Pseudocolor Image Processing

→ Pseudocolor (also known as False Color) image processing consists of assigning colors to grey values based on a specific criterion.

→ The principle use of pseudocolor image processing is for Human Visualization & Interpretation for gray scale events.

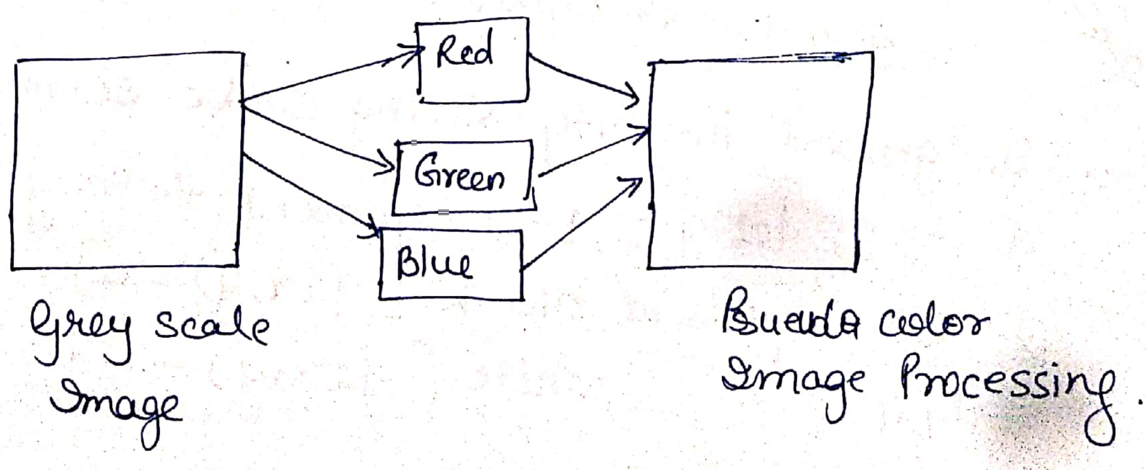
Human can discern b/w thousands of color shades & intensities, compared only about 2 dozen or shades of grey.

→ Three approaches for Pseudo Color Image Processing

(i) Intensity Slicing & color coding.

(ii) Grey-level to color transformations.

(iii) Filtering approach.



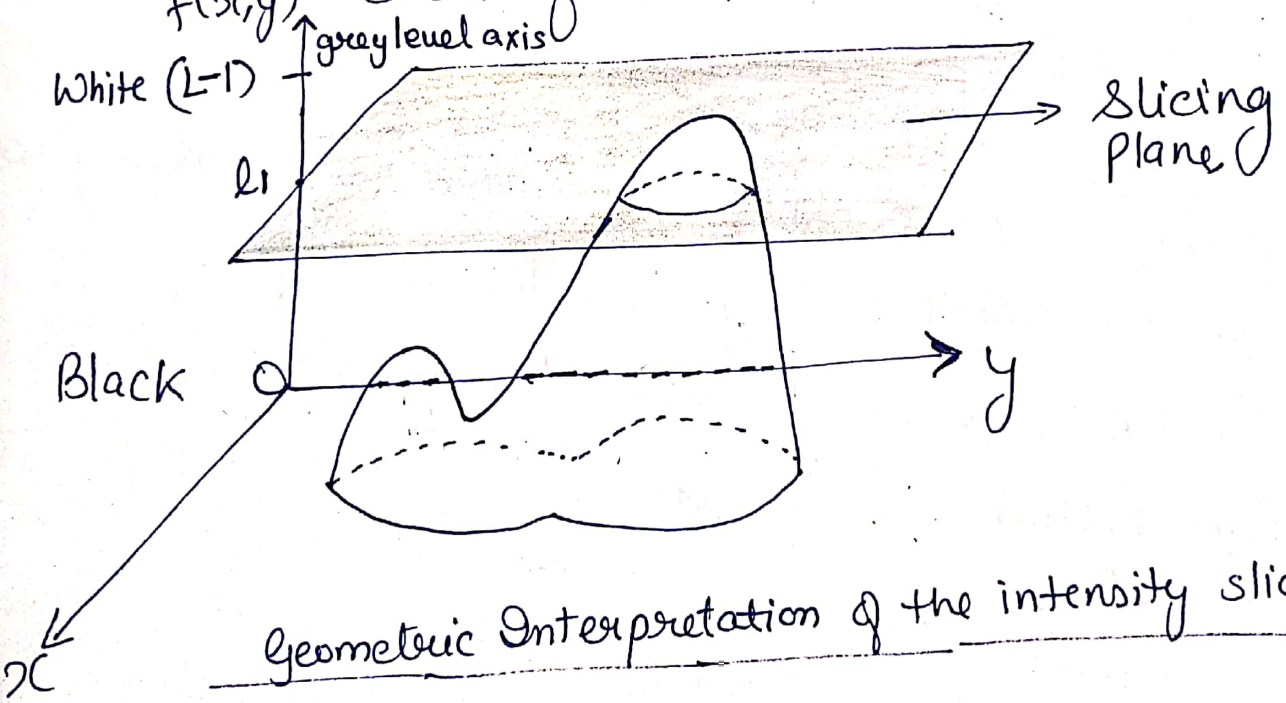
① Intensity slicing / Density slicing / color Coding

