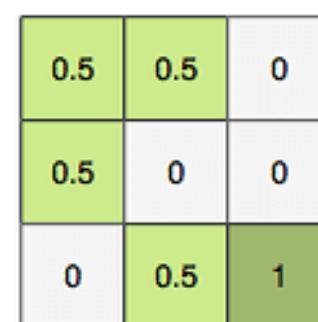


# Alati za modifikaciju i korekciju slika

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Matematički fakultet  
Univerzitet u Beogradu

# Konvolucija

$$\text{I} \quad \begin{array}{|c|c|c|c|} \hline 0 & 1 & 1 & 0 \\ \hline 0 & 0 & 0 & 0 \\ \hline 1 & 0 & 0 & 1 \\ \hline 0 & 1 & 1 & 0 \\ \hline \end{array} \quad * \quad \text{K} \quad \begin{array}{|c|c|} \hline 0 & 0.5 \\ \hline 0.5 & 0 \\ \hline \end{array} \quad = \quad \text{S} \quad \begin{array}{|c|c|c|} \hline 0+0.5 \\ +0+0 & 0+0.5 \\ +0+0 & 0+0 \\ +0+0 & \\ \hline 0+0 \\ +0.5+0 & 0+0 \\ +0+0 & 0+0.5 \\ +0.5+0 & \\ \hline 0+0 \\ +0+0 & \\ +0+0 & \\ +0+0 & \\ \hline \end{array}$$

=  $\text{S}$  

# Zamućivanje konvolucijom

# Gauß filter

$$\frac{1}{256} \begin{bmatrix} 1 & 4 & 6 & 4 & 1 \\ 4 & 16 & 24 & 16 & 4 \\ 6 & 24 & 36 & 24 & 6 \\ 4 & 16 & 24 & 16 & 4 \\ 1 & 4 & 6 & 4 & 1 \end{bmatrix}$$

