Supplemental Materials

1.1 Qualitative Comparison of True Color to Grayscale Conversion Methods

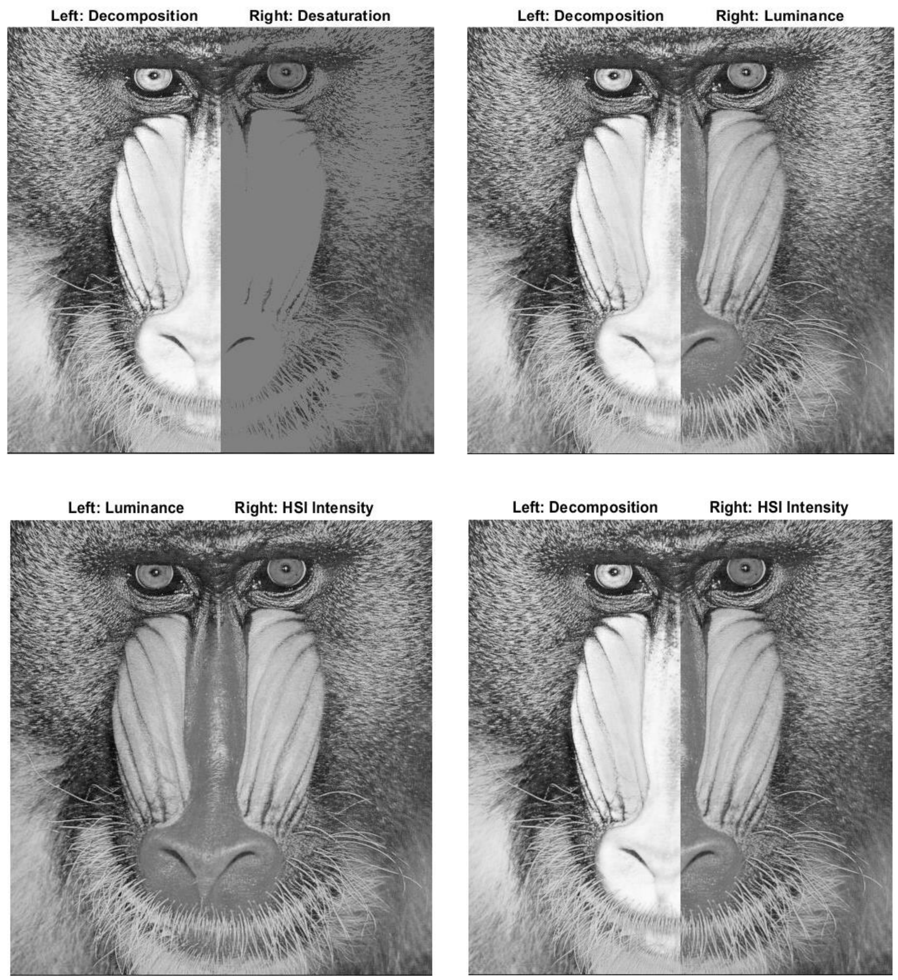

Fig 1. Comparison of grayscale conversion methods. Compared with the other three methods, desaturation led to the most loss in fine details in the image. The ridges of the baboon's nose are imperceptible as a result of desaturation (see image on top left), whereas decomposition preserves many of the details. Compared with luminance and the HSI intensity, decomposition overall has a higher intensity but preserves most if not all of the details as the other two methods. Lastly, the difference between HSI intensity and luminance is not apparent to the human eye and the two result in images that look exactly the same (see image on the bottom left).

Fig 2. Comparison of HSI intensity to luminance (Y). The top halves of these images are the HSI intensity while the bottom halves are from the luminance conversion. Although the difference is imperceptible in the wolf image, the top half of the space image has a slightly higher intensity than the bottom half. The difference, however, is not significant. From this we can conclude that the grayscale method chosen to convert true color images into grayscale images depends on the image and is subjective.

