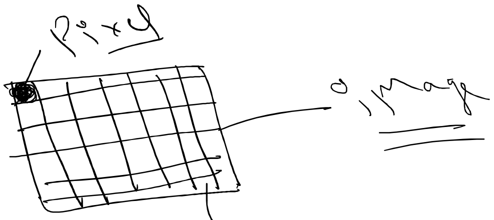
23 December 2023 20:38

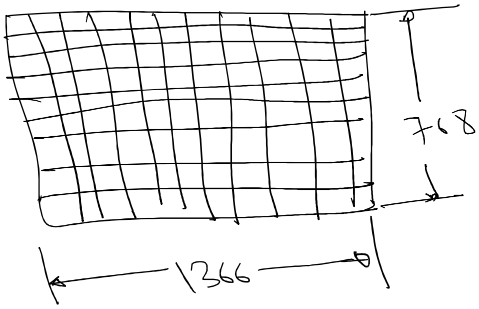
* CNN (Convolutional Neural Network)

→ image processing / image classification

→ How image generated ?.



Pixel (Grid like Structure)



Resolution → 1366 × 768

→ count of pixel

(SD, HD, Ultra HD, Full HD)

* Pixel
  - concept → take any three primary color (Red, Green, Blue) change their color intensity (Brightness intensity), by doing this we can form any color.

* RGB formate (RGB scale)

→ 3 Primary color

↳ 3 Primary color
(Red, Green, Blue)

Range → 0 to 255

Red Green Blue 0 → No Brightness (Black)
0 0 0

255 → Full Brightness (White)

Red Green Blue
255 255 255

→ RGB scale is used to form color images

* Gray Scale

↳ Primary color — ①

↳ Black

Range → 0 to 255

0 → No Brightness → Black

} → Shades of gray color.

255 → Full Brightness → White

* Color Depth / Depth of color

↳ How many primary colors are used to form any image

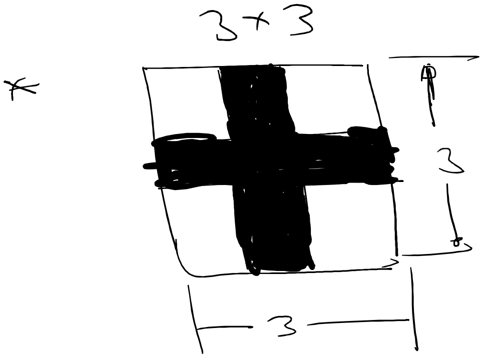
Color image → RGB scale → 3

→ Color Depth → 3

Black and white image → Gray scale → 1

→ Color Depth → 1

*



1 RGB scale → 3

R - 255 G - 255 B - 255	R - 0 G - 0 B - 0	R G B
	RGB	RGB
	RGB	RGB

1 3×3×3

2 3×3 RGB

2 Gray scale

B-255	B-0	B-255
B-0	B-0	B-0
B-255	B-0	B-255

1 3×3×1

2 3×3

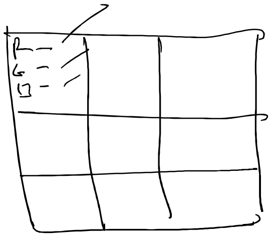
* In image data each individual pixel consider as a individual feature.

→ Black and white → 3×3×1

→ No features → 9

↳ No features → 9

Color image → 3×3×3



↳ No features → 27

* Why we cannot used ANN over image data directly ?

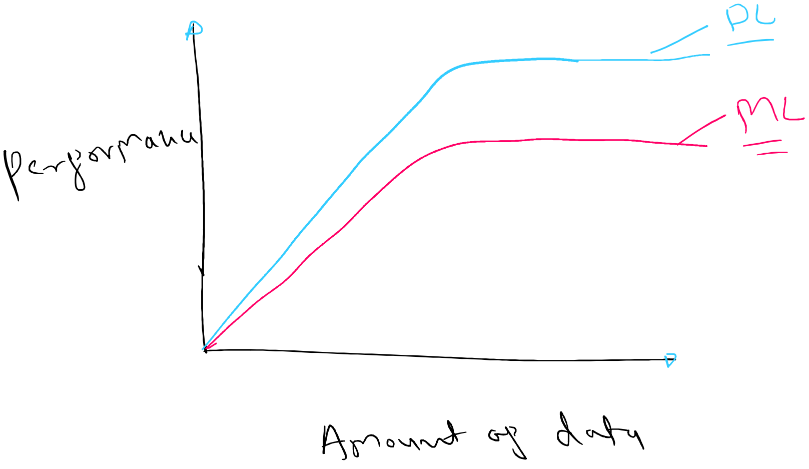
→ laptop screen (15 inches)

↳ Resolution

↳ 1366 × 768 × 3

↳ 10 × 3

↳ 30 lakh (Features)



* Convolutional Neural Network (CNN)

(How CNN work ?)

① convolutional layer

it is used to extract features from the images.

② pooling layer

→ it is used to reduce size of extracted feature.

→ How convolutional layer worry

→ let's say we have 4x4 original image

□ ① ② 4x4

a	e	i	m
b	f	j	n
c	g	k	o
d	h	l	p

①

1	4	7
2	5a	8e
3	6b	9f

Data loss

→ 3x3 filter ②

logic — multiplication

1	4	7
2	5	8
3	6	9

3x3

1a	4e	7i	0
2b	5f	8j	0
3c	6g	9k	0
0	0	0	0

zero padding

→ Filter

odd no x odd no

(3x3, 5x5, 7x7, 9x9)

it is depend upon

size of the images

image size ↑ → filter ↑

image size ↓ → filter ↓

4×4×3 — original image

*

R-a_R G-a_G B-a_B	e_R e_G e_B	i_R i_G i_B	m
b_R b_G b_B	f_R f_G f_B	j_R j_G j_B	n
c_R c_G c_B	g_R g_G g_B	k_R k_G k_B	o
d_R d_G d_B	h	l	p

$1a_R$ $1a_G$ $1a_B$		
$2b_R$ $2b_G$ $2b_B$		
$3c_R$ $3c_G$ $3c_B$		

Logic
└ multiplication

1	4	7
2	5	8
3	6	9

* Stride → By how many pixel filter get moved to form new feature.

→ 100×100×3
└ 10,000×3
└ 30,000 features
^
60,000

* Pooling Layer :-

it is used to reduce the size of extracted features.

1) Max pooling ✓
2) Avg pooling ✓
3) Sum pooling ×

→ when we have good quality of images that time we use avg pooling so that we can bring some bad quality pixel values in to our consideration to build robust model.

→ When we have bad quality images that time we use max pooling so that we can build our model on good quality pixel value.

* Flow of CNN

Image Data

↓

[Convolutional layer → to extract features.

Cont

Set → [Convolutional layer → to extract features.

Pooling layer → to reduce size of extracted feature.]

↓

Flatten

↓

Fully connected layer (ANN)

↓

Classification

* What do you mean by Flattening of data in CNN?

3×3×1

	p	q	r
a	125	208	211
b	255	209	212
c	207	210	33

I

Cat

	p	q	r
a	120	108	203
b	25	33	255
c	60	126	108

II

Dog

features → ap, aq, ar,
bp, bq, br
cp, cq, cr

	ap	aq	ar	bp	bq	br	cp	cq	cr	target
I	125	208	211	255	209	—	—	—	—	Cat
II	120	108	203	25	33	—	—	—	—	—

* Data Augmentation

→ in data augmentation we create different synthetic copies from original images by using some logic.