EE6427 Exercise CNN

Q (i) output after the convolution layer.

$A=\begin{bmatrix}4&0&1\\4&0&2\\0&2&2\end{bmatrix}$ $F=\begin{bmatrix}1&0&-1\\2&0&-2\\1&0&-1\end{bmatrix}$ zero padding 1 stride 2.

sigmod $\sigma(x)=\frac{1}{1+e^{-x}}$

2×2 max pooling stride 2.

Solution ① zero padding

$$\begin{bmatrix}0&0&0&0&0\\0&4&0&1&0\\0&4&0&2&0\\0&0&2&2&0\\0&0&0&0&0\end{bmatrix}$$

② convolution

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

$\begin{bmatrix}0&0&0\\0&4&0\\0&4&0\end{bmatrix}\begin{bmatrix}1&0&-1\\2&0&-2\\1&0&-1\end{bmatrix}=\begin{bmatrix}0&0&0\\8&0&-8\\8&0&-8\end{bmatrix}$

不是矩阵乘法，而是对应相乘再相加

Sum = 0

$4\times0+4\times0=0$

output $=\begin{bmatrix}0&0\\-4&4\end{bmatrix}$

$$\begin{bmatrix}0&0&0\\0&1&0\\0&2&0\end{bmatrix}\begin{bmatrix}1&0&-1\\2&0&-2\\1&0&-1\end{bmatrix}=\begin{bmatrix}0&0&0\\2&0&-2\\4&0&-4\end{bmatrix}$$ sum = 0

$1\times0+2\times0=0$

$$\begin{bmatrix}0&4&0\\0&0&2\\0&0&0\end{bmatrix}\begin{bmatrix}1&0&-1\\2&0&-2\\1&0&-1\end{bmatrix}=\begin{bmatrix}8&0&-8\\2&0&-2\\0&0&0\end{bmatrix}$$ sum = 0 -4

$4\times0+2\times(-2)=-4$

$$\begin{bmatrix}0&2&0\\2&2&0\\0&0&0\end{bmatrix}\begin{bmatrix}1&0&-1\\2&0&-2\\1&0&-1\end{bmatrix}=\begin{bmatrix}4&0&-4\\6&0&-6\\0&0&0\end{bmatrix}$$ sum = 0 4

$2\times2=4$

(ii) effect of F ?

Solution extract the vertically feature due to the number of the filter is vertical

The effect of filter F is that it computes the horizontal gradient information which reflects the edge information

水平方向的数量变化率

(iii) output after activation

Solution

$$e(x)=\frac{1}{1+e^{x}}$$

$$\begin{bmatrix} 0 & 0 \\ -4 & 4 \end{bmatrix} \frac{1}{1+e^{x}} = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{e^{4}}{e^{4}+1} & \frac{1}{1+e^{4}} \end{bmatrix} = \begin{bmatrix} 0.5 & 0.5 \\ 0.982 & 0.01799 \end{bmatrix}$$

$$\frac{1}{1+e^{-4}} = \frac{e^{4}}{e^{4}+1}$$

$\frac{1}{1+e^{4}}$ $\frac{1}{1+e^{-4}}$

0.018 0.982

(iv) Q output after max pooling layer

Solution Max = 0.9820

(v) Q: parameters?

Solution 100x100x3 → 6 channel

filter 3x3x3 parameter

number of filter: 6

total 3x3x3x6 = 162