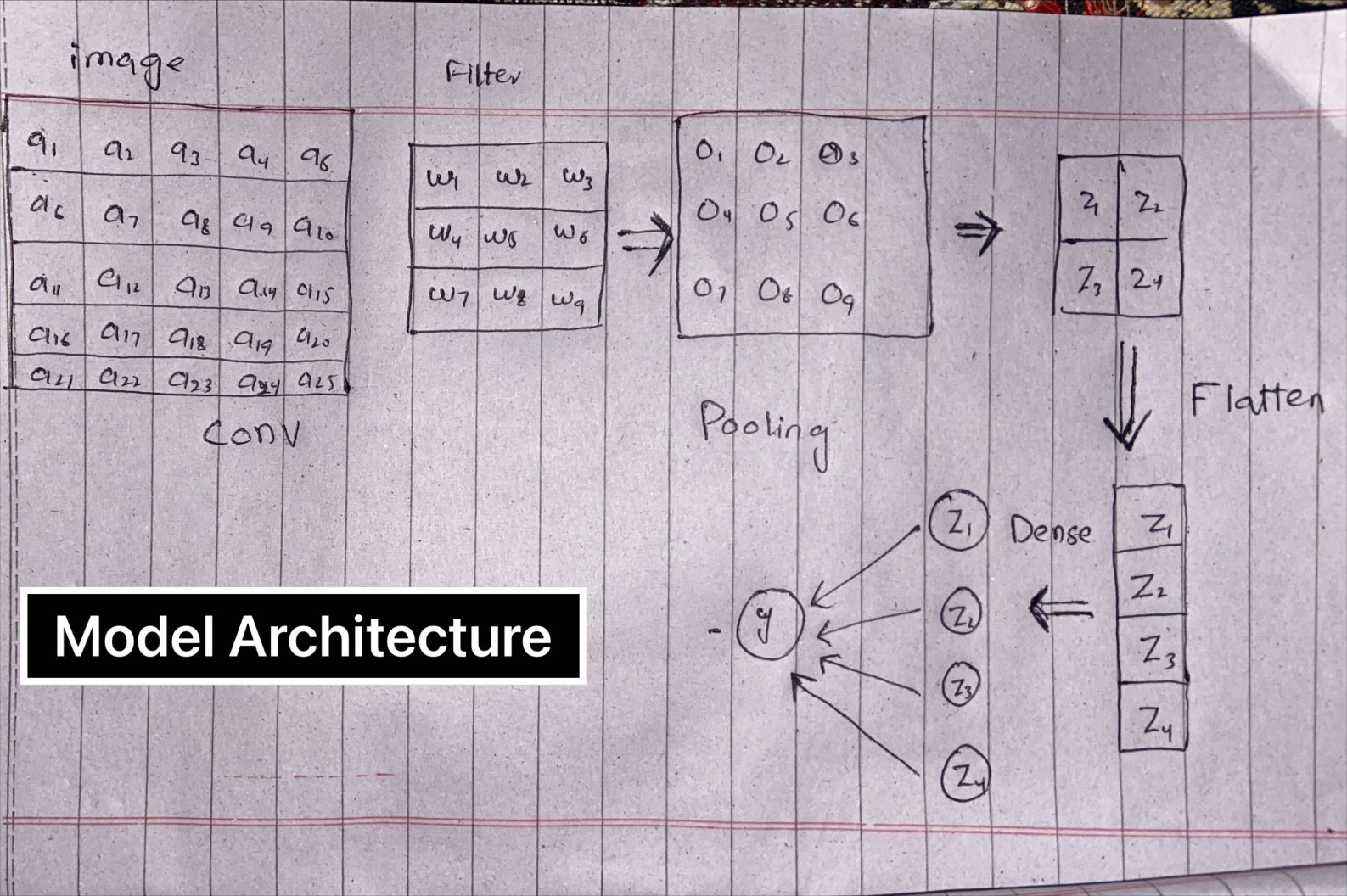
image
Filter
Conv
Pooling
Flatten
Dense
Model Architecture

Explaination

Input image : 5×5

a_1	a_2	a_3	a_4	a_5
a_6	a_7	a_8	a_9	a_{10}
a_{11}	a_{12}	a_{13}	a_{14}	a_{15}
a_{16}	a_{17}	a_{18}	a_{19}	a_{20}
a_{21}	a_{22}	a_{23}	a_{24}	a_{25}

