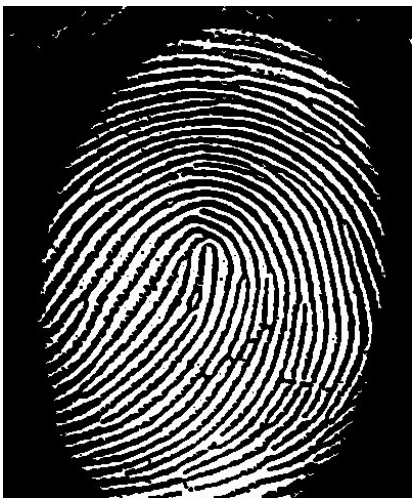
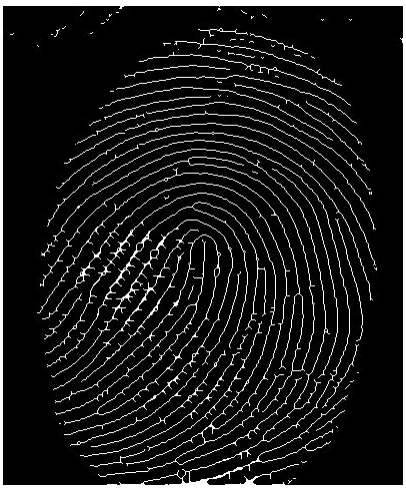
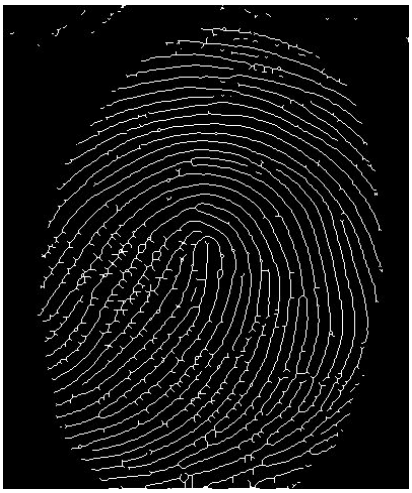
DIP Report A4

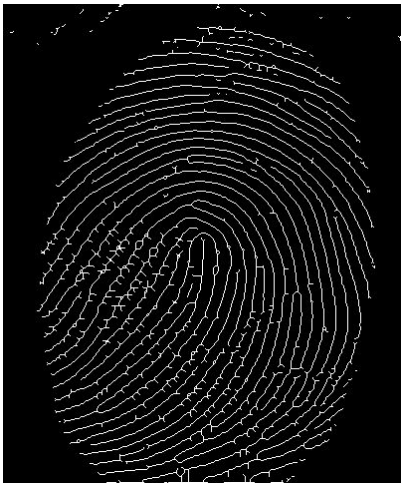
Q1:

a) Intermediate results:

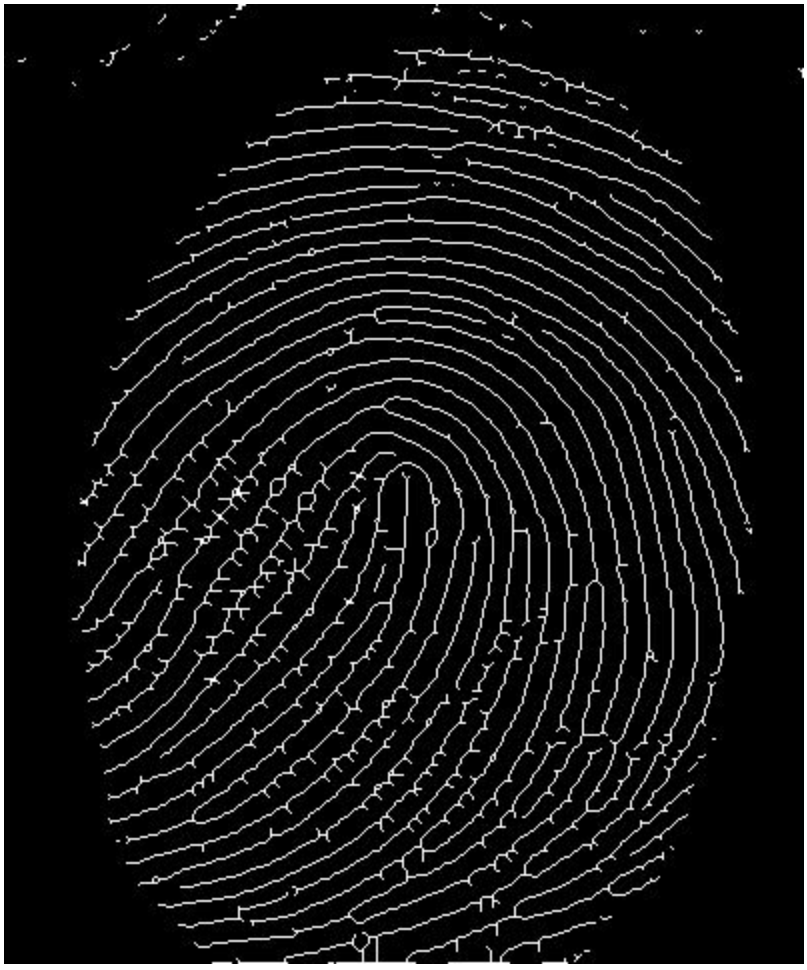
Iteration 0: 

