

Digital Image Processing and Pattern Recognition

E1528

Fall 2022-2023

Lecture 11



Color Image Processing

INSTRUCTOR

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TOPICS

1

COLOR FUNDAMENTAL.

2

COLOR MODELS.

A

RGB model.

B

CMY model.

C

HIS model.



COLOR FUNDAMENTALS



WHY COLOR IMAGE?

1-Color is a powerful descriptor that often simplifies object identification and extraction from a scene.

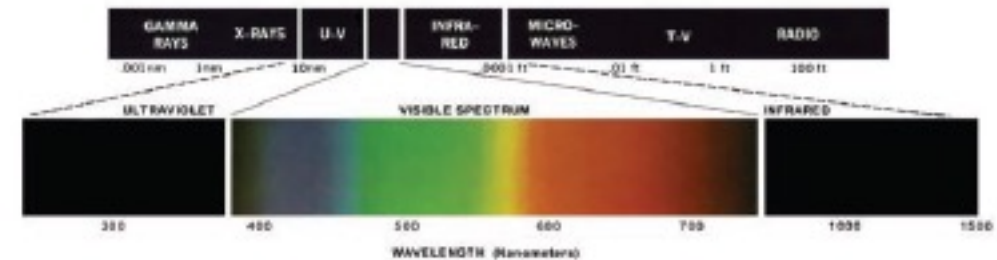
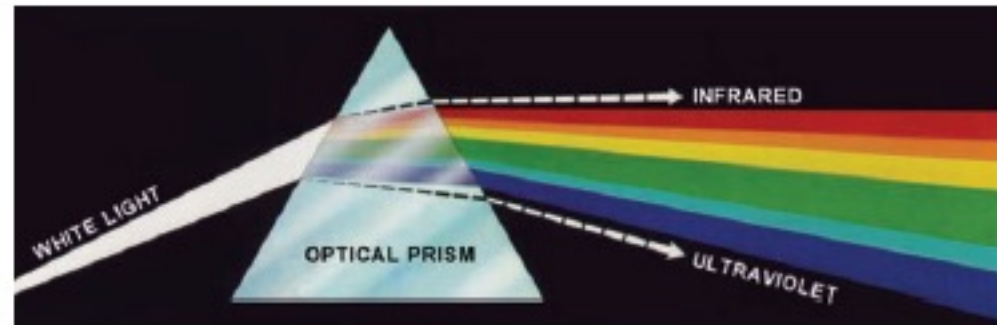
2-Human eye can discern thousands of color shades and intensities (only two dozen shades of gray).

Lecture Objectives

1. Understand the fundamentals of color and the color spectrum.
2. Be familiar with several of the color models used in digital image processing.
3. Know how to apply basic techniques in pseudo color image processing, including intensity slicing and intensity-to-color transformations.
4. Be familiar with how to determine if a grayscale method is extendible to color images
5. Understand the basics of working with fullcolor images, including color transformations, color complements, and tone/color corrections.
6. Be familiar with the role of noise in color image processing.
7. Know how to perform spatial filtering on color images.
8. Understand the advantages of using color in image segmentation.

COLOR FUNDAMENTAL

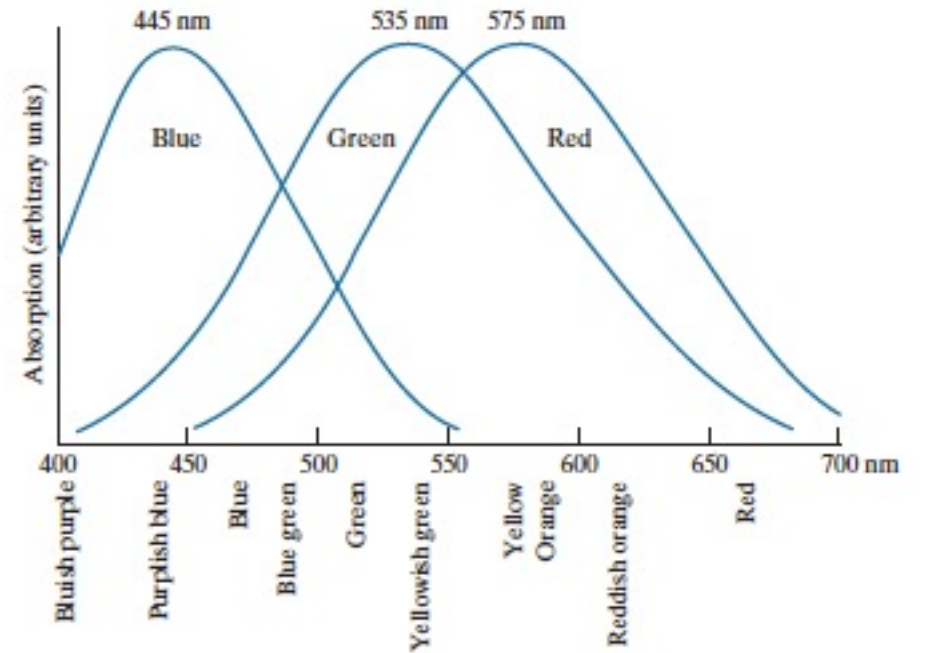
1. In 1666, Sir Isaac Newton discovered that when a beam of sunlight passes through a glass prism, the emerging light is not white, but consists instead of a continuous spectrum of colors ranging from violet at one end to red at the other.

