CNN :- Convolutional Neural Network.

Key concept :-

① Input (Image) → Pooling → Flattening → output
(It is downsampling tech)

Pooling – It is downsampling tech use in CNN to reduce the size of image without losing imp. feature.

⇒ Computational fast & reduce overfitting.

Flattening :- Convert Pooled image → 1D (easy for classification)

Before fully connected layer.

It process images into matrices

⇒ Neural N/W like fully connected layer ko input dene ke liye inp. lia

⇒ model use inp. feature & give final decision.

$$\text{output size} = \frac{n+2p-f}{s}+1$$

Q  channel

39 × 39 × 3

image

filter size = always odd → 3×3

Stride = 1, Padding = 0, No. of filter = 10, n = 39, filter = 3

Step 1 :- output size $= \frac{n+2p-f}{s}+1 \Rightarrow \frac{39+2\times0-3}{1}+1$

$\Rightarrow 39-3+1 \Rightarrow 37$

$= \boxed{37\times37\times10}$

Step 2 :- For deep extracting & extracting imp. feature we will increase filter size, stride

filter size = 5×5, stride = 2, n = 37, f = 5

output $= \frac{n+2p-f}{s}+1 \Rightarrow \frac{37\times2\times0-5}{2}+1$

$= 16+1 = 17 \Rightarrow 17\times17\times20$

Step 3 :- Same stride padding increase karenge.

$P = \frac{f-1}{2} = \frac{5-1}{2} = \frac{4}{2} = 2$ (even no.)

$S = 2$ filter 5×5, $n = 17$, $f = 5$

output $= \frac{n+2p-f}{s} + 1$

$= \frac{17+2\times2-5}{2} + 1 = \frac{17+4-5}{2} + 1 \Rightarrow \frac{16}{2} + 1$

$= 9$

$\Rightarrow 9 \times 9 \times 40$ {∵ step 1 se step 3 tak Pooling hua}

Step 4:- calculate flatten

Given 120 neuron — $9 \times 9 \times 40 \times 120 + 120$ (neuron, Bias)

imp feature $= 38920$

CNN:- ① understanding the image isme pure image ko cover karenge. ~~output size nikalenge~~.

② Pooling — ① output size nikalenge (To understand the img)
② filter size & stride increase karenge (To cover imp feature)
③ Padding increase kiya (To avoid info. loss)

③ calculate flatten

Max Pooling:- Down sampling tech. Cover only most imp. feature of image.

Calculate one time output size =

$32 \times 32 \times 3$, $S = 2$, $f = 2$, $n = 32$, $P = 0$

output $= \frac{n+2p-f}{s} + 1 \Rightarrow \frac{32+2\times0-2}{2} + 1 \Rightarrow \frac{30}{2} + 1 = 16$

$\Rightarrow$ ~~$18 \times 18 \times 3$~~

$\frac{32-2}{2} + 1 \Rightarrow 15 + 1 = 16$

$15 \times 15 \times 3$

LeNet-5 Arch — CNN + max pooling.

CNN (extract features)
max pooling (reduce size)
fully connected (final decision)
softmax layer (which digit)

Q 32×32×3 $f = 5\times5$, $f = 5$, $S = 1$, $P = 0$, $n = 32$, no. of $f = 8$

CNN Output size $= \frac{n+2p-f}{s} + 1 = \frac{32+2\times0-5}{1} + 1$

$= \frac{27}{1} + 1 \Rightarrow 28$

28×28×8

max pooling $= \frac{n+2p-f}{s} + 1$ $S = 2$, $f = 2$, $P = 0$

$\Rightarrow \frac{28+2\times0-2}{2} + 1 \Rightarrow \frac{26}{2} + 1 = 14$

14×14×8 $f = 5$, $S = 1$

CNN :- $\frac{n+2p-f}{s} + 1 \Rightarrow \frac{14+2\times0-5}{1} + 1 \Rightarrow 9+1 \Rightarrow 10$

10×10×16

max padding = $S = 2$, $f = 2$, $P = 0$

$= \frac{n+2p-f}{s} + 1 \Rightarrow \frac{10+2\times0-2}{2} + 1 \Rightarrow \frac{8}{2} + 1 = 5$

5×5×16

Falttiing = 120, 84 fully connected layers

120 :- $5\times5\times16\times120 + 120 = 48120$

84 :- $84\times120 + 84 = 10164$

final = $1\times84 + 1 = 85$ Same Process for CNN ke liye

~~32×32×3 | 28×28×8 | 10×10×16~~

CNN layer Flatten:

5x5x8

~~(5x5x8 x3) +8 =~~

~~(5x5x16 x3) +16~~

~~5x5x16+16~~

5x5x8 =

5x5x3x8+8 =

5x5x16 =

5x5x3x16+16 =

Total =