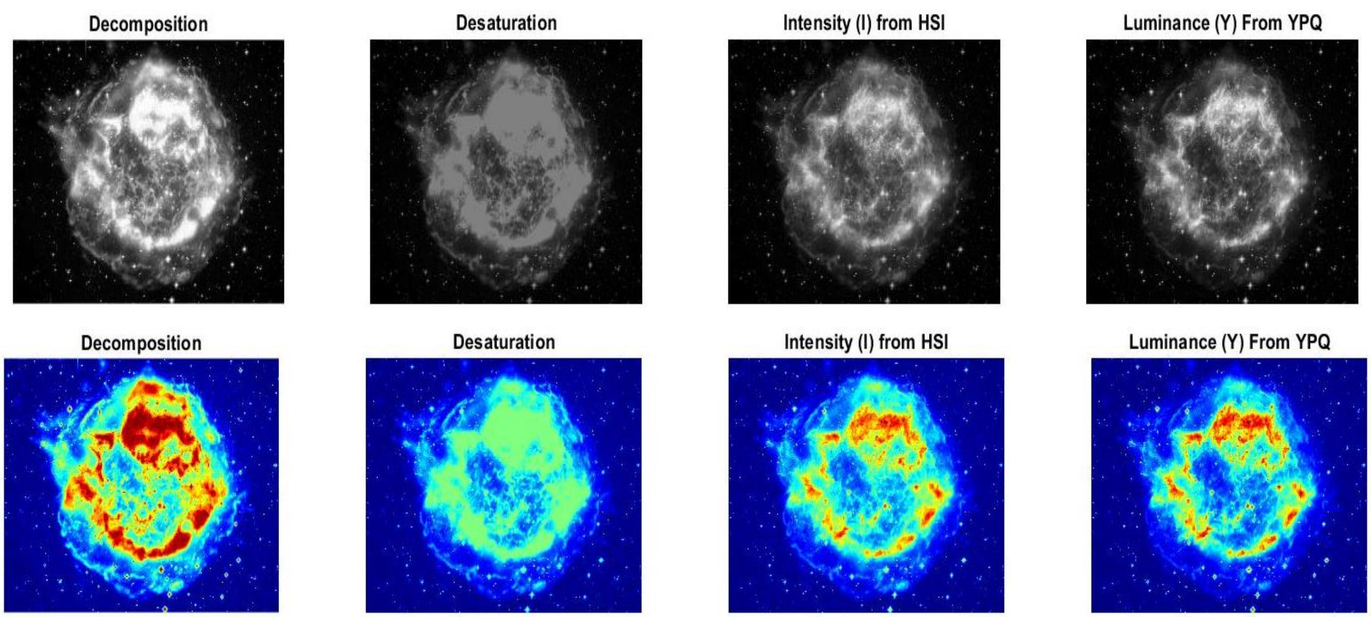

Fig 3. Comparison of pseudocolored images. Desaturation leads to a great loss of detail, while the other three are more accurate representations of the original image.

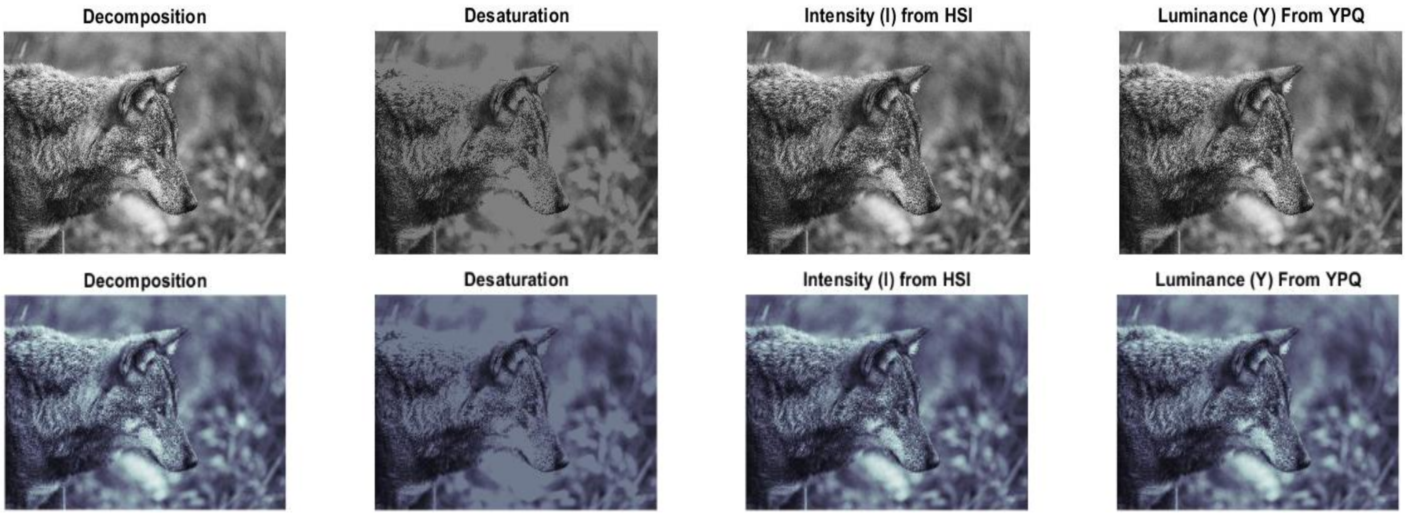

Fig 4. Comparison of pseudocolored images. Desaturation leads to a great loss of detail, while the other three are more accurate representations of the original image.

