CS 66: Machine Learning

Prof. Sara Mathieson

Spring 2019

Lab 7: in-lab notes
(Lab A)

$M = 1$

X	1	2	3	4	5	6
f(x)	0	3	-1	2	0	1	8	0

m	-1	0	1
g(m)	1	0	2

cross-correlation $f \star g(x) = \sum_{m=-M}^{M} f(x+m)\,g(m)$

$$f \star g(2) = f(2-1)g(-1) + f(2-0)g(0) + f(2+1)g(1)$$
$$= 3 \cdot 1 + -1 \cdot 0 + 2 \cdot 2 = 7$$

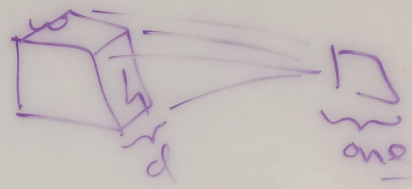
output

Same size!

-2	7	-1	4	16	1

padding = "SAME"

input size matches output



$-1 + 1 - 1 + 1 = 0$

in $5 \times 5 \times 3$

out $3 \times 3 \times 2$

Conv Layer

- depth = # of filters
- stride = how much to shift each time
- zero-padding
- filter size

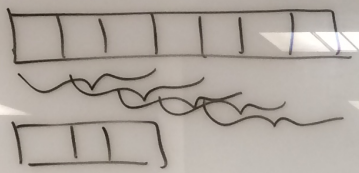
W = width of input

F = filter size (width & height)

P = padding

S = stride

W = 7



F = 3

P = 0

S = 1

$7 - 3 + 1 = 5$

output size.

in general

output size

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

Shape of filters

$(5 \times 5 \times 3) \times 12$

- 5 ↑ filter width
- 5 ↑ filter height
- 3 ↑ input depth.
- 12 ↑ # of filters.

Lab 7: in-lab notes
(Lab B)

$M = 1$

x	1	2	3	4	5	6
f(x)	0	3	-1	2	0	1	8	0

m	-1	0	1
g(m)	1	0	2

cross-correlation

$$f \star g(x) = \sum_{m=-M}^{M} f(x+m)\,g(m)$$

$$f \star g(2) = f(2-1)g(-1) + f(2-0)g(0) + f(2+1)g(1)$$

$$= 3 \cdot 1 + -1 \cdot 0 + 2 \cdot 2 = 7$$

output

same size!

	-2	7	-1	4	16	1
	1	2	3	4	5	6

→ ReLU

0	7	0	4	16	1

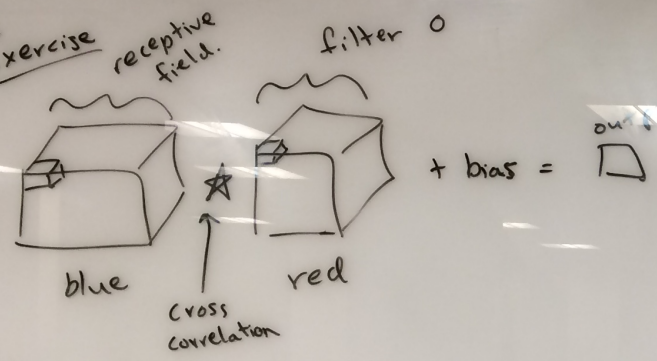
↓ POOL

padding = "SAME"

CONV

0	7	4	16	0

Exercise



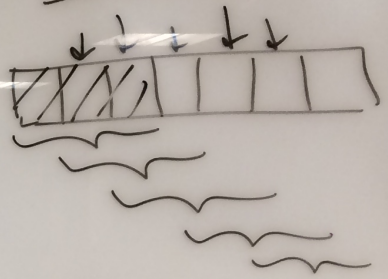
$-1+1+1-2+1=0$

Conv Layer

- filter size = F
- Stride = S
- # of filters
- padding = P

Input width = W

W = 7



output dim?

5

P=0
F=3
S=1

$7 - 3 + 1 = 5$

in general

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

output size

filter weight shape

$5 \times 5 \times 3 \times 12$

- 5: filter width
- 5: filter height
- 3: input depth
- 12: output depth } # filters.