

2025-08-07 - Apply the concepts of Convolution Neural Network on the given data

07 August 2025 09:19

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 26, 26, 64)	640
max_pooling2d (MaxPooling2D)	(None, 13, 13, 64)	0
flatten (Flatten)	(None, 10816)	0
dense (Dense)	(None, 128)	1,384,576
dense_1 (Dense)	(None, 10)	1,290

→ layer      Neuron Shape      Activation Shape      Parameters  
 I/P      (28, 28, 1)      784      0

⇒ (3, 3, 64)

$$\left[ \frac{28-3}{1} \right] + 1 = 26$$

→ conv2d      (26, 26, 64)      43264      640

$$\begin{aligned}
 Y &= [\text{Height of filter} \times \text{Width of filter} \times \text{No. of filters in last layer}] \\
 &\quad [Y+1] \times \text{No. of filters in current layer}
 \end{aligned}$$

$$\{ [3 \times 3 \times 1] + 1 \} \times 64 = \underline{640}$$

→ MaxPool2D      (13 x 13 x 64)      10816      0

$$\left[ \frac{26-2}{2} \right] + 1 = \underline{\underline{13}}$$

→ Flatten()      10816      0

→ Dense()      128      128      1384576

$$\left[ \text{Previous Layer Neuron} \times \text{Curr Layer Neuron} \right] + \text{CNN}$$

$$\left[ 10816 \times 128 \right] + 128 = \underline{\underline{1384576}}$$

→ Dense()      10      10      1290

$$\left[ 128 \times 10 \right] + 10 = 1290$$

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 26, 26, 64)	640
max_pooling2d (MaxPooling2D)	(None, 13, 13, 64)	0
conv2d_1 (Conv2D)	(None, 11, 11, 64)	36928
max_pooling2d_1 (MaxPooling2D)	(None, 5, 5, 64)	0
flatten (Flatten)	(None, 1600)	0
dense (Dense)	(None, 128)	204928
dense_1 (Dense)	(None, 10)	1290

Handwritten calculations and annotations:

- For conv2d:  $\left[ \frac{26-3}{1} \right] + 1 = 24$  (circled in blue),  $\left[ \frac{26-2}{2} \right] + 1 = 13$  (circled in red),  $\left[ \frac{26-1}{1} \right] + 1 = 26$  (circled in blue). Formula:  $(3 \times 3 \times 1) + 1 \times 64$ .
- For conv2d\_1:  $\left[ \frac{13-3}{1} \right] + 1 = 11$  (circled in green),  $\left[ \frac{13-2}{2} \right] + 1 = 6$  (circled in green). Formula:  $(3 \times 3 \times 64) + 1 \times 64$ .
- For dense:  $\left[ \frac{11-2}{2} \right] + 1 = 5$  (circled in green),  $5 \times 5 \times 64$  (circled in green). Formula:  $(1600 \times 128) + 128 = 204928$ .
- For dense\_1:  $(128 \times 10) + 10 = 1290$  (circled in green).

$$(1600 \times 128) + 128 = 204928$$

=> Underfitting Strategies :

=> Train a Deeper N/W

=> Overfitting Strategy for CNN's

Data Augmentation