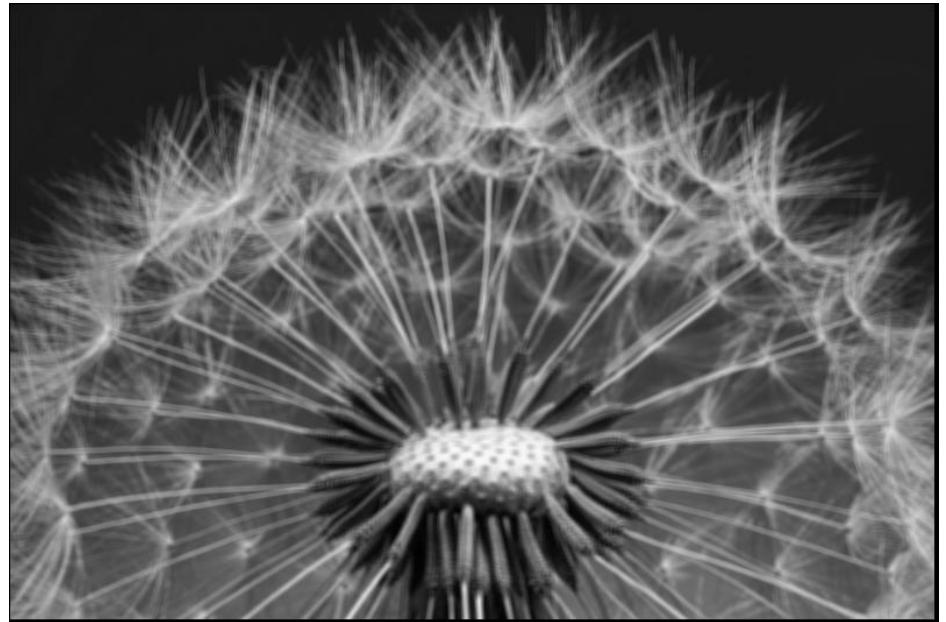
# Gauß filter



# Prosek filter

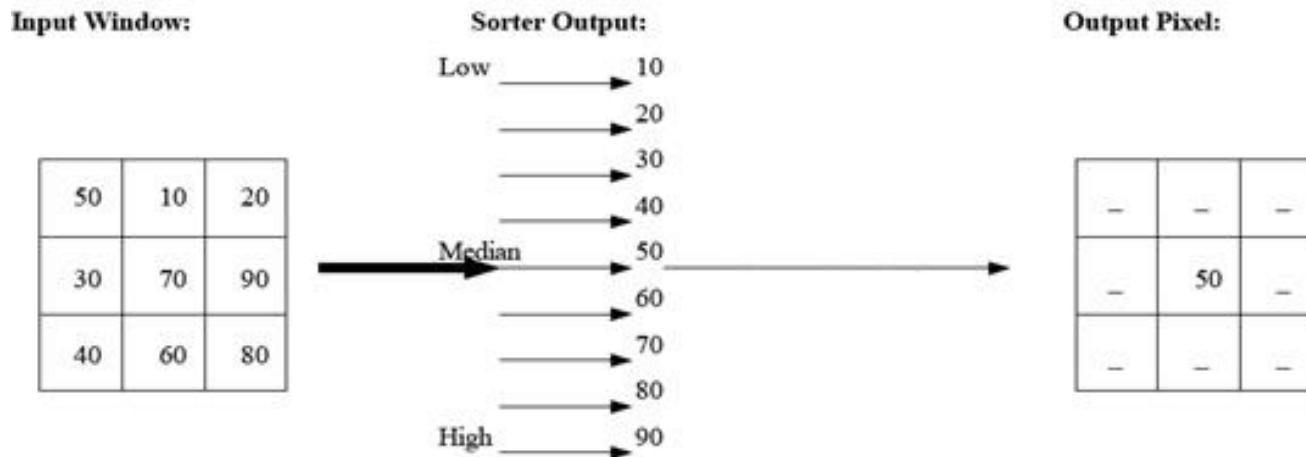
$$\frac{1}{9} \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

