CNN

RECOGNITION OF A IMAGE

INPUT LAYER ACEPTS PIXELS OF THE IMAGE AS ARRAYS

HIDDEN LAYER ->

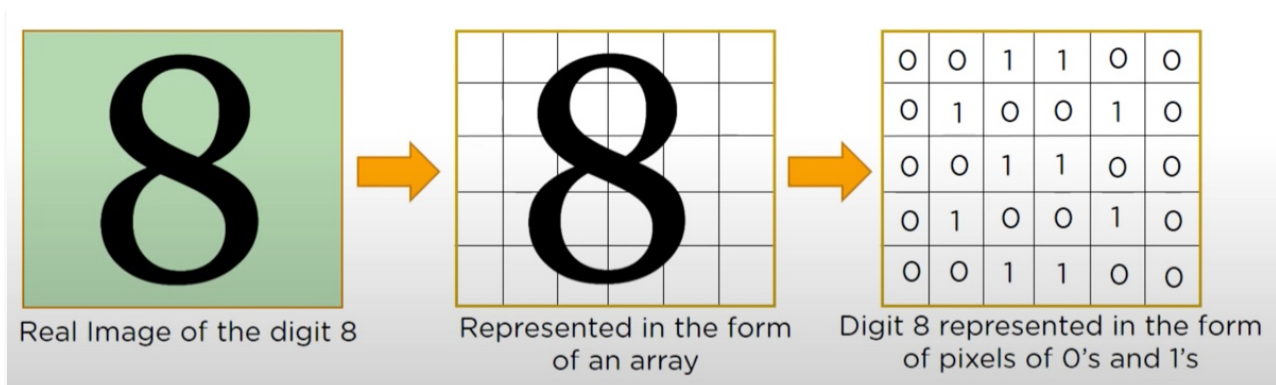USES A MATRIX FILTER AND PERFORMS CONVOLUTION OPERATION TO DETECT PATTERNS IN A IMAGE -> TWIST THE IMAGE

ReLU-> ACTIVATION FUNCTION APPLIED TO THE CONVOLUTION LAYER TO GET A RECTIFIED FEATURE MAP OF THE IMAGE

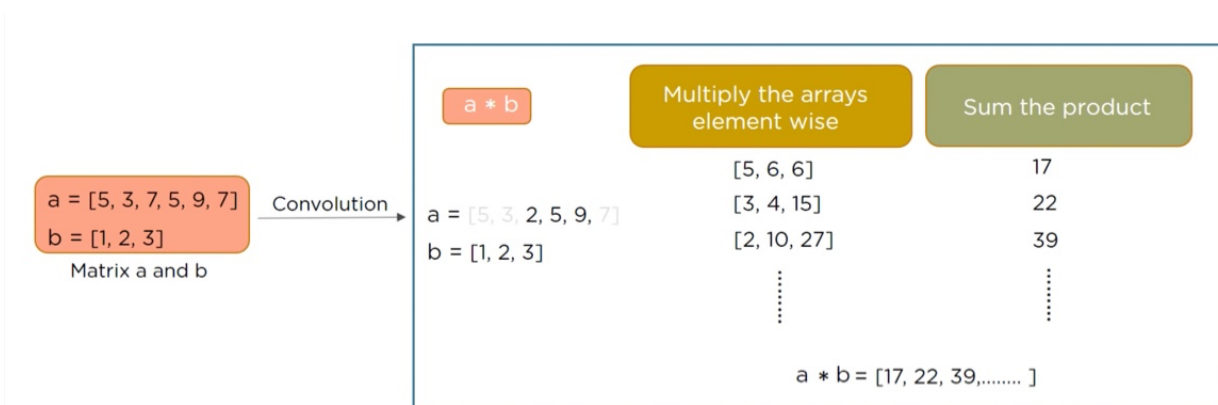POOLING-> FILTERS TO DETECT EDGES, CORNERS,EYES, FEATHERS...

OUTPUT LAYER-> IDENTIFIES THE OBJECT IN THE IMAGE

CONVOLUTION NEURAL NETWORK

IN CNN EVERY IMAGE IS REPRESENTED IN THE FORM OF ARRAYS OF THE PIXEL VALUES

Real Image of the digit 8 → Represented in the form of an array → Digit 8 represented in the form of pixels of 0's and 1's

CONVOLUTION OPERATION

a = [5, 3, 7, 5, 9, 7]
b = [1, 2, 3]
Matrix a and b

Convolution →

a = [5, 3, 2, 5, 9, 7]
b = [1, 2, 3]

a * b

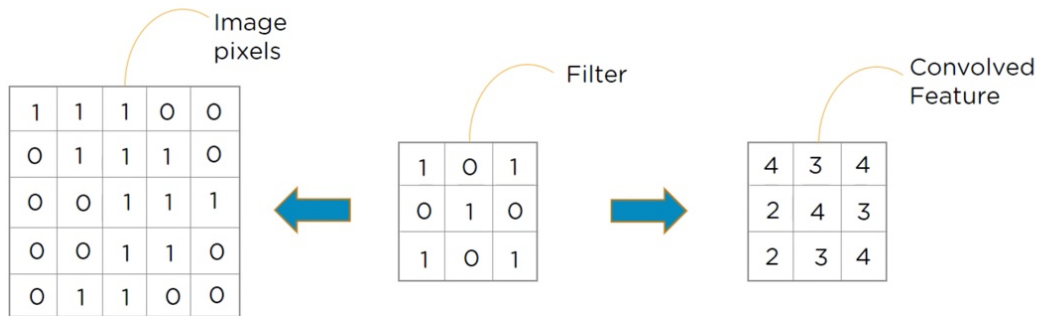| Multiply the arrays element wise	Sum the product
[5, 6, 6]	17
[3, 4, 15]	22
[2, 10, 27]	39
⋮	⋮

a * b = [17, 22, 39,........]

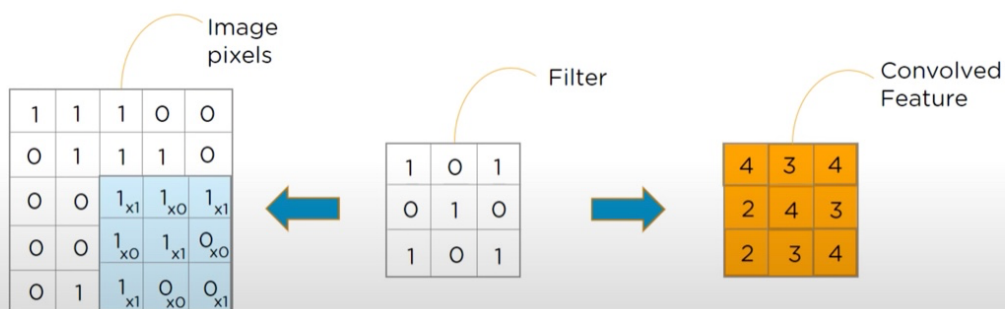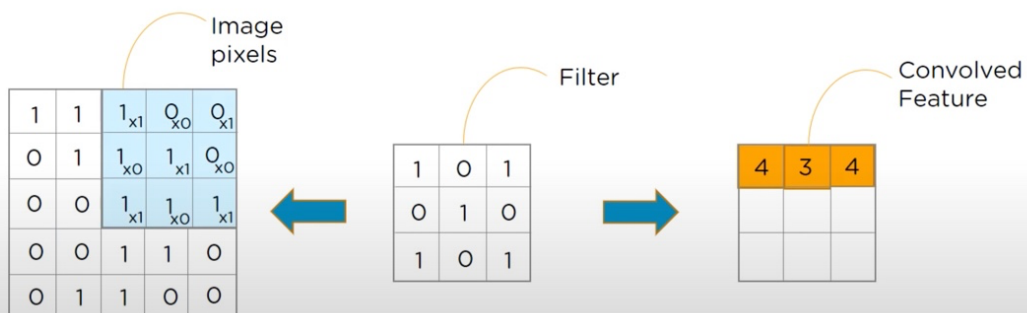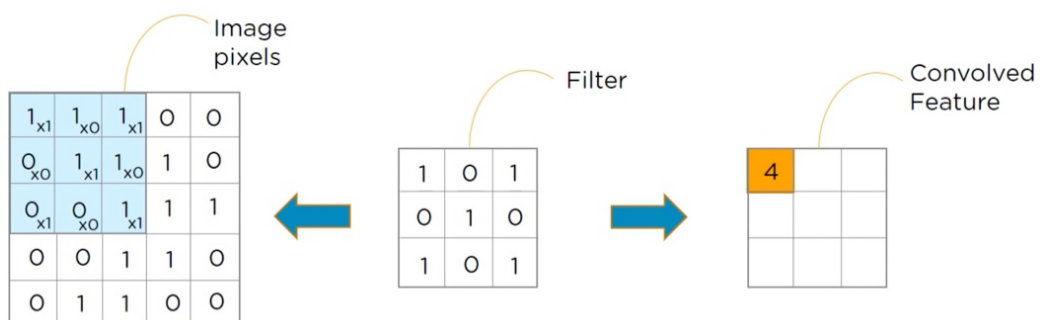## LAYERS IN CONVOLUTION NEURAL NETWORK

CONVOLUTION LAYER

CENTRAL ASPECT OF PROCCESONG IMAGES

Every image is considered as a matrix of pixel values.
Consider the following 5*5 image whose pixel values are only 0 and 1

Image pixels

1	1	1	0	0
0	1	1	1	0
0	0	1	1	1
0	0	1	1	0
0	1	1	0	0

Filter

1	0	1
0	1	0
1	0	1

Convolved Feature

4	3	4
2	4	3
2	3	4

Sliding the filter matrix over the image and computing the dot product to detect patterns

Image pixels

1_{x1}	1_{x0}	1_{x1}	0	0
0_{x0}	1_{x1}	1_{x0}	1	0
0_{x1}	0_{x0}	1_{x1}	1	1
0	0	1	1	0
0	1	1	0	0

Filter

1	0	1
0	1	0
1	0	1

Convolved Feature

4		

Image pixels

1	1	1_{x1}	0_{x0}	0_{x1}
0	1	1_{x0}	1_{x1}	0_{x0}
0	0	1_{x1}	1_{x0}	1_{x1}
0	0	1	1	0
0	1	1	0	0

Filter

1	0	1
0	1	0
1	0	1

Convolved Feature

4	3	4

Image pixels

1	1	1	0	0
0	1	1	1	0
0	0	1_{x1}	1_{x0}	1_{x1}
0	0	1_{x0}	1_{x1}	0_{x0}
0	1	1_{x1}	0_{x0}	0_{x1}

Filter

1	0	1
0	1	0
1	0	1

Convolved Feature

4	3	4
2	4	3
2	3	4

ReLU LAYER

1. PERFORMS A ELEMENT WISE OPERATION R(Z)=MAX(0,Z)

2. SETS ALL NEGATIVE PIXELS TO 0

3. INTRODUCES NON LINEARITY TO THE NETWORK

4. OUTPUT IS A RECTIFIED FEATURE MAP

Real image is scanned in multiple convolution and ReLU layers for locating features
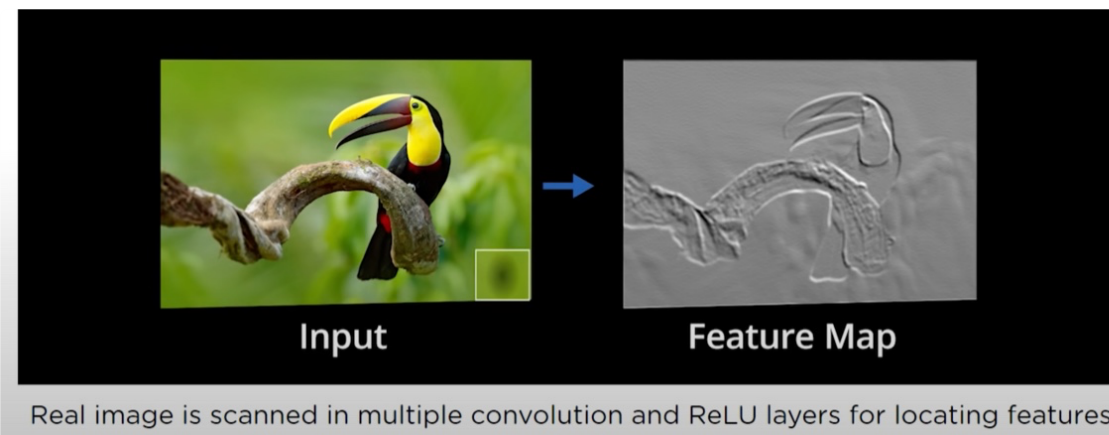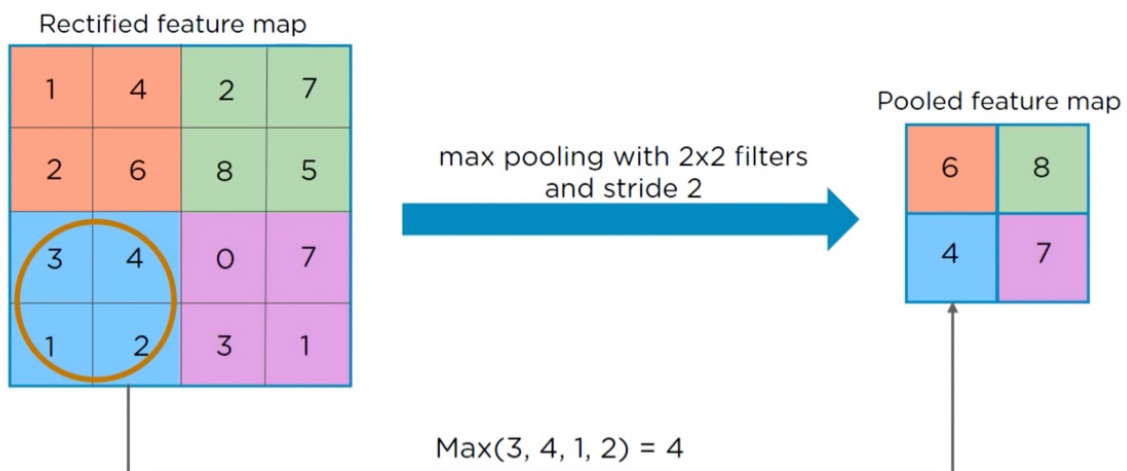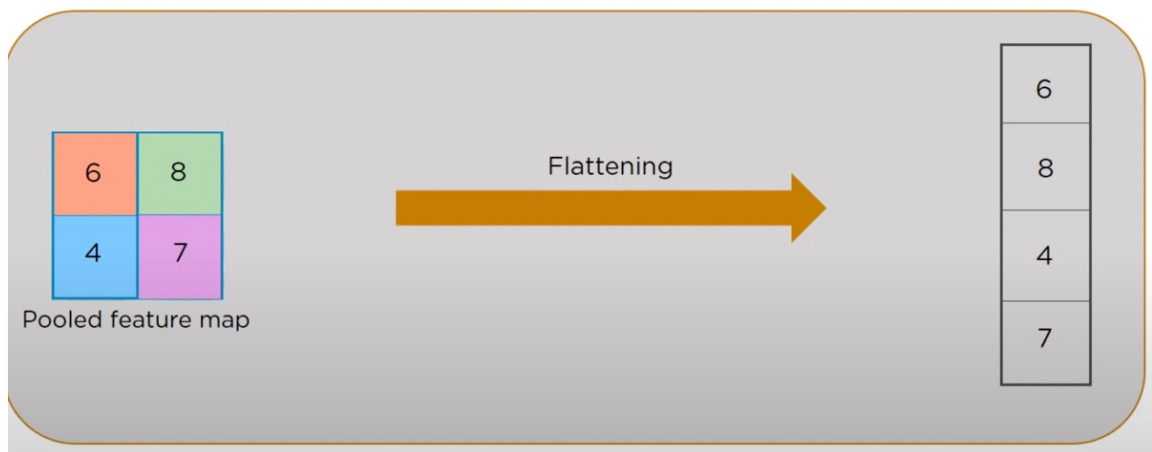
POOLING LAYER

REDUCE THE DATA TO A SINGLE ANSWER

THE RECTIFIED FEATURE MAP NOW GOES TRHOUGH A POOLING LAYER.

- POOLING IS A DOWN-SAMPLING OPERATION THAT REDUCES THE DIMENSIONALITY OF THE FEATURE MAP

FLATTENING

IS THE PROCESS OF CONVERTING ALL THE RESULTANT 2 DIMENSIONAL ARRAYS FORM POOLED FEATURE MAP INTO A SINGLE LONG CONTINUOUS LINEAR VECTOR

Pooled feature map

Flattening

6
8
4
7

FULLY CONNECTED LAYER

THE FLATTENED MATRIX FROM THE POOLING LAYER IS FED AS INPUT TO THE FULLY CONNECTED LAYER TO CLASSIFY THE IMAGE

Flattened Matrix

Pixels from the flattened matrix fed as input

Dog

Bird

Cat