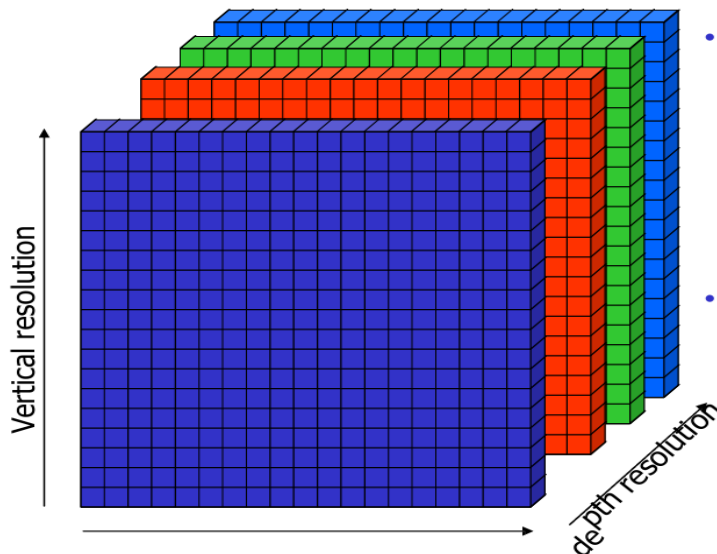


Image Format



- **Spatial resolution**

- horizontal/vertical

- 256×256, 512×512

- 1024×768, 1280 ×1024

- 2048×2048

- 1800×1200

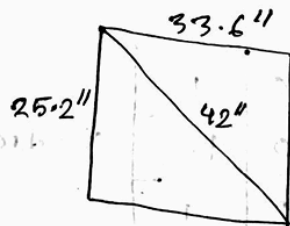
- **Depth resolution**

- B/W: 8bits, 12bits

- Color: 24bits(true color) 16bits(high color)

8 bits (256colors)

☐ calculate the resolution of a 42" monitor working with 3072 × 2304 image.



$$\text{Aspect ratio} = \frac{\text{width}}{\text{Height}} = \frac{3072}{2304}$$

$$\text{Aspect ratio} = 4:3$$

$$\text{Image resolution} = 3072 \times 2304$$

$$(4x)^2 + (3x)^2 = (42)^2$$

$$25x^2 = 1764$$

$$\therefore x = 8.4$$

$$\therefore 4x = 4 \times 8.4 = 33.6$$

$$3x = 3 \times 8.4 = 25.2$$

from pythagoras law,

Given,

$$\text{width} = 3072$$

$$\text{Height} = 2304$$

$$\text{PPI} = \frac{3072}{33.6}$$

$$\frac{2304}{25.2}$$

$$= 91.42$$

Resolution:

∴ 91.42 PPI or DPI [A.]

12. Find the resolution (in PPI) of a 15" monitor working on

- i) 800 x 600
- ii) 1024 x 768
- iii) 1280 x 1024

i) 800 x 600 resolution:

- Width = 800 pixels
- Height = 600 pixels
- Diagonal size = 15 inches

$$\text{PPI} = \frac{\sqrt{800^2 + 600^2}}{15}$$

$$\text{PPI} = \frac{\sqrt{640000 + 360000}}{15}$$

$$\text{PPI} = \frac{\sqrt{1000000}}{15}$$

$$\text{PPI} = \frac{1000}{15}$$

$$\text{PPI} \approx 66.67 \text{ PPI}$$

ii) 1024 x 768 resolution:

- Width = 1024 pixels
- Height = 768 pixels
- Diagonal size = 15 inches

$$\text{PPI} = \frac{\sqrt{1024^2 + 768^2}}{15}$$

$$\text{PPI} = \frac{\sqrt{1048576 + 589824}}{15}$$

$$\text{PPI} = \frac{\sqrt{1638400}}{15}$$

$$\text{PPI} = \frac{1280}{15}$$

$$\text{PPI} \approx 85.33 \text{ PPI}$$

iii) 1280 x 1024 resolution:

- Width = 1280 pixels
- Height = 1024 pixels
- Diagonal size = 15 inches

$$\text{PPI} = \frac{\sqrt{1280^2 + 1024^2}}{15}$$

$$\text{PPI} = \frac{\sqrt{1638400 + 1048576}}{15}$$

$$\text{PPI} = \frac{\sqrt{2686976}}{15}$$

$$\text{PPI} = \frac{1638.4}{15}$$

$$\text{PPI} \approx 109.23 \text{ PPI}$$

9 Find the resolution (in PPI) of a 15" monitor working on 640 x 480.

Ans: Aspect ratio = $\frac{\text{width}}{\text{height}} = \frac{640}{480} = \frac{4}{3} = 4:3$

so, $(4x)^2 + (3x)^2 = (15)^2$

or, $16x^2 + 9x^2 = 225$

or, $25x^2 = 225$

or, $x = 3$

Now, length = $4x = 4 \times 3 = 12$

resolution = $\frac{640}{12}$

= 53.3 PPI (Ans)

