H

W

color channels

H

W

grayscale image.

Convolution

Image

Conv2D

f_2

f_2

$f_1 \rightarrow$

$S=1$

100

5

O

$5=f$

28

(28)

24

H?

d?. $=100$

wp 24

$$H' = \frac{H-f}{S} + 1 \qquad\qquad w' = \frac{w-f}{S} + 1$$

$$w' = \frac{28-5}{S=1} + 1$$

$$H' = \frac{28-5}{1} + 1 \qquad\qquad = 24$$
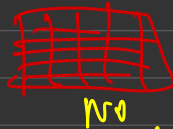
$$H' = 24$$

air
to

28

$\overline{1000}$

28 1000

Conv2D $\left(100, \underline{(5 \times 5)}, S=2 \right)$

(100×26)

12

12

$\rightarrow 25$ (2600)

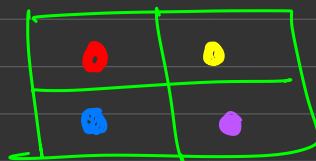$$\frac{28-5}{2} + 1$$

$$11+1 = 12$$

No

Trainable parameters ??

25 + 1 bias = 26 parameters

weights

$$\left(\frac{H-f}{s} + 1 \right) \times \left(\frac{W-f}{s} + 1 \right)$$

H

Image

W

Conv2D

H'

FM

W'

4

4
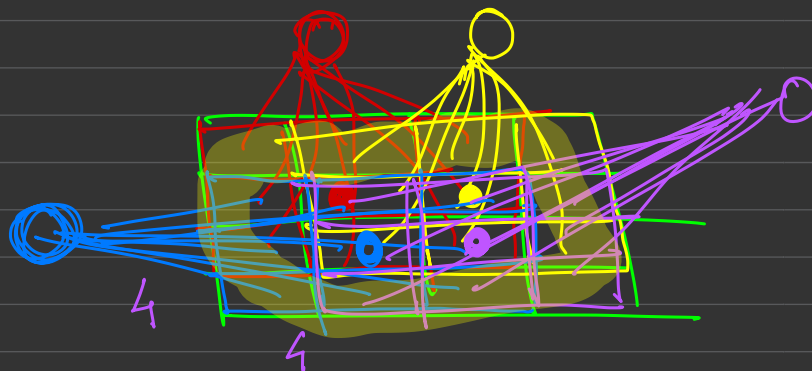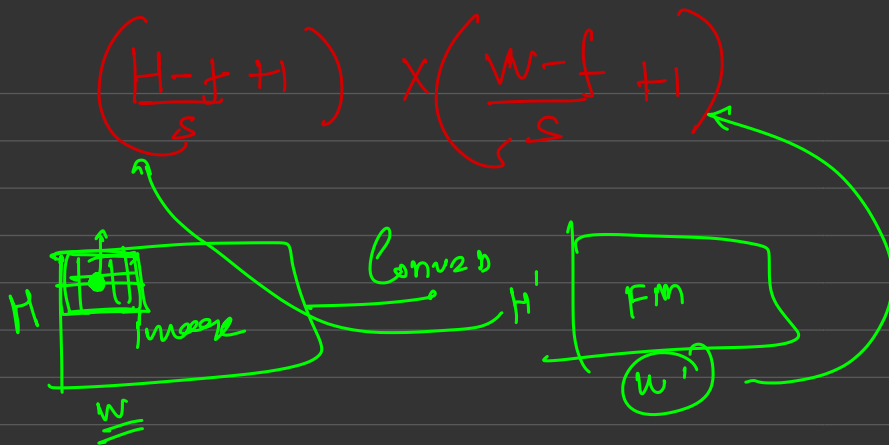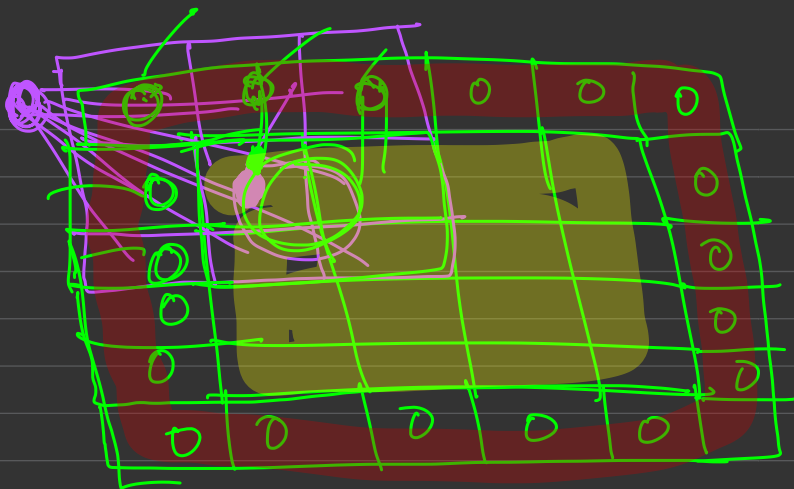
H , W of the image/fm before Conv2D =