Filter = 3×3

w_1	w_2	w_3
w_4	w_5	w_6
w_7	w_8	w_9

$$Z_1 = w_1 a_1 + w_2 a_2 + w_3 a_3 + w_4 a_6 \ldots + w_9 a_{13}$$

$$Z_2 = w_1 a_1 + a_3 w_2 + w_3 a_5 + w_4 a_8 \ldots + w_9 a_{15}$$

$$Z_3 = w_1 a_{11} + a_2 a_{12} + w_3 a_{13} + w_4 a_{16} \ldots + w_9 a_{23}$$

$$Z_4 = w_1 a_{13} + w_2 a_{14} + w_3 a_{15} + w_4 a_{18} \ldots + w_9 a_{25}$$

Z_1	Z_2
Z_3	Z_4

Flatten ⇒

Z_1
Z_2
Z_3
Z_4

⇒ $\hat{y}$ = output → L

Weight Updation : $w_i^* = w_i - \alpha \times \frac{\partial L}{\partial w_i}$

w^* = updated weight

w = old weight

i = number of weight from 1 to 9

α = learning weight

$\partial L/\partial w_1$	$\partial L/\partial w_2$	$\partial L/\partial w_3$
$\partial L/\partial w_4$	$\partial L/\partial w_5$	$\partial L/\partial w_6$
$\partial L/\partial w_7$	$\partial L/\partial w_8$	$\partial L/\partial w_9$

change in w_1 will cause change in z_1 & z_1 will cause change in $\hat{y}$ and Loss

$$\frac{\partial L}{\partial w_1} = \frac{\partial z_1}{\partial w_1} \cdot \left[\frac{\partial \hat{y}}{\partial z_1} \cdot \frac{\partial L}{\partial \hat{y}}\right] \Rightarrow \frac{\partial L}{\partial z_1}$$

$$+ \frac{\partial z_2}{\partial w_1} \cdot \left[\frac{\partial \hat{y}}{\partial z_2} \cdot \frac{\partial L}{\partial \hat{y}}\right] \Rightarrow \frac{\partial L}{\partial z_2}$$

$$+ \frac{\partial z_3}{\partial w_1} \cdot \left[\frac{\partial \hat{y}}{\partial z_3} \cdot \frac{\partial L}{\partial \hat{y}}\right] \Rightarrow \frac{\partial L}{\partial z_3}$$

$$+ \frac{\partial z_4}{\partial w_1} \cdot \left[\frac{\partial \hat{y}}{\partial z_4} \cdot \frac{\partial L}{\partial \hat{y}}\right] \Rightarrow \frac{\partial L}{\partial z_4}$$

$$\frac{\partial L}{\partial w_i} = \frac{\partial z_1}{\partial w_i} \cdot \frac{\partial L}{\partial z_1} + \frac{\partial z_2}{\partial w_i} \cdot \frac{\partial L}{\partial z_2} + \frac{\partial z_3}{\partial w_i} \cdot \frac{\partial L}{\partial z_3} + \frac{\partial z_4}{\partial w_i} \cdot \frac{\partial L}{\partial z_4}$$

M T W T F S

$$\frac{\partial L}{\partial w_1} = \boxed{\frac{\partial z_1}{\partial w_1}} \cdot \frac{\partial L}{\partial z_1} + \frac{\partial z_2}{\partial w_1} \cdot \frac{\partial L}{\partial z_2} + \frac{\partial z_3}{\partial w_1} \cdot \frac{\partial L}{\partial z_3} + \frac{\partial z_4}{\partial w_1} \cdot \frac{\partial L}{\partial z_4}$$

↓ to find partial derivative of this we have,

$z_1 = w_1 a_1 + w_2 a_2 + \ldots + w_9 a_{13}$

$= a_1$

$z_2 = w_1 a_3 + w_2 a_4 + \ldots + w_9 a_{15}$

$= a_3$

$z_3 = w_1 \times a_{11} + w_2 a_{12} + \ldots + w_3 a_{23}$

$= a_{11}$

$z_4 = w_1 \times a_{13} + w_2 w_{14} + \ldots + w_3 a_{25}$

$= a_{13}$

$$\frac{\partial L}{\partial w_1} = a_1 \frac{\partial L}{\partial z_1} + a_3 \frac{\partial L}{\partial z_2} + a_{11} \frac{\partial L}{a z_3} + a_{13} \frac{\partial L}{\partial z_4}$$

Same for w_2.

M T W T F S

$$z_1 = w_1 \times a_1 + w_2 a_2 + \dots + w_q a_{13}$$
$$= a_2$$

$$z_2 = w_1 \times a_3 + w_2 a_4 + \dots + w_q a_{15}$$
$$= a_4$$

$$z_3 = w_1 a_1 + w_2 a_{12} + \dots + w_q a_{23}$$
$$= a_{12}$$

$$z_4 = w_1 a_{13} + w_2 a_{14} + \dots + w_q a_{25}$$
$$= a_{14}$$

$$\frac{\partial L}{\partial w_2} = a_2 \frac{\partial L}{\partial z_1} + a_4 \frac{\partial L}{\partial z_2} + a_{12} \frac{\partial L}{\partial z_3} + a_{14} \frac{\partial L}{\partial z_4}$$

$$\vdots$$

$$\frac{\partial L}{\partial w_q} = a_{13} \frac{\partial L}{\partial z_1} + a_{15} \frac{\partial L}{\partial z_2} + a_{23} \frac{\partial L}{\partial z_3} + a_{26} \frac{\partial L}{\partial z_4}$$