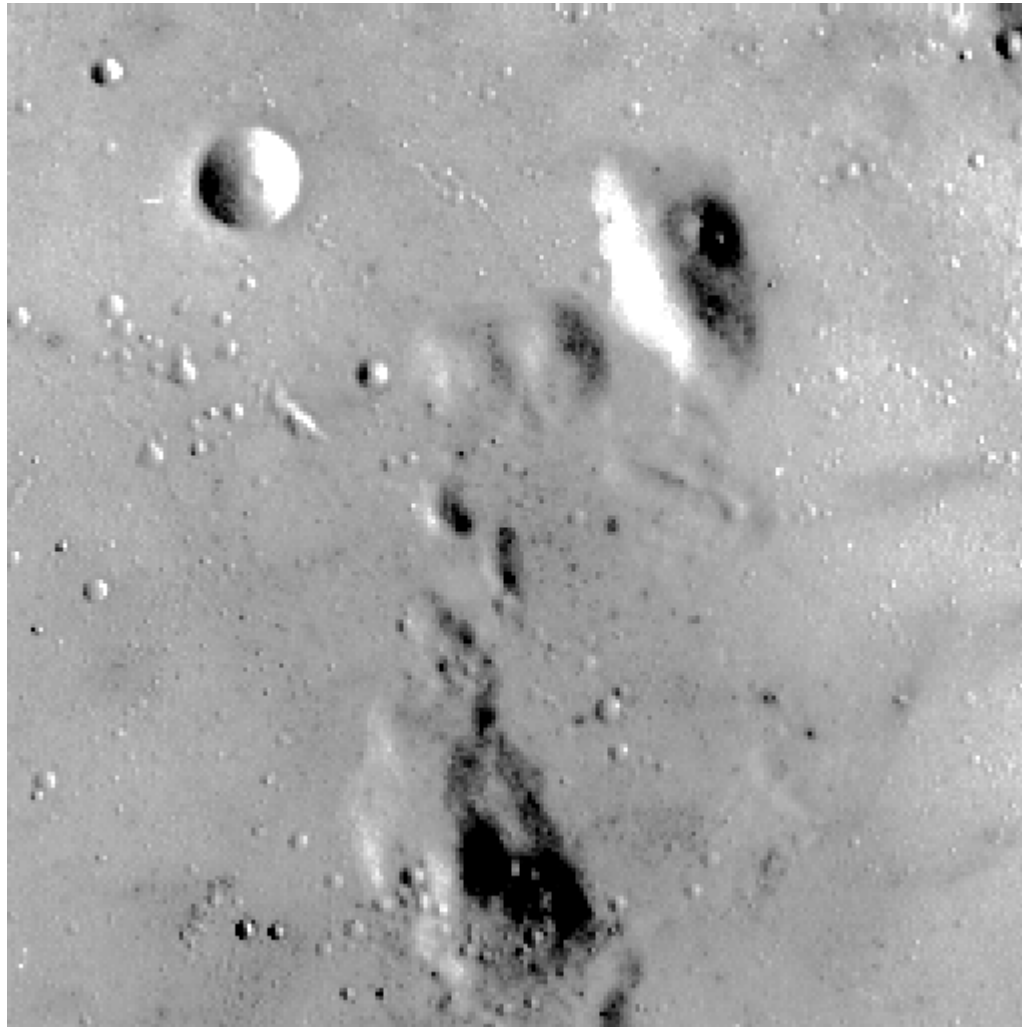
+ Brightness - Brightness

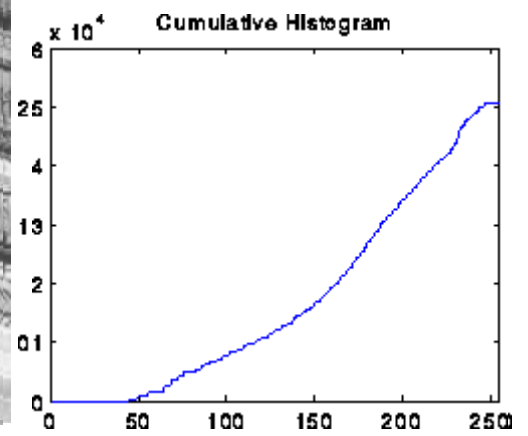
+ Contrast - Contrast

+ Gamma - Gamma

Info Close

Ekvalizace histogramu





**Díky, pro dnešek končíme
s úpravami kontrastu!**

Nějaké otázky ?