Iteration 4: 

Iteration 7: 

Iteration 9: 

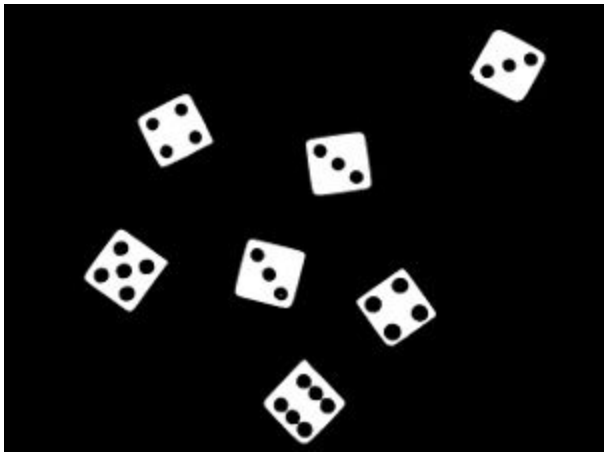
Final convergences at iteration 9:

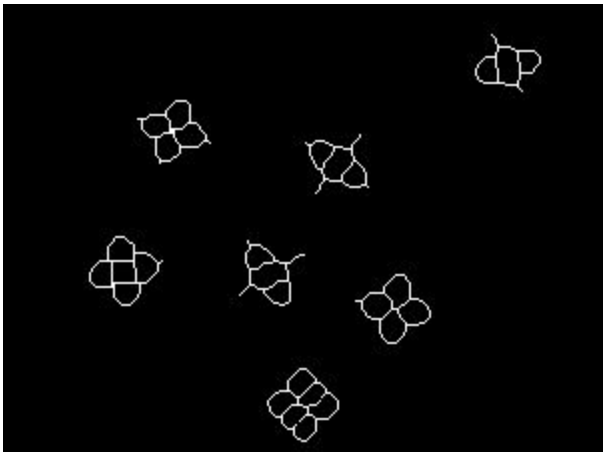


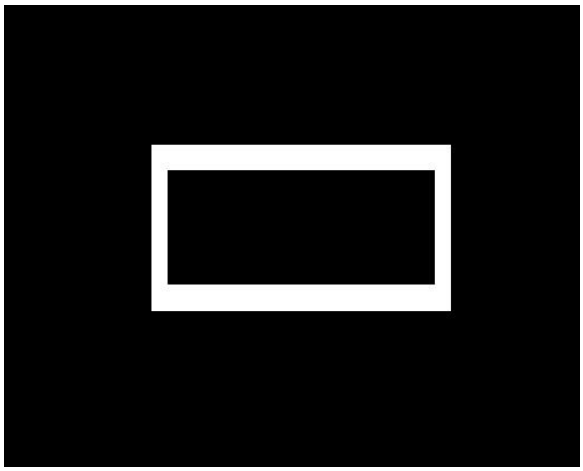
b) The structuring element represents the edge pixels of the image. When we replace the pixels with the value of background for matching pixels, we are essentially shaving of the edge pixels. S1 represents straight lines in the edges and S2 represents the corners. Rotating them help identify all different types of corners and lines at the edges.

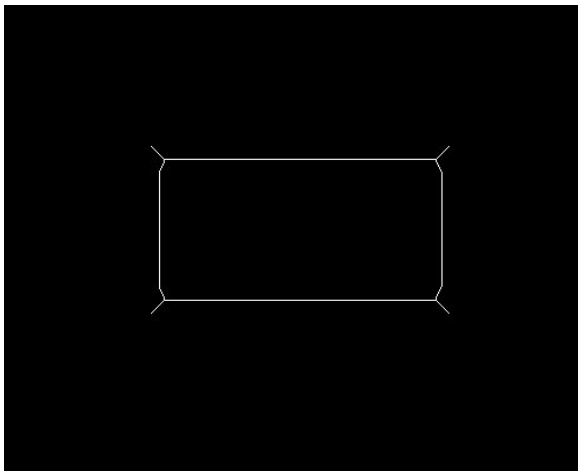
c) We need multiple passes because we replace with the background pixel value, we are thinning the image at every iteration by removing one layer of edge pixels. For skeleton images, the final representation should be one pixel thick. Given the nature of the structuring element, it will not match any pixel is the image is one pixel thick, this is when the structuring element will have no effect on the image. Therefore we repeated removing a layer of edge pixels until there is only a one pixel thich edge remaining.