1.2 Effect of Histogram Equalization on Pseudo-Colored Images

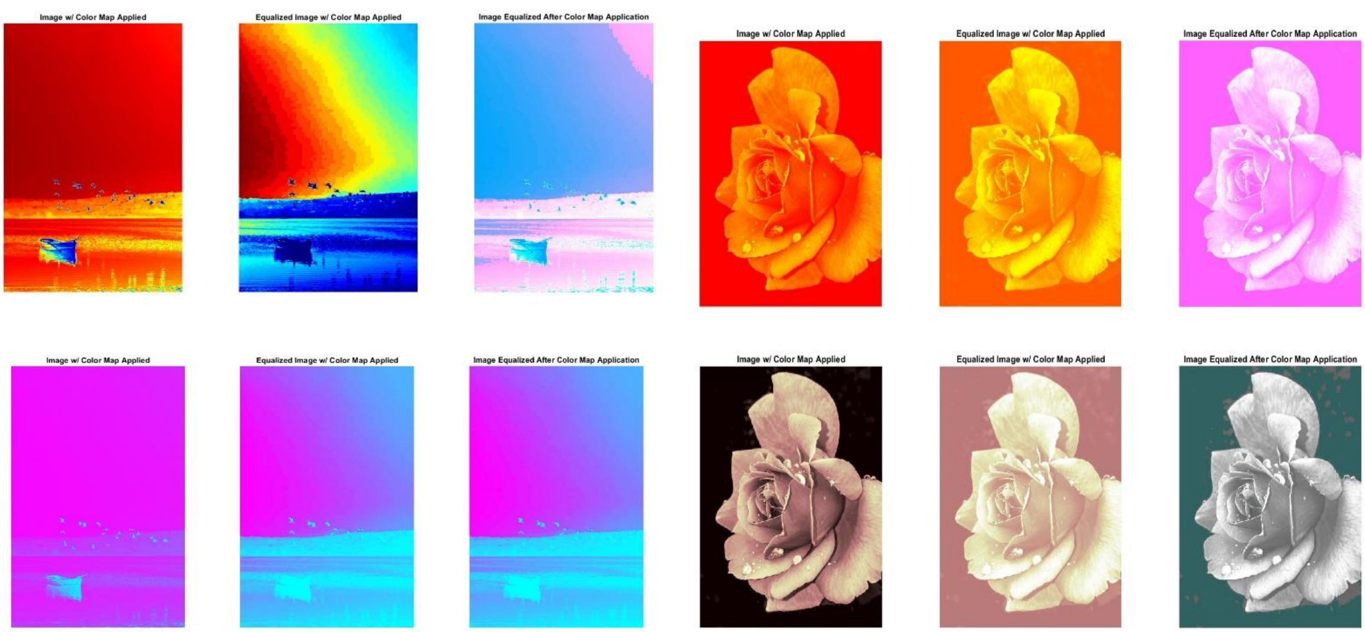

Fig 5. Effect of histogram equalization on pseudocolored images. For the boat images on the left, equalizing the image histogram before and after applying a color map resulted in the formation of very visible artifacts and pixelation. For the rose images on the top right, histogram equalization resulted in some artifacts around the top of the rose but they are not very visible. For the bottom right, the spots of missing color in the background are more apparent. In general, we concluded that histogram equalization does not enhance the pseudocolored image in a meaningful way.