10 Find the resolution (in PPI) of an image 12" x 9", which is converted from a 35 mm photo negative with 4500 PPI.

Ans: Here, 35 mm = 3.5 cm [10 mm = 1 cm]

we know, 2.54 cm = 1 inch [2.54]

3.5 cm = $\frac{3.5}{2.54}$ inch

1 inch has = 4500

$$\frac{3.5}{2.54} \text{ " } = \frac{3.5}{2.54} \times 4500$$
$$= 6200 \text{ PPI}$$

In 1" the value of pixels are = $\frac{6200}{12}$

$$= 516.67 \text{ PPI}$$

(Ans)

Colors

$$\text{Intensity } I = \frac{R + G + B}{3}$$

$$\text{Normalized Red } r = \frac{R}{R + G + B}$$

$$\text{Normalized Blue } b = \frac{B}{R + G + B}$$

$$\text{Normalized Green } g = \frac{G}{R + G + B}$$

RGB to HSI Conversion

RGB to HSI Conversion

$$I = \frac{1}{3}(R + G + B), \quad \text{where } 0 \leq I, R, G, B \leq 1$$

$$H = \cos^{-1} \left\{ \frac{\frac{1}{2}[(R - G) + (R - B)]}{\sqrt{(R - G)^2 + (R - B)(G - B)}} \right\}, \quad \text{if } g_0 > b_0$$

$$H = 360^\circ - H, \quad \text{if } g_0 < b_0 \quad \text{where } g_0 = G/I, \quad b_0 = B/I$$

$$S = 1 - \frac{3}{R + G + B} \times (\min\{R, G, B\})$$

HSI to RGB Conversion

HSI to RGB Conversion

$$B = \frac{1}{3}(1 - S)$$

$$R = \frac{1}{3} \left[1 + \frac{S \cos H}{\cos(60^\circ - H)} \right] \quad \text{assume } 0^\circ \leq H \leq 120^\circ$$

$$G = 1 - R - B$$

YCbCr Color Conversion

13

- The RGB image is converted into the YCbCr image as the RGB image is more sensitive to illumination

- RGB is more **sensitive** to illumination variation
- YCbCr color space is a **linear** luminance color space

Y = Luminance
Cb = Chromaticity of **Blue**
Cr = Chromaticity of **Red**

RGB to YCbCr conversion formula

$$Y = 16 + (65.481 * R + 128.553 * G + 24.966 * B) \quad (1)$$

$$Cb = 128 + (-37.797 * R - 74.203 * G + 112 * B) \quad (2)$$

$$Cr = 128 + (112 * R + 93.786 * G + 18.214 * B) \quad (3)$$

Information Range

$$Y = 16 \text{ to } 235$$

$$Cb = 16 \text{ to } 240$$

$$Cr = 16 \text{ to } 240$$

Color Space – CMYK

Conversion from RGB:

$$\square C = 255 - Y - 1.4021(Cr - 128)$$

$$\square M = 255 - Y + 0.3441(Cb - 128) + 0.7142(Cr - 128)$$

$$\square Y = 255 - Y - 1.7718(Cb - 128)$$

$$\square K = \min(C, M, Y)$$

If a color image has 2160 x 3240 pixels with resolution 200 dpi. What will be the space taken by the image? What will be the size of the image?

■ প্রশ্ন:

যদি একটি রঙিন চিত্রের রেজোলিউশন ২০০ ডিপিআই হয় এবং চিত্রটির আকার হয় ২১৬০ × ৩২৪০ পিক্সেল, তাহলে —

ছবিটি কত পরিমাণ জায়গা দখল করবে? ছবিটির বাস্তব আকার কত হবে?

📌 Given:

- Image dimensions: 2160 × 3240 pixels
 - Resolution: 200 dpi (dots per inch)
 - It's a **color image** (assume 24 bits per pixel = 3 bytes per pixel)
-

✅ 1. Total number of pixels:

$$2160 \times 3240 = 7,004,400 \text{ pixels}$$

✅ 2. Space taken by the image:

- Each pixel = 3 bytes (for RGB)

$$7,004,400 \times 3 = 21,013,200 \text{ bytes}$$

Convert to MB:

$$\frac{21,013,200}{1024 \times 1024} \approx 20.04 \text{ MB}$$

✅ 3. Physical size of the image (in inches):

Use the formula:

$$\text{Size in inches} = \frac{\text{pixels}}{\text{dpi}}$$

- Width:

$$\frac{3240}{200} = 16.2 \text{ inches}$$

- Height:

$$\frac{2160}{200} = 10.8 \text{ inches}$$

- Space taken by image: ≈ 20.04 MB
- Physical size of image: 16.2×10.8 inches