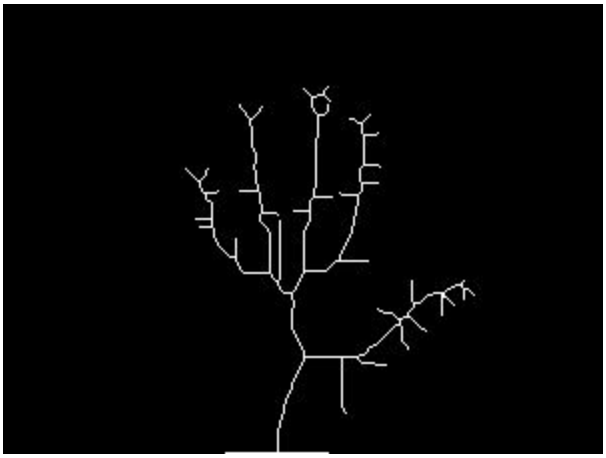
d)







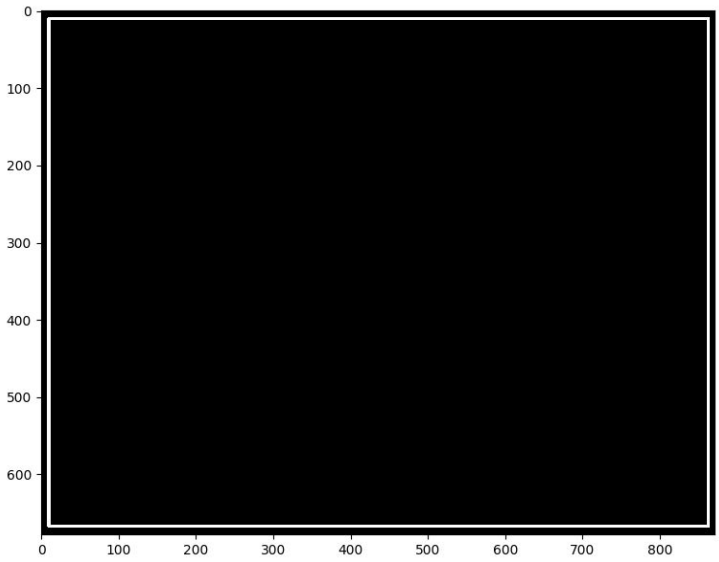




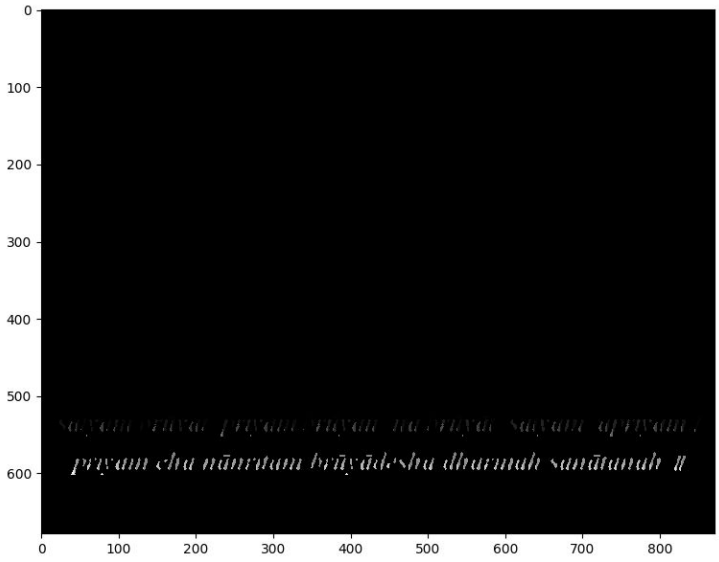
Q2: We use Hough Transform to estimate the circles in the image. We can find edge circles based on values in the accumulator. We then try and find all the intersecting circles using the properties of circles. Once we find all those that intersect, we can find all the non intersecting circles as well.

Q3:
a)
Segmentation was done by analysing the histogram of the color image to identify peaks. These peaks were taken as the anchor points and assigned a specific value. The remaining colors were then matched to the nearest peak and assigned the same value as that of the peak. In this way, each color is assigned a specific value/label. The image is then segmented based on the label.

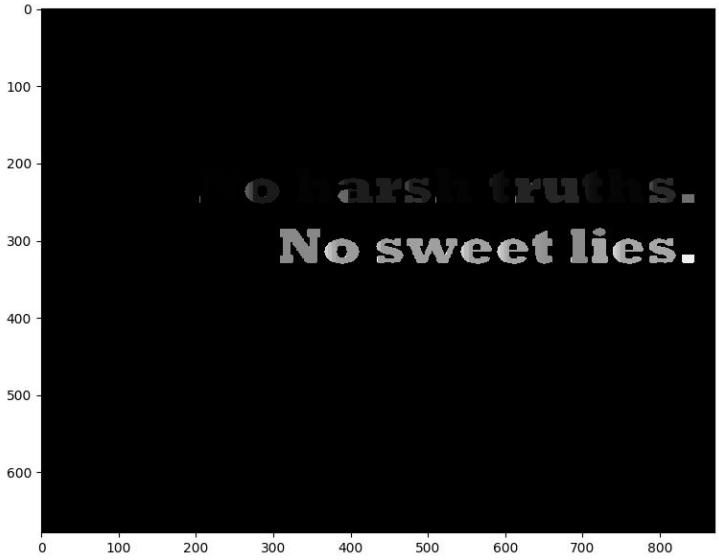
Morphological opening is done to remove small components that act as noise. We then apply the two pass connected components algorithm on each segmented part to get the number of connected components.T



2 connected components (Boundary of the image)