3. Segmenting Images for Coloring Using K-Means Clustering, Edge Detection, and Connectivity

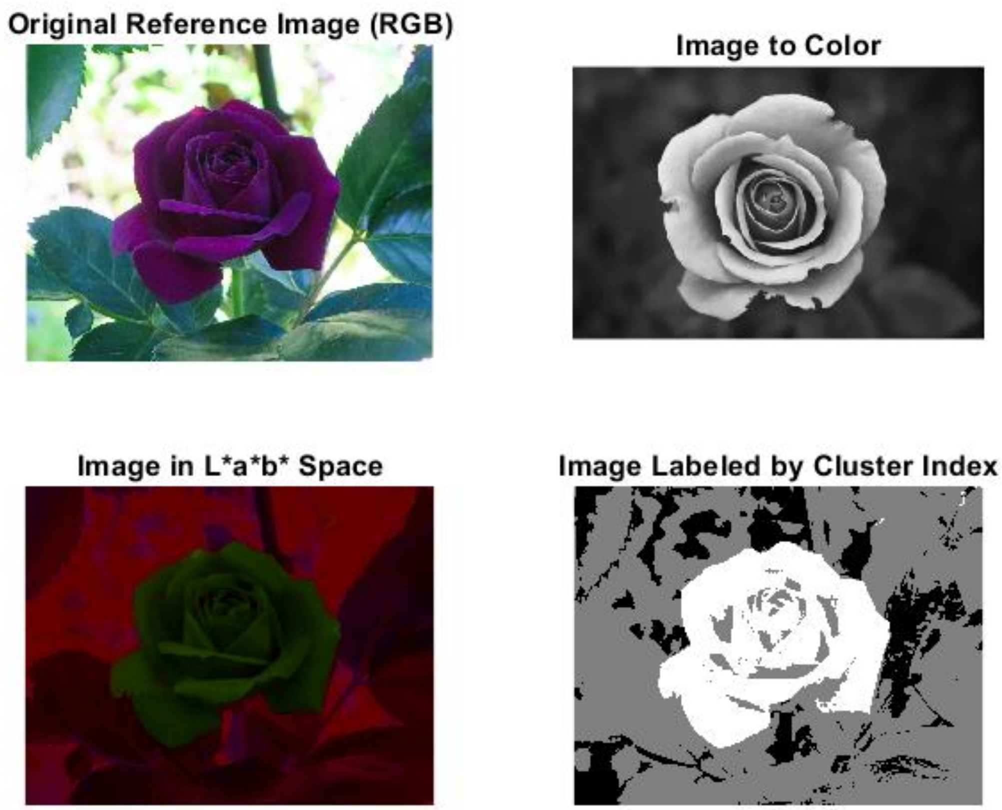

Fig 6. Images used for k-means clustering. With k = 3, we obtained three clusters for our original true color image as shown in the bottom right image. Each color (white, gray, and black) in the image represents a separate cluster.

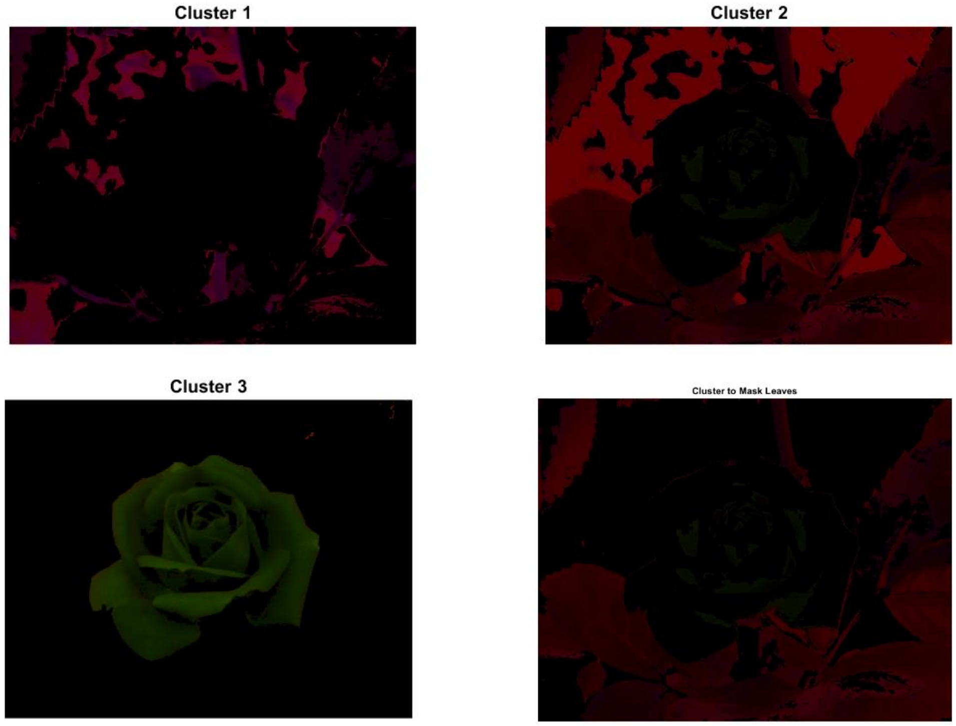

Fig 7. Clusters. To separate the background image from the leaves, we combined clusters 1 and 2 and filtered out the bright red pixels to obtain the cluster shown in the bottom right. This cluster was then used to create a color map for the background.

