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CSC 578

Homework #6

#1.)

$$W_2 = \frac{(W_1 - F + 2P)}{S + 1}$$

$$H_2 = \frac{(H_1 - F + 2P)}{S + 1}$$

$$D_2 = K$$

The formulas can be found on the resource web page "CS231n Convolutional NN for Visual Recognition".

Now, if each filter produces an activation map, based on the inputs and the parameters, then the output is calculated by stacking each of the activation maps of each filter, along the depth. Not sure if this is explained correctly, but it seems that the output consists of the sum of each activation filter.

#2.) A.) The size of a single feature map will be $32 \times 32 \times 1$.
There are 100 features, so the final size will be $32 \times 32 \times 100$.

B.) one filter is $(3,3)$ or $3 * 3$ plus 1 for bias = 10

The total number of filters is 100.

$(3 * 3 + 1) * 100 = 1000$ total parameters.

#3.)

$$(m-n+1) * (m-n+1) = (6-4+1) * (6-4+1) = 3 \times 3$$

A.)

$$\begin{array}{cccc} 0 & 0 & 0 & 0 \\ 0 & 2 & 2 & 2 \\ 0 & 2 & 2 & 2 \\ 0 & 2 & 2 & 2 \end{array} \rightarrow -6$$

$$\begin{array}{cccc} 0 & 0 & 0 & 0 \\ 2 & 2 & 2 & 0 \\ 2 & 2 & 2 & 0 \\ 2 & 2 & 2 & 0 \end{array} \rightarrow 6$$

$$\begin{array}{cccc} 0 & 0 & 0 & 0 \\ 2 & 2 & 0 & 0 \\ 2 & 2 & 0 & 0 \\ 2 & 2 & 0 & 0 \end{array} \rightarrow 12$$

$$\begin{array}{cccc} 0 & 2 & 2 & 2 \\ 0 & 2 & 2 & 2 \\ 0 & 2 & 2 & 2 \\ 0 & 0 & 0 & 0 \end{array} \rightarrow -6$$

$$\begin{array}{cccc} 2 & 2 & 2 & 0 \\ 2 & 2 & 2 & 0 \\ 2 & 2 & 2 & 0 \\ 0 & 0 & 0 & 0 \end{array} \rightarrow 6$$

$$\begin{array}{cccc} 2 & 2 & 0 & 0 \\ 2 & 2 & 0 & 0 \\ 2 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{array} \rightarrow 12$$

$$\begin{array}{cccc} 0 & 2 & 2 & 2 \\ 0 & 2 & 2 & 2 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{array} \rightarrow -4$$

$$\begin{array}{cccc} 2 & 2 & 2 & 0 \\ 2 & 2 & 2 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{array} \rightarrow 4$$

$$\begin{array}{cccc} 2 & 2 & 0 & 0 \\ 2 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{array} \rightarrow 8$$

$$\begin{array}{ccccc} \text{FEATURE MAP} = & -6 & 6 & 12 \\ & -6 & 6 & 12 \\ & -4 & 4 & 8 \end{array}$$

B.) To take a guess, this filter could be a Gaussian Blur..?

#4.) using $(n + 2p - f + 1) * (n + 2p - f + 1)$, the convolution operation with the filter. $P = \text{padding}$, $n = \text{input}$, $f = \text{filter}$

$$(7 + 2p - 3 + 1) * (7 + 2p - 3 + 1)$$

$$\text{if } p = 1$$

$$(7 + 2 - 3 + 1) * (7 + 2 - 3 + 1)$$

$$(7 * 7)$$

Padding size should be 1.

#5.)

$$\begin{aligned}\text{Convolution layer - parameters} &= (\text{filter shape} * \text{number filters in previous} + 1) * \text{number filters} \\ &= ((5 * 5 * 3) + 1) * 32 \\ &= 2432\end{aligned}$$

Max Pooling layer - 0 parameters, because this layer only calculates a number.

$$\begin{aligned}\text{Convolution layer - parameters} &= (5 * 5 * 32) + 1 * 32 \\ &= 25632\end{aligned}$$

Max Pooling layer - 0 parameters, only calculates a number.

$$\begin{aligned}\text{Fully connected - parameters} &= (\text{current layer} * \text{previous}) + 1 * \text{current layer} \\ &= (512 * 800) + (1 * 512) \\ &= 410112\end{aligned}$$

$$\begin{aligned}\text{Fully connected - parameters} &= (10 * 512) + (1 * 10) \\ &= 5130\end{aligned}$$