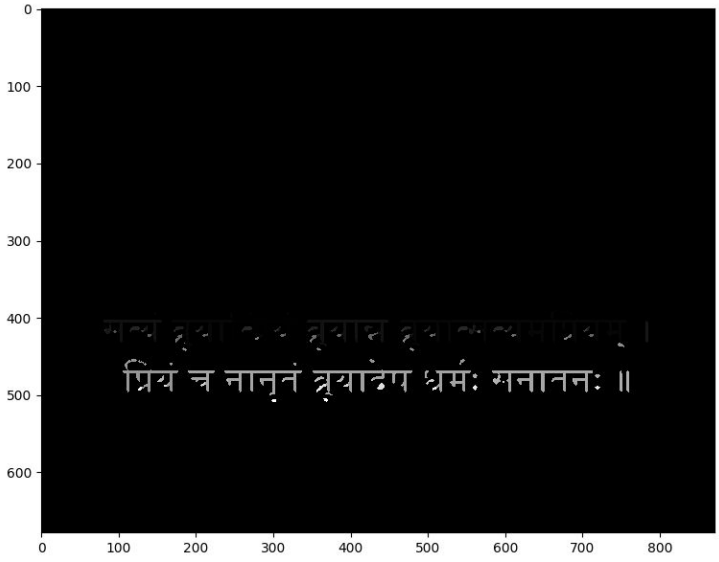


454 connected components.

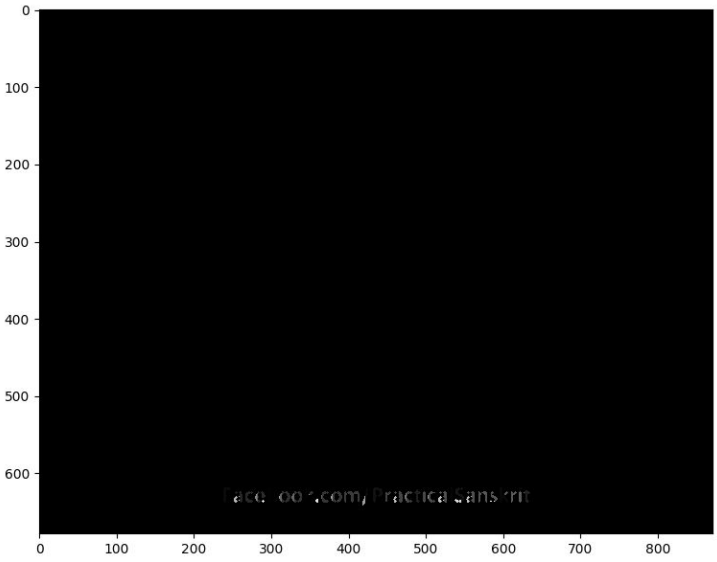


97 connected components

86 connected components



185 connected components



83 connected components

b)

Q4:

Afterimage: An afterimage is an image that continues to appear in one's vision after the exposure to the original image has ceased. Afterimages occur because photochemical activity in the retina continues even when the subject is no longer experiencing the original stimulus.

There are primarily two types of afterimages:

- Positive afterimage: They appear the same color as the original image. They are often very brief, lasting less than half a second
- Negative afterimage: Negative afterimages are caused when the eye's photoreceptors, primarily known as rods and cones, adapt to overstimulation and lose sensitivity. This images appear as distortions over the current stimulus.

There is also the phenomenon of Afterimage on empty shape. In this, an empty (white) shape is presented on a colored background for several seconds. When the background color disappears (becomes white), an illusionary color similar to the original background is perceived within the shape. The reason for this effect is uncertain.

Color moiré: Color moiré is artificial color banding that can appear in images with repetitive patterns of high spatial frequencies, like fabrics or picket fences.

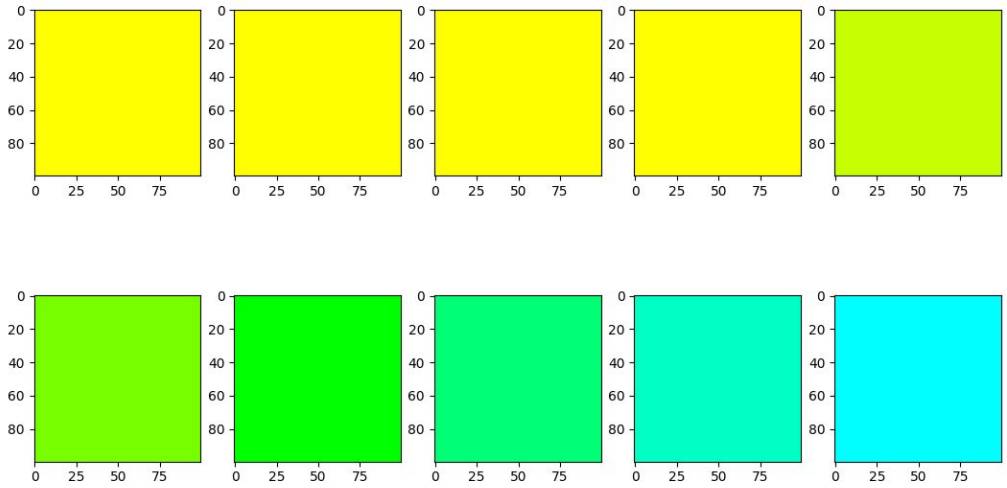
Moiré occurs when two patterns are overlaid and result in a new, third pattern. With digital photography, these artifacts result when the frequency of detail in a scene exceeds the sensor's pixel pitch and ability to resolve “real” information. In general, the finer the pixel pitch and/or resolution of a sensor, the fewer instances of moiré should be rendered

Its effect can be commonly seen in screens when a picture of the screen is taken, a rainbow like effect is seen in the image. Color moiré is the result of aliasing in image sensors that employ Bayer color filter arrays. It is most noticeable in the red and blue channels. Color moiré is measured by Log Frequency.