→ It is one of the simplest kinds of pseudocolor image processing.

Step1 :- We consider an image as a 3-D fun^n mapping spatial co-ordinates to Intensities. (that we consider heights).

Step 2 :- Now consider placing planes at certain levels parallel to the co-ordinate plane.

If a value is one side of such a plane it is rendered in one color & different color if on the other side



Geometric Interpretation of the intensity slicing mth.

→ In general intensity slicing can be summarised as :- ① let $[0, L-1]$ represent the grey scale

② l_0 represent black $[f(x,y) = 0]$

l_{L-1} " white $[f(x,y) = L-1]$

③ Suppose P plane is perpendicular to the intensity axis are defined at levels $l_1, l_2, \dots l_p$

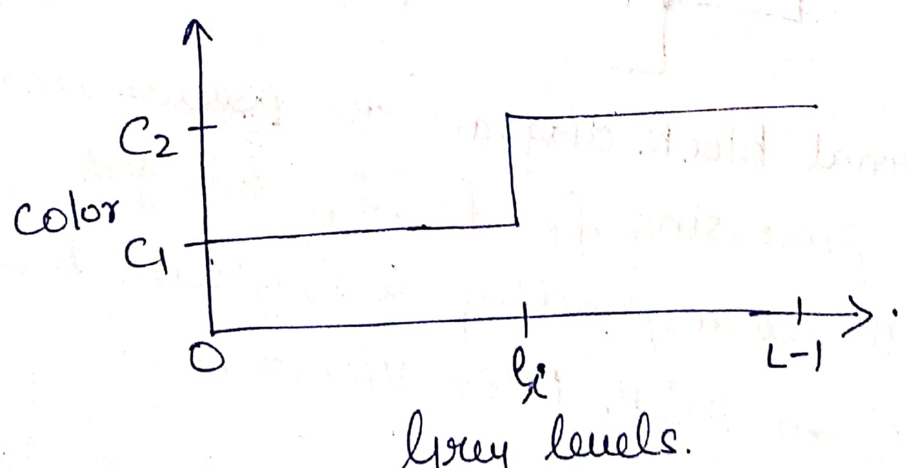
④ Assuming that $0 < P < L-1$ then the P planes partition the grey scale into P+1 intervals $V_1, V_2, \dots V_{p+1}$

⑤ Grey level color assignments can then be made according to the relation:

$$f(x,y) = c_k \quad \text{if } f(x,y) \in V_k$$

color associated with k^{th} intensity level

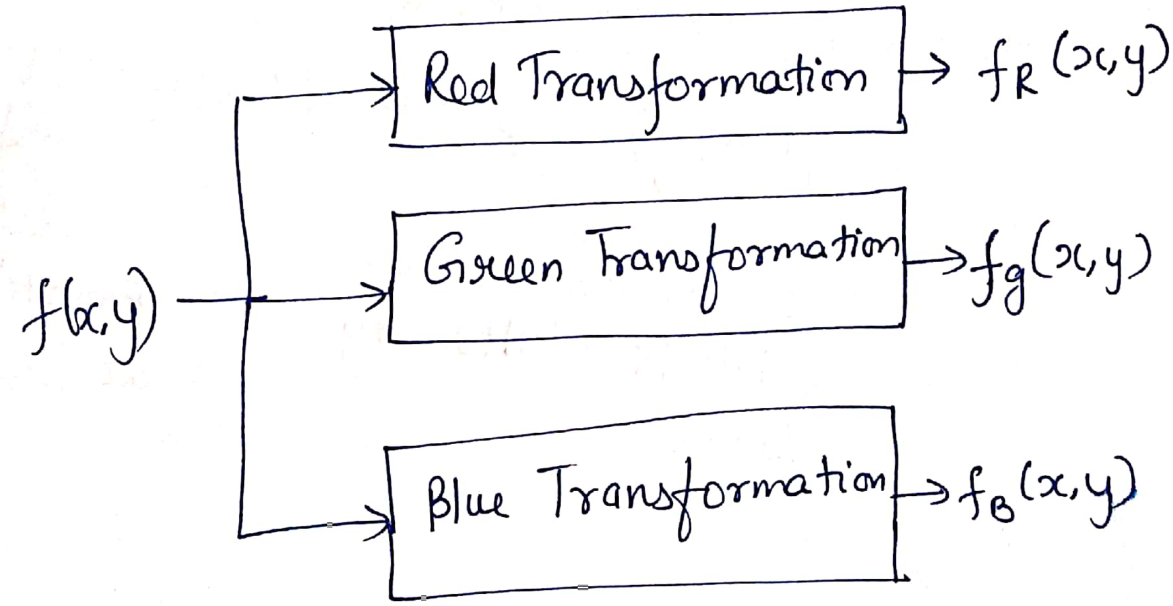
defined by the partitioning planes at $l = k-1$ & $l = k$.



