UNIT-I

1. Image acquisation:

→ capturing imag from sensor
→ Digital image

Step involved:
→ capturing
→ Processing
→ Digitisation
→ Quantisation
→ Storage

2. Image Representation:

→ Visual information
→ use various technique to represent the content of image

Types:
→ Histogram representation
→ Raster
→ Spatial
→ frequency
→ Vector

3. Image file formate:

→ How image data & (Pixel) data stored in storage

Types:
→ JPEG (Joint Photographic expert group)
→ PNG (Portable network graphic)
→ TIFF (Tagged information file formate)
→ SVG (Scalable Vector gaphic)

4. Colour model.:

→ Metheimatical mode
→ colour represented in no. of touple
→ Represented by 3 or 4 colour component

Types:
→ RGB
→ CMYK
→ HSV

5. Overview of computer Vision & Application:

→ Taking Decision by Visual data
→ Make high level understanding

Key concept of CV:
→ Image acquasition
→ Image processing
→ Feater extraction
→ object Recognisation

Application:

- Image and Vedio Analysis
  - → object recognisation
  - → Object tracking
  - → Gesture recognisation
- Medical image recognisation
- Autovehicle
- Agriculture

6. The EM - Algorithm:

→ E-step and M-Steps
Expection and maximization.
→ missing data
→ latent variable

Basic Step:
1. Initialization
2. E-Step
3. M-Step
4. Iteration

	H	T
C1	2	2
C2	1	2
C3	1	1

$\theta_A(H) = 3/6$ (0.5) $\quad \theta_B(H) = 1/3$ (0.33)

Likelyhood $(A) = 0.5^H (1-0.5)^T$

~~$0.5^H (1-0.5)^T$~~

$L(A) = 0.0156$
$L(B) = 0.147$

Normalize = $L_A/(A+B)$ $\quad L_B/(A+B)$

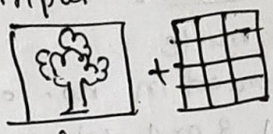
0.095	A
0.90	B

7. Image filtering:

→ Removing noise, Blurring
→ Edge, Corner detection

(1.) Spatial filtering
→ Work at pixel level

Process:
1. Kernel filter
→ Define the small matrix. (kernel)
2. Convolution
→ Matrix is convolved with the input image



3. Output image:
→ give new Convolution image

Types
Linear: Avg. Replace pixel with Avge pixel value
Non Linca- Median

Advantage:
→ Simplicity
→ computationally efficient

8. Fourier Transformation:

→ Mathematical function transform time func and Space fun. in frequency domain

Application-
→ Vedio processing
→ Audio processing
→ Image processing
→ Communication System processing

9. Geometric Transformation:

→ Applied to change the shape, size, and orientation
→

Types
1. Translation
2. Rotation
3. Scaling
4. Shearing
6. Affine
8. Perspective

10. Convert RGB to HSV:

Normalize

$$r = \frac{R}{255} \quad g = \frac{G}{255} \quad b = \frac{B}{255}$$

$$V = \max(r, g, b)$$

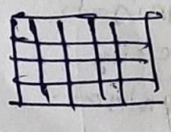
$$S = \frac{V - \min(r, g, b)}{V}$$

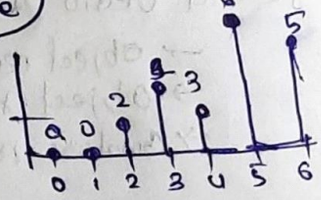
$$H = \begin{cases} 0 & \text{if } V = 0 \\ \frac{b-g}{\min(r,g,b)} \times 60 + 360 & \text{if } V = r \\ \frac{b-r}{\min(r,g,b)} \times 60 + 120 & V = g \\ \frac{r-g}{\min(r,g,b)} \times 60 + 240 & V = b \end{cases}$$

11. Histogram Equalization:

→ To enhance contrast level
→ pixel intensity vary (1 to i-1) (1 to $2^8 - 1$)

→ 0 → Black
→ 255 → White





→ Calculate in the table
PDF, CDF, (Sk) (Sk x 7) Hist
or
(CDF x 7)

UNIT-IV

1. Hariss Operator:

→ Pixel are Corner or not
→ We Can Calculate Pixel are Corner pixel or not

→ M-matrix = $\begin{bmatrix} \sum I_x^2 & \sum I_x I_y \\ \sum I_x I_y & \sum I_y^2 \end{bmatrix}$

