

Feed forward

Assignment 10

Convolution layer

Convolutional layer

$$Q = I = \begin{bmatrix} 1, 2, 0, 1 \\ 3, 1, 2, 2 \\ 0, 1, 3, 1 \\ 2, 2, 2, 0 \end{bmatrix}, \quad K_1 = \begin{bmatrix} 1, 0, -1 \\ 1, 0, -1 \\ 1, 0, -1 \end{bmatrix}, \quad K_2 = \begin{bmatrix} 0, 1, 0 \\ 0, 1, 0 \\ 0, 1, 0 \end{bmatrix}$$

$$\begin{aligned} H_{out} &= (H - k + 2p/s) + 1 \\ &= (4 - 3 + 0/1) + 1 \\ &= 2 \end{aligned}$$

Now

from Row 1 col 1

$$\begin{bmatrix} 1 & 2 & 0 \\ 3 & 1 & 2 \\ 0 & 1 & 3 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & -1 \\ 1 & 0 & -1 \\ 1 & 0 & -1 \end{bmatrix}$$

$$(1 \times 1 + 2 \times 0 + 0 \times (-1)) + (3 \times 1 + 1 \times 0 + 2 \times (-1)) + (0 \times 1 + 1 \times 0 + 3 \times (-1))$$

$$1 + 1 - 3$$

$$-1$$

from Row 1, col 2

$$\begin{bmatrix} 2 & 0 & 1 \\ 1 & 2 & 2 \\ 1 & 8 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & -1 \\ 1 & 0 & -1 \\ 1 & 0 & -1 \end{bmatrix}$$

$$= (2 \times 1 + 0 + 1 \times -1) + (1 \times 1 + 0 + 2 \times -1) + (1 \times 1 + 0 + 1 \times -1)$$

$$= (2 - 1) + (1 - 2) + (1 - 1)$$

$$= 1 + 0 - 1$$

$$= 0$$

from Row 2, Col 1

$$\begin{bmatrix} 3 & 1 & 2 \\ 0 & 1 & 3 \\ 2 & 2 & 2 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & -1 \\ 1 & 0 & -1 \\ 1 & 0 & -1 \end{bmatrix}$$

$$= (3 \times 1 + 0 + 2 \times -1) + (0 \times 1 + 1 \times 0 + 3 \times -1) + (2 \times 1 + 0 \times 2 + 2 \times -1)$$

$$= 3 - 2 + -3 + 2 + 0$$

$$= 2$$

from Row 2, col 2

$$\begin{bmatrix} 0 & 1 & 3 \\ 1 & 3 & 1 \\ 2 & 2 & 0 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & -1 \\ 1 & 0 & -1 \\ 1 & 0 & -1 \end{bmatrix}$$

$$= (0 + 0 + 3 \times -1) + (1 + 0 - 1) + (2 + 0 + 0)$$

$$= -1$$

$$\text{output } k_1 = \begin{bmatrix} -1 & 0 \\ -2 & -1 \end{bmatrix}$$

Again  
from Row 1, col 1

$$= \begin{bmatrix} 1 & 2 & 0 \\ 3 & 1 & 2 \\ 0 & 1 & 3 \end{bmatrix} \times \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

$$= 2 + 1 \times 4$$

$$= 4$$

from Row 1, col 2

$$= \begin{bmatrix} 2 & 0 & 1 \\ 1 & 2 & 2 \\ 1 & 3 & 1 \end{bmatrix} \times \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

$$= 0 + 2 + 3$$

$$= 5$$

from Row 2, col 1

$$\begin{bmatrix} 3 & 1 & 2 \\ 0 & 1 & 3 \\ 1 & 2 & 2 \end{bmatrix} \times \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

$$= 1 + 1 + 2$$

$$= 4$$

From Row 2, col 2

$$= \begin{bmatrix} 0 & 1 & 3 \\ 1 & 3 & 1 \\ 2 & 2 & 0 \end{bmatrix} \times \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

$$= 1 + 3 + 2$$

$$= 6$$

$$\text{output} \cdot t_2 = \begin{bmatrix} 4 & 5 \\ 4 & 6 \end{bmatrix}$$