

03-Cont. Egalizare de histogramă pg. 28.

Corectarea contrastul slab. Număr de pixeli din fiecare mână de dăm "aproximativ" identice.



intensitate $I(x,y) \rightarrow J(x,y)$

$$h(\text{value}) = \left\lfloor \frac{\text{cdf}(\text{value}) - \text{cdf}_{\min}}{M \times N - 1} (L - 1) \right\rfloor$$

Round

intensitate în img. mătă

cdf - funcție de densitate cumulativă

$M \times N$ - mătă, lăime mătă

$L = 256$ $[0, 255]$

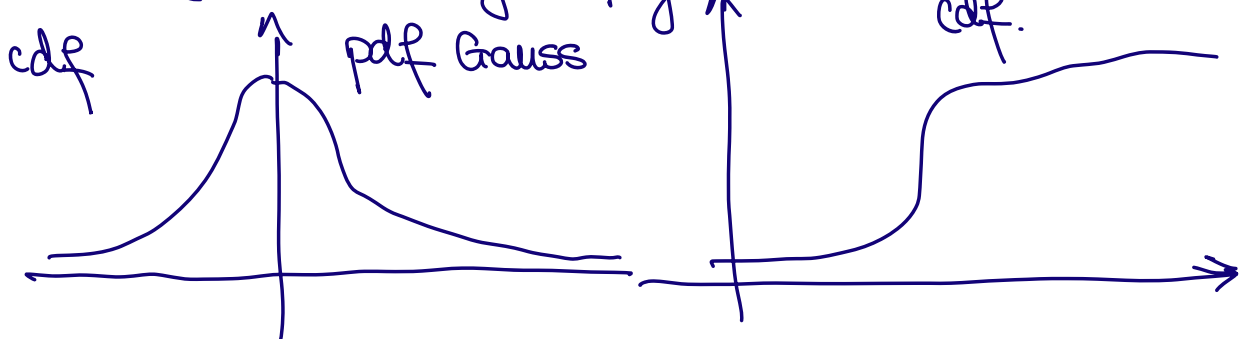
funcția de densitate de probabilitate:

pdf
cdf

frecvența intensității pdf(52) = 1.

histograma intensității pdf(53) = 3.

$$P(x < \text{valoare} < y) = P_{x,y}$$



$$\text{cdf}(y) = \text{cdf}(y-1) + \text{pdf}(y)$$

$$\begin{aligned}
 f(52) &= 1. & cdf(52) &= 1. \\
 f(55) &= 2. & cdf(55) &= cdf(52) + 2 = 3. \\
 f(56) &= 3. & cdf(56) &= cdf(55) + 3
 \end{aligned}$$

$$f(154)_{max} = 4. \quad cdf(154) = cdf(153) + 1 = 64 (8 \times 8)$$

$$78 \quad f(78) = \frac{1}{46}. \quad cdf(78) = 46. \quad \begin{matrix} L-1 \\ \downarrow \end{matrix} \quad L=256.$$

$$\begin{aligned}
 h(78) &= \text{round} \frac{cdf(78) - cdf_{min}}{8 \cdot 8 - 1} (255) \\
 &= \text{round} \left(\frac{46 - cdf(52)}{8 \cdot 8 - 1} \right) \cdot 255 \\
 &= \frac{45}{63} \cdot 255 = 182.
 \end{aligned}$$

$$[52, 154] \longrightarrow [0, 255] \text{ imagine de m\u0103re gri}$$

$$78 \longrightarrow 182$$

\u00c2m\u0103r\u0163te de ambrearea unui sistem b.i. se recomand\u0103 egalizarea de histogram\u0103.

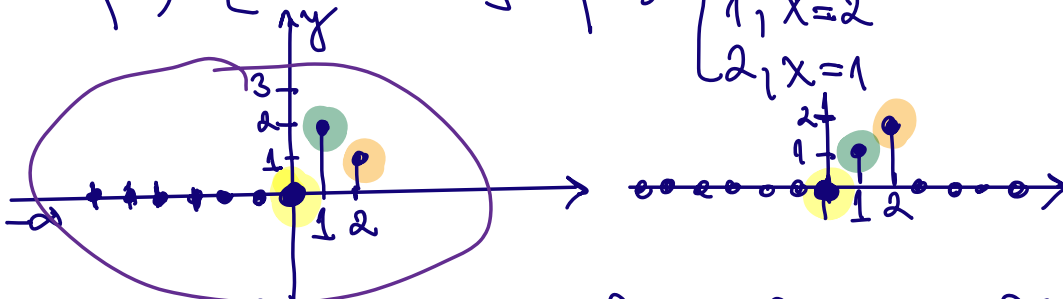
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Data prezentării mape: 16-20 (13 stud. 3+3+3+1)  
 Termen de trimitere în assignment Terms joi 26 septembrie  
 Corecția gamma  $f(x) = x^2$  23.09.

