

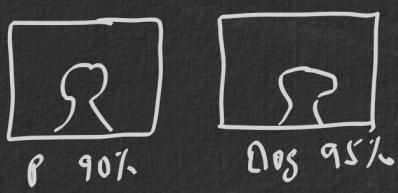
# AGENDA

- 1> Computer Vision Basics
- 2> Understand Images / Video data (Theory)
- 3> Understand Images / Video data (Practical)
- 4> filters and its use cases (T/P)
- 5> CNN

## 1> CV Basics

Enables machine or computer to have a vision system close to human.

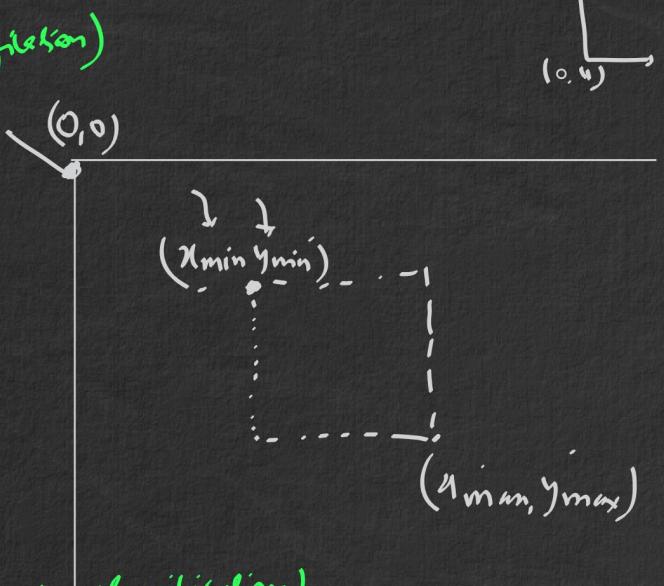
### Classification



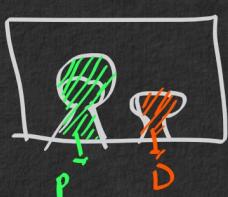
Note  
→  $(x, y)$



### Detection (Regression, Classification)

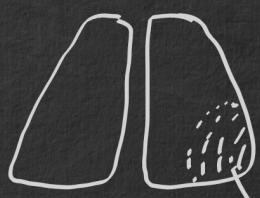


### Image Segmentation (Pixel wise classification)



Healthcare domain

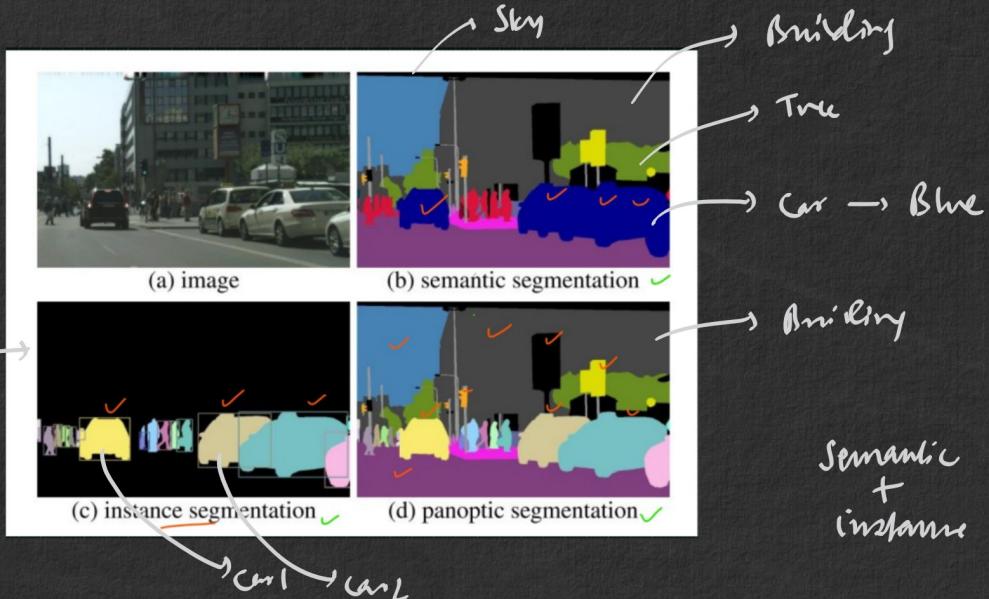




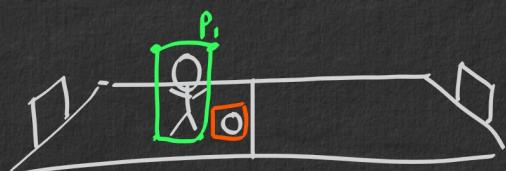
model

cond + ve  $\rightarrow$  img amplification

1 image segmentation



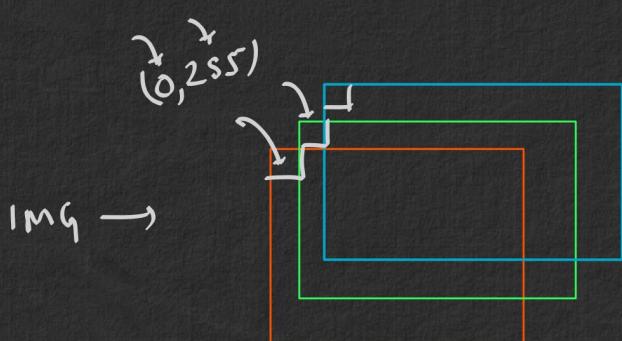
## Object Tracking -

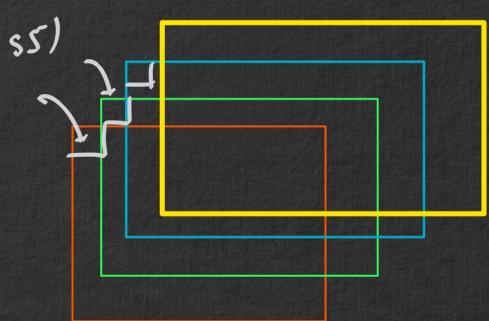


## 2) Image Dataset

Primary colors: R G B

$\downarrow$   
R G B  
 $(0, 150, 255) \rightarrow \square$





alpha  $\rightarrow$  transparency.

8-bit images

$0 \rightarrow$

$\underbrace{\text{11111111}}_{0}$

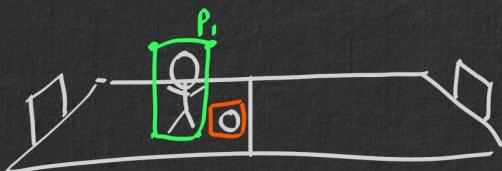
$\underbrace{\text{11111111}}_{2^8 - 1}$