H & w of the image /fm after Conv2D

$$\frac{H-k+1}{s}$$

$$\frac{W-k+1}{s}$$

$$\left(\frac{H+2p-k}{s}+1\right)$$

$$\left(\frac{W+2p-k}{s}+1\right)$$

$$= \underline{H}$$

$$= \underline{W}$$

Image
28 x 28

5 × 5 → 24

28

28 x 28

5 × 1

24

24

24
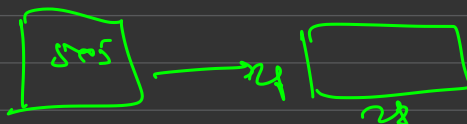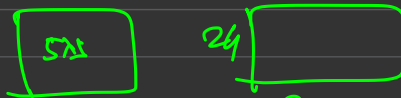
Conv2D → feature engineering

H, w → H' w' x d

Max pooling

Conv2D → feature
extra → Padding

Map2D
feature charno.
x Padding

H + 2p

$$\frac{H + 2p - f}{s} + 1 = H$$
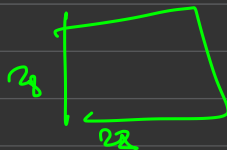
Conv2D (100, 5x5)

learnable parameters

$(2500+1)$

5×5

100

28

$(25 \times 100 + 1)$

28

$\xrightarrow{\quad}$ Conv 2D $\left(\;50\;,\;5 \times 5\;\right)$
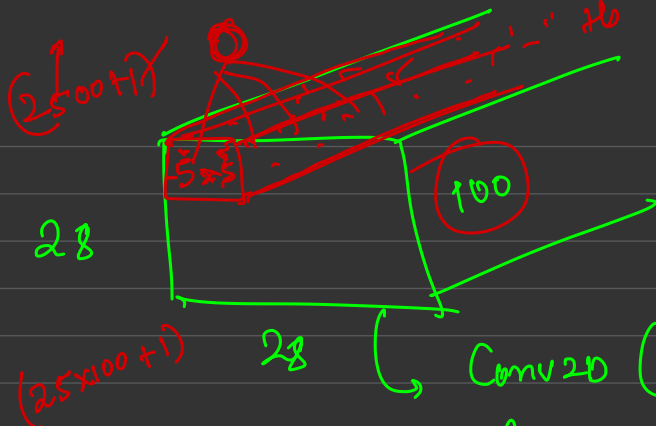
$50 \times (2500 + 1)$

