CSC566

LAB 8

Name: Amir Hafizi Bin Musa
Student ID: 2024745815
Group: A4CDCS2306A

Colour Image Processing Using MATLAB

Part 0: Starter Code and Image Setup

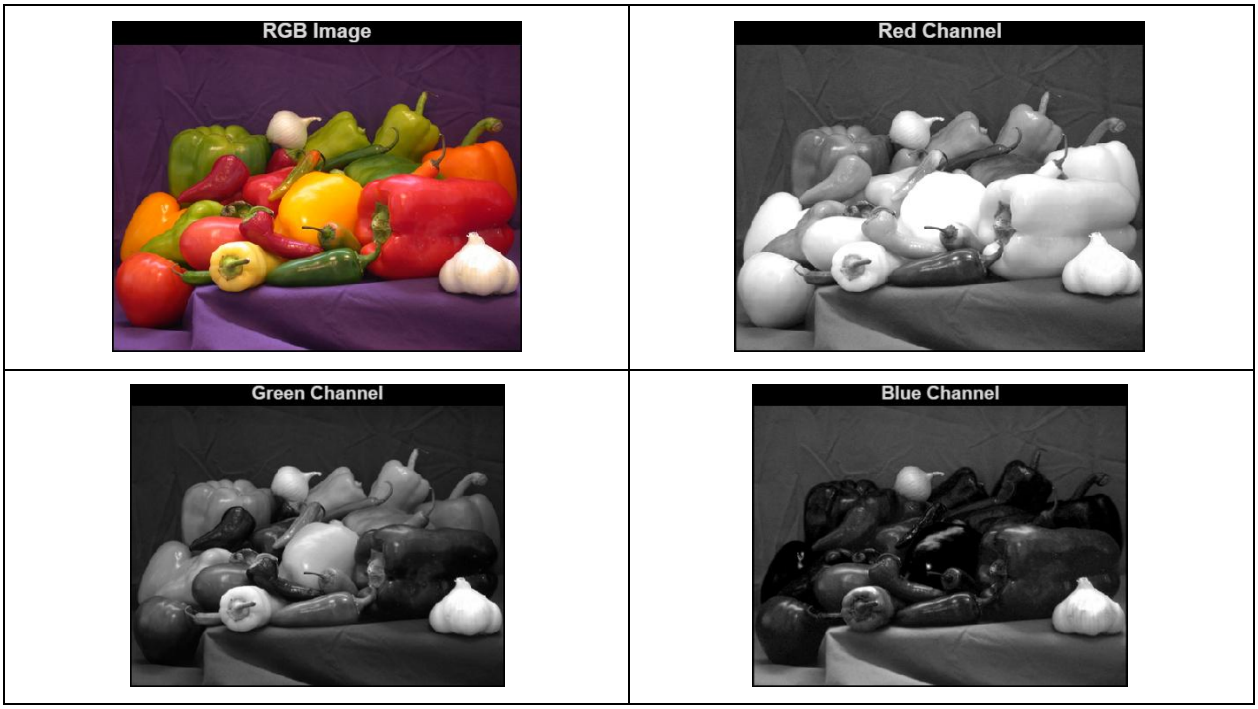
Using the (peppers.jpg) image.