Video  
=

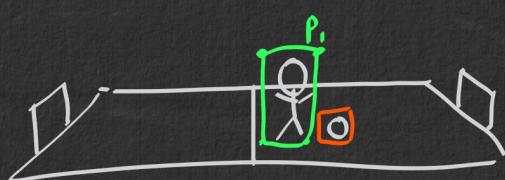
frame 1 frame 2 frame 3

$P_1 \quad P_2 \quad P_3$   
---  
 $t=0 \quad t=1 \quad t$

$\rightarrow$  time



frame 1



frame 2

## Filter .

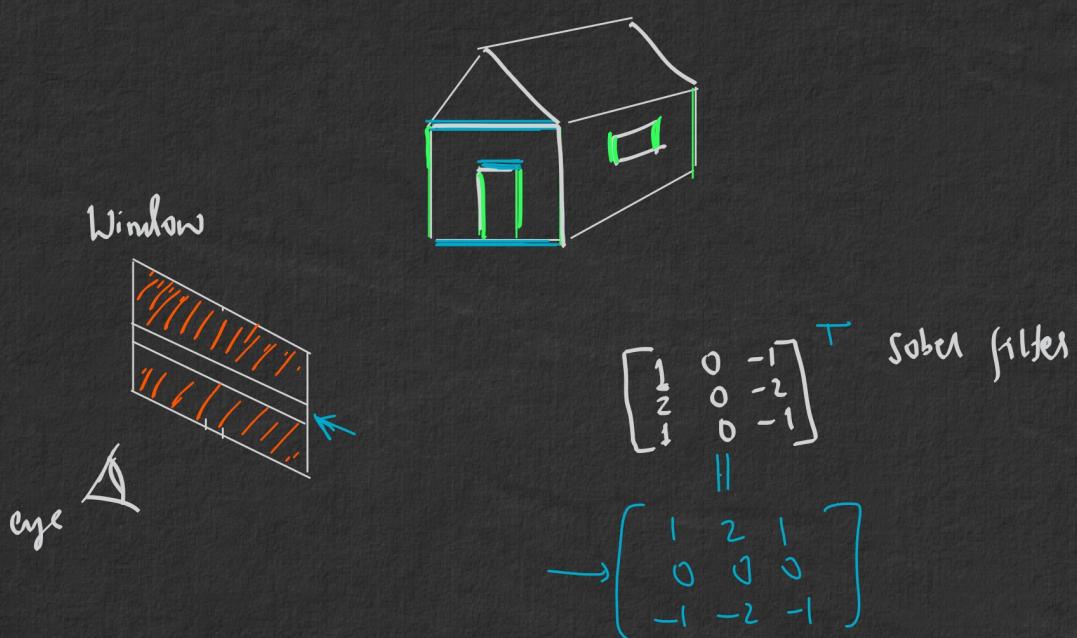
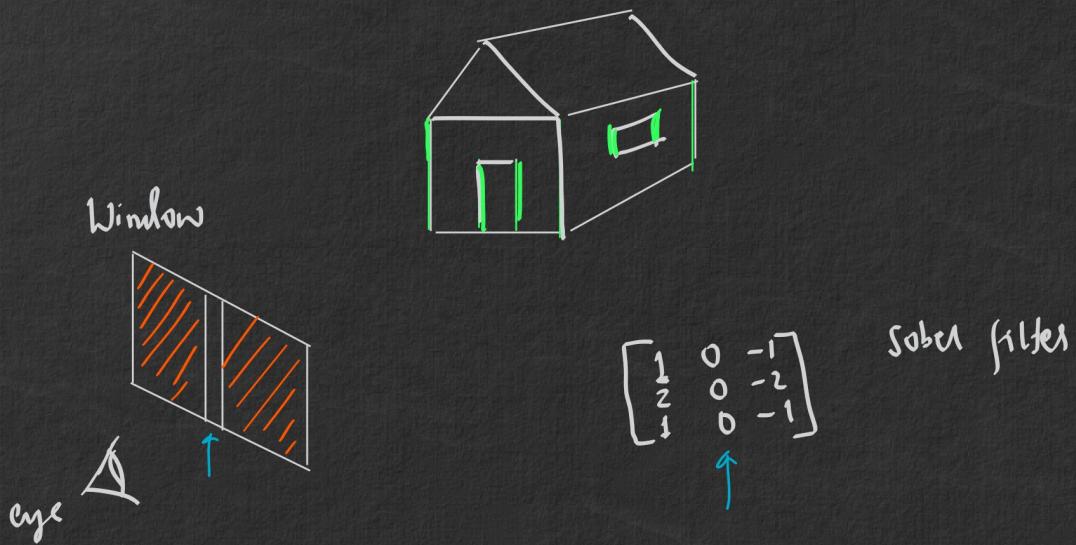


Diagram showing the calculation of a new pixel value  $Z_1$  from a 3x3 input window and a 3x3 filter.

|       |       |       |          |       |       |       |          |          |
|-------|-------|-------|----------|-------|-------|-------|----------|----------|
| $p_1$ | $p_2$ | $p_3$ | $\vdots$ | $p_7$ | $p_8$ | $p_9$ | $\vdots$ | $p_{15}$ |
| $p_4$ | $p_5$ | $p_6$ |          |       |       |       |          |          |
| $p_7$ | $p_8$ | $p_9$ |          |       |       |       |          |          |
|       |       |       |          |       |       |       |          |          |
|       |       |       |          |       |       |       |          |          |
|       |       |       |          |       |       |       |          |          |