Structural coloration: Structural coloration is cause by tiny microscopic structures in an object that are so small that they can interfere with visible light. This causes production of color that is not necessarily the same as that of the pigment of the object.
A good example of structural coloration is with peacock feathers. The pigment of the feathers are brown, however they also reflect blue, turquoise, and green light. The feathers are also iridescent, i.e. they appear a different color when viewed from different angles.

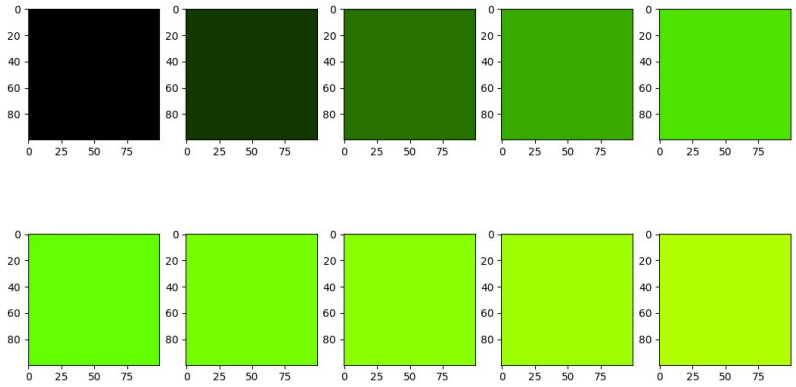
Structural coloration is caused by interference effects rather than by pigments. Colours are produced when a material has parallel lines, formed of one or more parallel thin layers, or otherwise composed of microstructures on the scale of the colors wavelength. Light reflecting from these structure interfere and cause new wavelengths to be visible.

Q5:



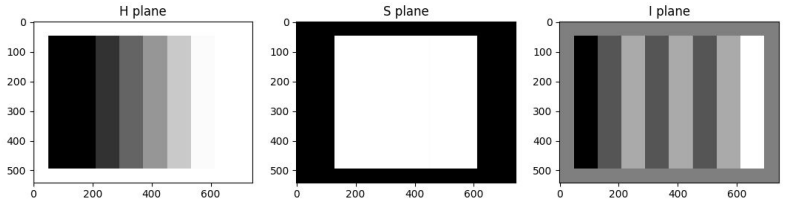
As the step size increases, the change in color due to Hue value is less perceptually uniform. Smaller step sizes would give a more perceptually uniform change in the colour, going from green to blue.

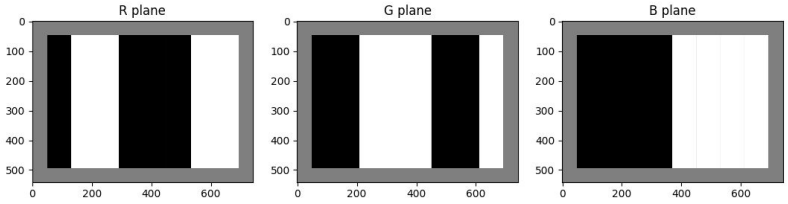
Changing the step size to 5, makes the change more perceptually uniform, however a change in the intensity values will also make the change more uniform. For example, changing the value of I while keeping H and S fixed gives us:

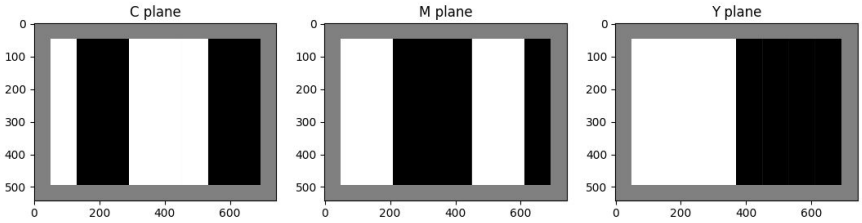


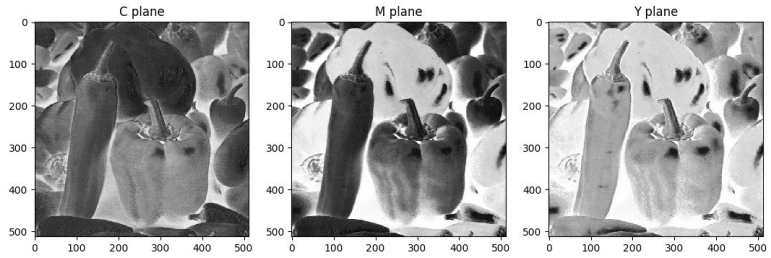
Therefore for a more perceptually uniform change, varying the value of H in smaller steps as well as varying the value of I will lead to a more uniform change.