# Prosek filter

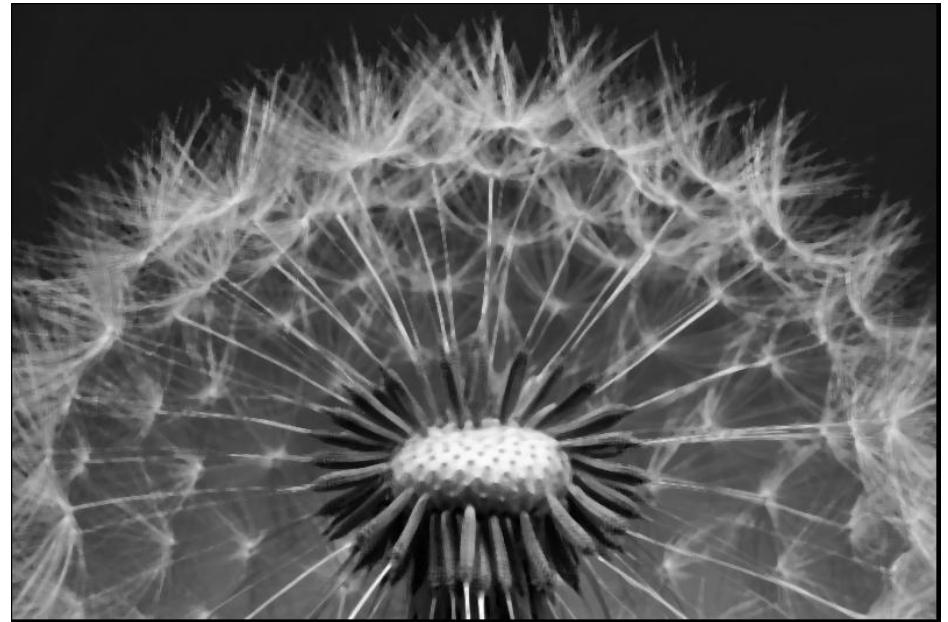


# Zamućivanje medijanom

# Medijana filter



# Medijana filter



# Poređenje



Gauß

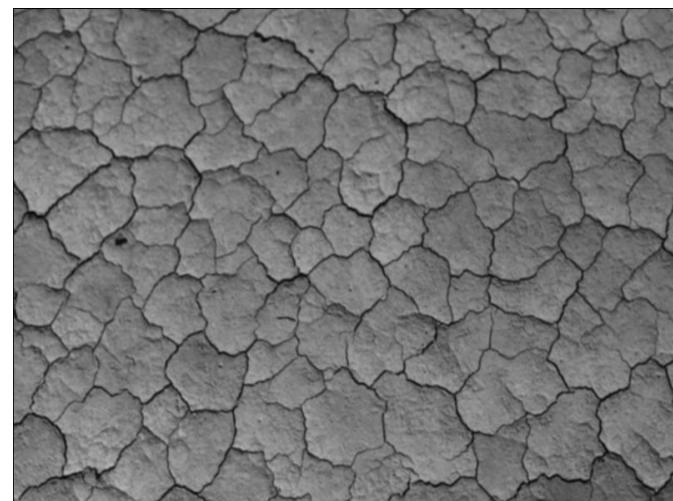


Prosek

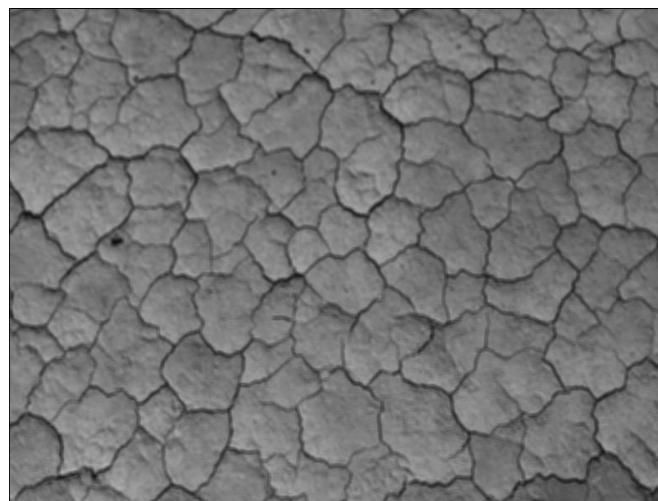


Medijana

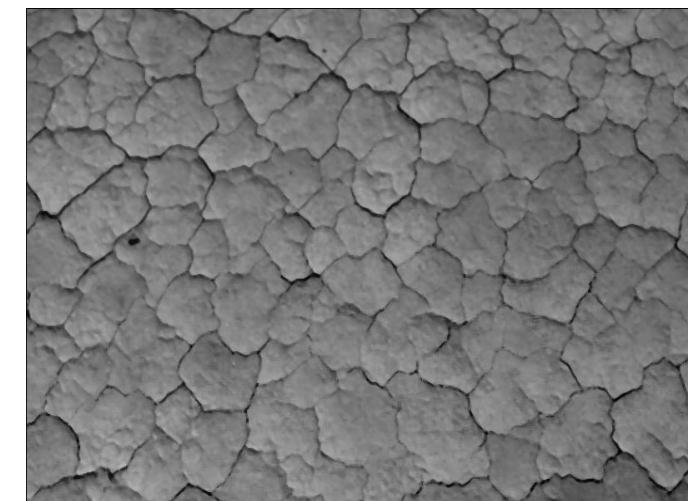
# Poređenje



Gauß



Prosek



Medijana

# Poređenje



Gauß



Prosek



Medijana

# Primena

- Zamućivanje
- Otklanjanje šuma
- Preprocesiranje (detektovanje ivica)