→ $R = \det M - (k(\text{trace } M))^2$

$I_x =$  $I_y =$ 

2. Hassian Operator:

→ Used for feature detection Corner, edge detection

Given fn

$$f(x) = x_1 + 2x_2 + x_1x_2 - x_1^2 - x_2^2$$

$$\frac{\partial f(x)}{\partial x_1} = 1 + 0 + x_2 - 2x_1 - 0 = 0 \quad (1)$$

$$\frac{\partial f(x)}{\partial x_2} = x_1 + 2 + x_1 - 2x_1 - 2x_2 = 0 \quad (2)$$

$$x_1 = 4/3 \quad x_2 = 5/3$$

The function is max or min at above point

$$H = \begin{bmatrix} \frac{\partial^2 f}{\partial x_1^2} & \frac{\partial^2 f}{\partial x_1 x_2} \\ \frac{\partial^2 f}{\partial x_1 x_2} & \frac{\partial^2 f}{\partial x_2^2} \end{bmatrix}$$

det A , minor A

Negative defnet → max fn
Pos — — → min fn

3. Weight Distance fn

$$D(x,y) = \sqrt{\sum_{i=1}^{n} w_i (x_i - y_i)^2}$$

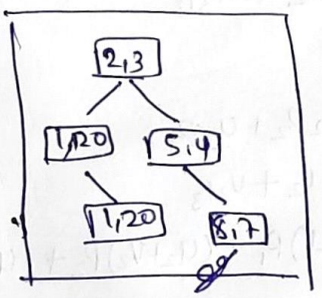
D(x,y) : ~~Distan~~ weighted distance between the two data point in space
n = no. of Dimensional
w_i = weighted of ith feature
(x_i, y_i) = ith data point

→ Used in cv for image processing calculate weighted dist
→ Pattern detection, feature detection

4. K-D Tree:

→ k-Dimensional tree
k = no. of dimensions
→ we can store any data of 2D, 3D, 4D in K-D Tree, data structure.
→ It is a data structure

(2,3) (5,4) (8,7) (1,12) (1,20)



5. Descripton:

Visual Discriptor

- Image descriptor
- Vedio descriptor

→ Shap
→ colour
→ Texture
→

Application:

→ Object Recognisation
→ Feature detection
→ Image retrival
→ Medro Analysis
→ Robotics
→ Remote sensing

UNIT - V

1. Trichromatic colour theory:

→ make any with three colour

Principle:

→ The three colour should be subtractive
→ The three colour should be primaries.

2. Grassmans Law:

① $A = U_1P_1 + U_2P_2 + U_3P_3$
$B = U_1P_1 + U_2P_2 + U_3P_3$
$A = B$

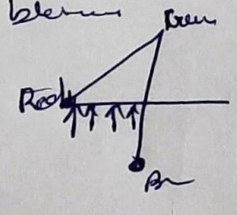
② $A = U_1P_1 + U_2P_2 + U_3P_3$
$B = V_1P_1 + V_2P_2 + V_3P_3$
$A + B = (U_1+V_1)P_1 + (U_2+V_2)P_2 + (U_3+V_3)P_3$

