BASIC IMAGE AND IMAGE PROCESSING CONCEPTS

IMAGE PROCESSING

- Image / Pixels
  - An array or a matrix of multiple pixels which are properly arranged in columns and rows
  - A pixel is the smallest unit in a digital image
- Binary Image
  - Composed of 1 an 0 (Black = 0 and White = 1)
  - 1 bit per pixel
- Grayscale
  - Each pixel would need 8 bit storage space
  - Multiple shades between black and white
- Color Image
  - Each pixel will have color information
  - 3 channels, red, green, blue
  - Each channel require 8 bit (24 bits per pixel)
  - The shade of each pixel is based on the intensity of RGB

REAL LIFE APPLICATION

- Agriculture
  - Sorting Fruits
  - Grading Fruits
  - Crop Disease Identification
  - Species Identification
- Automobile
  - Driver Assistance
  - Toll Application
  - Lane Detection
  - Car/Plate Recognition
- Industrial
  - Defect Identification
  - Inspection
  - Robotic Control or Guidance
- Medicine
  - X-ray analysis
  - Robotic Surgery
- Security
  - Navigation
  - Surveillance
  - Object/Entity Detection

BITS PER PIXEL, CONCEPT OF CONTRAST, BRIGHTNESS, AND INTENSITY

- BPP
  - Number of bit of information stored each pixel
  - More bits and more pixel, the sharper the image is
- Intensity
  - A value corresponding to a pixel
  - Example, how “red” a color
  - Refers to the grayscale value of a color
- Brightness
  - A perception as to how intense the color of the image is
  - Lighter to darker

COLOR MODEL

- System which makes use of 3 primary colors
  - RGB, CMY, HSV, YUV
- RGB (RED, GREEN, BLUE)
  - Additive color model
  - Provides wide range of color by stacking RGB
  - R + G + B = WHITE
- CMY (CYAN, MAGENTA, YELLOW)
  - Subtractive color model
  - C + M + Y = BLACK
- HSV (HUE, SATURATION, VALUE)
  - Hue
    - Color
  - Saturation
    - Connected to the intensity of the color or the range of gray in the color space
    - Represented as percentage
  - Value
    - Brightness represented as percentage
- YUV
  - One of the color encoding systems
  - Uses:
    - Image source and image rendering
    - Camera
    - Display devices
  - One of the more efficient options in image processing where displays are involved
  - Luminance = Y
    - Brightness

- Chrominance = UV
  - Color
- BLUE
  - blue - Y = U
- RED
  - red - Y = V
- GREEN
  - Indirectly derived from YUV
- RGB to YUV conversion
  - Y = 0.299R + 0.587G + 0.114B
  - U = -0.147R - 0.289G + 0.436B
  - V = 0.615R - 0.515G - 0.100B
- Purpose
  - To save processing power (bandwidth)