# Detektovanje ivica konvolucijom

# Sobel filter

$$G_x = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & -2 \\ -1 & 0 & 1 \end{bmatrix} \quad G_y = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & 1 \end{bmatrix}$$

# Sobel filter



# Prewitt filter

$$G_x = \begin{bmatrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{bmatrix}$$

$$G_y = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ -1 & -1 & -1 \end{bmatrix}$$

# Prewitt filter



# Roberts filter

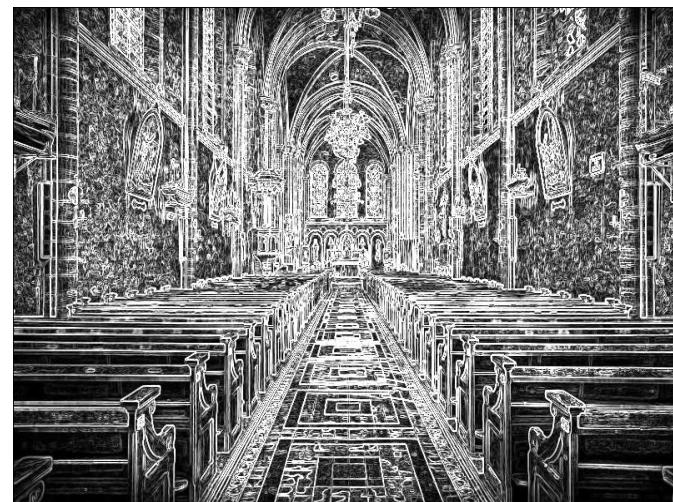
$$G_x = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$$