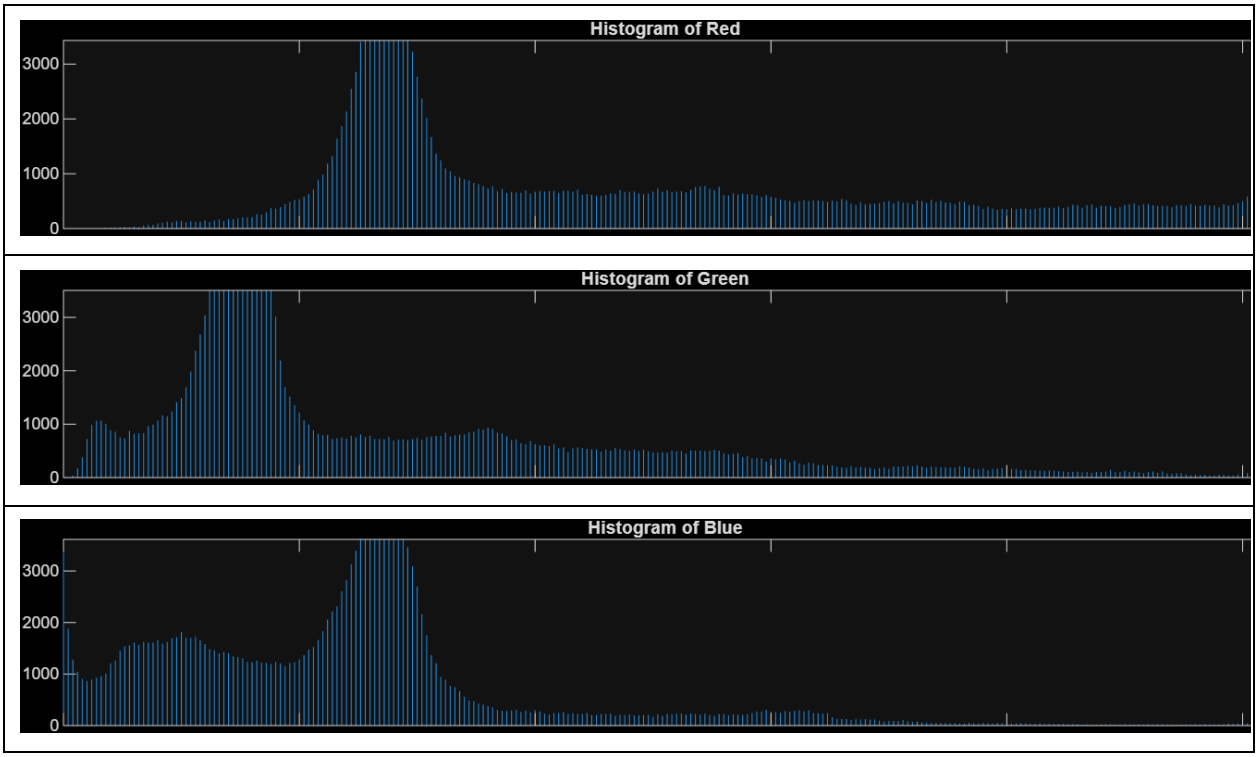
Image Result of Task 0:

Original RGB image result of peppers.jpg

Part 1: RGB Channel Analysis

Image Result of Part 1:





Question:

1. Which RGB channel best highlights the object of interest?

Red Channel: Since the peppers have high red content, it appear very bright (almost white) in the Red channel grayscale image. This creates a strong contrast against the background and allows us to clearly see the shape, texture, and shading of the main subjects. **Green Channel:** The red peppers appear dark because they lack green pigment, causing them to recede into the shadows. **Blue Channel:** Most natural vegetation (like peppers) contains very little blue. As a result, the peppers appear nearly black in the Blue channel, obscuring their details.

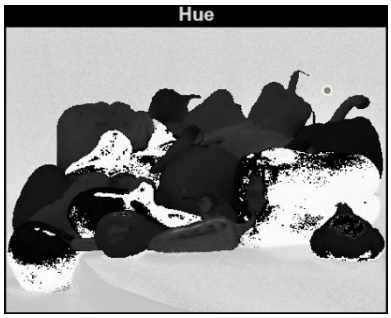
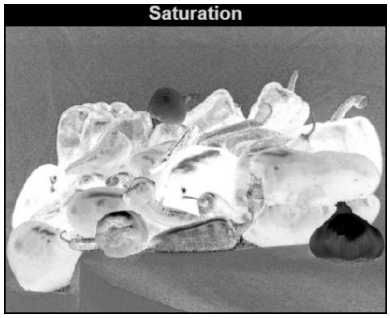
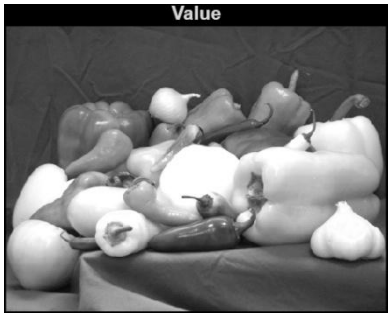
In conclusion, The **Red Channel** is generally considered the one that best highlights the objects of interest the peppers in this specific image.

