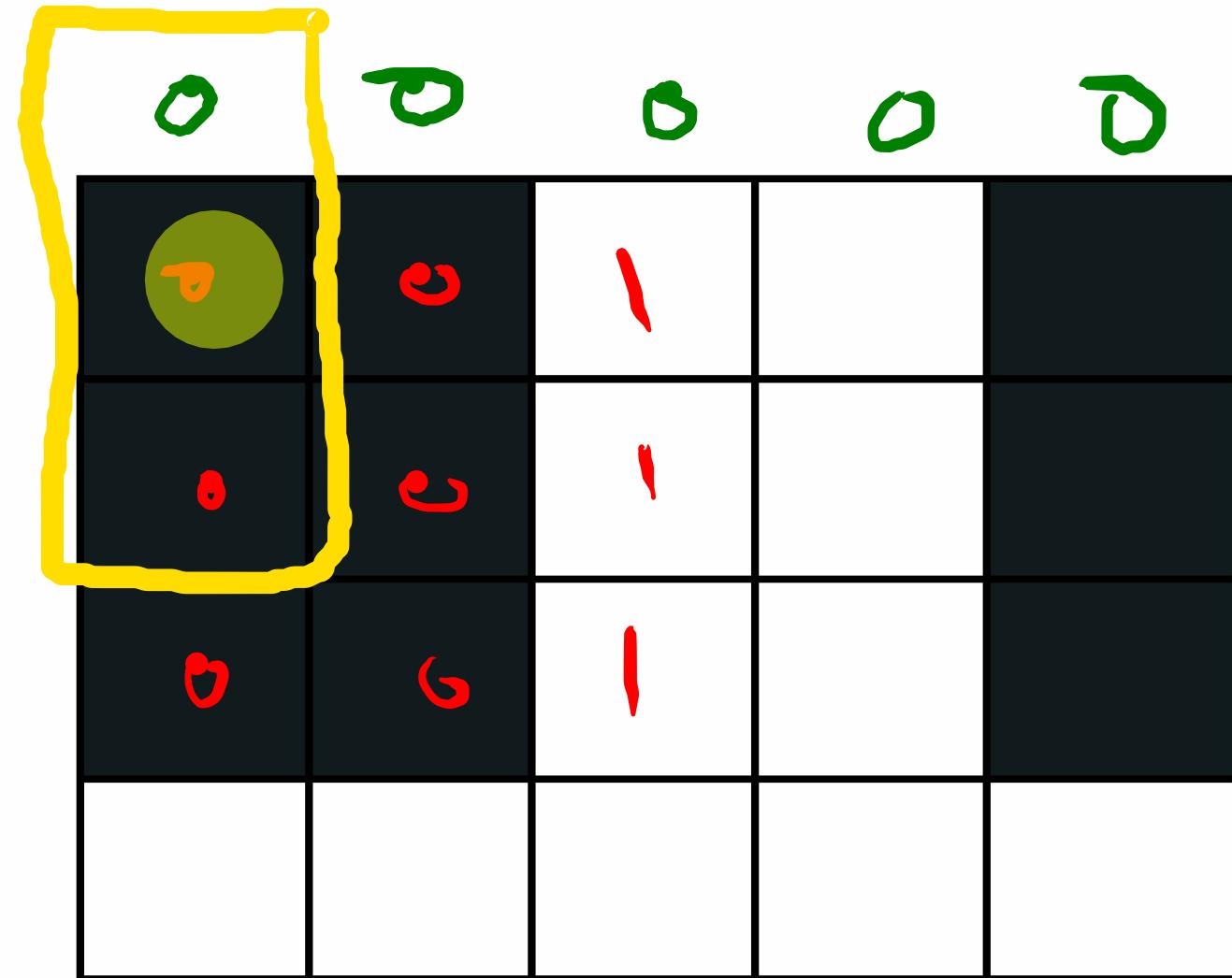


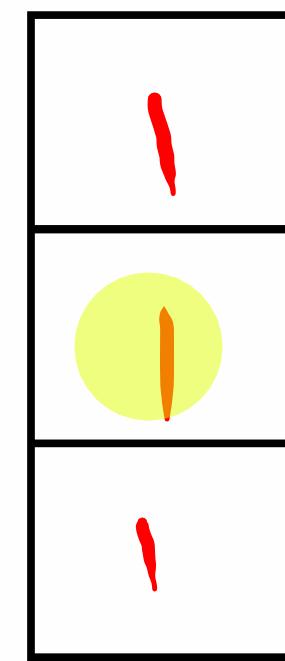
Exercises 17

Morphological methods, Convolution and Denoising (1400)

