CSE 5526 - Autumn 2019
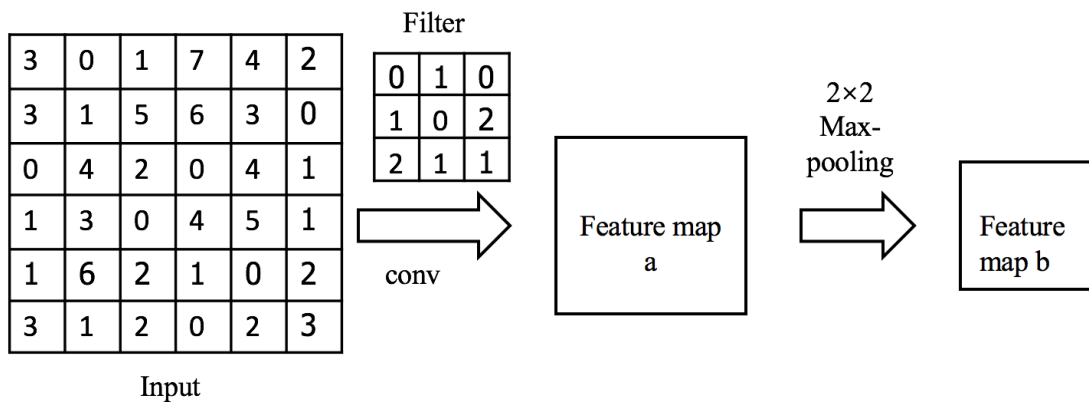# Introduction to Neural Networks

Homework #5
Due Tuesday, Nov. 26

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Problem 1. Exercise 11.14 in textbook (p. 625).

Problem 2. As shown below, a 2-D input with dimensions 6×6 is convolved with a 3×3 filter with stride 1 (i.e. shift by one "pixel") to obtain feature map a, which then undergoes 2×2 max pooling with stride 2 to get feature map b.

    (a) Give the values of feature maps a and b.

    (b) How many "pixels" do we need to pad around the borders of the input in order to maintain the size of the input image after convolution? With such zero padding, what are the values of feature maps a and b then?

Input:

3	0	1	7	4	2
3	1	5	6	3	0
0	4	2	0	4	1
1	3	0	4	5	1
1	6	2	1	0	2
3	1	2	0	2	3

Filter:

0	1	0
1	0	2
2	1	1

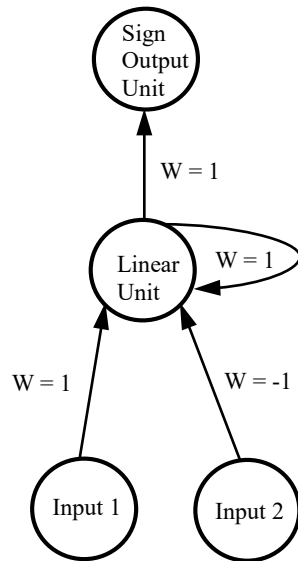conv → Feature map a → 2×2 Max-pooling → Feature map b

Problem 3. An RNN and its corresponding inputs at three time steps are given below. Recall that, for a linear unit, the output is the same as the input, and the sign activation function is

$$\text{Sign}(x) = \begin{cases} 1 & \text{if } x \geq 0 \\ -1 & \text{if } x < 0 \end{cases}$$

Answer the following questions:
- (a) Unfold the network and show the values of the hidden unit and the output unit at $t = 1$, 2, and 3.
- (b) Describe the computational task this RNN performs and justify your answer.

	$t = 1$	$t = 2$	$t = 3$
Input 1	2	1	0
Input 2	-2	5	1