The calculation is:

$$Z_1 = f_1 p_1 + f_2 p_2 + \dots + f_9 p_9$$

New image  
↓  
Pixel length of image  
↓  
len of filters  
 $P - f + 1$   
stride → 1

$$Z_1 = \sum_{i=1}^9 f_i p_i$$

$Z_2$

$$\text{image} = \begin{pmatrix} 6, 6 \\ \uparrow \quad \uparrow \end{pmatrix} \quad \text{filter} \begin{pmatrix} 3, 3 \\ \uparrow \quad \uparrow \end{pmatrix} \quad \text{Stride, skip} = 1$$

$$\text{new image len} = \frac{6-3}{1} + 1 = 4$$

$$\text{width} = \frac{6-3}{1} + 1 = 4$$

(4,4)

STEP 1

$$6 \left\{ \begin{array}{|c|c|c|c|c|c|} \hline 1 & 2 & 3 & 4 & 5 & 6 \\ \hline 7 & 8 & 9 & 10 & 11 & 12 \\ \hline 13 & 14 & 15 & 16 & 17 & 18 \\ \hline 19 & 20 & 21 & 22 & 23 & 24 \\ \hline 25 & 26 & 27 & 28 & 29 & 30 \\ \hline 31 & 32 & 33 & 34 & 35 & 36 \\ \hline \end{array} \right. \underbrace{\quad}_{6}$$

pic

$$3 \left\{ \begin{array}{|c|c|c|} \hline 1 & 0 & -1 \\ \hline 2 & 0 & -1 \\ \hline 1 & 0 & -1 \\ \hline \end{array} \right. \underbrace{\quad}_{3} = \begin{bmatrix} z_1 & z_2 & z_3 & z_4 \\ & & & \\ & & & z_{16} \end{bmatrix} \underbrace{\quad}_{4}$$

