Convolutional
Neural Networks

Convolutions over
volumes

deeplearning.ai
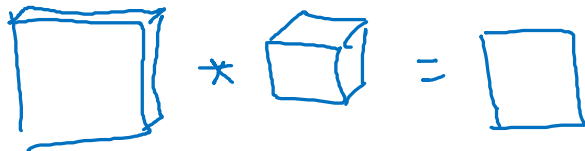
# Convolutions on RGB images



$6 \times 6 \times \boxed{3}$     $3 \times 3 \times \boxed{3}$     $4 \times 4$

height     width     #channels
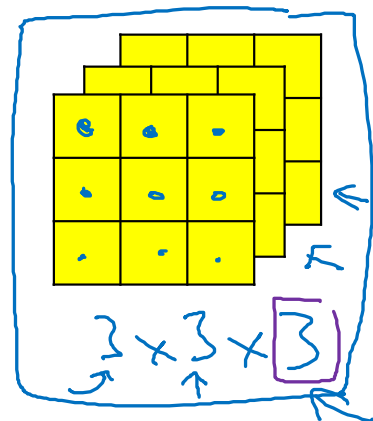
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# Convolutions on RGB image



6 x 6 x **3**

$*$    3 x 3 x **3**

27 numbers

=    4 x 4

R
| 1 | 0 | -1 |
| 1 | 0 | -1 |
| 1 | 0 | -1 |

G

B    → 3 x 3 x 3

R
| 1 | 0 | -1 |
| 1 | 0 | -1 |
| 1 | 0 | -1 |

G
| 1 | 0 | -1 |
| 1 | 0 | -1 |
| 1 | 0 | -1 |

B
| 1 | 0 | -1 |
| 1 | 0 | -1 |
| 1 | 0 | -1 |    → 3 + 3 + 3

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# Multiple filters



6 x 6 x 3

channels

*Vertical edge*

3 x 3 x 3