## Convolutia / Operația de convoluție

conv2D  
 $f(x) * g(x) = \int_{-\infty}^{\infty} f(\tau) \cdot g(x-\tau) d\tau$  continuă  
 $f(x) \otimes g(x) = \sum_{k=-\infty}^{\infty} f[k] \cdot g[x-k]$  discretă

$$f(x) = [0 \ 2 \ 1 \ 0] = f(x) = \begin{cases} 0, \text{ altfel} \\ 1, x=2 \\ 2, x=1 \end{cases}$$



$$g(x) = \begin{cases} 0, \text{ altfel} \\ 1, x=1 \\ 2, x=2 \end{cases}$$

$$f(x) = f(-x) \Rightarrow f(-x) \\ f(0)=0, f(-1)=2, f(-2)=1.$$

lungimea convolutului final  $1+2-1 = L_r$

$$\begin{array}{c|cccccc} -3 & -2 & -1 & 0 & 1 & 2 & 3 & 4 & 5 & 6 \\ \hline & & & 1 & 2 & 1 & 0 & 0 & 0 & 0 \end{array} \quad \begin{array}{c|ccc} [0 \ 2 \ 1] & [1 \ 2 \ 0] \\ \hline & & & \end{array}$$

$$x: -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6$$

$$f(-x) \quad g(x) \quad f(x)$$

$$f(-x)$$

$$\begin{array}{cccccc} 1 & 2 & 0 & 0 & 0 & 0 \\ 1 & 2 & 0 & 0 & 0 & 0 \\ 1 & 2 & 0 & 0 & 0 & 0 \\ 1 & 2 & 0 & 0 & 0 & 0 \end{array}$$

$$r(-1) = 0.$$

$$r(0) = g(0) \cdot f(0) = 0 \cdot 0 = 0.$$

$$r(1) = g(0) \cdot f(1-1) + g(1) \cdot f(1-1) = 0 \cdot 2 + 1 \cdot 0 = 0.$$

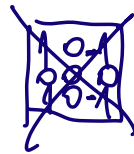
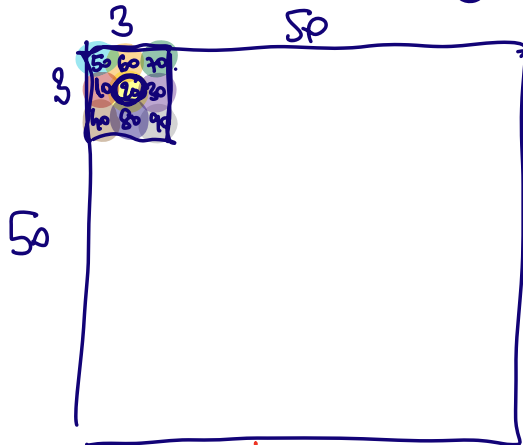
$$r(2) = 0 \cdot 1 + 1 \cdot 2 + 2 \cdot 0 = (2)$$

$$U=2. \quad | \Rightarrow L_R = 2+2-1$$

$$L_2=2. \quad = 3$$

Max. 5 valori

Convolutie in 2D / Pentru imag.



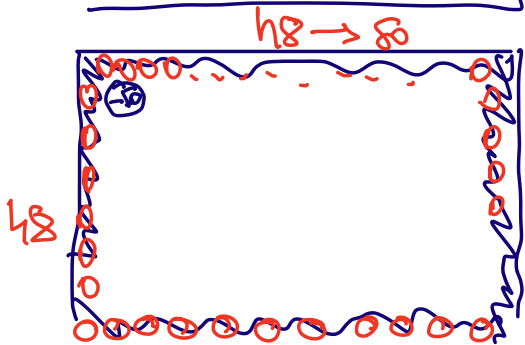
filtru  
kernel

$$50 \cdot 1 + 60 \cdot 2 + 70 \cdot 1 +$$
~~$$10 \cdot 0 + 20 \cdot 0 + 30 \cdot 1$$~~

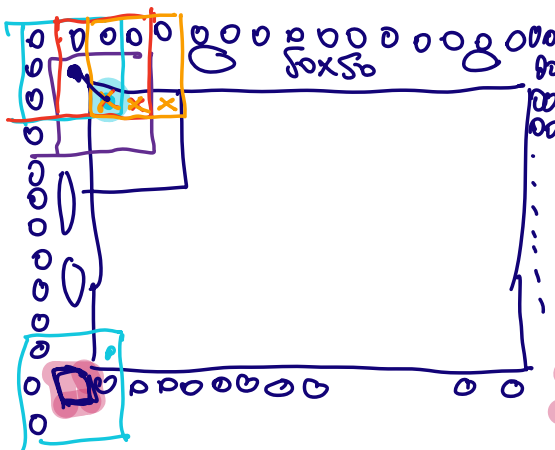
$$40 \cdot (-1) + 80 \cdot 2 + 90 \cdot (-1)$$

$$= 50 + 120 + 70 - (40 + 60 + 90)$$

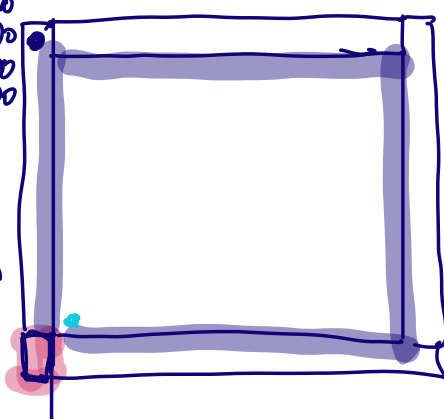
$$= 240 - 290 = -50.$$



conv2d(3, 3, "same")



conv. 5x5



$$1 \cdot 1 + 1 \cdot 0 + 1 \cdot 1 +$$
~~$$0 \cdot 0 + 1 \cdot 1 + 1 \cdot 0$$~~

$$0 \cdot 1 + 0 \cdot 0 + 1 \cdot 1 = 4.$$

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conf2D(3,3, "full")  $\rightarrow$  acoperire parțială  
conf2D(3,3) ;  $\rightarrow$  acoperire totală a felului cu img.  
conf2D(3,3, "same")  $\rightarrow$  acoperire totală  
 $\rightarrow$  se compl. cu 0