$$G_y = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$$

# Roberts filter



# Poređenje



Sobel



Prewitt



Roberts

# Poređenje



Sobel

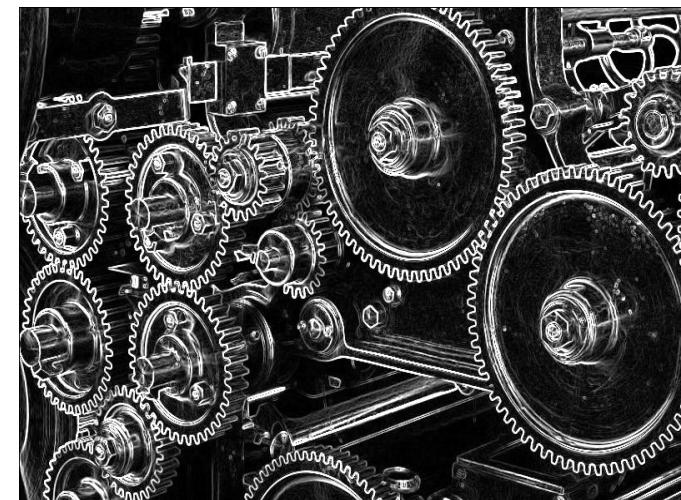


Prewitt

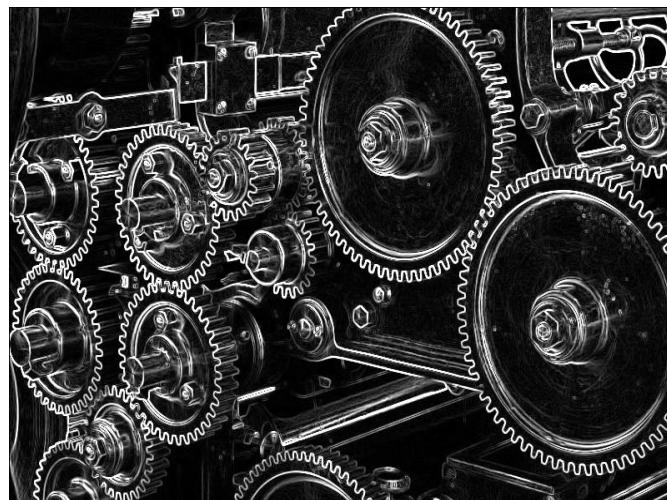


Roberts

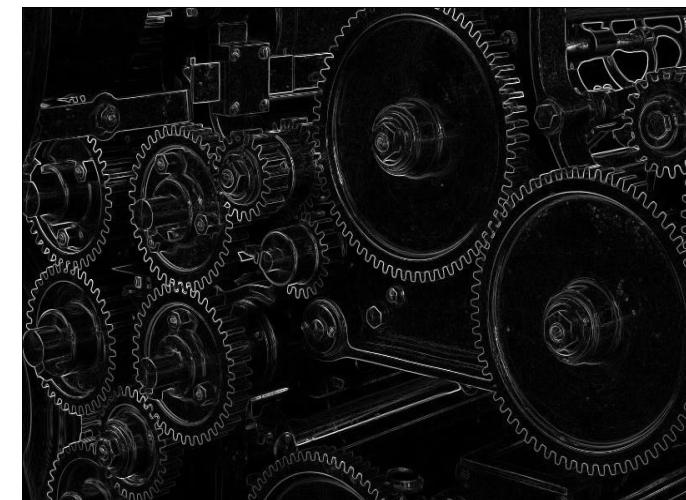
# Poređenje



Sobel



Prewitt



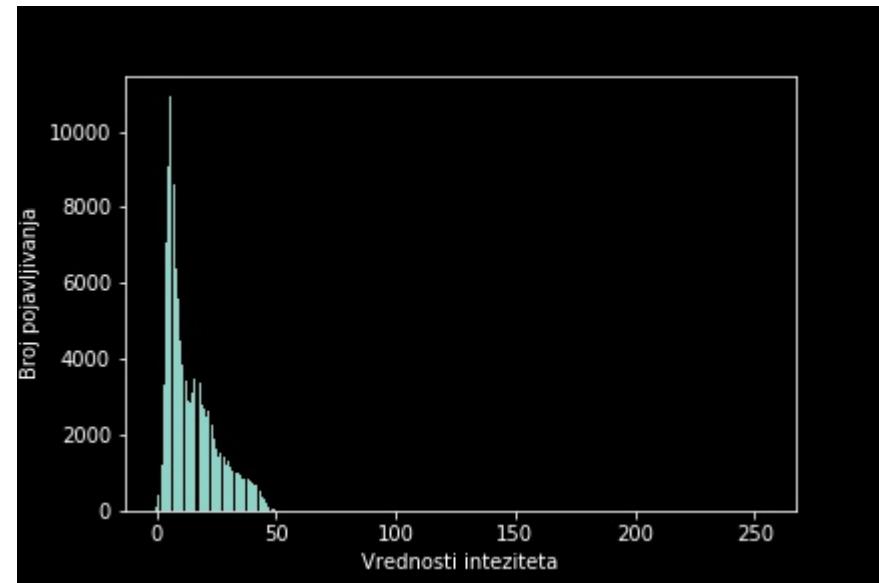
Roberts

# Primena

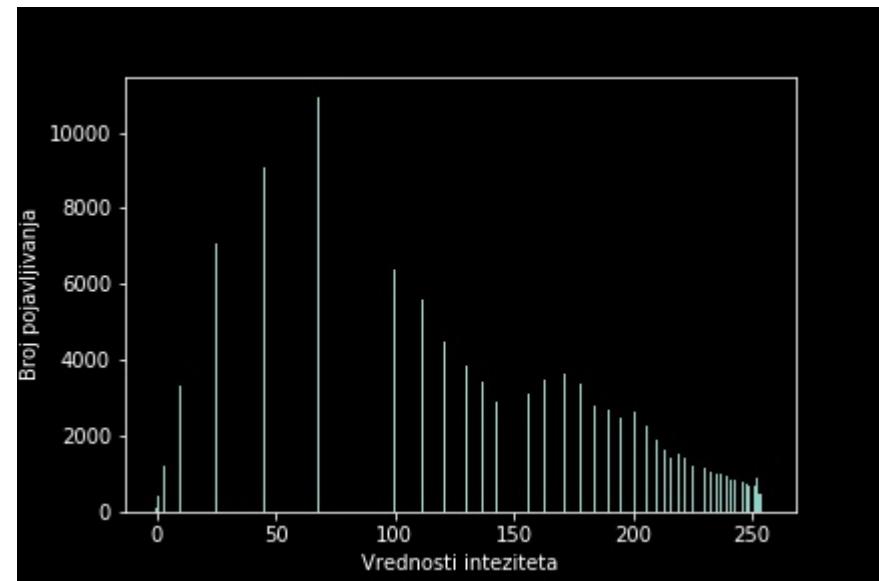
- Automobilska industrija
- Medicina
- Robotic vision

