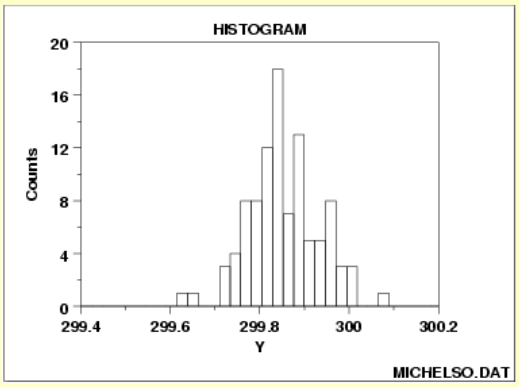
1- What is a Histogram?
   - Is a graphic representation of an universal data set distribution.

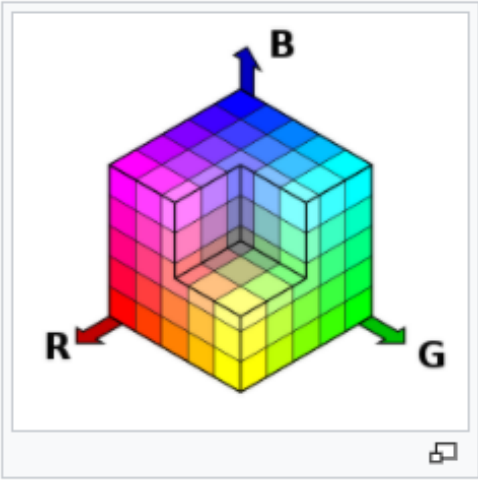
Sample Plot



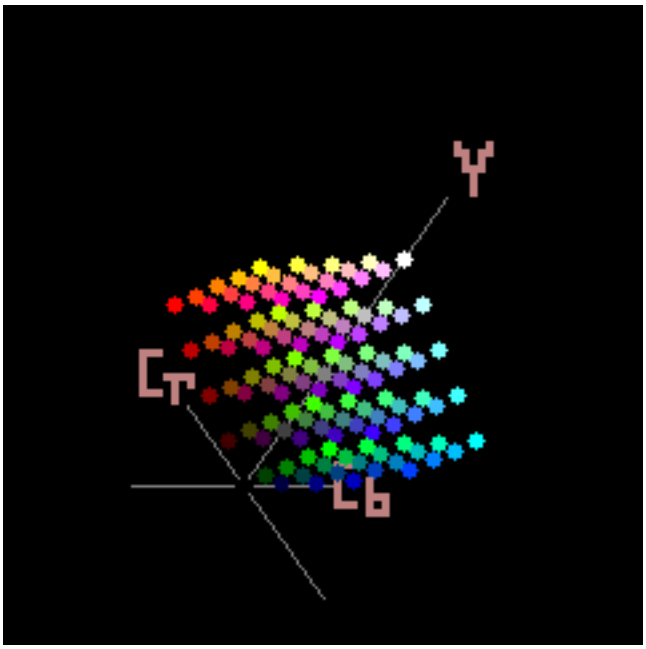
The above plot is a histogram of the Michelson speed of light data set.

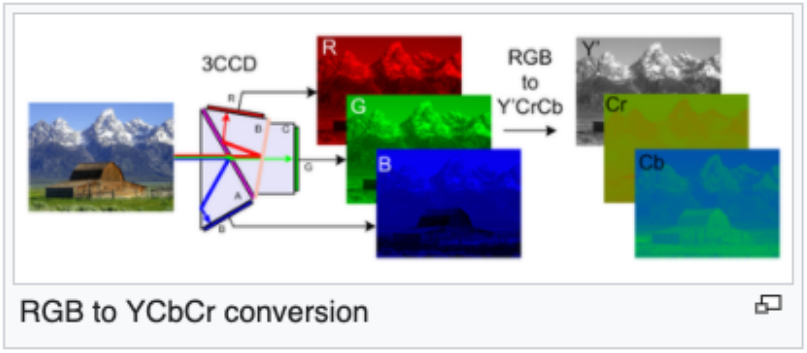
(https://www.itl.nist.gov/div898/handbook/eda/section3/histogra.htm)

2- What types of color model exists?
   a. RGB: This model uses additive color mixing between Blue, Green and Red light signals.