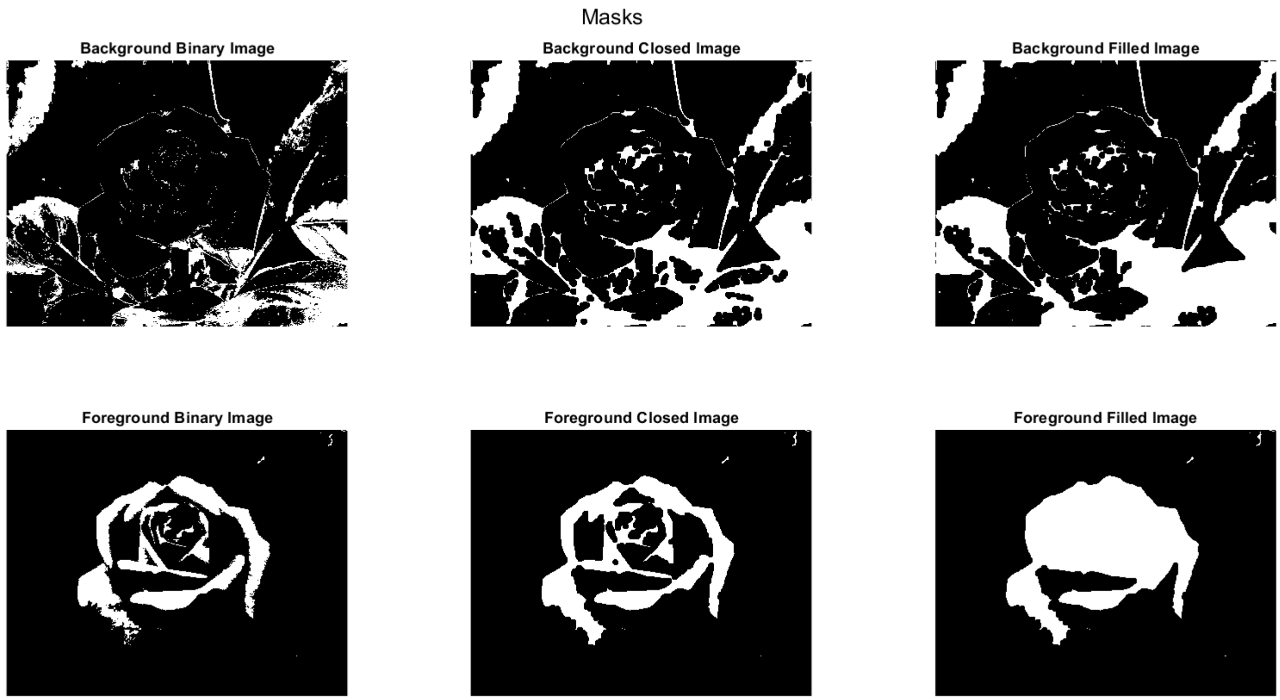

Fig 8. Masks for the background and foreground. We created masks for the foreground and background through thresholding the clusters into binary images. As the clusters were not exact and had some pixels from regions we did not wish to include, we formed binary images and applied erosion. This ensured that our color maps were generated solely based on the region of interest.

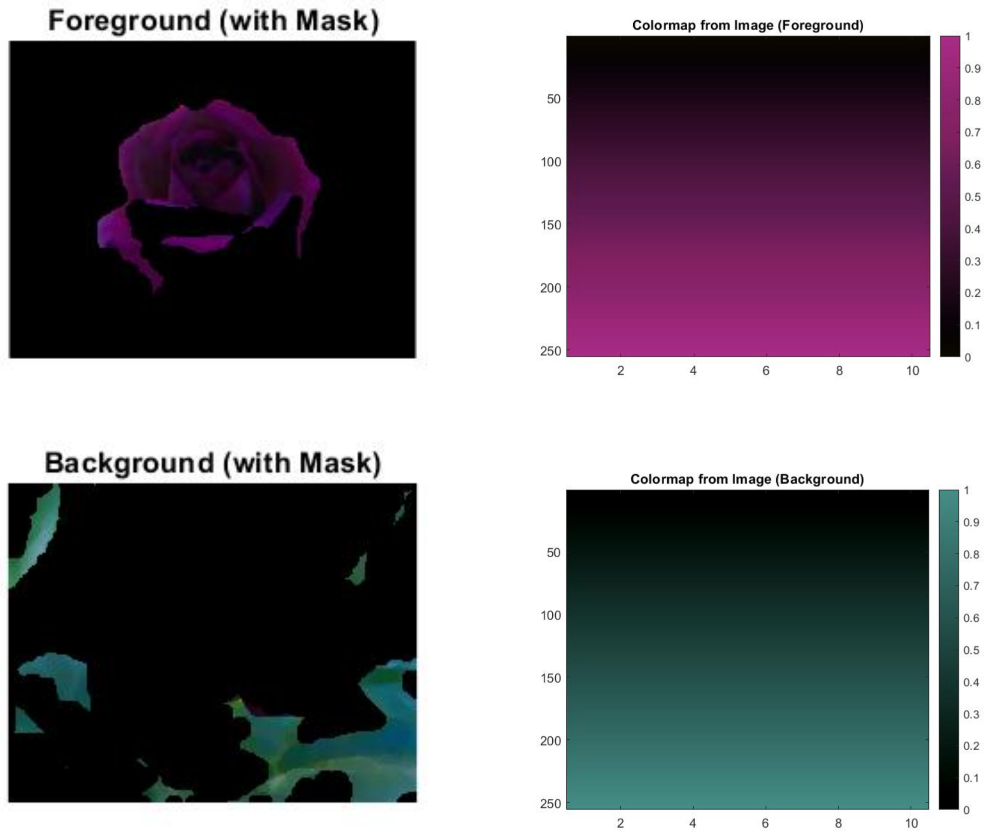

Fig 8. Color maps generated from foreground and background after the application of the binary masks and erosion.

