Image Processing - Assignment 2

Group 3
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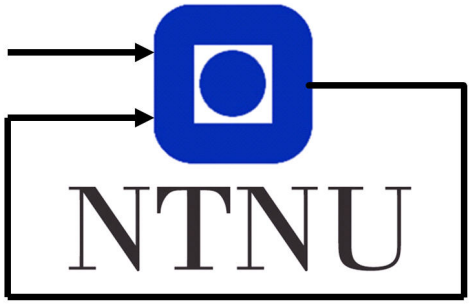

Department of Engineering Cybernetics

Contents

1 Convolutional Neural Networks

1.1 Task 1: Theory

a)

Listing the equations for calculating the resulting height and width:

$$W_{i+1} = (W_i - F_W + 2P_W)/S_W + 1 \tag{1}$$
$$H_{i+1} = (H_i - F_H + 2P_H)/S_H + 1 \tag{2}$$

Now defining:

$$\begin{aligned} S_W &= S_H = 1 \\ F_W &= F_H = 5 \\ H_2 &= H_1 = H \\ W_2 &= W_1 = W \end{aligned}$$

Then we get for the width:

$$\begin{aligned} W_2 &= (W_1 - F_W + 2P_W)/S_W + 1 \\ W - 1 &= W - 5 + 2P_W \\ 2P_W &= 4 \\ P_W &= 2 \end{aligned}$$

And for height:

$$\begin{aligned} H_2 &= (H_1 - F_H + 2P_H)/S_H + 1 \\ H - 1 &= H - 5 + 2P_H \\ 2P_H &= 4 \\ P_H &= 2 \end{aligned}$$

So we should therefore be padding with $P_H = 2$ and $P_W = 2$.

c)

1.2 Task 2: Programming

2 Filtering in the Frequency Domain

2.1 Task 3: Theory

a)

From the convolution theorem, we can see that the Fourier transform of a convolution of two signals is multiplication of the Fourier transforms of those individual signals. So a stepwise description would be:

- Find the Fourier transform of the individual signals (i.e. using FFT)
- Pointwise multiply the transformed signals
- Use inverse Fourier transform to find the convolution of the original signals

b)

2.2 Task 4: Programming