$$\frac{6-3}{1} + 1 = 4$$

$$\text{pic} [0:3, 0:3]^{0,1,2} = z_1 =$$

$$\begin{array}{c} 1 \quad 2 \quad 3 \\ 7 \quad 8 \quad 9 \quad 1 \\ 13 \quad 14 \quad 15 \end{array} \times \begin{array}{|c|c|c|} \hline 1 & 0 & -1 \\ \hline 2 & 0 & -1 \\ \hline 1 & 0 & -1 \\ \hline \end{array}$$

$$\text{sum} \begin{pmatrix} 1 & 0 & -1 \\ 14 & 0 & -18 \\ 13 & 0 & -15 \end{pmatrix} = \text{sum} (28, 0, -36) \\ z_1 = -8$$

$$z_1 = 1 \times 1 + 2 \times 0 + 3 \times (-1) \dots \dots \quad 15 \times (-1) \\ = -8$$

6

$$\left\{ \begin{array}{|c|c|c|c|c|c|} \hline 1 & 2 & 3 & 4 & 5 & 6 \\ \hline 7 & 8 & 9 & 10 & 11 & 12 \\ \hline 13 & 14 & 15 & 16 & 17 & 18 \\ \hline 19 & 20 & 21 & 22 & 23 & 24 \\ \hline 25 & 26 & 27 & 28 & 29 & 30 \\ \hline 31 & 32 & 33 & 34 & 35 & 36 \\ \hline \end{array} \right\}$$

pic

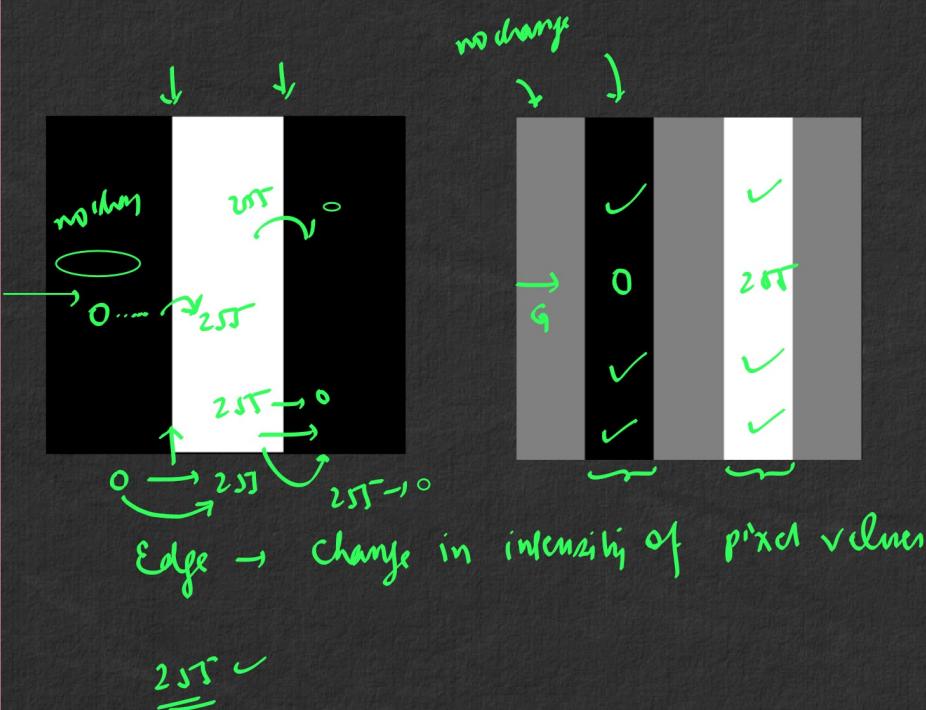
$\underbrace{\hspace{1cm}}_{6}$

3

$$\left\{ \begin{array}{|c|c|c|} \hline 1 & 0 & -1 \\ \hline 2 & 0 & -L \\ \hline 1 & 0 & -1 \\ \hline \end{array} \right\}$$

$\underbrace{\hspace{1cm}}_3$

$$\begin{array}{|c|c|c|} \hline 2 & 3 & 4 \\ \hline 8 & 9 & 10 \\ \hline 14 & 15 & 16 \\ \hline \end{array} \times \left\{ \begin{array}{|c|c|c|} \hline 1 & 0 & -1 \\ \hline 2 & 0 & -L \\ \hline 1 & 0 & -1 \\ \hline \end{array} \right\} = \rightarrow z_2$$



$$\frac{d}{dx} 5 = 0$$

∅

$$\frac{\partial}{\partial x} \neq 0$$

$$y = mn$$

$$y = l n \rightarrow 2$$

$$y = 2 \rightarrow 0$$