x_0	x_1	x_2	x_3	x_4
x_5	x_6	x_7	x_8	x_9
x_{10}	x_{11}	x_{12}	x_{13}	x_{14}
x_{15}	x_{16}	x_{17}	x_{18}	x_{19}
x_{20}	x_{21}	x_{22}	x_{23}	x_{24}

一、一个 5x5 卷积核

W_0	W_1	W_2	W_3	W_4
W_5	W_6	W_7	W_8	W_9
W_{10}	W_{11}	W_{12}	W_{13}	W_{14}
W_{15}	W_{16}	W_{17}	W_{18}	W_{19}
W_{20}	W_{21}	W_{22}	W_{23}	W_{24}

x_0	x_1	x_2	x_3	x_4
x_5	x_6	x_7	x_8	x_9
x_{10}	x_{11}	x_{12}	x_{13}	x_{14}
x_{15}	x_{16}	x_{17}	x_{18}	x_{19}
x_{20}	x_{21}	x_{22}	x_{23}	x_{24}

$\times$

W_0	W_1	W_2	W_3	W_4
W_5	W_6	W_7	W_8	W_9
W_{10}	W_{11}	W_{12}	W_{13}	W_{14}
W_{15}	W_{16}	W_{17}	W_{18}	W_{19}
W_{20}	W_{21}	W_{22}	W_{23}	W_{24}

$=$ $\boxed{T_0}$

$T_0 = W_0X_0 + W_1X_1 + \ldots + W_{12}X_{12} + \ldots W_{23}X_{23} + W_{24}X_{24}$

$$T_0 = G(X_0, X_{24}) \Rightarrow \left.\begin{array}{r} X_0 = f(X_{24}) \\ X_0 \perp X_{12} \\ X_{24} \perp X_{12} \end{array}\right\} \begin{array}{r} W_{12} = 0 \\ \Rightarrow W_0 \neq 0 \\ W_{24} \neq 0 \end{array}$$

二、两个 3x3 卷积核

W_0	W_1	W_2
W_3	W_4	W_5
W_6	W_7	W_8

W'_0	W'_1	W'_2
W'_3	W'_4	W'_5
W'_6	W'_7	W'_8

x_0	x_1	x_2	x_3	x_4
x_5	x_6	x_7	x_8	x_9
x_{10}	x_{11}	x_{12}	x_{13}	x_{14}
x_{15}	x_{16}	x_{17}	x_{18}	x_{19}
x_{20}	x_{21}	x_{22}	x_{23}	x_{24}

$\times$

W_0	W_1	W_2
W_3	W_4	W_5
W_6	W_7	W_8

$=$

A_0	A_1	A_2
A_3	A_4	A_5
A_6	A_7	A_8

$$A_0 = W_0X_0 + W_1X_1 + \ldots + W_4X_6 + \ldots W_7X_{11} + W_8X_{12}$$
$$A_1 = W_0X_1 + W_1X_2 + \cdots + W_4X_7 + \cdots W_7X_{12} + W_8X_{13}$$
$$\vdots$$
$$A_4 = W_0X_6 + W_1X_7 + \ldots + W_4X_{12} + \ldots W_7X_{17} + W_8X_{18}$$
$$\vdots$$
$$A_7 = W_0X_{11} + W_1X_{12} + \ldots + W_4X_{17} + \ldots W_7X_{22} + W_8X_{23}$$
$$A_8 = W_0X_{12} + W_1X_{13} + \ldots + W_4X_{18} + \ldots W_7X_{23} + W_8X_{24}$$

W'_0	W'_1	W'_2
W'_3	W'_4	W'_5
W'_6	W'_7	W'_8

$\times$

A_0	A_1	A_2
A_3	A_4	A_5
A_6	A_7	A_8

$=$

T'_0

$$T_0{}' = W_0{}'A_0 + W_1{}'A_1 + \ldots + W_4{}'A_4 + \ldots + W_7{}'A_7 + W_8{}'A_8$$

$$= (W_0X_0 + W_1X_1 + \ldots + W_4X_6 + \ldots W_7X_{11} + W_8X_{12})W_0{}' + (W_0X_1 + W_1X_2 + \ldots + W_4X_7 + \ldots W_7X_{12} + W_8X_{13})W_1{}'$$
$$+ \ldots + (W_0X_6 + W_1X_7 + \ldots + W_4X_{12} + \ldots W_7X_{17} + W_8X_{18})W_4{}' + \ldots +$$
$$(W_0X_{11} + W_1X_{12} + \ldots + W_4X_{17} + \ldots W_7X_{22} + W_8X_{23})W_7{}' + (W_0X_{12} + W_1X_{13} + \ldots + W_4X_{18} + \ldots W_7X_{23} + W_8X_{24})W_8{}'$$

$$= (W_0W_0{}')X_0 + (W_1W_0{}' + W_0W_1{}')X_1 + \ldots$$
$$+ (W_8W_0{}' + W_7W_1{}' + W_6W_2{}' + W_5W_3{}' + W_4W_4{}' + W_3W_5{}' + W_7W_2{}' + W_6W_6{}' + W_1W_7{}' + W_0W_8{}')X_{12}$$
$$\ldots + (W_7W_8{}' + W_8W_7{}')X_{23} + (W_8W_8{}')X_{24}$$

$$T_0{}' = G(X_0, X_{24}) \Rightarrow \left.\begin{array}{c} X_0 = f(X_{24}) \\ X_0 \perp X_{12} \\ X_{24} \perp X_{12} \end{array}\right\} \Rightarrow \begin{array}{l} W_0W_0{}' \neq 0 \\ W_8W_8{}' \neq 0 \\ W_8W_0{}' = 0 \\ W_0W_8{}' = 0 \end{array} \Rightarrow Contradiction$$