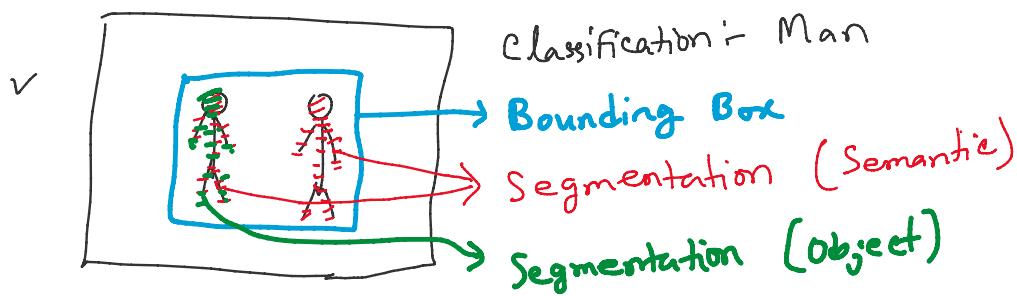


Chapter 1:-

- ✓ What is CV? → Teaching Computer to see and interpret world through visual data.
- ✓ Stages → 1. Image acquisition, 2. Preprocessing, 3. Annotation & Labeling
4. Feature extraction, 5. Interpretation



Human Vision	Computer vision
1. Sees holistically and groups objects automatically.	1. Sees through grids of pixels. Can't reason unless further programmed.
2. Red, Green and Blue wavelength perceived from Cones	2. Numerical values for RGB
3. Can automatically adjust lighting variations.	3. Cannot automatically adjust lighting variations unless programmed.
-- -- (Binary)	4. Mostly 2D. Could be made 3D

Lighting variations

4. 3D vision (Binocular)

4. Mostly 2D. Could be made 3D by stereographic vision (2 camera).

5. Understands objects, actions, intentions, emotions instinctively.

5. Relies on algorithms

✓ Use case → 1. Medical imaging, 2. Autonomous vehicles, 3. AR/VR

✓ Challenges → 1. Light variability, 2. Occlusion (Overlapping objects),
3. Viewpoint variability.

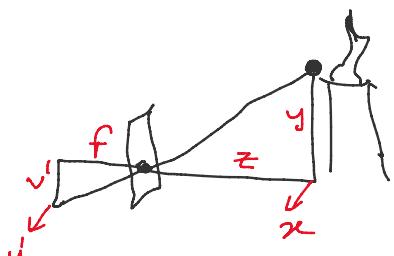
Chapter 2 :-

✓ Pinhole camera :-

$$\therefore \frac{y}{z} = \frac{v'}{-f}$$

$$\Rightarrow v' = y \cdot \frac{-f}{z}$$

$$\text{Similarity } v' = x \cdot \frac{-f}{z}$$



$$\text{Similarly, } u^t = x \cdot \frac{-f}{z}$$

✓ Projection:- 1. Perspective , 2. Orthographic

✓ Kernels:-

1. Box/Average filter :- $\frac{1}{9} \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

2. Gaussian blur :- $\frac{1}{16} \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$

3. Sobel filter for edge detection = $\begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix}, \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$

4. Sharpening :- $\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$

5. Non-linear Filters:- 1. Median , 2. Bilateral
 (Salt & Pepper) (Blur without edges)

✓ Dimensions:-

$$\text{Image} = W_I \times H_I$$

$$\text{kernel} = W_K \times H_K$$

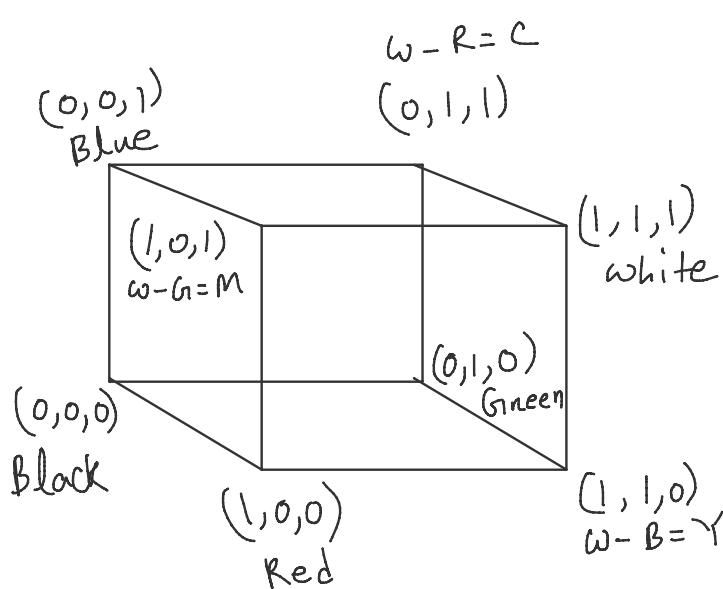
$$\therefore \text{Output width} = \frac{W_I - W_K + (2 \times P)}{S} + 1$$

↑ Padding
↑ S stride

$$\therefore \text{Output height} = \frac{H_I - H_K + 2P}{S} + 1$$

Chapter 3 :-

✓ Color cube:-



✓

Color Space	Properties	Common Uses
RGB	Device-friendly, non-perceptual	Display, general image storage
HSV	Intuitive, perceptual attributes	Color detection, segmentation
YCbCr	Efficient for compression	Video, TV broadcasting
L*a*b*	Perceptually uniform, accurate	Color correction, analysis

Chapter 4:-

✓ α matting :-

$$\alpha F + (1 - \alpha) B$$

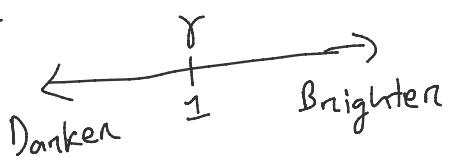
Foreground Background

$\alpha = 1 \rightarrow$ Only Foreground, $\alpha = 0 \rightarrow$ Only Background,
 $0 < \alpha < 1 \rightarrow$ Smooth transition

✓ Gamma Connection :-

$$(\text{Image})^{\frac{1}{\gamma}}$$

$\gamma = 2.2$ usually



Non-linear relation: Intensity \leftrightarrow Perceived Brightness

Non-linear relation: Intensity \leftrightarrow Perceived Brightness
for making images connect for Human Vision.