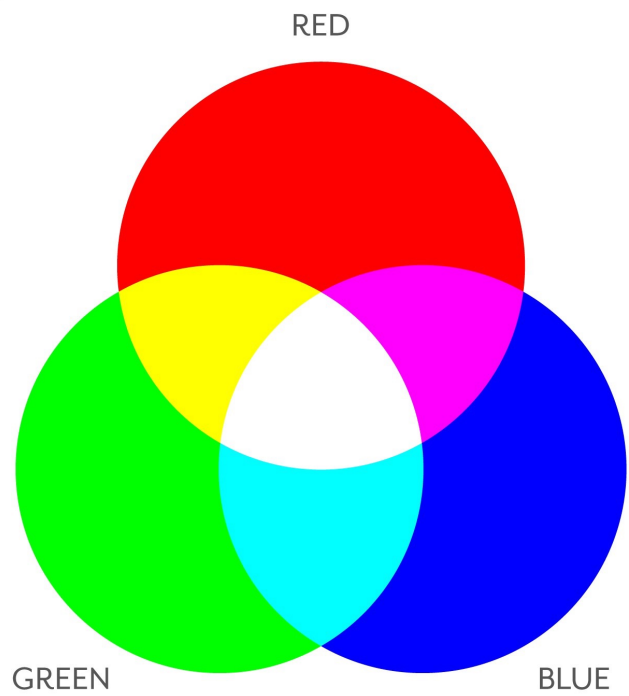


COLOR FUNDAMENTAL



FIGURE 6.3
Absorption of light by the red, green, and blue cones in the human eye as a function of wavelength.

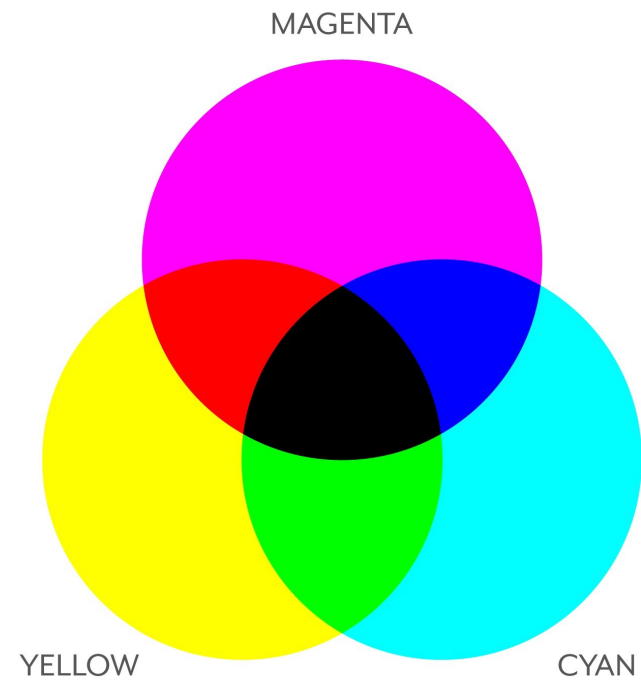




Primary colors

COLOR FUNDAMENTAL

Secondary colors



COLOR MODELS

The purpose of a color model (also called a color space or color system) is to facilitate the specification of colors in some standard way.

