Exercise 1

den 1 april 2021 10:18

$$I = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & -3 & -4 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 2 & 1 & 0 \\ 0 & 1 & -3 & -4 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$k = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

1.1)

$k(I)_{0,0} = 4$ $k(I)_{1,0} = 5$

$k(I)_{0,1} = 5$ $k(I)_{1,1} = 3$

$k(I)_{0,2} = 1$ $k(I)_{1,2} = -7$

$k(I)_{0,3} = 4$ $k(I)_{1,3} = 1$

$k(I)_{2,0} = 6$ $k(I)_{3,0} = 4$

$k(I)_{2,1} = 3$ $k(I)_{3,1} = 6$

$K(I)_{2,2} = 3$ $K(I)_{3,1} = 6$

$K(I)_{2,2} = -7$ $K(I)_{3,2} = 0$

$K(I)_{2,3} = 0$ $K(I)_{3,3} = 4$

$$K(I) = \begin{bmatrix} 4 & 5 & 6 & 4 \\ 5 & 3 & 3 & 6 \\ 1 & -7 & -2 & 0 \\ 4 & 1 & 0 & 4 \end{bmatrix}$$

1.2) ReLU activation $f(x) = \max(0, x)$

$$\begin{bmatrix} \boxed{4 & 5} & 6 & 4 \\ \boxed{5 & 3} & 3 & 6 \\ 1 & 0 & 0 & 0 \\ 4 & 1 & 0 & 4 \end{bmatrix} \Rightarrow \text{Max}$$

1.3) $\Rightarrow \begin{bmatrix} 5 & 6 \\ 4 & 4 \end{bmatrix}$ $K(I)_{\text{maxpooled}}$

1.4) $K(I)_{\text{Flattened}} = [5, 6, 4, 4]^T$

1.5) $W = [1 \ 2 \ 3 \ 4 \ ?]$

1.5) $W = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix} \cdot [5, 6, 4, 4]$

$= \begin{bmatrix} 45 \\ 121 \end{bmatrix} \Rightarrow \left(\begin{bmatrix} a_1 \\ a_2 \end{bmatrix} \right)$

1.6) Softmax: $\sigma(z)_j = \dfrac{e^{z_j}}{\sum_{k=1}^{K} e^{z_k}}$ for $j = 1 \ldots k$

$\text{Softmax}\left(\begin{bmatrix} 45 \\ 121 \end{bmatrix} \right) = \begin{bmatrix} 9.85 \cdot 10^{-34} \\ 1 \end{bmatrix}$

$\begin{bmatrix} a_1 \\ a_2 \end{bmatrix}$

$\therefore a_2 = 1 > a_1 = 9.85 \cdot 10^{-34}$