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CSC 578
HW - 07

★ Q.1

Ans:- K = number of filters
F = their spatial extent
S = the stride
P = the amount of zero padding

Input = $W_1 \times H_1 \times D_1$ (height, weight & depth)

hyper parameters of K, F, S, P

Output = $W_2 \times H_2 \times D_2$

$W_2 = ?$, $H_2 = ?$, $D_2 = ?$

$$\therefore W_2 = \frac{W_1 + (2P) - F}{S} + 1 \quad \text{--- eq.1}$$

$$h_2 = \frac{h_1 + (2P) - F}{S} + 1 \quad \text{--- eq.2}$$

$$d_2 = K$$

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Q: 2

image (i) = 32 x 32

filter (n) = 100

Size of filter = 3 x 3

S = 1

D = 1

from eq - 1

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

$W_2 = 30$ (After substituting values in the eq - 1)

After substituting values in the eq-2

$H_2 = 30$

And,

$D_2 = 100$

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Hence, output $H_2 \times W_2 \times D_2$

$30 \times 30 \times 100$

Parameters (n) =

$(3 \times 3 + 1) \times 100$

$= (9+1) \times 100 = 10 \times 100$

$= 1000$

There are total 1000 number of parameters.

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filter =

| | | | |
|---|---|---|---|
| 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 |
| -1 | -1 | -1 | -1 |
| -1 | -1 | -1 | -1 |

Image (i) =

| | | | | | |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 2 | 2 | 2 | 0 | 0 |
| 0 | 2 | 2 | 2 | 0 | 0 |
| 0 | 2 | 2 | 2 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 |

Image (o) = 3x3

Now, Performing dot product without Rotation or Correlation

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Node (1,1)

= filter × Image(0):

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

$$= 6 - 6 - 6$$

$(1,1) = -6$ , $(1,2) = -6$

$(1,3) =$

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

$$= 0 + 4 - 4 - 4$$

$$= -4$$

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Likewise for

(2, 1) = 6 + 6 - 6 = 6

(2, 2) = 6 + 6 - 6 = 6

(2, 3) = 4 + 4 - 4 = 4

(3, 1) = 6 + 6 = 12

(3, 2) = 6 + 6 = 12

(3, 3) = 4 + 4 = 8

3×3 output will look like as below.

$$\begin{bmatrix} -6 & -6 & -4 \\ 6 & 6 & 4 \\ 12 & 12 & 8 \end{bmatrix}$$

Step 2 : Add Activation form

Add ReLU

$$= \begin{bmatrix} 0 & 0 & 0 \\ 6 & 6 & 4 \\ 12 & 12 & 8 \end{bmatrix}$$

(∵ ReLU provide 0 effect for negatives)

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B.)

From the final output we can say it have loss of in first row, so we can say failed to capture the dimention of the image. Although it can always capture image data which is either in the one dimention or in two dimention.

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Q=4

Image (i) = 7×7

filter = 3×3

S = 2

output = 3×3

P = 1

Assume padding size = ?

Formula: $\left[\frac{(n+2\times P-b)}{S}+1\right]\times\left[\frac{(n+2P-b)}{S}+1\right]$

layer (o) =

$$1+\frac{n+2\times P-F}{S}$$

$$=1+\frac{7+2\times P_1-3}{2}$$

$$\frac{4+2P}{2}+1=7$$

$$4+2P=6\times 2$$

$$2+P=6 \quad \boxed{P=4}$$

W = filter(size) x B x Input
+ n(parameter)

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Q.=5

Image (i) = 32 x 32 x 3

explain 'Param #'

layers | Param # Calculation

1st - 32, 5x5, S=1
ReLU

= (5x5x32x3) + 32
= (75x32) + 32

= 2400 + 32
= 2432

2nd - 2x2, S=2

= 0

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3rd

32, 5×5, S=1

ReLU

= (25 × 32)(32) + 32

= 25600 + 32

3rd = 25632

4th

2×2, S=2

4th = 0

5th

N=512, ReLU

= (800 × 512)

5th = 409,600

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6th

Node = 10, Softmax

= (512 x 10)

6th = 5120