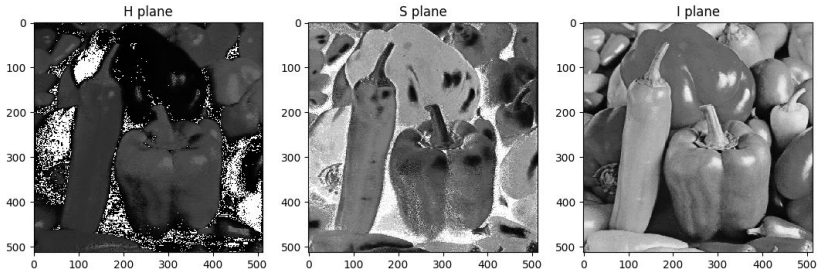
Q6: 1) Planes of different images:

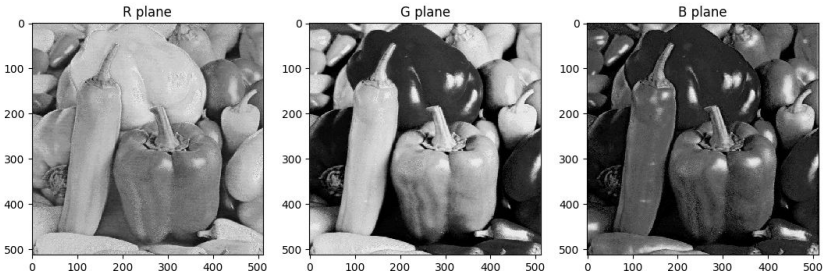


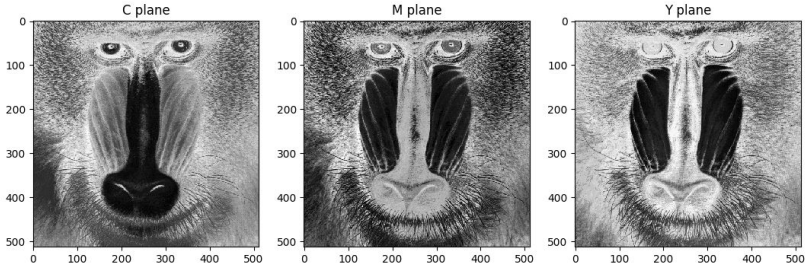


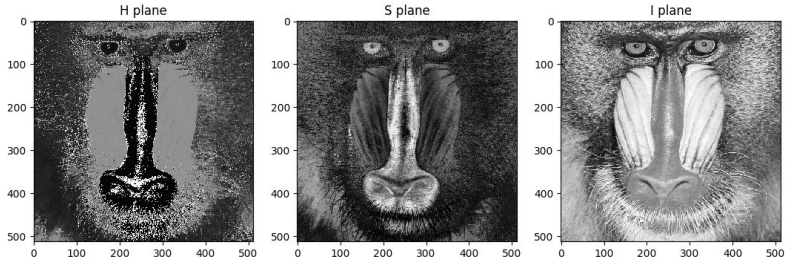


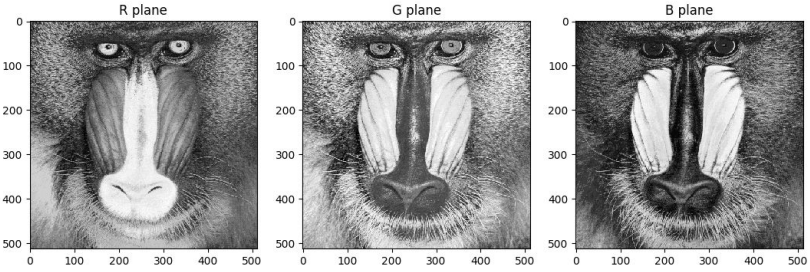

C plane
M plane
Y plane


H plane
S plane
I plane

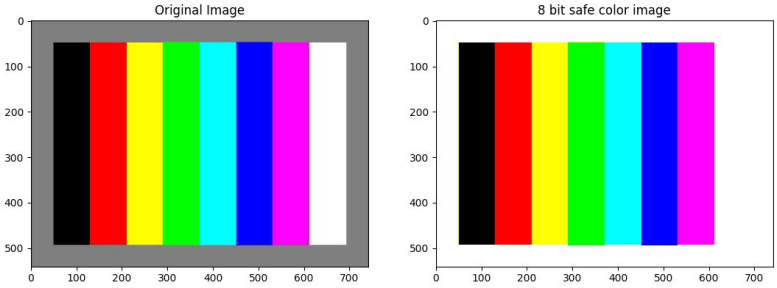

R plane
G plane
B plane

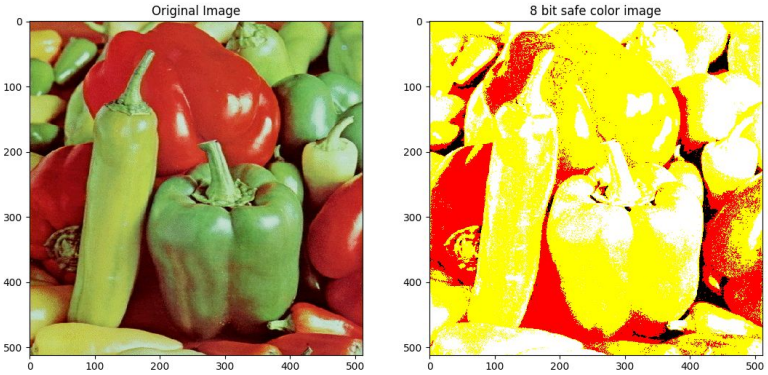

C plane
M plane
Y plane

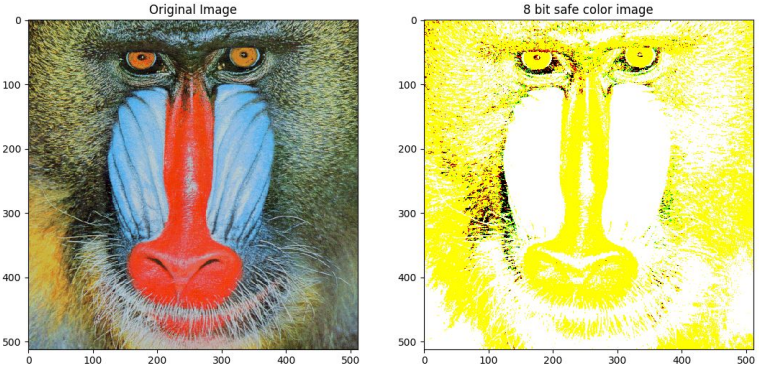

H plane
S plane
I plane


R plane
G plane
B plane