1- Apply the kernel to the image with **erosion** method. Use Zero-Padding method for padding. (300 points)

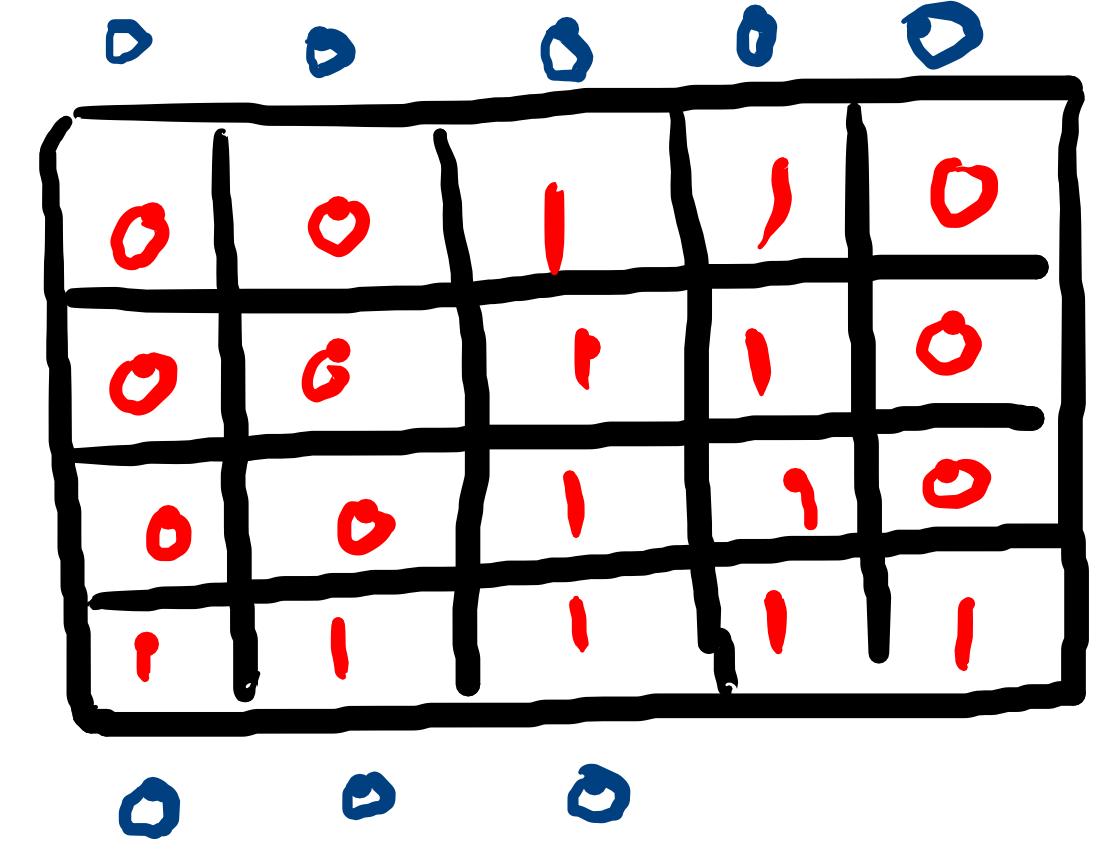


Original Image (4 x 5)