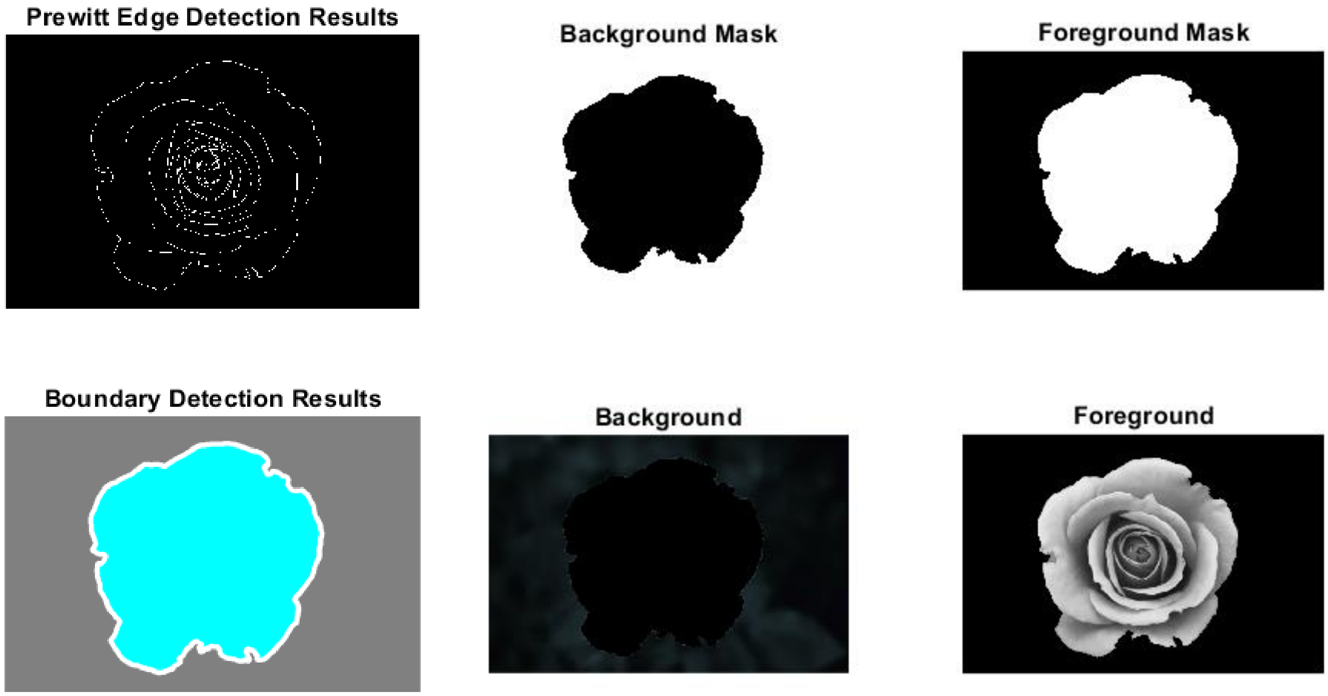

Fig 9. We used edge detection to detect the rose in the grayscale image we wanted to color. Since the rose was a solid object with a drastically different intensity than the background, we decided that edge detection would be the most straightforward way to segment the image.

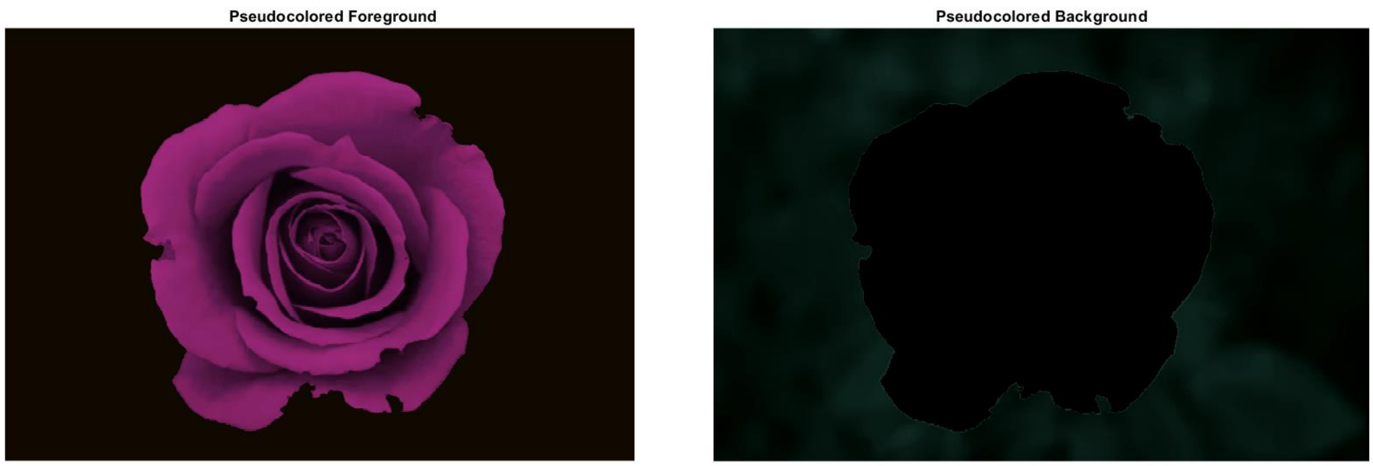

Fig 10. Pseudocolored foreground and background. These images were combined to obtain the final pseudocolored image.

