

Exercise 1

a)

- $S=1, P=0$

$$(1 \cdot 2) + (3 \cdot 1) + ((-2) \cdot (-1)) + 2 = 9$$

$$(3 \cdot 2) + ((-2) \cdot 1) + (0 \cdot (-1)) + 2 = 6$$

$$((-2) \cdot 2) + (0 \cdot 1) + (2 \cdot (-1)) + 2 = -4$$

$$(0 \cdot 2) + (2 \cdot 1) + ((-1) \cdot (-1)) + 2 = 5$$

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

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

$$(3 \cdot 2) + (1 \cdot 1) + (2 \cdot (-1)) + 2 = 7$$

- $S=4, P=0$

$$(1 \cdot 2) + (3 \cdot 1) + ((-2) \cdot (-1)) + 2 = 9$$

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

- $S=1, P=1 \rightarrow$  input sequence is now

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

$$(1 \cdot 2) + (3 \cdot 1) + ((-2) \cdot (-1)) + 2 = 9$$

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$$(3 \cdot 2) + (1 \cdot 1) + (2 \cdot (-1)) + 2 = 7$$

$$(1 \cdot 2) + (2 \cdot 1) + (0 \cdot (-1)) + 2 = 6$$

- $S=4, P=1$

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

$$(0 \cdot 2) + (2 \cdot 1) + ((-1) \cdot (-1)) + 2 = 5$$

$$(1 \cdot 2) + (2 \cdot 1) + (0 \cdot (-1)) + 2 = 6$$

We get an output of same dimension as the input for

$$S=1, P=1$$

b)

- How many activation maps will we obtain?
- With  $S = 1$  and  $P = 0$ , what will be the shape of the output?
- With  $S = 2$  and  $P = 0$ , what will be the shape of the output?
- Give a filter size, padding value and stride value that will preserve the shape of the input.
- Compute the values of the output with  $S = 1$  and  $P = 0$  using an appropriate iPython notebook.

- We will obtain two activation maps because we apply two filters.

$$\text{output height} = \left( \frac{4 - 2 + 2 \cdot 0}{1} \right) + 1 = 3$$

$$\text{output width} = \left( \frac{4 - 2 + 2 \cdot 0}{1} \right) + 1 = 3$$

$$\Rightarrow \text{output shape} = 3 \times 3 \times 2$$

$$\text{output height} = \left( \frac{4 - 2 + 2 \cdot 0}{2} \right) + 1 = 1$$

$$\text{output width} = \left( \frac{4 - 2 + 2 \cdot 0}{2} \right) + 1 = 1$$

$$\Rightarrow \text{output shape} = 1 \times 1 \times 2$$

$$\text{input size} = 4 \times 4$$

with one filter of size 3 and a stride of 1

$$\text{padding} = \left\lfloor \frac{\text{filter size} - 1 \cdot \text{stride}}{2} \right\rfloor = 1$$

$\Rightarrow$  filter size: 3,  $P$ : 1,  $S$ : 1 preserve the shape of the input