learnable parameters
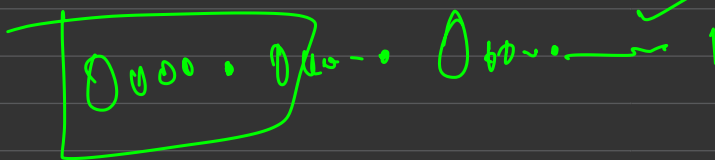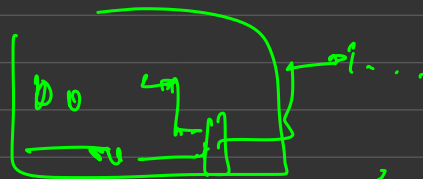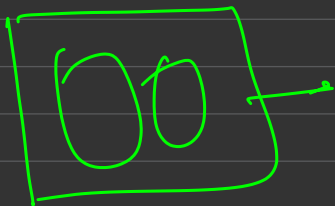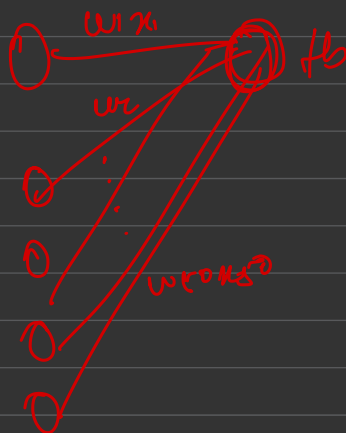
$w_1 x_1$

w_2

wrong

D_0

famous architectures

Config from Base

transfer learning

Steps

10,000 images

CNN

D D D dataset

Base Base
Conf
Tomak

Remove
last directive
own layer

data

1000 images

ship

8:02 : 8:10 pm

hunt   Alexnet

$25 \times 3 = 75 + 16$
$= 76 $

32

32

3

Conv2D $\left(\underline{6} , 5 \times 5 \right)$

28

6

28

$\dfrac{H - f}{S} + 1 = \dfrac{32 - 5}{1} + 1 \qquad 28 \times 28$

(6×6)