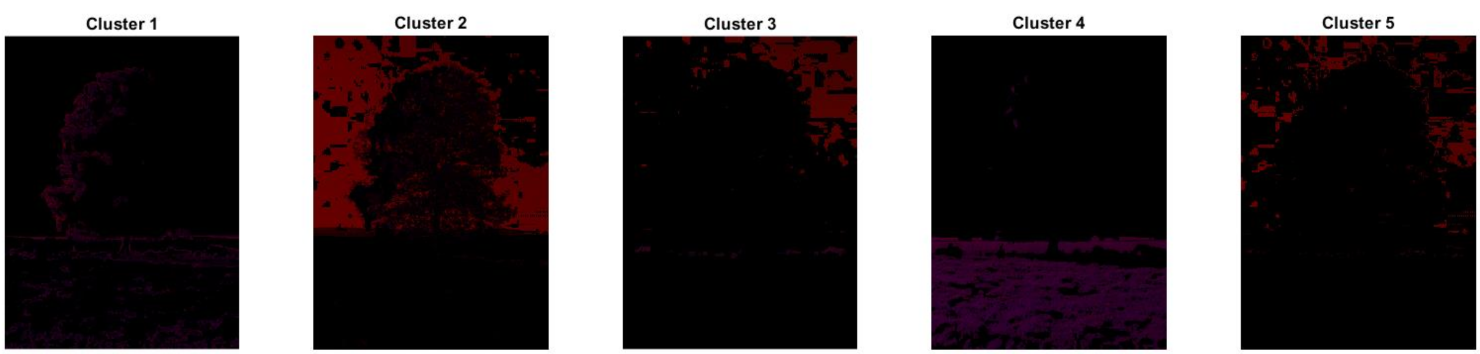

Fig 10. Clusters formed from the true color tree image.

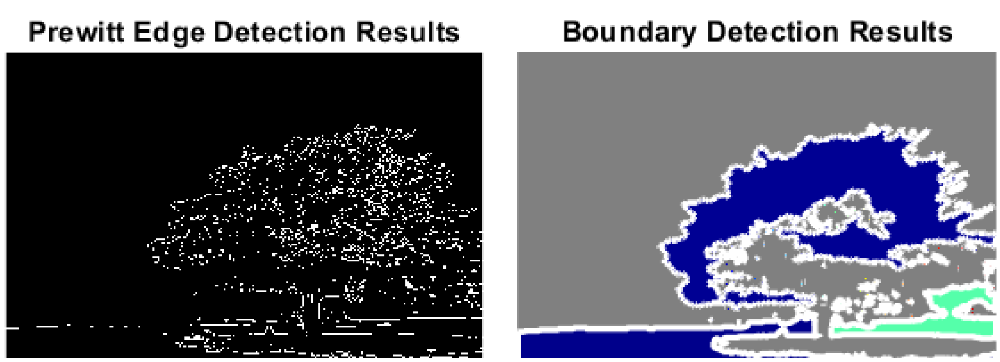

Fig 10. Boundary detection results of the grayscale tree image. The results were not accurate due to the intensity variations in the tree.

