EE7403 2022-2023 S2 (Similar to 2023-2024-4)

4.(a) $y_{ijk} = \sum_{n=1}^{K_1} \sum_{l=1}^{J} \sum_{m=1}^{I} w(l,m,n,k)\cdot x_{l,m,n} + b_k$

for each pixel, there're $(k_1 \cdot J \cdot I + 1)$

for each channel, there're $(I-2)(J-2)$ pixels, and k_2 channels.

$\therefore$ The total num of parameters $= (I-2)(J-2)k_2(k_1 J I + 1)$

$= \underline{(I-2)(J-2)k_2 \cdot I \cdot J \cdot k_1 + (I-2)(J-2)k_2}$

the number of muplications = the number of $w()$

$\therefore$ the number of muplication $= \underline{(I-2)(J-2)k_2 \cdot I \cdot J \cdot k_1}$

(b) $y_{i,j,k} = \sum_{n=1}^{k_1} \sum_{m=-1}^{1} \sum_{l=-1}^{1} h(l,m,n,k)\cdot x_{i-l,j-m,n} + b_k$

for each layer: the parameters are the same.

$\therefore$ the number of each layer $= 3\times 3\times k_1 + 1 = 9k_1 + 1$

$\therefore$ the total number $= \underline{k_2 \cdot (9k_1 + 1) = 9k_1k_2 + k_2}$

for each pixel, the muplication $= 3\times 3\times k_1 = 9k_1$

for each layer, there're $(I-2)(J-2)$ pixels muplication num $= 9(I-2)(J-2)\cdot k_1$

there're k_2 layers, so the total is:

$\underline{9(I-2)(J-2)k_1k_2}$

(c) for the networks in 4(a), each pixel of input takes part in the calculation of output's pixels, and has different parameters.

for the network in 4(b), the pixels share the same parameters, which decreases the number of parameters greatly. The ~~outpu~~ network computes the local features.