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# 1. Introduction

1. Computer Graphics: Processing an image description (Geometry + Photometry appearance) to show a digital image

Pattern Recognition: Can also be considered as Computer vision takes the digital image to an image description after being processed

Image Processing: Processing an image to enhance or compress the images or manipulate it to change how it looks or its attributes

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2. • Pixar Studios, MAPPA and other animation studios use graphics and CGI to animate scenes

• 3Ds Max, SolidWorks, and other 3D Graphics and CAD applications

• Physics Simulations and Visualization

• Flight Simulators, Showing the Human Skeleton as a 3D Model

• Visual & AR stores and Much More...

## 2. Raster Graphics and Color Spaces:

NOTES

① • Pixel:- It's the smallest unit in digital images and graphics usually consisting of 3 led lights Red Blue Green, to show multiple colors.

• Resolution:- It's the number of points per centimeter that can be plotted horizontally and vertically although it's often simply stated as the total number of points in each direction (NPPL * NHL = # of pixels / line * # of horizontal lines)

• Phosphor Persistence:- it's the time it takes the emitted light from the phosphor coating of the screen to decay to one tenth of it's original intensity.

• Aspect Ratio:- The ratio of vertical points to horizontal points to produce equal-length lines in both directions of the screen = $\frac{\text{Width of a pixel}}{\text{height of a pixel}}$

• Palette:- Number of colors available, simultaneously, for auser

• Gamut:- Range of all colors a physical system can produce

② A CRT monitor displays color pictures by using a combination of phosphors that emit different colors when an electron hits that phosphor it emits it and the electron gun moves a line at a time.

③. PAT = (FT − NHL * HRT − 2 * VRT) / Resolution

FT: Frame Time — time between one frame and another (each complete scan)
NHL: Horizontal lines
HRT: Retrace Time
VRT: Retrace Time

- Refresh Rate = # of frames / 1 second
- Resolution = NPPL * NHL
  (NPPL: # of Pixels/line)
- HRT
- VRT

$$FT = \frac{1}{\text{Refresh Rate}}$$

$$\text{PAT} = \frac{\frac{1}{RR} - NHL * HRT - 2 * VRT}{NHL * NPPL}$$

(NHL * NPPL: Resolution)

$$\text{PAT} = \frac{\frac{1}{RR} - NHL * HRT - 2 * VRT}{\text{Resolution}}$$

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NOTES.

④ Resolution 1280 * 1024 , RR = 60 Frames/Second
NPPL NHL

HRT = 5 μsec , VRT = 500 μsec

$$PAT = \frac{\frac{1}{RR} - HRT * NHL - VRT}{Resolution}$$

- Resolution = 1280 * 1024
- RR = 60 FPS = $\frac{1}{Fi}$
- HRT = $5 \times 10^{-6}$ second
- VRT = $500 \times 10^{-6}$ seconds

NHL = 1024

$$PAT = \frac{\frac{1}{60} - 1024 * 5 \times 10^{-6} - 500 \times 10^{-6}}{1280 * 1024}$$

$$\boxed{PAT = 8.43 \times 10^{-9} \text{ seconds/Pixel}}$$

$$\text{Pixels Per second} = \frac{1}{PAT} = 118.624 \times 10^{6} \text{ Pixels/Sec}$$

⑤ No, both the combination of RGB are good enough to represent most colors.

⑥
$$\begin{bmatrix} C \\ M \\ Y \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

NOTES

(7) The vector going from (0,0,0) to (1,1,1)

(8) Palette:- Number of colors availble, simultaniously, for a User.

Gamut:- Range of all colors a physical system can produce.

(9) RGB Color:-

Resolution: 800 * 600

Palette of size 64 ~~8 bit color = 2 bits for~~

gamut of 16 million = $2^8 \times 2^8 \times 2^8$ colors = 8-bit colors

64 simultaneous colors

Frame buffer = Resolution x 64 = 3750 KBytes

(10)

| Raster | Random |
|---|---|
| • Pixels not lines | • One line Drawn at a time |
| • less Precisious | • Higher Precision |
| • RR is fixed | • Refresh rate depends on complexity |
| • Frame buffer | • ~~Not~~ Display list used |
| • used for realistic scences | • Not used for realistic shaded scenes |