# Korekcija slika pomoću histograma intenziteta piksela

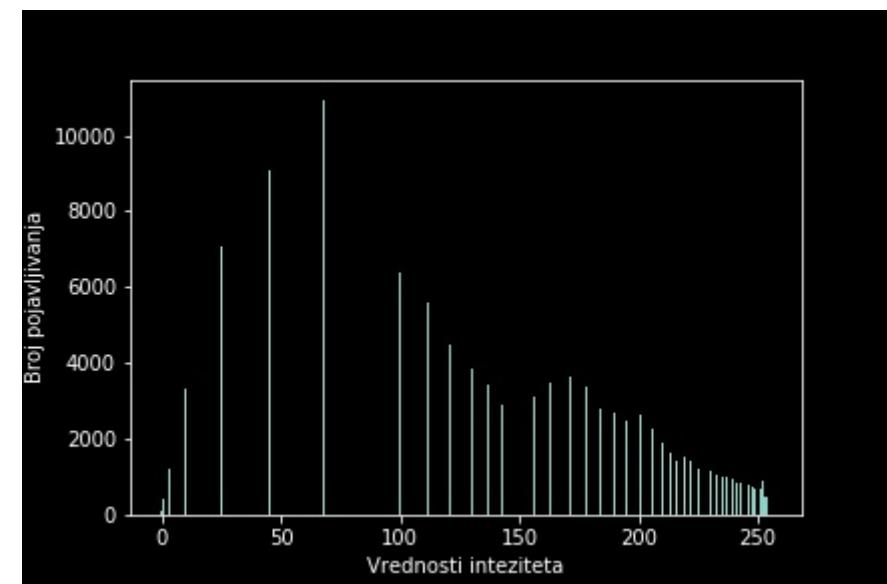
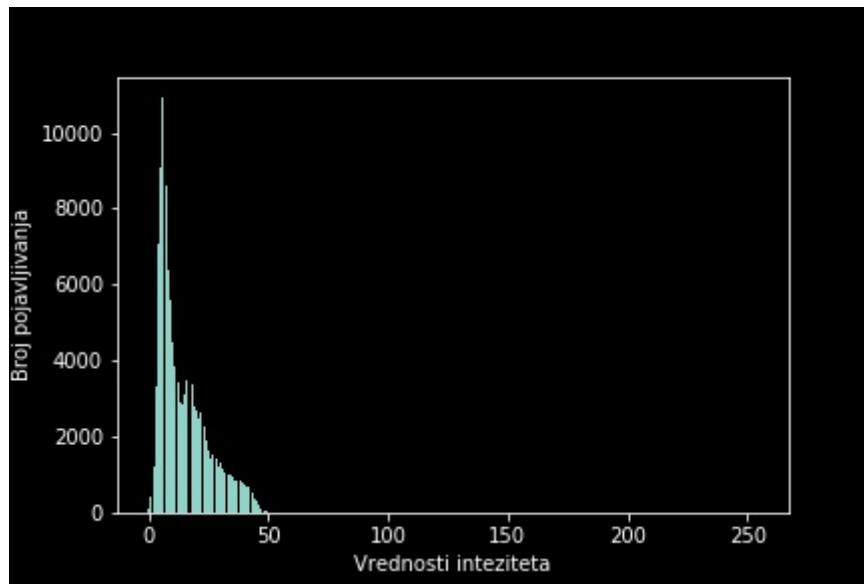
# Histogram inteziteta piksela



# Histogram inteziteta piksela



# Histogram inteziteta piksela



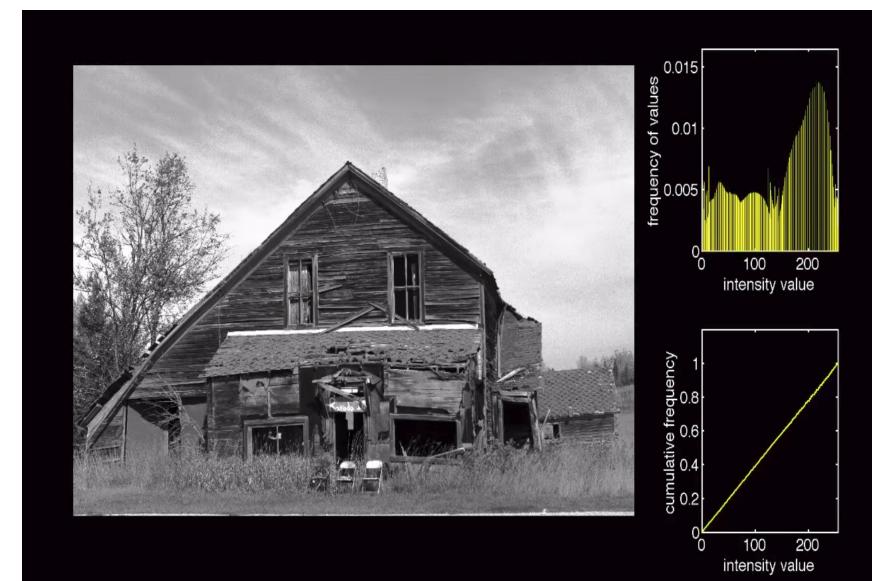
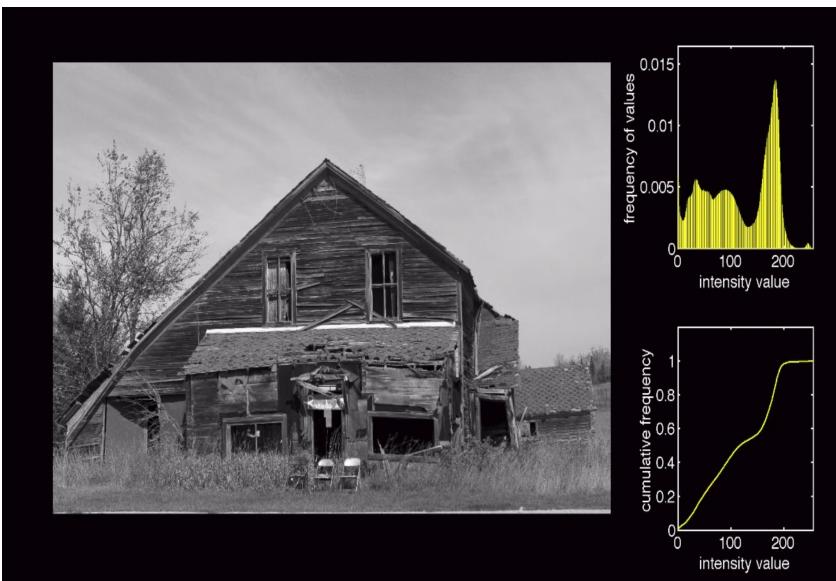
# Funkcija transfera