*horizontal edge*

3 x 3 x 3

= 4 x 4

= 4 x 4

4 x 4 x 2

4 x 4 x 2
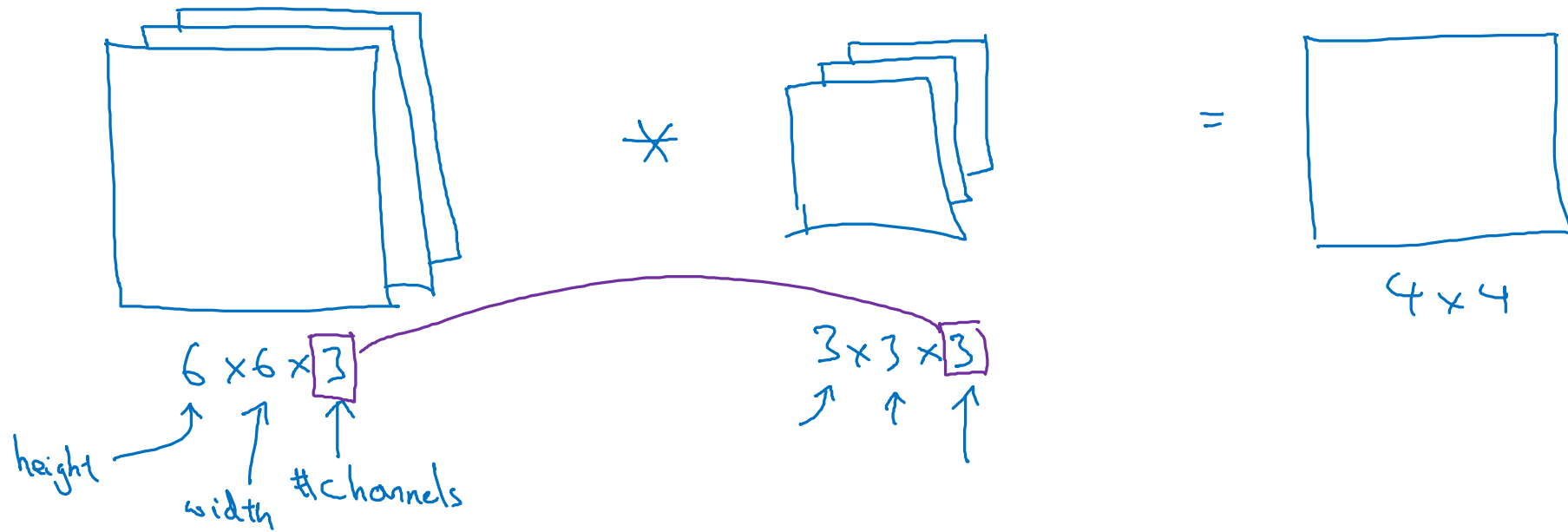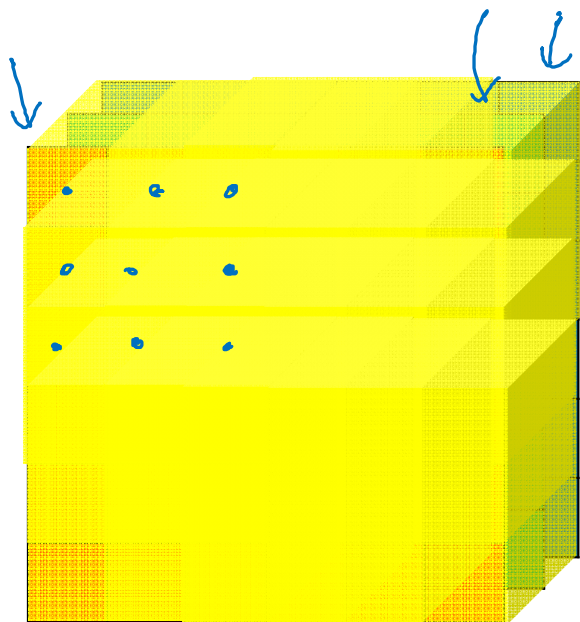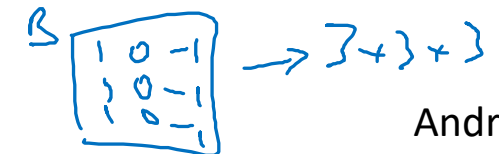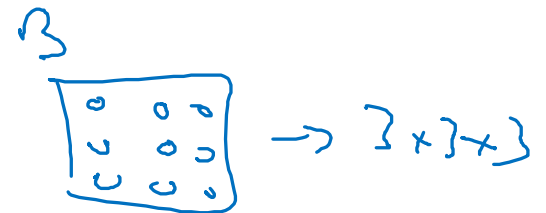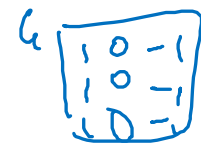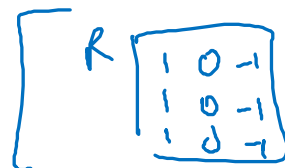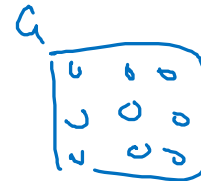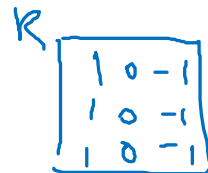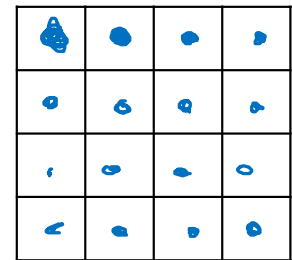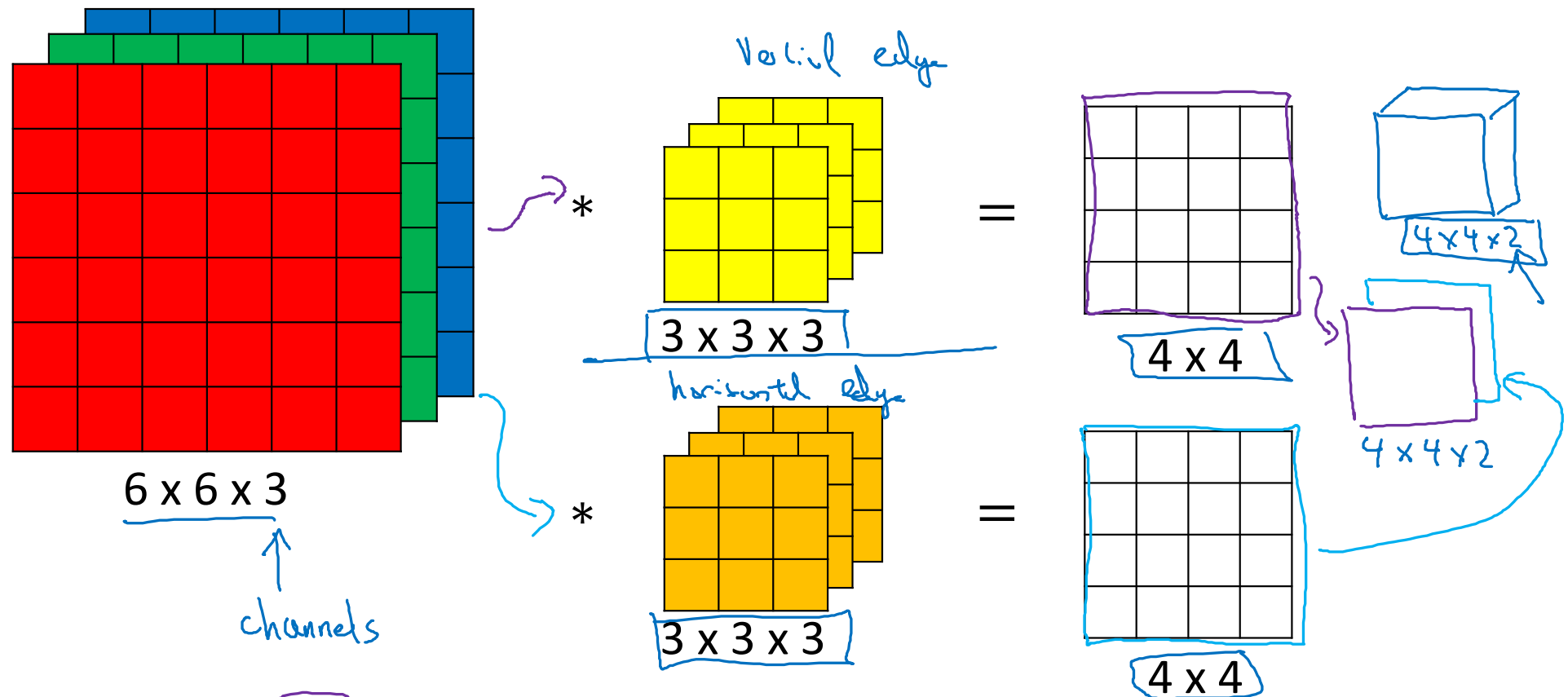
Summary: $n \times n \times \boxed{n_c}$ $\quad * \quad f \times f \times \boxed{n_c} \quad \longrightarrow \quad \frac{n-f+1}{4} \times \frac{n-f+1}{4} \times n_c'$

$6 \times 6 \times 3 \qquad\qquad 3 \times 3 \times 3 \qquad\qquad\qquad 4 \quad\times\quad 4 \quad \times 2 \quad$ #filters

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