(II) Gray Level to color transformations.

→ Perform 3 Independent transformations on the gray level of any i/p pixel & combine the three results (eg. for color television monitor: feed the results seprately into Red, Green & Blue guns)

→



functional block diagram for pseudocolor image processing f_R, f_G, f_B are fed into the corresponding red, green, blue i/ps of ~~an~~ RGB color Monitor.

→ The main idea behind pseudo color transformation is to perform 3 Independent transformation (Red, Green, Blue) on the grayscale or Intensity image & map the corresponding intensity value in the image to the result obtained.

Example:- ① Consider an intensity or grey scale image of size $M \times N$ say $A = \begin{bmatrix} 4 & 3 & 1 & 2 \\ 2 & 1 & 5 & 1 \\ 4 & 3 & 2 & 3 \end{bmatrix}$

② Define a colormap with 3 columns namely RED, GREEN & BLUE & no. of rows depending on the maximum possible intensity of the i/p image.

Let us define a colomap of size 5×3 by assuming 5 is the maximum value.

$$\text{my-map} = \begin{bmatrix} 0 & 0 & 0 \\ 1 & .5 & .5 \\ .5 & 1 & .5 \\ 0 & .5 & 1 \\ 1 & 1 & .5 \end{bmatrix}$$

The 1st col^n corresponds to RED
2nd " " to GREEN
3rd " " to BLUE

Scanned by CamScanner

③ Pre-allocate an o/p matrix, say B with zeros of size $M \times N \times 3$

$$B(:,:,1) = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Red

$$B(:,:,2) = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Green

$$B(:,:,3) = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Blue.

④ Map the position of the values in the colormap to the intensity or pixel value of the gray scale image & replace it with the corresponding value from the colormap.

Take the pixel value at the index position (1,1) in A, here 4

Find the corresponding color values at the index 4 of the colormap [0 0.5 1]

$$\text{my\_map} = \begin{bmatrix} 0 & 0 & 0 \\ \text{[illegible]} & 0.5 & 0.5 \\ 0.5 & 1 & 0.5 \\ \boxed{0 \quad 0.5 \quad 1} \\ 1 & 1 & 0.5 \end{bmatrix}$$

update the RGB matrix B at pixel position (1, 1, 1), (1, 1, 2), (1, 1, 3) with 0, 0.5 & 1

$$B(:,:,1) = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad B(:,:,2) = \begin{bmatrix} 0.5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$B(:,:,3) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Repeat this process for all pixel values in matrix A $= \begin{bmatrix} 4 & 3 & 1 & 2 \\ 2 & 1 & 5 & 1 \\ 4 & 3 & 2 & 3 \end{bmatrix}$

Final updated Matrix B

$$B(:,:,1) = \begin{bmatrix} 0 & 0.5 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 0.5 & 1 & 0.5 \end{bmatrix}$$

$$B(:,:,2) = \begin{bmatrix} 0.5 & 1 & 0 & 0.5 \\ 0.5 & 0 & 1 & 0 \\ 0.5 & 1 & 0.5 & 1 \end{bmatrix}$$

$$B(:,:,3) = \begin{bmatrix} 1 & 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 & 0 \\ 1 & 0.5 & 0.5 & 0.5 \end{bmatrix}$$

(6) Convert the matrix B to unit 8 format

(7) Display or write pseudo color image.