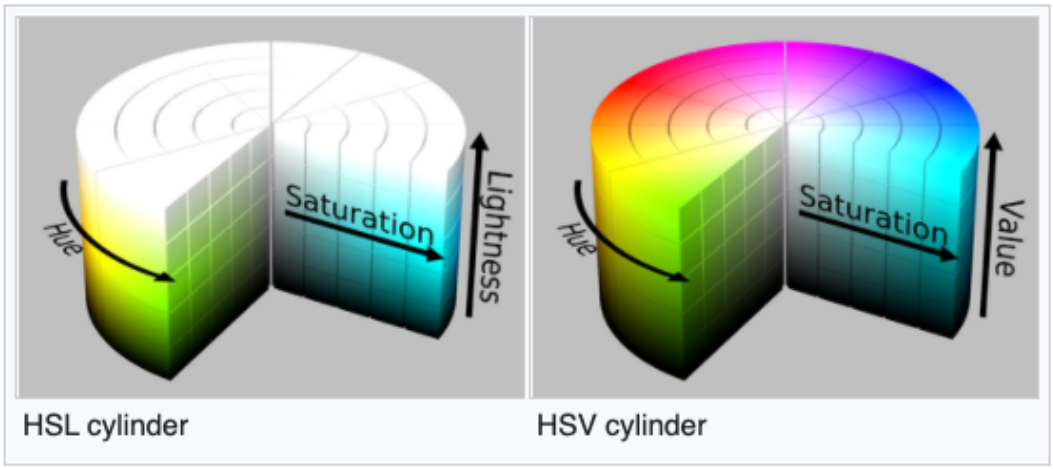
   b. YCbCr: Is used as part of the color image pipeline in video and digital photography systems, Y is the luma component and CB and CR are the blue-difference and red-difference chroma components. Y' (with prime) is distinguished from Y, which is luminance, meaning that light intensity is nonlinearly encoded based on gamma corrected RGB primaries.





RGB to YCbCr conversion

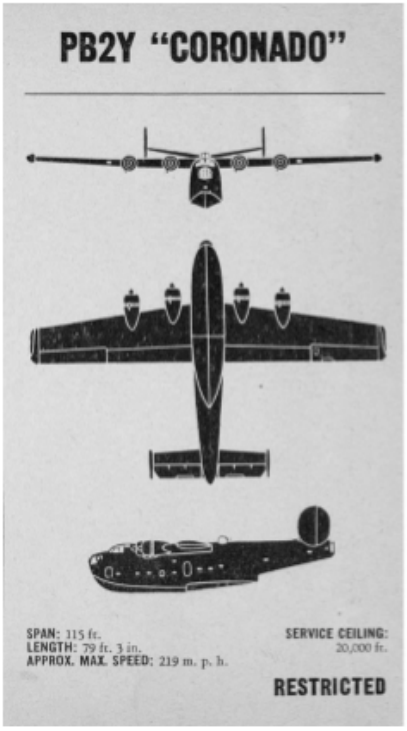
c. HSV
d. HSL
   HSL and HSV are both cylindrical geometries, with hue, their angular dimension, starting at the red primary at 0°, passing through the green primary at 120° and the blue primary at 240°, and then wrapping back to red at 360°. In each geometry, the central vertical axis comprises the neutral, achromatic, or gray colors, ranging from black at lightness 0 or value 0, the bottom, to white at lightness 1 or value 1, the top. heir model was based more upon how colors are organized and conceptualized in human vision in terms of other color-making attributes, such as hue, lightness, and chroma

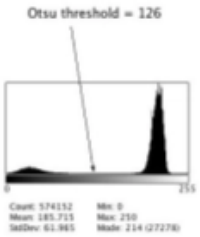


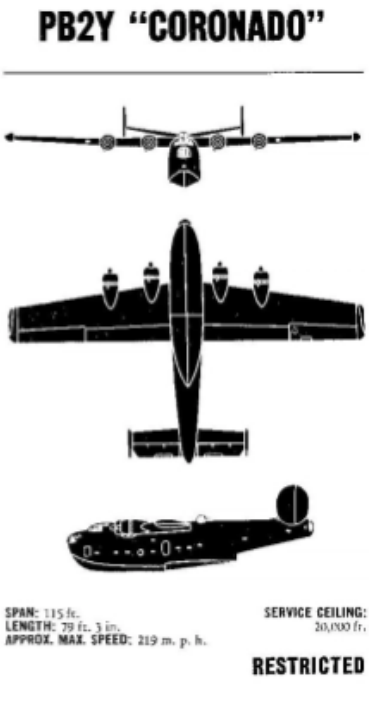
HSL cylinder HSV cylinder

3- What is binarization in images?

a. Is the process of taking a grayscale image and converting it to black-and-white, essentially reducing the information contained within the image from 256 shades of gray to 2: black and white, a binary image. The process of binarization works by finding a threshold value in the histogram – a value that effectively divides the histogram into two parts, each representing one of two objects (or the object and the background).







4- What is the Otsu method?

a. The algorithm returns a single intensity threshold that separate pixels into two classes, foreground and background. This threshold is determined by minimizing intra-class intensity variance, or equivalently, by maximizing inter-class variance. Otsu's method is a one-dimensional discrete analog of Fisher's Discriminant Analysis, is related to Jenks optimization method, and is equivalent to a globally optimal k-means performed on the intensity histogram.

An example image thresholded using Otsu's algorithm

Original image