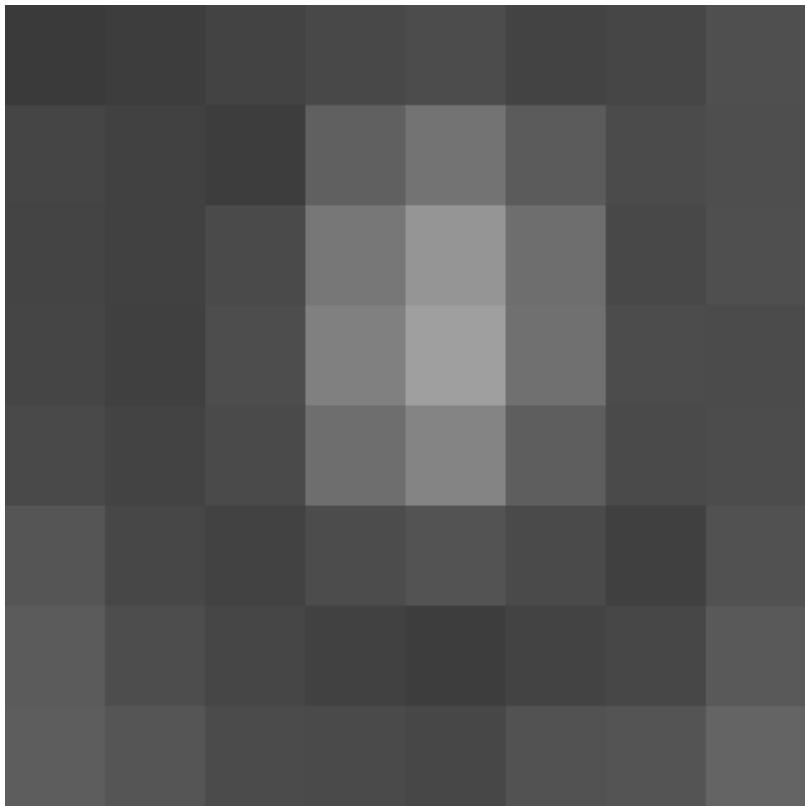
$$p_x(i) = p(x=i) = \frac{n_i}{n}$$

$$cdf_x(i) = \sum_{j=0}^i p_x(j)$$

$$h(v) = round\left(\frac{L-1}{n} * cdf(v)\right)$$

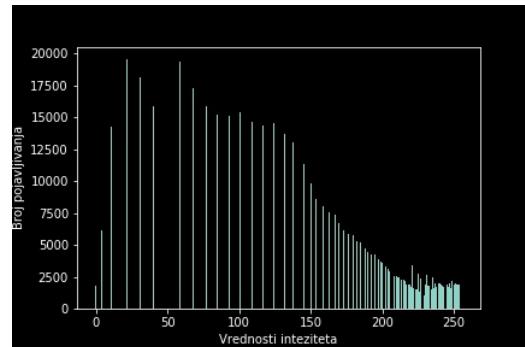
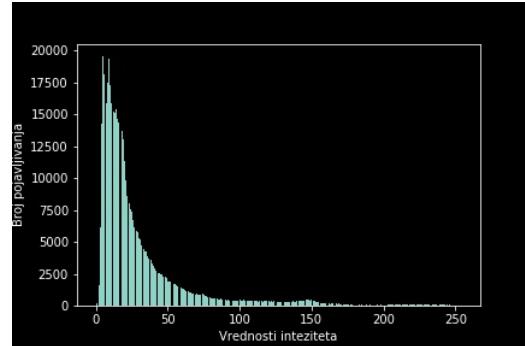
# Kumulativna funkcija distribucije