Color models classifications

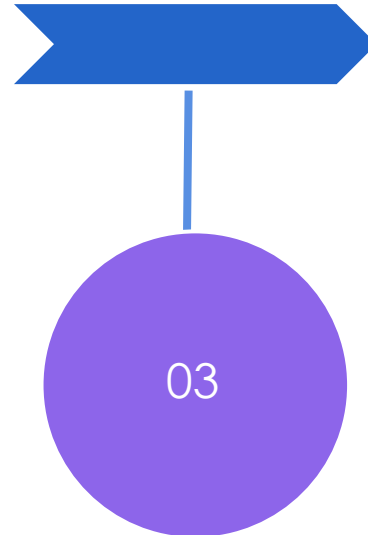
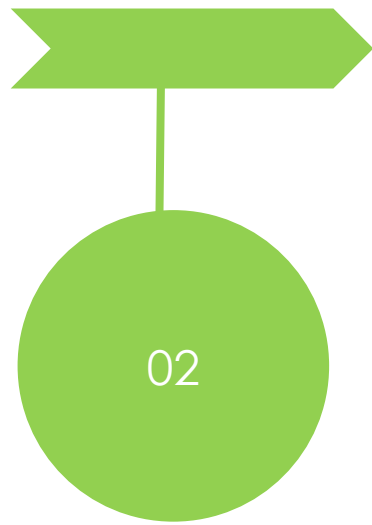
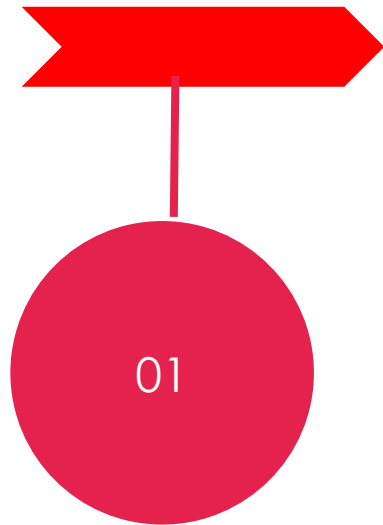
HARDWARE-ORIENTED COLOR MODELS

- .used in color monitors and printers
- . RGB, CMY (cyan, magenta, yellow),
- . CMYK (+black)

APPLICATION-ORIENTED COLOR MODELS

- . HSI (hue, saturation, intensity)

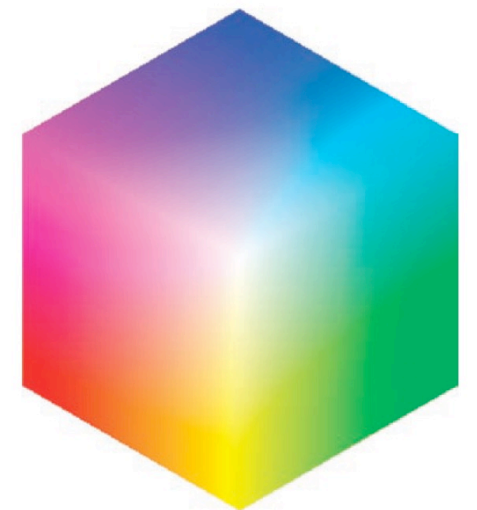
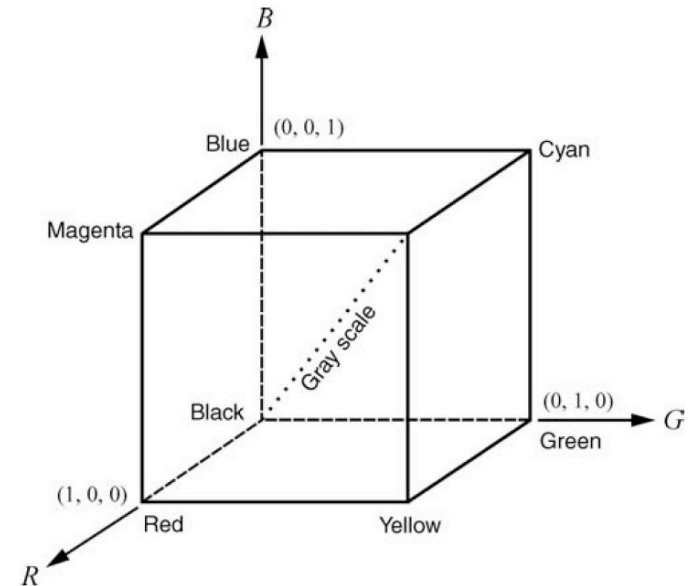
RGB COLOR MODEL