$C_1 \quad C_2$

6

27

28

Avg $\left(\underline{f,2} , \ell = 2 \right)$

6

14

14

$\boxed{\dfrac{28 - 2}{2} + 1} =$

$\dfrac{151}{5 \times 5 \times 6 + 1}$

5

5

14

6

14

Conv2D $\left(\underline{16} , 5 \times 5 , valid \right)$

151×16

10

16

10

9×9

$F = \dfrac{14 - 5}{1} + 1$

$[25] \times 6 + 1$

5×5

14

14

b $[5]$ $\times 16$

Convex

16 $0 \cdot 5$

16

14 5 10

10

$$H - F + 1 = 20$$

$$S = 1$$

10 16 16

7 26 $+laften$

7

784 69×16 $+16$ $[209]$ 121 $4 \, 9 \times 16$

20 84 10.85

850

69×16

785×120 121×84
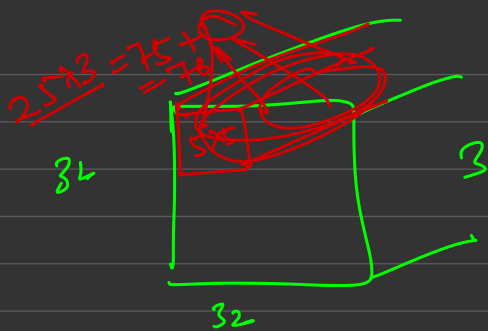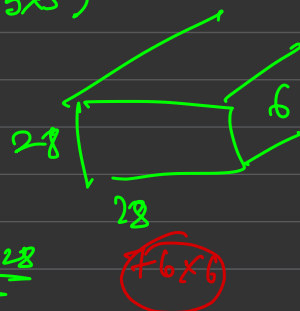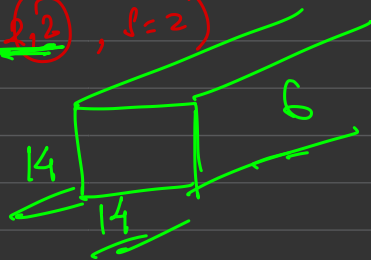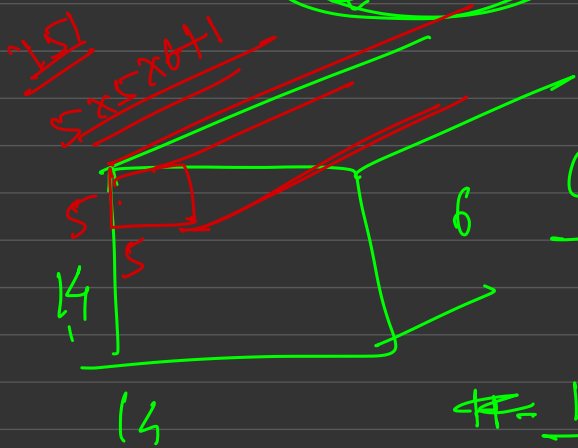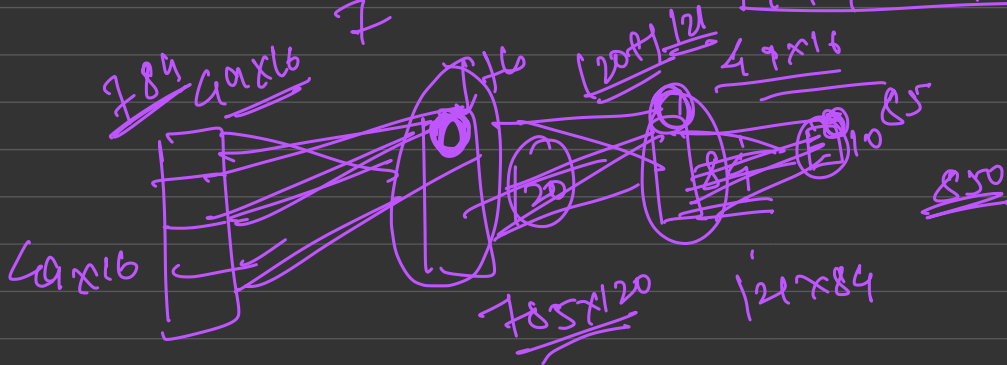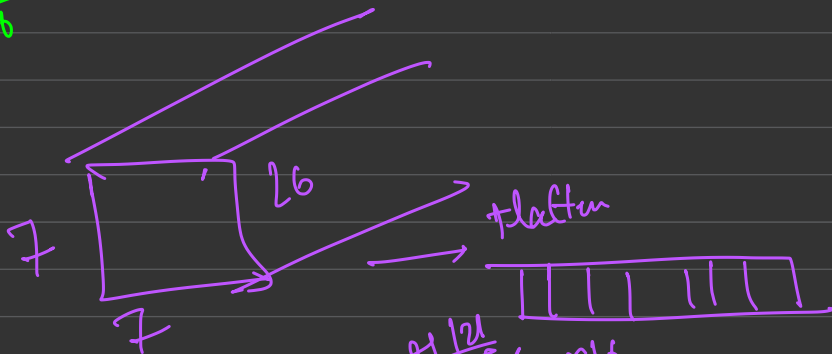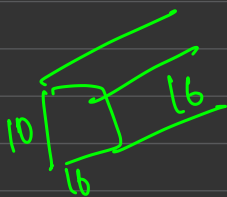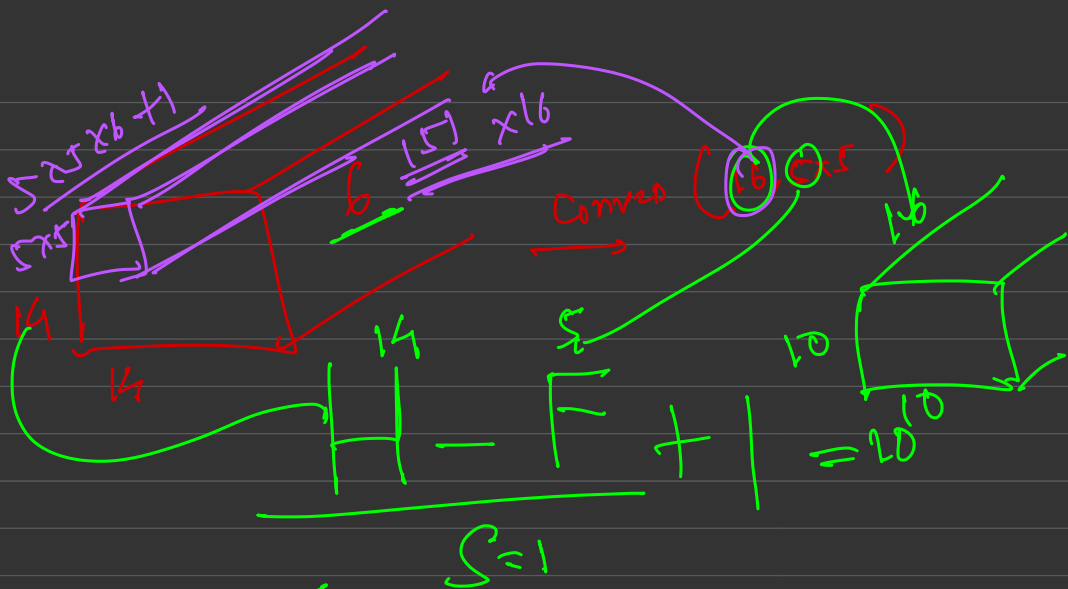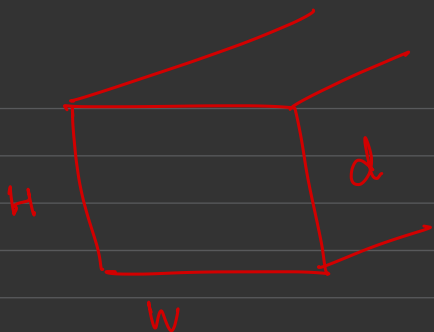
$\text{Conv2D } (n, f\times f, s)$