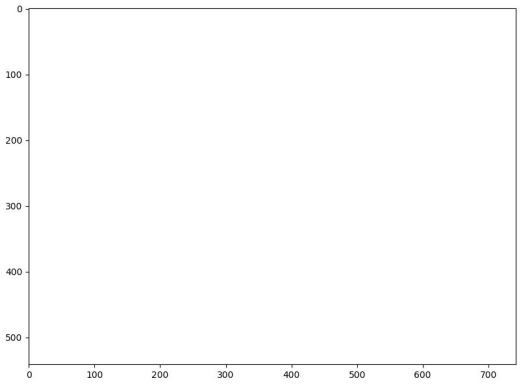
2. 8 bit safe model



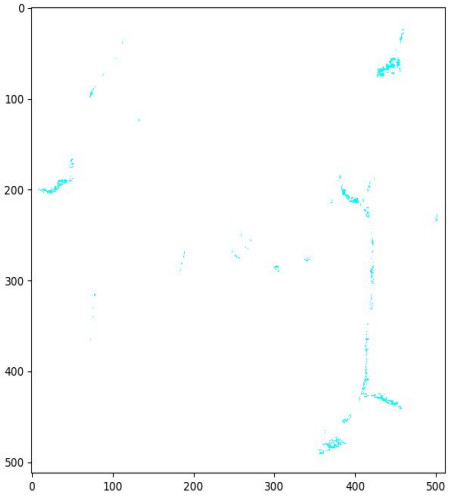




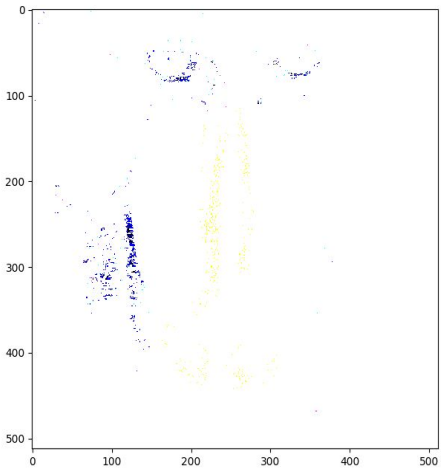
3. Histogram equalized RGB



color_bars.tif

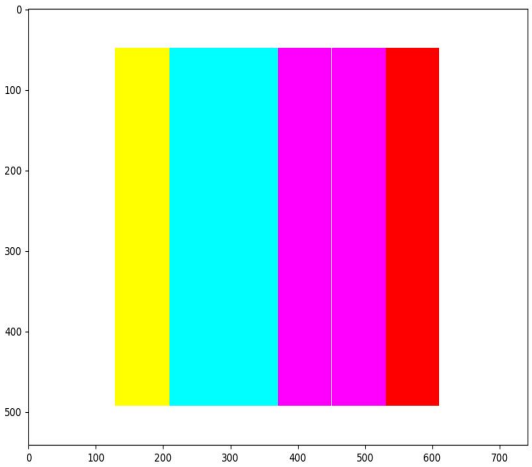


pepper_color.tif

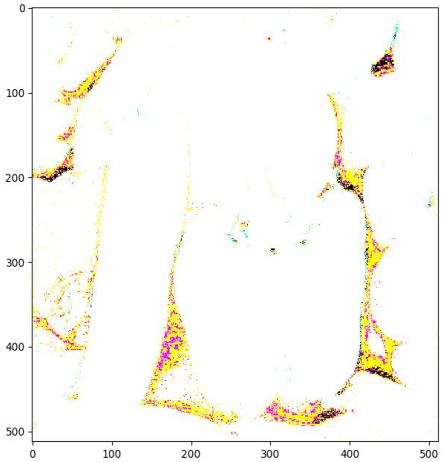


mandril color.tif

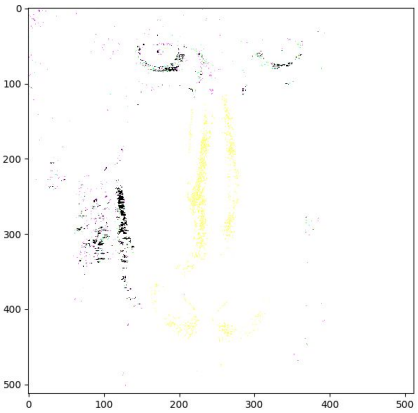
Histogram equalized HSI



color_bars.tif

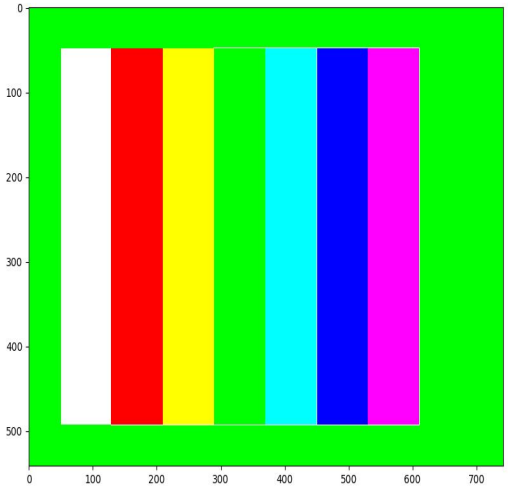


peppers_color.tif



mandril color.tif

