1.1 Convolution

$$I * k = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & -3 & -4 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix} * \begin{bmatrix} 0 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 4 & 5 & 6 & 4 \\ 5 & 3 & 3 & 6 \\ 1 & -7 & -7 & 0 \\ 4 & 1 & 0 & 4 \end{bmatrix}$$

1.2 Non linearity

$$\text{ReLu}(I * k) = \begin{bmatrix} 4 & 5 & 6 & 4 \\ 5 & 3 & 3 & 6 \\ 1 & 0 & 0 & 0 \\ 4 & 1 & 0 & 4 \end{bmatrix}$$

1.3 Max pooling

$$\text{Maxpool}(\text{ReLu}(I * k)) = \begin{bmatrix} 5 & 6 \\ 4 & 4 \end{bmatrix}$$

1.4 flattening

$$\text{Flatten}(\text{maxpool}(\text{ReLu}(I * k))) = \begin{bmatrix} 5 \\ 6 \\ 4 \\ 4 \end{bmatrix} = F$$

1.5 Fully connected layer

$$W \cdot F = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix} \begin{bmatrix} 5 \\ 6 \\ 4 \\ 4 \end{bmatrix} = \begin{bmatrix} 45 \\ 121 \end{bmatrix}$$

1.6 Softmax

$$\text{Softmax}(W \cdot F) = \text{Softmax}\left(\begin{bmatrix} 45 \\ 121 \end{bmatrix}\right) = \begin{bmatrix} \frac{e^{45}}{e^{45} + e^{121}} \\ \frac{e^{121}}{e^{45} + e^{121}} \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

Output is the second class