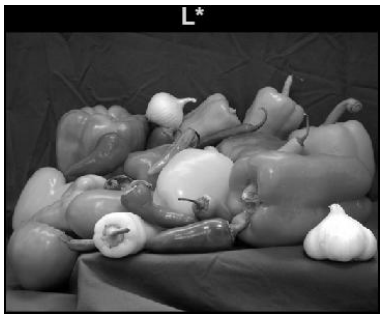
2. What does a wide histogram indicate about image contrast?

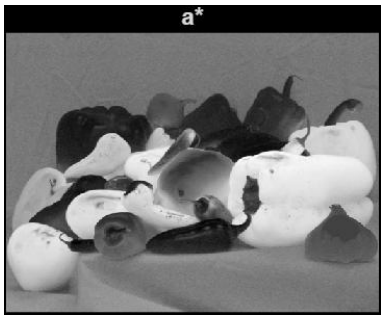
A wide histogram indicates **high contrast**.

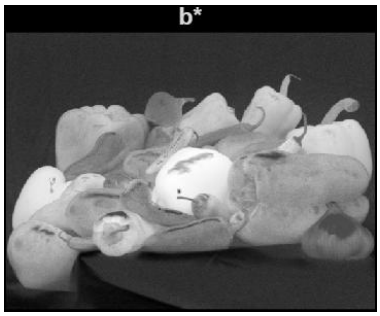
Part 2: Colour Space Conversion

Image Result of Task 2:

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
</table>







Question:

1. Why is HSV more suitable for colour segmentation than RGB?

HSV (Hue, Saturation, Value) is superior to RGB for segmentation because it **separates color information (chromaticity) from brightness (intensity).**

- **In RGB (Red-Green-Blue):** Color and intensity are mixed together. If you want to detect "red" objects, you have to account for bright reds, dark reds, and shadowed reds. A shadow falling on a red pepper changes its R, G, and B values simultaneously, making it mathematically difficult to define a simple threshold for "red."

- **In HSV:**
  - **Hue (H):** Represents the pure color (e.g., red, green, blue).
  - **Saturation (S):** Represents how "vibrant" or pure the color is.
  - **Value (V):** Represents brightness.
  - **The Benefit:** To segment the peppers, you can simply look at the **Hue** channel. Since shadows mostly affect the **Value** channel, the Hue remains relatively constant even in darker areas of the image. This makes HSV robust against lighting changes and shadows, whereas RGB is very sensitive to them.

2. Which Lab channel best represents colour differences?

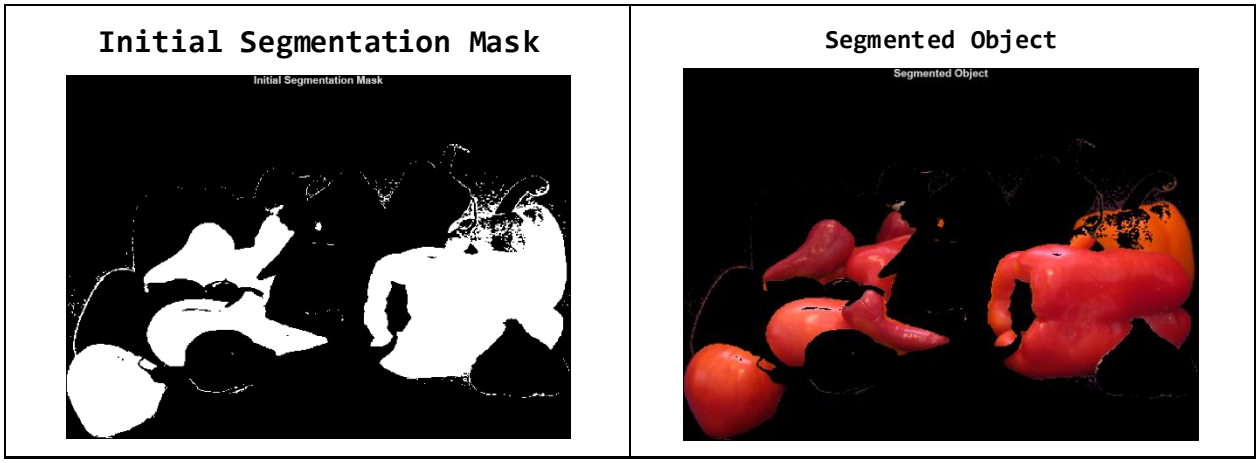
The **a* channel** (the Green-Red axis) best highlights the color differences.