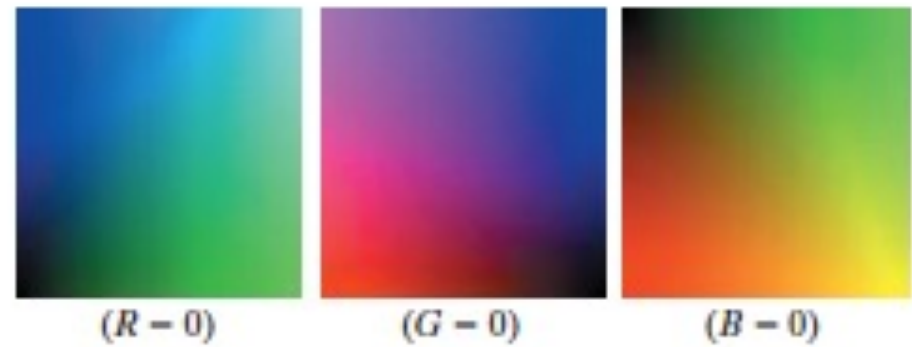
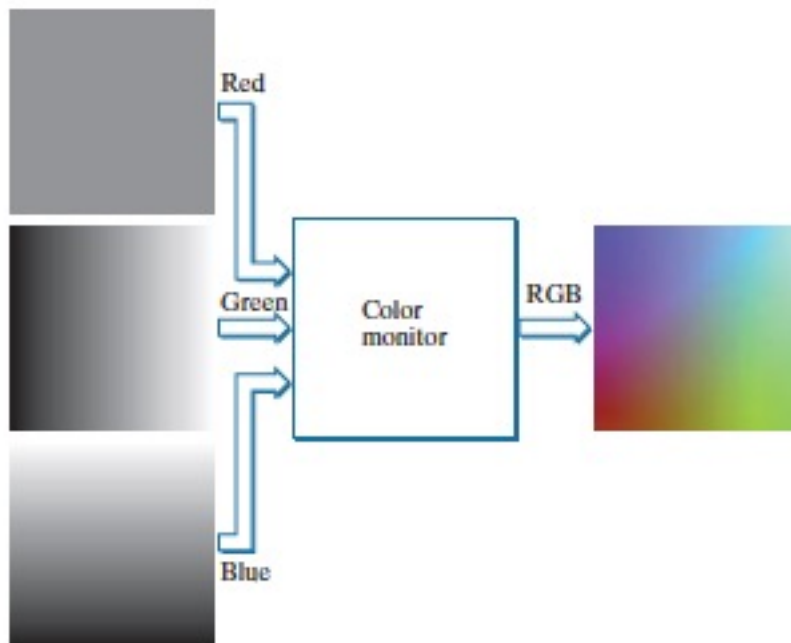
based on a Cartesian coordinate system whose axes represent the three primary colors of light (R , G , and B).

The eight vertices of the resulting cube correspond to the three primary colors and secondary color.

pixel depth, defined as the number of bits used to represent each pixel: value is 24 bits. The resulting cube is 16 million colors.
16, 777, 216



Displaying of color image



Safe RGB color



- RGB values are commonly not transferable between devices ,so we need to use safe color.
- formed by the combination of red,green and blue (rgb)

COLOR MODELS

CYM and CYM k models

What is CMY model ?

The CMY (cyan-magenta-yellow) model is a subtractive model appropriate to absorption of colours, for example due to pigments in paints.

Whereas the RGB model asks what is added to black to get a particular colour, the CMY model asks what is subtracted from white. In this case, the primaries are cyan, magenta and yellow, with red, green and blue as secondary colors .

When a surface coated with cyan pigment is illuminated by white light, no red light is reflected, and similarly for magenta and green, and yellow and blue. The relationship between the RGB and CMY models is given by:

$$\begin{array}{c} \text{RGB To CMY} \\ \begin{bmatrix} C \\ M \\ Y \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} R \\ G \\ B \end{bmatrix} \end{array} \qquad \begin{array}{c} \text{CMY To RGB} \\ \begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} C \\ M \\ Y \end{bmatrix} \end{array}$$

cyan (blue + green)

yellow (red + green)

magenta (red + blue)

white (red + green + blue)

The CMY model is used by printing devices and filters.

What is CMYK model ?

- The CMYK acronym stands for Cyan, Magenta, Yellow, and Key: those are the colors used in the printing process. A printing press uses dots of ink to make up the image from these four colors. 'Key' means black. It's called Key because it's the main color used to determine the image outcome. Black ink provides depth and shading, whereas the other colors create different colors on the spectrum depending on how they are mixed. For example, cyan and yellow create a green when one is overlaid on the other.
- The "black" generated by mixing commercially practical cyan, magenta, and yellow inks is unsatisfactory, so four-color printing uses black ink in addition to the subtractive primaries.

*Thank
you*