if padding = 'valid'

$$H' = \frac{H-f}{s} + 1$$

$$W' = \frac{W-f}{s} + 1$$
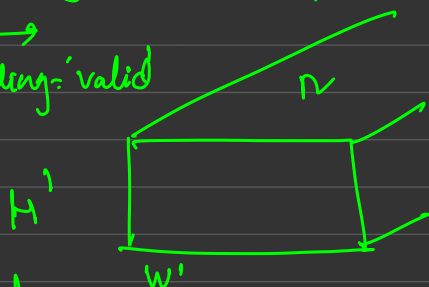
h.learnable parameters
$$= (f\times f\times d + 1)\times n$$
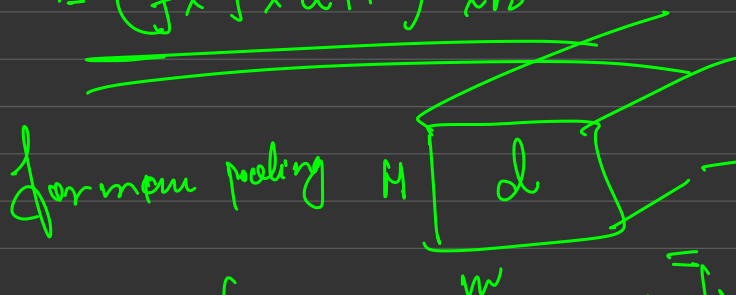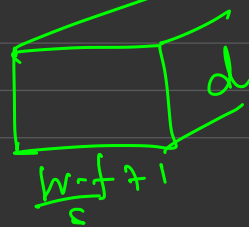
$\text{Conv2D }(n, f\times f, s)$

Padding : 'same'

$=$

h.learnable parameters
$$= (f\times f\times d + 1)\times n$$

for max pooling M

$\text{MP}(f\times f, s)$

h.learnable $= 0$

$$\frac{H-f}{s} + 1$$

$$\frac{W-f}{s} + 1$$

Softmax
Actual Dog

| 0.2 |
| 0.6 |
| 0.1 |
| : |

17   np.argmax(

(1) → Cat x Actual
Dog

Top-accuracy
0 %

[0 , 3 , 4 , 5]

Dog   Top-accuracy

17

Top-accuracy

| 0 | . | . - - - | - - | - | |

17   idices.

Dog   Dog