③ $A = U_1P_1 + U_2P_2 + U_3P_3$
$KA = KU_1P_1 + KU_2P_2 + KU_3P_3$

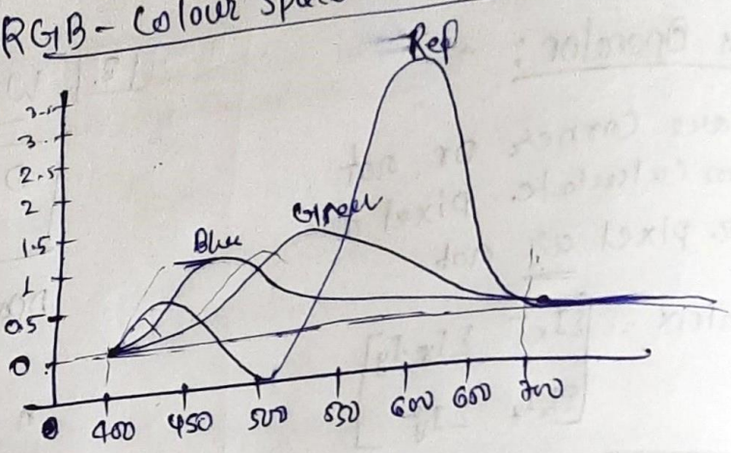
3. Linear colour-space

Blue ——— Red

→ After mixing of these two colour make colour of wave lenght in between



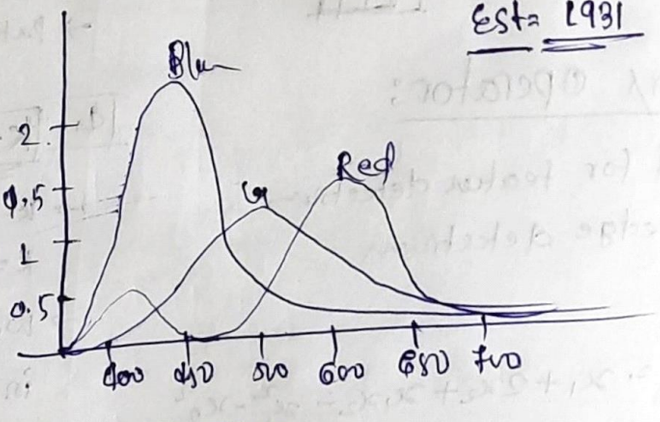
4. RGB - Colour Space and matching fun



5. CIE - Matching function:

→ Commission international de IEclairage
→ It define three primaries (x, y, z).

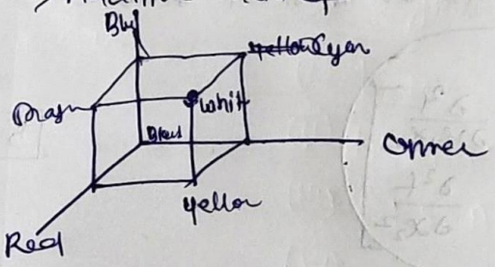
Est= 1931



$x = X/(X+Y+Z)$
$y = Y/(X+Y+Z)$

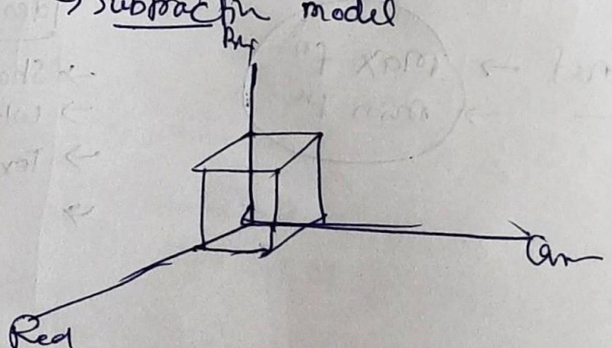
6. RGB - Colourmodel

→ Additive model



7. CMY K - Colormodel

→ Subtractive model



8 YIQ - Model

→ YIQ - for colour TV
→ Y → for Black & White TV (Luminance)

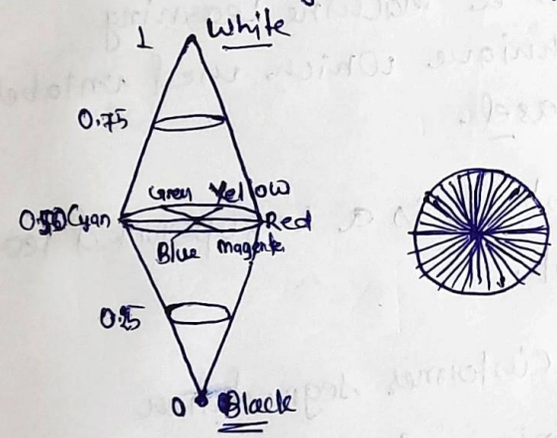
9 YCbCr - Model

$$\begin{bmatrix} Y \\ Cb \\ Cr \end{bmatrix} = \begin{bmatrix} 256 & 502 & 0098 \\ 147 & 292 & 438 \\ 438 & 366 & 071 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} + \begin{bmatrix} 0 \\ 128 \\ 128 \end{bmatrix}$$

→ use for image and video compression
→ Cb and Cr Rang 0 to 244

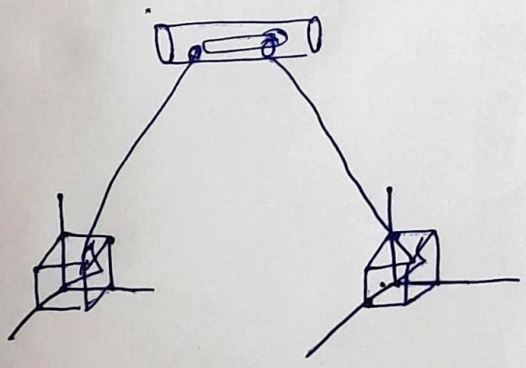
10 HSV - colour model

Hue, saturation and value.
→ Hue varies along 0 to 2π angle
→ saturation along 0 to 1
→ value varies along height (0 to 1)



11 Specularities

→ Strong effect on object appearance



12 The Eye: A Camera