4. H no change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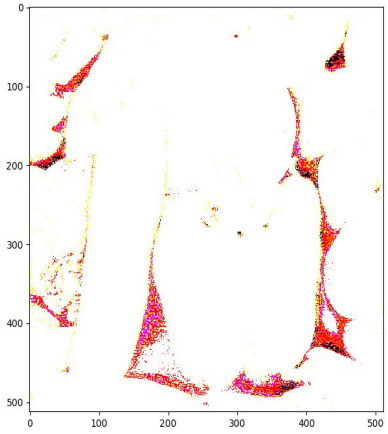
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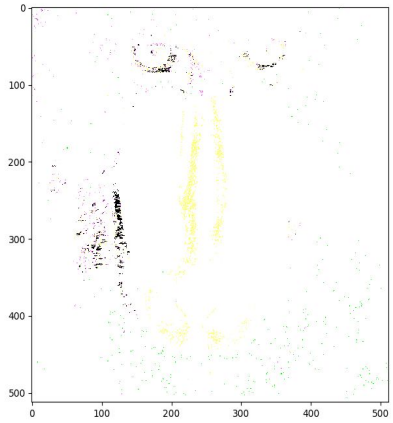
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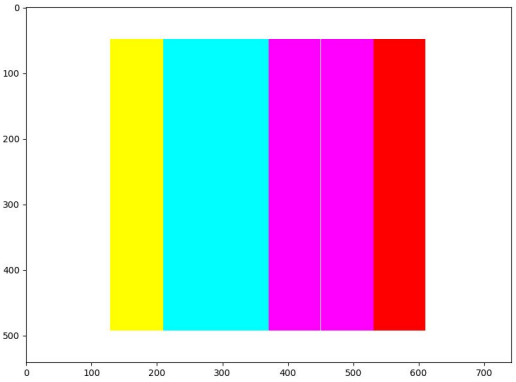
500

S no change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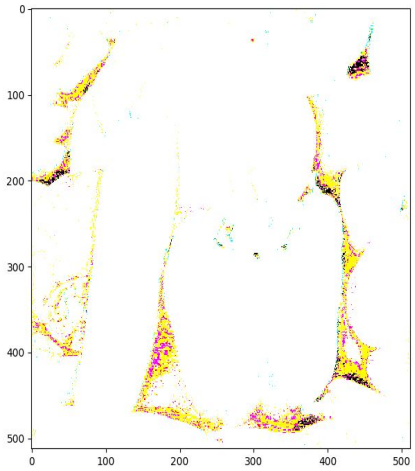
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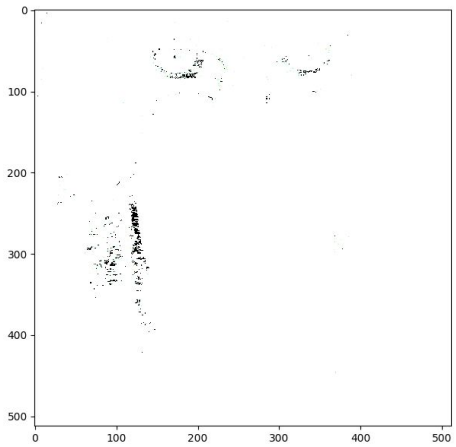
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H and S no change: