

What is Padding?

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The diagram illustrates a convolution operation. On the left, a 7x7 input matrix (labeled $n \times n$) is multiplied by a 3x3 filter matrix (labeled $f \times f$). The result is a 3x3 output matrix (labeled $(n-f+1) \times (n-f+1)$). The filter matrix has values: 1, 0, -1; 1, 0, -1; 1, 0, -1. The calculation for the output value 6 is shown as: $7 \times 1 + 4 \times 1 + 3 \times 1 + 2 \times 0 + 5 \times 0 + 3 \times 0 + 3 \times 1 + 3 \times -1 + 2 \times -1 = 6$. The output matrix is labeled $n-f+1=n$.

\uparrow

7×7

$n \times n$

5×5

3×3

$f \times f \rightarrow (n-f+1) \times (n-f+1)$

$(5-3+1) = 3 \times 3$

$n-f+1 = 5$

$n-3+1=5 \Rightarrow n=8$

$n=7$

convolution

7x7

Zero
padding

0	0	0	0	0	0	0
0	7	2	3	3	8	6
0	4	5	3	8	4	0
0	3	3	2	8	4	0
0	2	8	7	2	7	0
0	5	4	4	5	4	0
0	0	0	0	0	0	0

$$\underline{5 \times 5} \rightarrow 3 \times 3$$

$$\begin{array}{c}
 \begin{array}{ccc}
 & 5 \times 5 & \rightarrow 3 \times 3 \\
 - & & \\
 (\eta - f+1) & & \\
 \downarrow & & \\
 (\eta + 2p - f+1) & & \\
 5 + 2(1) - 3 + 1 & \checkmark & \\
 = 7 - 3 + 1 = 5 & \textcircled{5} &
 \end{array}
 &
 \begin{array}{c}
 \xrightarrow{\text{Kerns}} \\
 \boxed{\text{Valid}} \quad \boxed{\text{Same}}
 \end{array}
 \end{array}$$