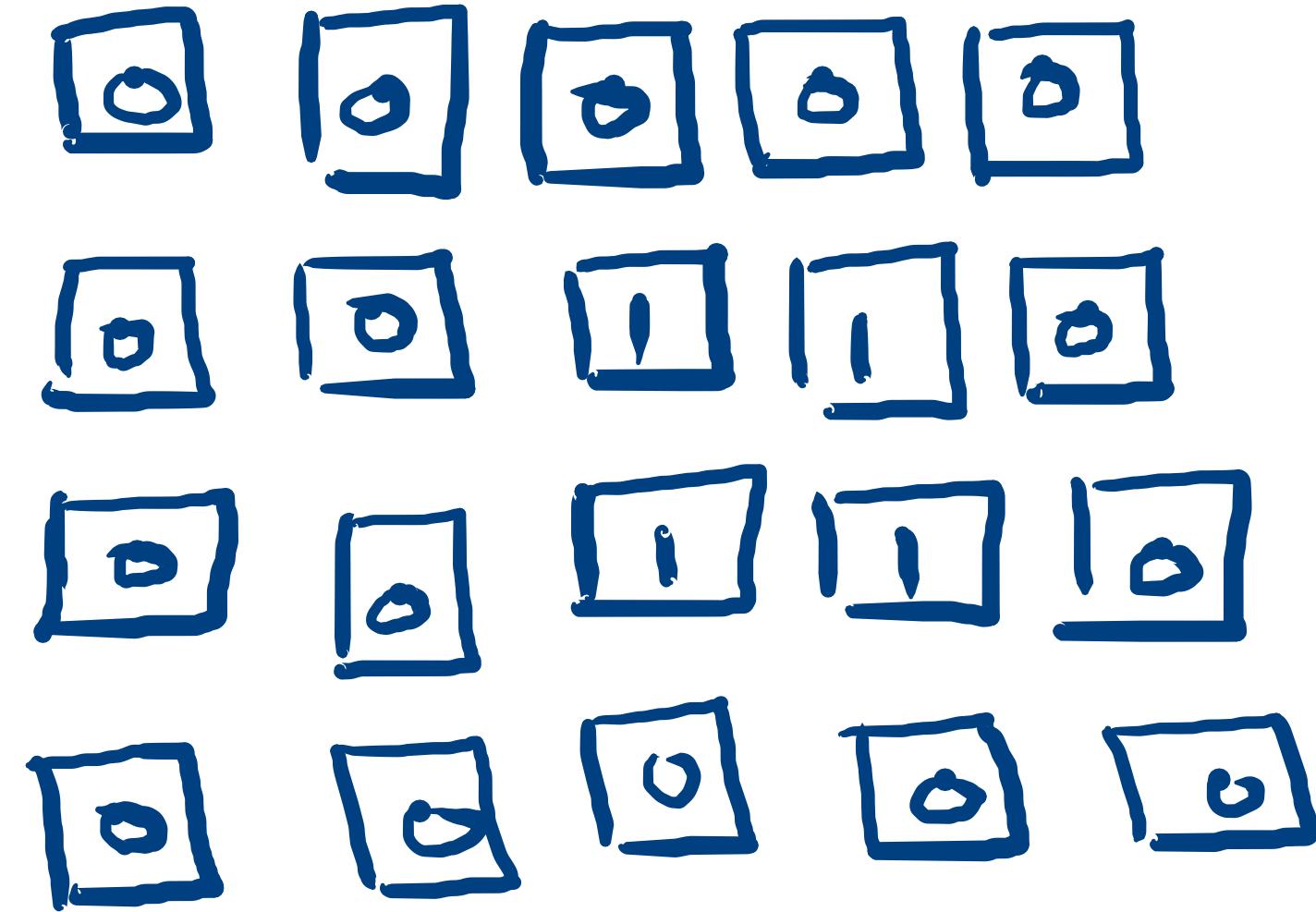
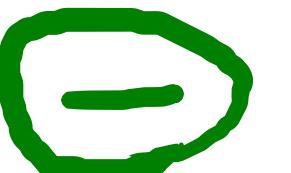
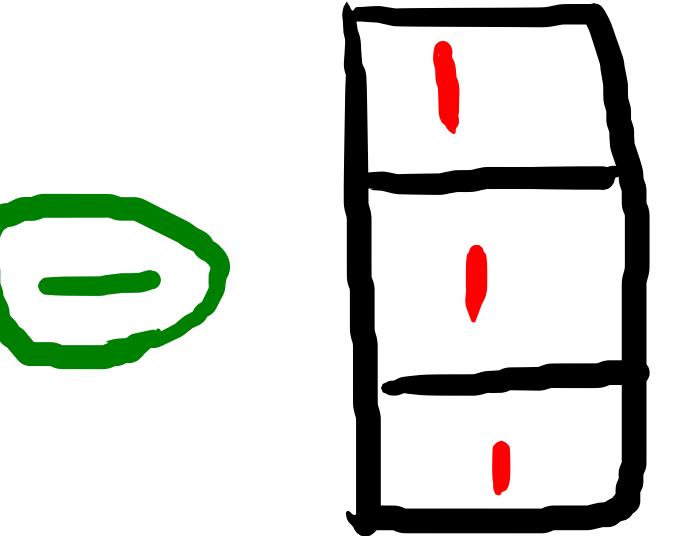
Kernel (3x1)