4. Improving Segmentation Results

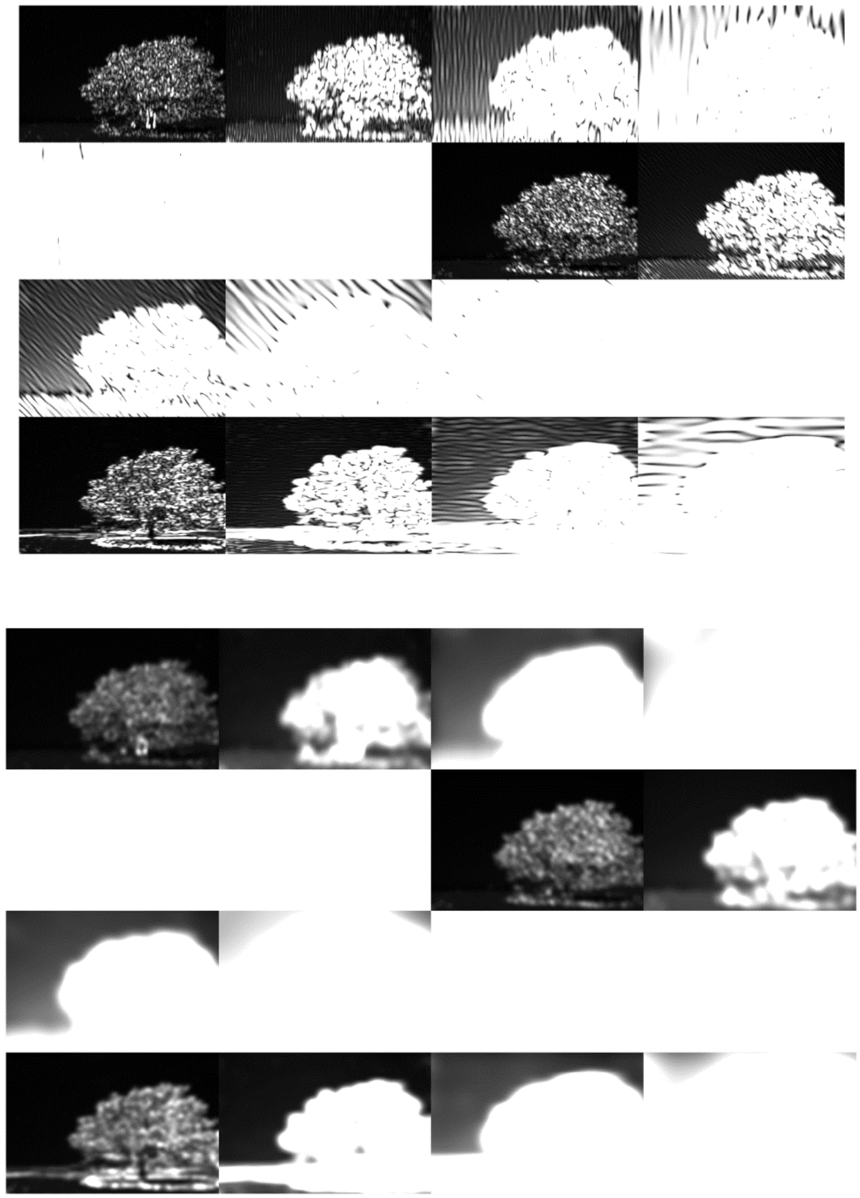

Fig 11. Gabor filters (original and smoothed). We created Gabor filters in multiple orientations to accurately obtain the texture information from the image.

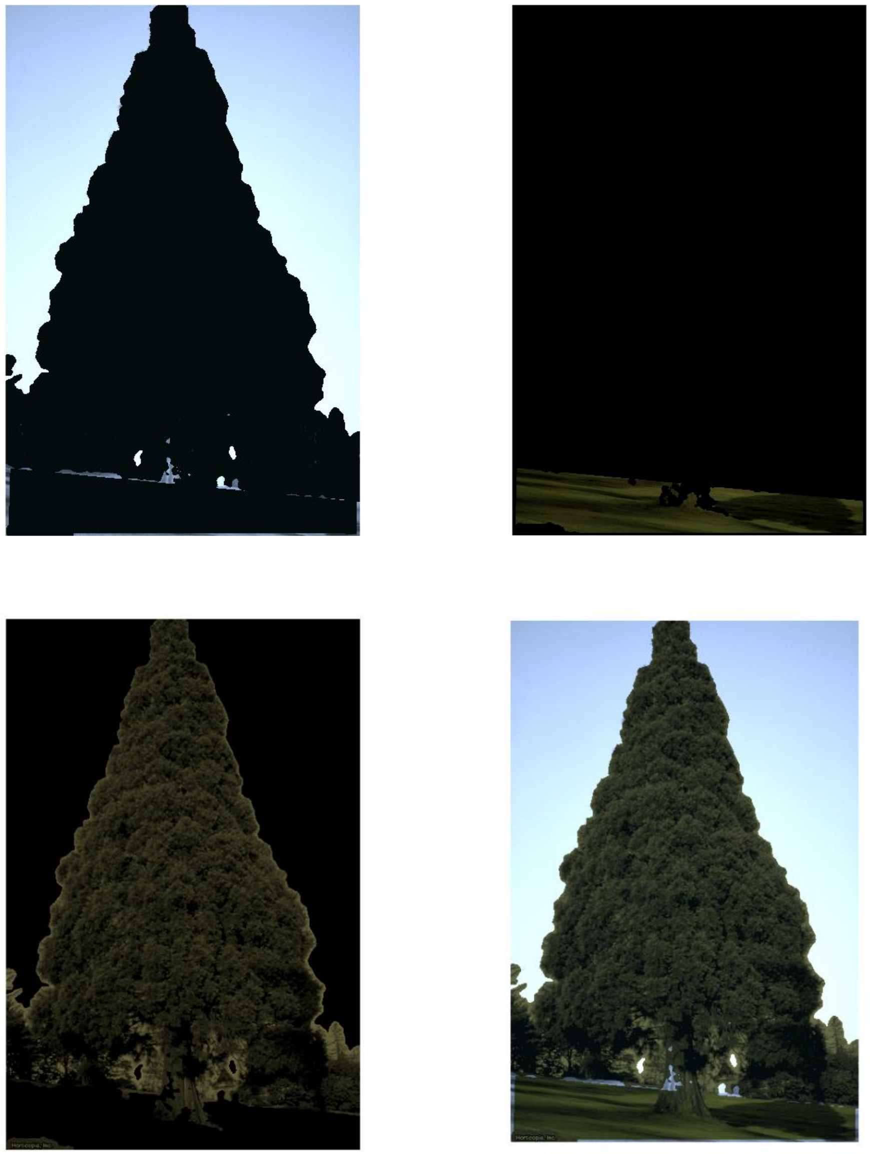

Fig 12. Pseudocolored image. Using the color maps generated from the true color tree image and the k-means segmentation based on a feature vector, we pseudocolored a grayscale image of a tree.