1. Task 1.1 Convolution

The original matrix is padded with zero below:

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 2 & 1 & 0 \\ 0 & 1 & -3 & -4 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 4 & 5 & 6 & 4 \\ 5 & 3 & 1 & 6 \\ 1 & -7 & -7 & 0 \\ 4 & 1 & 0 & 4 \end{pmatrix}$$

2. Task 1.2 Non Linearity

Applying: **ReLU(x)=*max*(0, X)**

$$\begin{pmatrix} 4 & 5 & 6 & 4 \\ 5 & 3 & 1 & 6 \\ 1 & -7 & -7 & 0 \\ 4 & 1 & 0 & 4 \end{pmatrix} = \begin{pmatrix} 4 & 5 & 6 & 4 \\ 5 & 3 & 1 & 6 \\ 1 & 0 & 0 & 0 \\ 4 & 1 & 0 & 4 \end{pmatrix}$$

3. Task 1.3 Max Pooling

$$\begin{pmatrix} 4 & 5 & 6 & 4 \\ 5 & 3 & 1 & 6 \\ 1 & 0 & 0 & 0 \\ 4 & 1 & 0 & 4 \end{pmatrix} = \begin{pmatrix} 4 & 5 & 6 & 4 \\ 5 & 3 & 1 & 6 \\ 1 & 0 & 0 & 0 \\ 4 & 1 & 0 & 4 \end{pmatrix} = \begin{pmatrix} 5 & 6 \\ 4 & 4 \end{pmatrix}$$

4. Task 1.4 Flattening

$$\begin{pmatrix} 5 & 6 \\ 4 & 4 \end{pmatrix} = \begin{pmatrix} 5 \\ 6 \\ 4 \\ 4 \end{pmatrix}$$

5. Task 1.5 Fully Connected Layer

$$\begin{pmatrix} 5 \\ 6 \\ 4 \\ 4 \end{pmatrix} * \begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{pmatrix} = \begin{pmatrix} 30 \\ 48 \\ 40 \\ 48 \end{pmatrix}$$

6. Task 1.6 SoftMax

$$\sigma(\vec{z})_i = \frac{e^{z_i}}{\sum_{j=1}^{K} e^{z_j}}$$

$$\begin{pmatrix} 30 \\ 48 \\ 40 \\ 48 \end{pmatrix}$$

$e^{z1} = e^{30} = 10686474581524$

$e^{z1} = e^{48} = 701673591209763173865$

$e^{z1} = e^{40} = 235385266837019985$

$e^{z1} = e^{48} = 701673591209763173865$

Total = 1403582578372837949239

Softmax_30 = 7.613712756332972202105803378195 9e-9

Softmax_48 = 0.4999

Softmax_40 = 1.677031835988590291166679756008 5e-4

Softmax_48 = 0.4999

Github Link for Practical:

Advanced-Deep-Learning-D7047E/Exercise_1 at main · jamieomoya/Advanced-Deep-Learning-D7047E (github.com)