full match: 1
semi match: 0
nomatch: 6

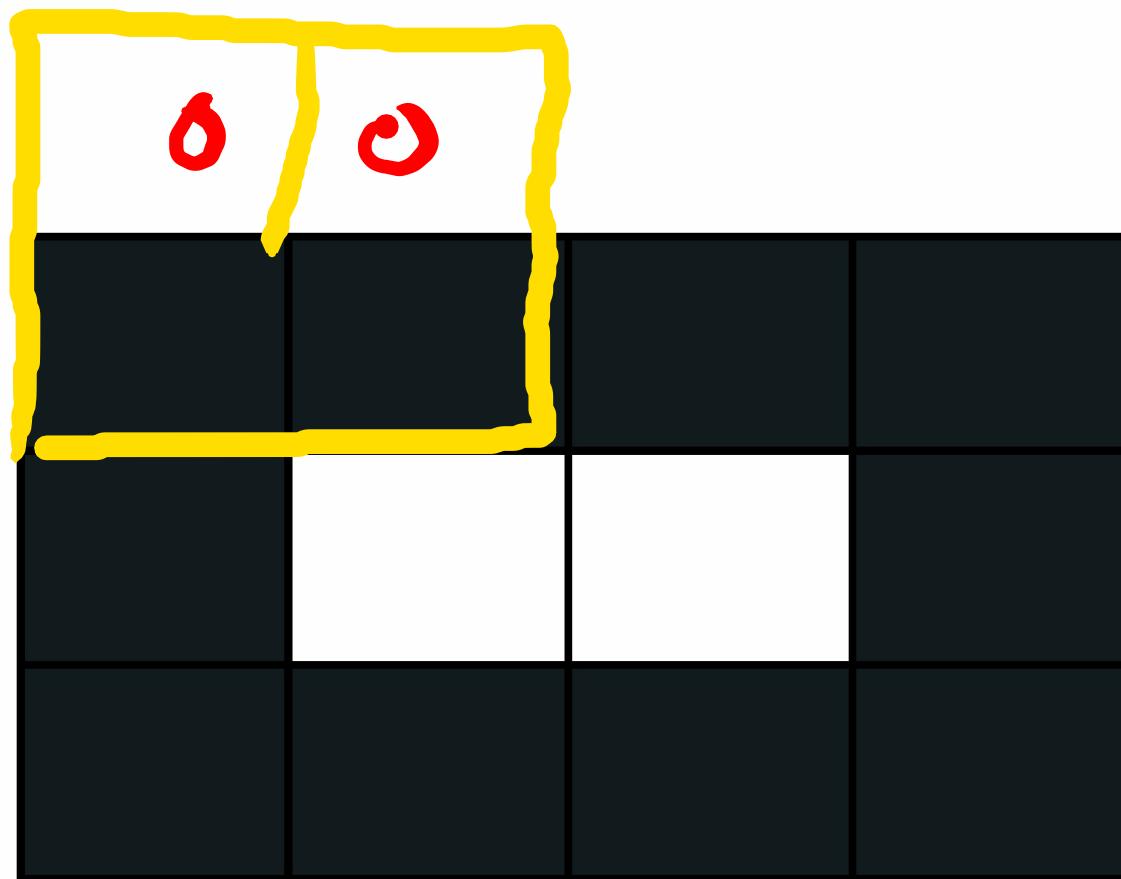


img

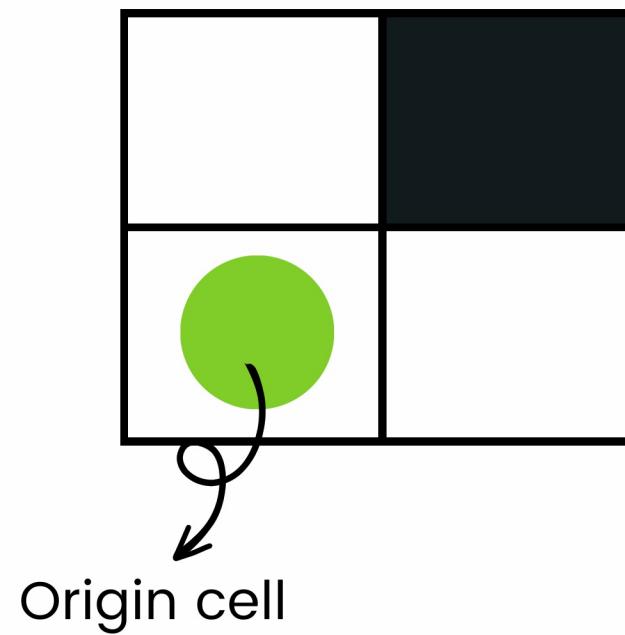
Kernel



2- Apply the kernel to the image with **dilation** method. Use Zero-Padding method for padding. (300 points)



Original Image (3 x 4)

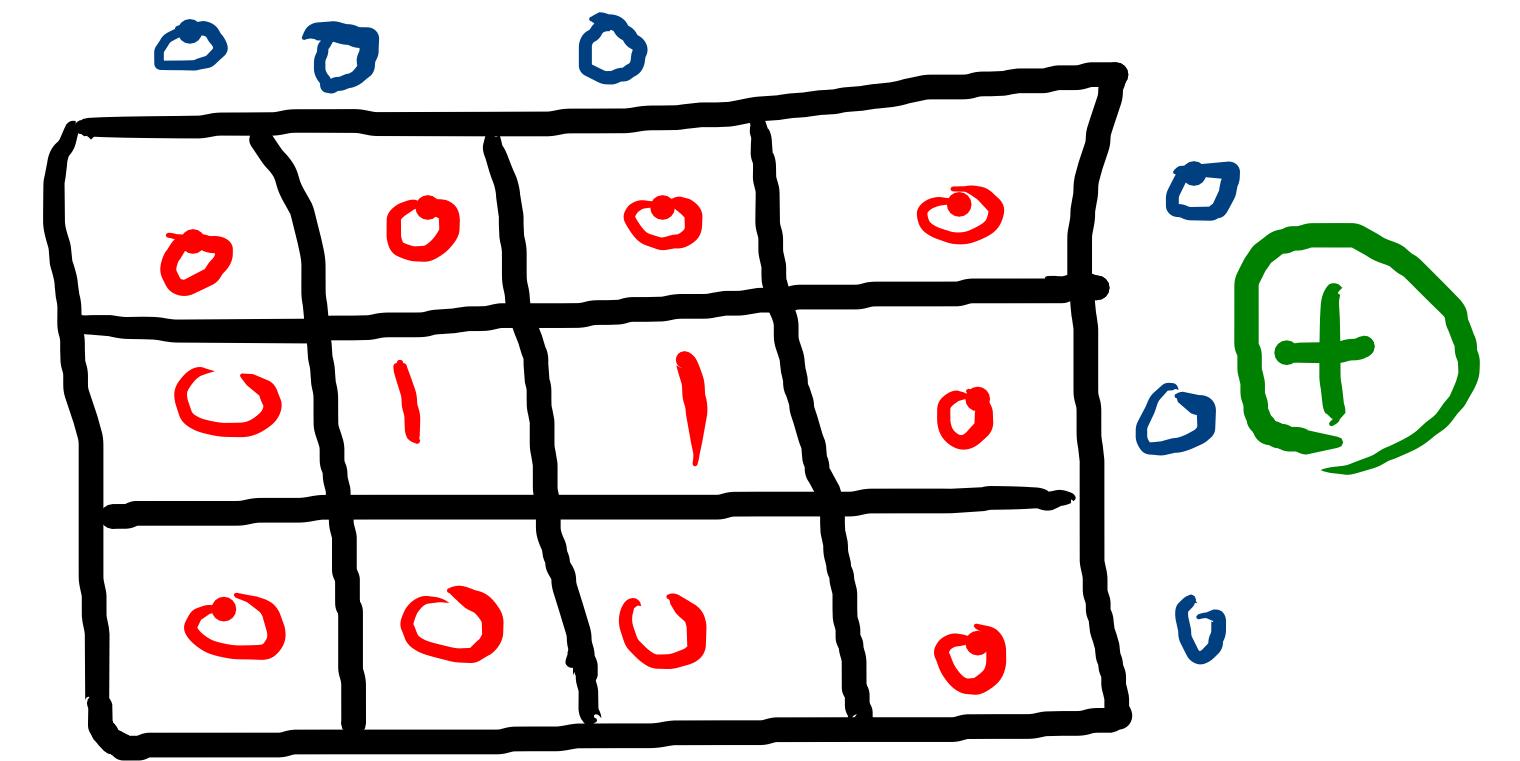


Kernel (2x2)

full match : 1

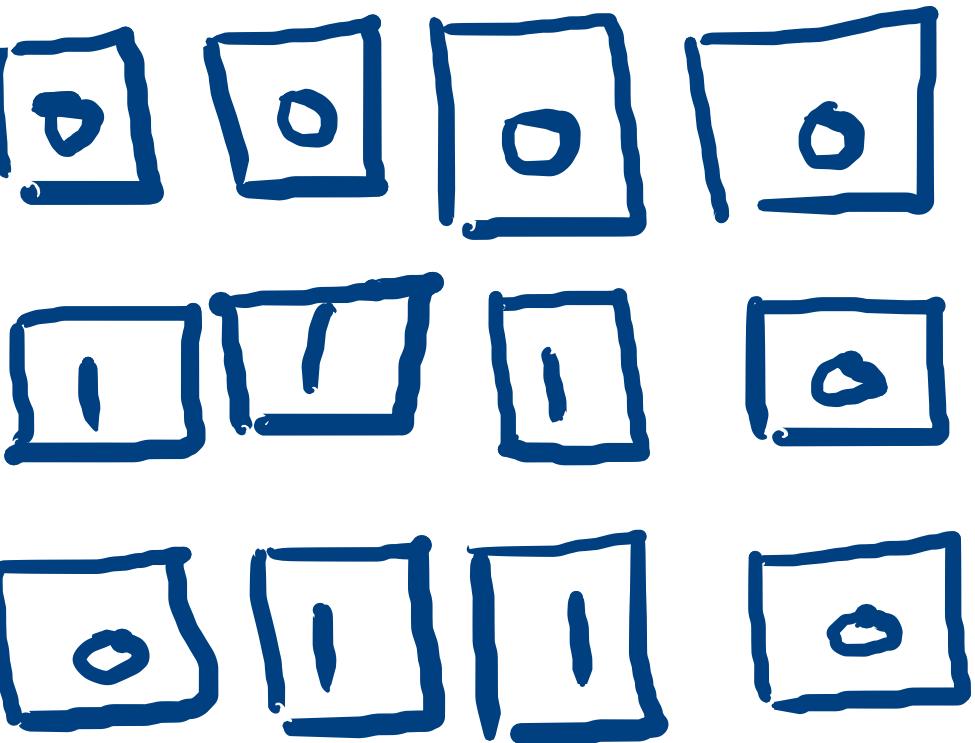
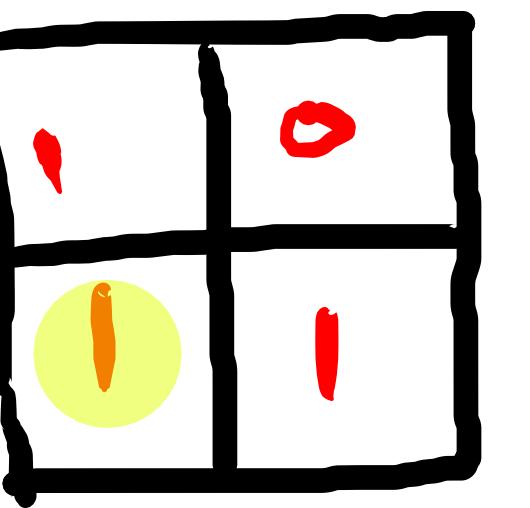
Semi match : 1

No match : 0



img

Kernel



3-Convolve the following image with Gaussian kernel (3x3), use Zero-Padding. (400 points)