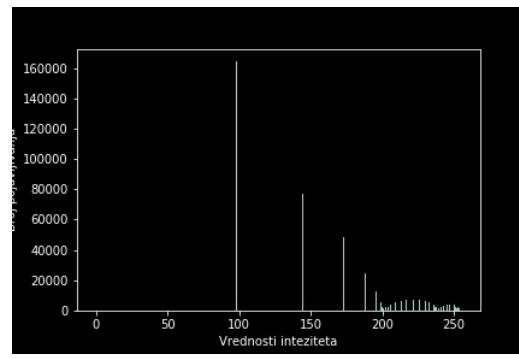
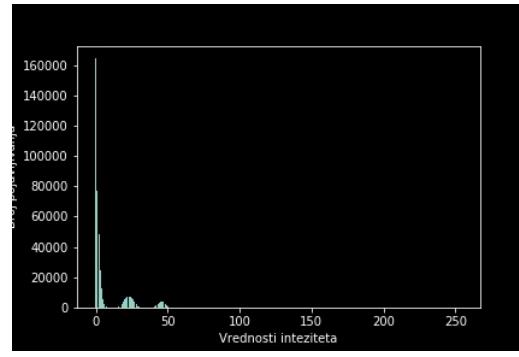
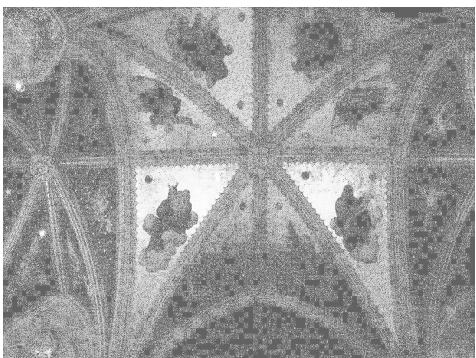
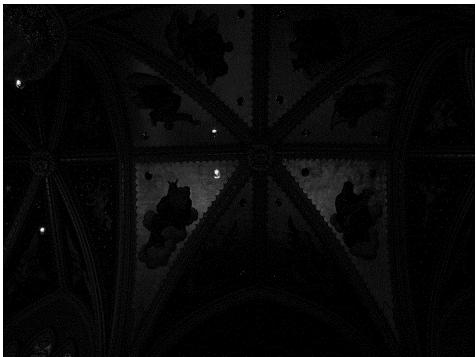


v (intenzitet piksela)	cdf (v)	h(v)
52	1	0
55	4	12
58	6	20
59	8	32
60	10	36
61	14	53
62	15	57
63	17	65
64	18	73
65	22	85
...	...	...

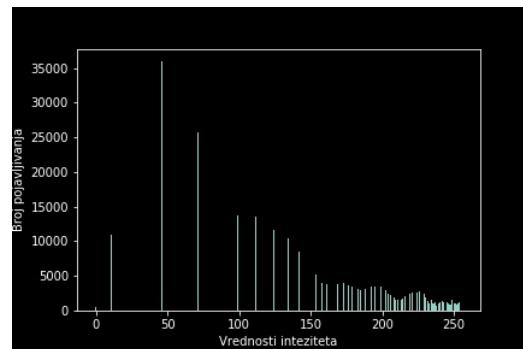
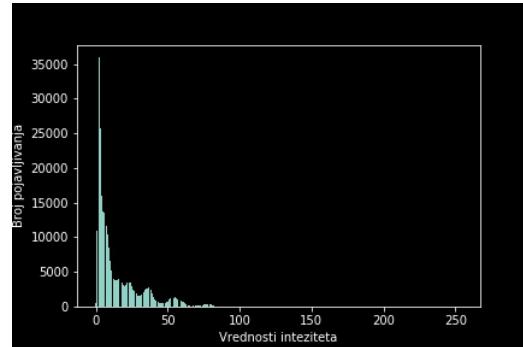
# Poređenje



# Poređenje



# Poređenje



# Primena

- Korekcija medicinskih snimaka
- Korekcija slika nebeskih tela (svemirska industrija)
- Korekcija slika dobijenih dronovima (vojna industrija)

**Hvala na pažnji!**