

Feed forward

Assignment 1D

Convolution layer

Convolutional layer

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

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

Now

from Row 1 col 1

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

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

$$= 1 - 3 = -2$$

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

from Row 1, col 2

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

$$\begin{aligned} &= 2x1 + 0 + 1x(-1) + (1x1 + 0 + 2x-1) + (1x1 + 0 + 1x-1) \\ &= (2-1) + (1-2) + (1-1) \\ &= 1+0-1 \\ &= 0 \end{aligned}$$

from Row 2, Col 1

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

$$\begin{aligned} &= (3x1 + 0 + 2x-1) + (0x1 + 1x0 + 3x-1) + (2x1 + 0x2 + 2x-1) \\ &= 3-2 + -3 + 2 + 0 \\ &= 2 \end{aligned}$$

from Row 2, col 2

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

$$\begin{aligned} &= [0+0+3x-1] + [1+0-1] + [2+0+0] \\ &= -1 \end{aligned}$$

$$\text{output } R_1 = \begin{bmatrix} -1 & 0 \\ -2 & -1 \end{bmatrix}$$

Again,

from Row 1, col 1

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

$$= 2 + 1 + 4$$

$$= 4$$

from Row 1, col 2

from Row 2, col 1

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

$$= 0 + 2 + 3$$

$$= 5$$

$$= 1 + 1 + 2$$

$$= 4$$

From Row 2, col 2

$$= \begin{bmatrix} 0 & 1 & 3 \\ 1 & 3 & 1 \\ 2 & 2 & 0 \end{bmatrix} \times \begin{bmatrix} 0 & 1 & 6 \\ 0 & 1 & 8 \\ 0 & 1 & 0 \end{bmatrix}$$

$$= 1 + 3 + 2$$

$$= 6$$

$$\text{output} \cdot t_2 = \begin{bmatrix} 1 & 5 \\ 4 & 6 \end{bmatrix}$$