$$\frac{1}{16} \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

6	0	0		
0	50	60	90	0
0	18	95	20	36
8	10	1	0	0
6	20	40	20	80
3	0	0	15	0

Original Image

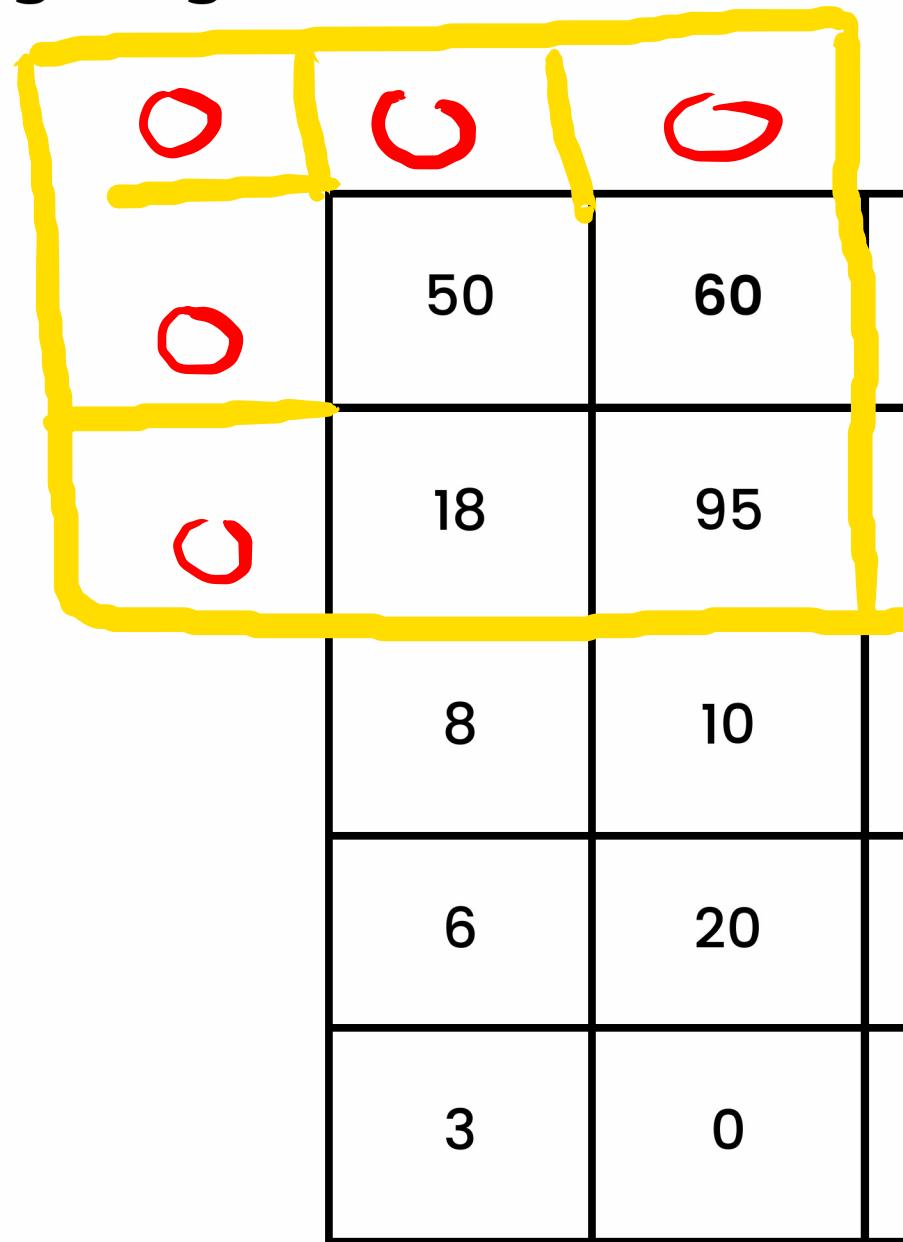
$$O(0,0) = \frac{1}{16} \left[0 + 0 + 0 + 0 + (4 \times 50) + (60 \times 2) + 0 + (18 \times 2) + (1 \times 95) \right] = 28$$

$$O(0,1) = \frac{1}{16} \left[0 + 0 + 0 + (50 \times 2) + (60 \times 4) + (90 \times 2) + (18 \times 1) + (95 \times 2) + (20 \times 1) \right] = 47$$

$$O(672) = \frac{1}{16} [O + O + O + (60 \times 2) + (90 \times 4) + O + \\ (75 \times 1) + (20 \times 2) + (36 \times 1)] = 41$$

28	47	41	17	2
28	47	37	17	5
13	23	26	16	14
6	13	17	22	23
3	16	9	14	13

4-Convolve the following image with Median kernel (3x3), use Zero-Padding. (400 points)



0	0	0			
0	50	60	90	0	0
0	18	95	20	36	0
8	10	1	0	0	
6	20	40	20	80	
3	0	0	15	0	

Original Image

max

min

$$T(0,0) \rightarrow (0,0,0,0,0,18,50,60,95) \rightarrow 0^{\circ} \quad 95^{\circ}$$

$$T(0,1) \rightarrow (0,0,0,18,20,50,60,90,95) \rightarrow 20^{\circ} \quad 95^{\circ}$$

$$T(0,2) \rightarrow (0,0,0,0,20,36,60,90,95) \rightarrow 20^{\circ} \quad 95^{\circ}$$

$$T(0,3) \rightarrow (0,0,0,0,0,20,36,90) \rightarrow 0^{\circ} \quad 90^{\circ}$$

0 20 120 0 0

10 20 20 0 0

8 18 20 20 0

3 6 16 10 0

0 0 0 0 0