This is because:

- **L*:** Only shows brightness (grayscale), containing no color info.
- **a*:** This is the most distinct channel for this specific image. In the provided a*output, you can see the red peppers appear very bright (positive values) and the green peppers appear very dark (negative values). This creates a powerful contrast that perfectly separates the two main subjects.
- **b***: While this also contains color info, the contrast between the yellow/orange peppers and the background is less sharp than the red-green split in the a* channel.

Part 3: Colour-Based Segmentation Using HSV

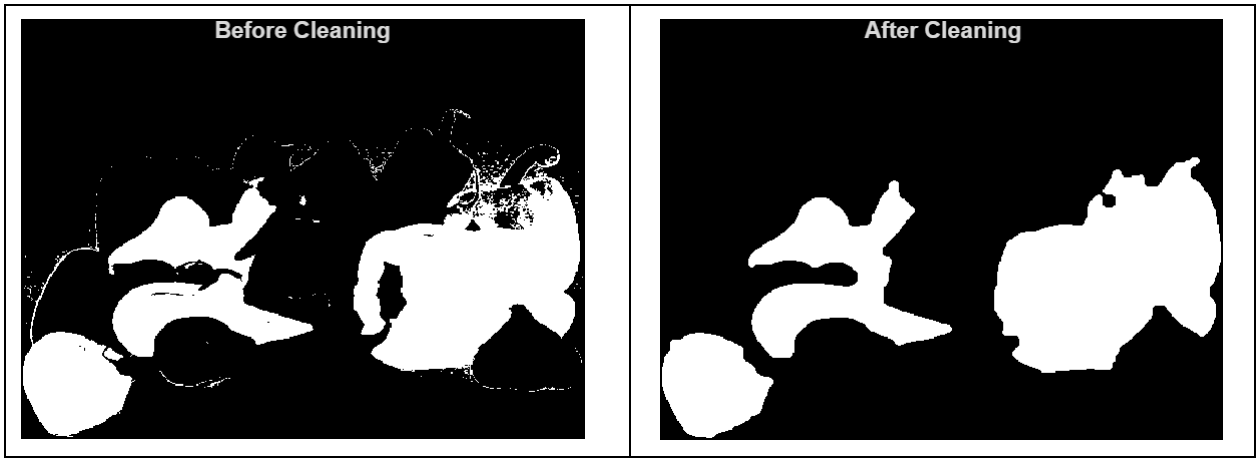
Image Result of Task 3:



The computer used HSV to define a "Red Color Rule," created a black-and-white map (mask) of where that color exists, and then used that map to cut out the red peppers from the scene.

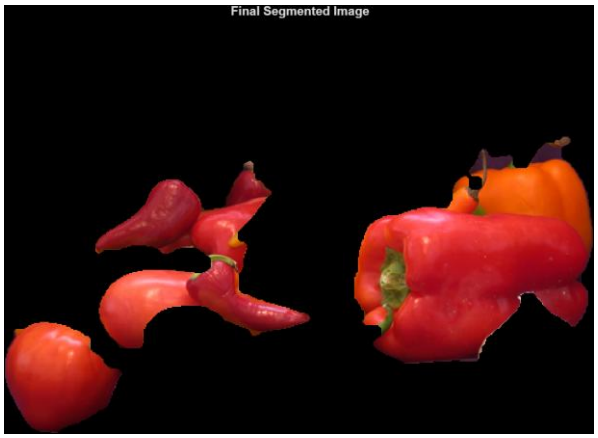
Part 4: Mask Refinement Using Morphology

Image Result of Task 4:



Before: There is also a lot of "noise" small, random white specks in the background that don't belong there and the edges of the peppers look rough or jagged.

After: The small white specks (noise) have been erased and the jagged edges of the big white shapes have been smoothed out.



This is the finished product. The computer has electronically "picked up" only the red vegetables.

Part 5: Color Image Enhancement

Image Result of Task 5:

In the "Original" image, the colors are a bit muddy, and the lighting is soft. It looks like looking through a slightly foggy window. The darks aren't very black, and the brights aren't very white.

The Result:

- **Texture:** Taking a look at the purple cloth. In the "Enhanced" version, we can clearly see the wrinkles and fabric texture.
- **Depth:** The shadows are deeper, giving the peppers a more 3D appearance.
- **Clarity:** The "fog" is gone.