Convolutional Neural Networks

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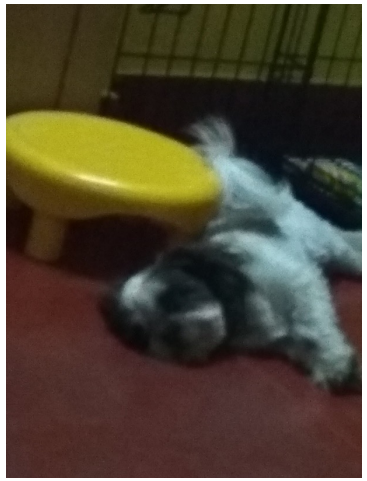
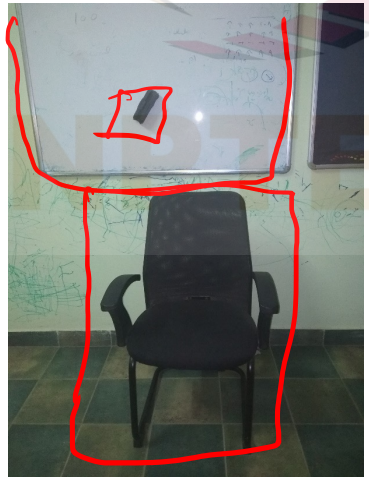
CNN - Applications

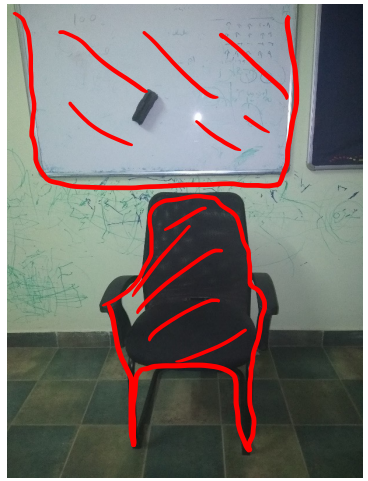
- Image Recognition ⟶ Photo Organization, Face recognition
- Object Detection ⟶ Self driving cars
- Semantic Segmentation ⟶ Medical Image analysis



CAT or DOG

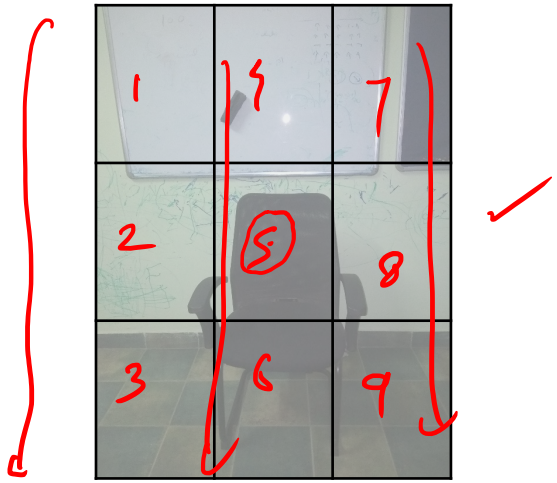


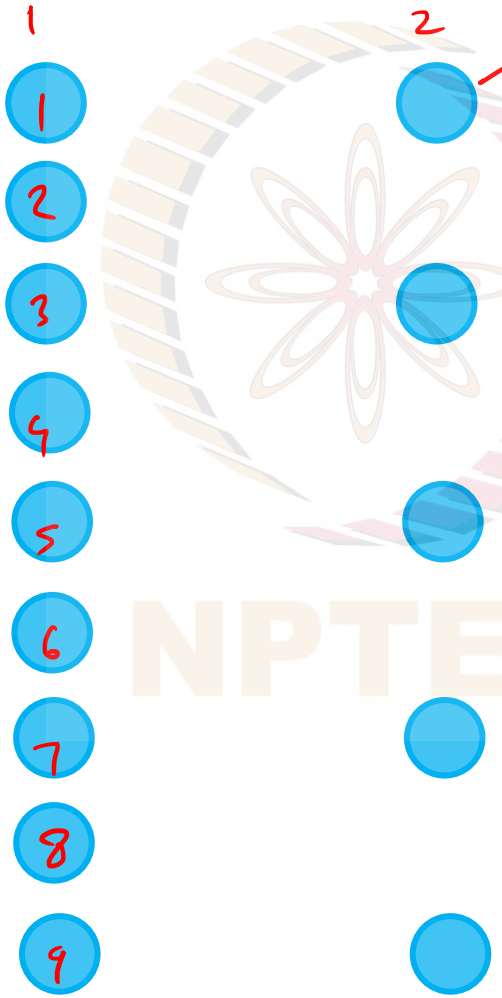
Detection



Segmentation

Neural Networks for Images





$9 \times 5 = 45$ weights

$3000 \times 4000 \sim 10^6$ pixels

$10^6 \rightarrow 10^3$

$\rightarrow 10^9$ weights

Sparse → weights

Convolution Kernels

1	0	2	2	1
0	2	1	1	3
7	0	1	2	1
5	1	3	2	2
2	3	6	1	5

Image

*

Convolution

1	1	0
2	1	1
1	0	2

3x3 Kernel

=

Convolution Kernels

1	0	2	2	1
0	2	1	1	3
7	0	1	2	1
5	1	3	2	2
2	3	6	1	5

Image

*

1	1	0
2	1	1
1	0	2

3x3 Kernel

Convolution

=

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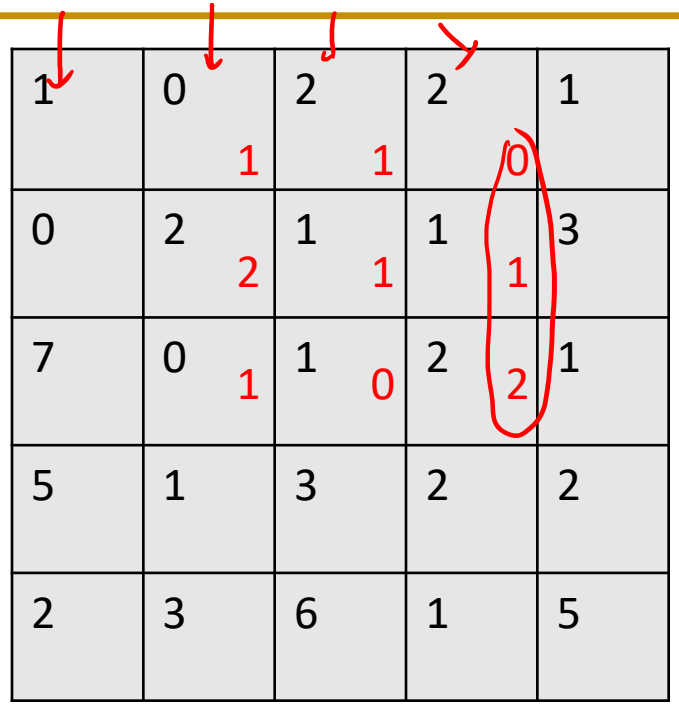
Convolution Kernels



Convolution Kernels

-1	0
0	1

0	-1
1	0

Roberts Cross Gradient Kernel

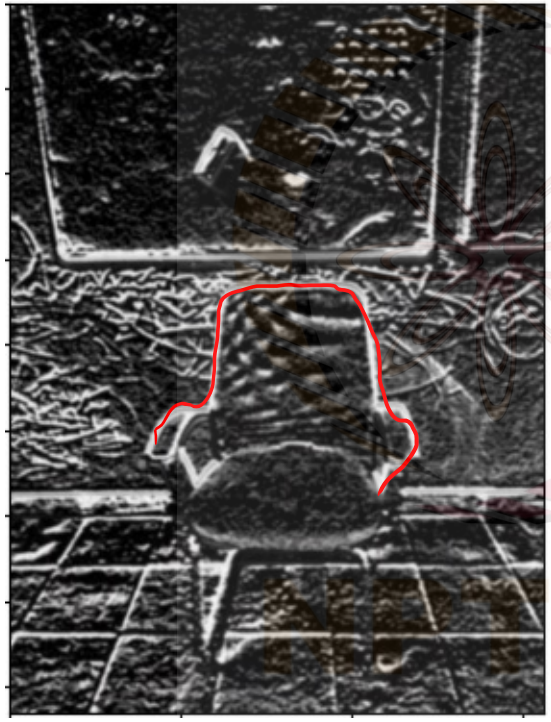
-1	-2	-1
0	0	0
1	2	1

-1	0	1
-2	0	2
-1	0	1

Sobel Kernel

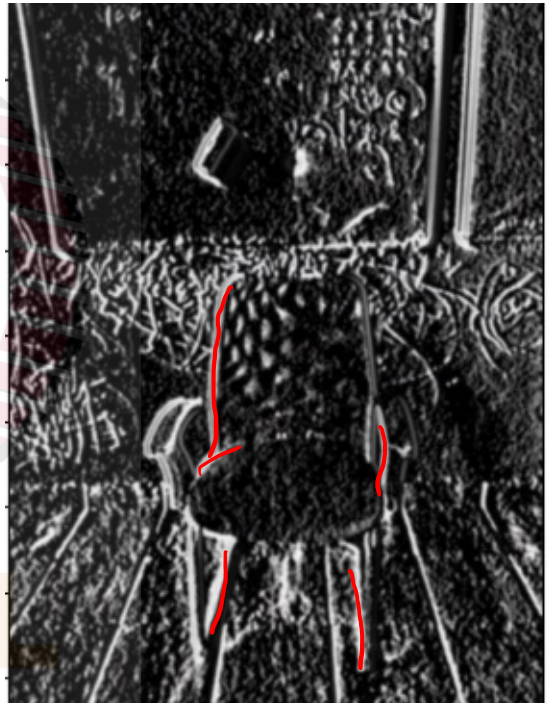
The filters are used to detect edges

Convolution Kernel



Sobel Y

-1	-2	-1
0	0	0
1	2	1



Sobel X

-1	0	1
-2	0	2
-1	0	1

The filter kernel
Detect Edges

A Convolution Layer