

### Exercise 10.1

In lecture material was introduced a function `convolution()`. Make a new version of this function so that it includes also the padding mechanisms.

Let's assume we have the following  $6 \times 6$  matrix

$$\begin{bmatrix} 0.6 & 0.2 & 0.2 & -0.2 & 1.1 & 0.5 \\ 0.2 & 0.4 & 0.0 & 0.6 & -0.1 & 0.8 \\ 0.3 & 0.8 & 0.2 & 0.3 & 1.2 & 1.5 \\ -0.6 & 0.8 & 0.8 & -0.7 & 0.1 & 0.2 \\ 0.1 & 0.1 & 0.1 & 0.8 & 0.9 & 1.2 \\ 0.2 & -0.5 & 0.1 & -0.3 & 0.5 & 0.2 \end{bmatrix}$$

Do the following two convolutions:

- first convolution using  $3 \times 3$  filter  $\begin{bmatrix} 1 & 0 & 0.5 \\ 0.5 & 1 & 0.5 \\ 0.1 & 0.8 & 0.2 \end{bmatrix}$ , stride = 2 and padding = 2.
- second convolution for the result of previous convolution using  $2 \times 2$  filter  $\begin{bmatrix} 0.1 & 0.5 \\ 0.5 & 1 \end{bmatrix}$ , stride = 1 and padding = 1.

What is the mean of the final feature map? Give the answer rounded to two decimals.

Answer:

## Exercise 10.2

Lets assume that a convolutional neural network has the following structure:

- Input layer takes a color image of size  $400 \times 400 \times 3$ .
- Input layer is followed by convolutional layer, which has 10 filters each of size  $10 \times 10 \times 3$ , a stride of 3 and no padding. Convolution layer sums up the feature maps as an output.
- After the convolutional layer comes second convolutional layer, which has 10 filters each of size  $5 \times 5$ , a stride of 2 and padding of 1. Convolution layer sums up the feature maps as an output.
- After the convolutional layer comes a normal hidden layer of neurons, which has neuron for each of the values coming from the convolutional layer.
- After the hidden layer there is a dropout layer with the value of 0.20, i.e. 20 % of neurons are left out.

How many values are there in the vector coming out of the dropout layer? Give the answer rounded to an integer.

Answer: