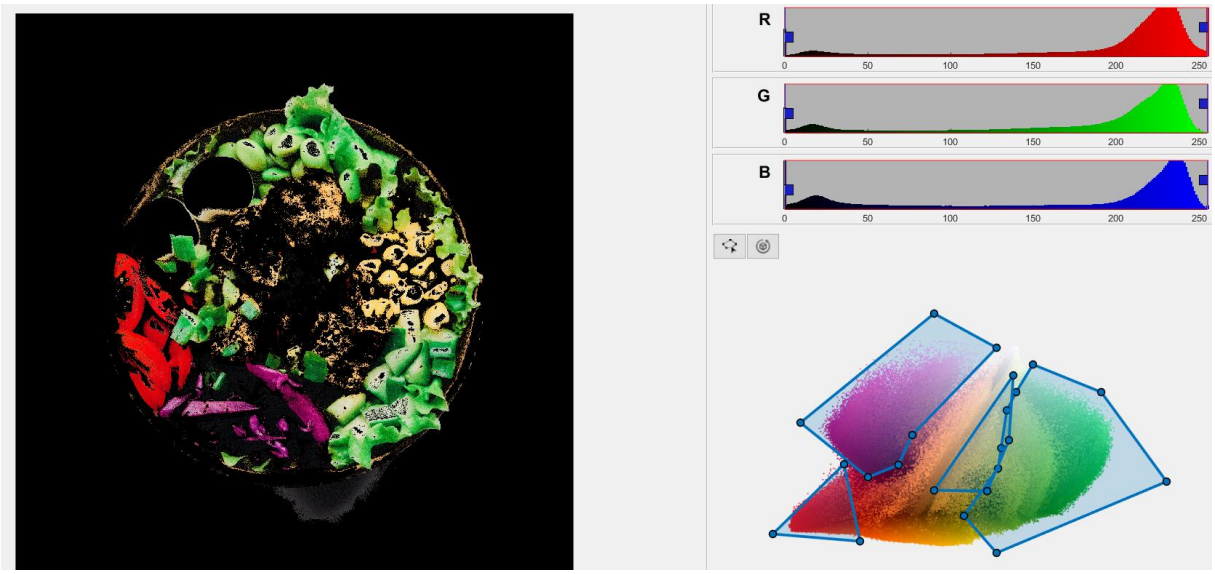
Test Results Food Classification project

For these tests we created several functions using the image thresholder app, each of these functions focused on one color. For these tests, the colors we classified were green, light green, red, yellow, purple, and orange since these are the 6 main colors in vegetables.

After classifying the different colors, we fuse the resulting images together to create one resulting image with all the vegetables highlighted.



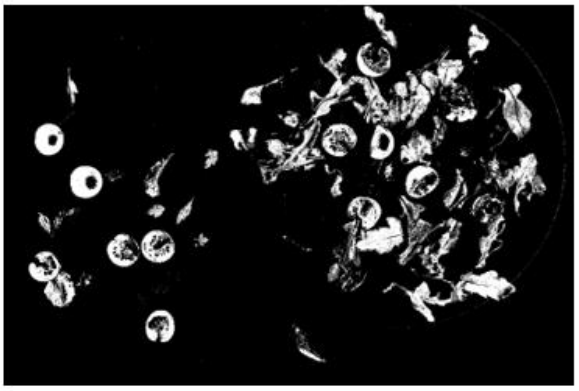
Snapshot from the Image Threshholder (note in this example the tool has been used to classify several colors)

These tests results will contain the following: The original image, followed by the initial resulting image (classified colors) followed by the result after post processing and lastly the result.

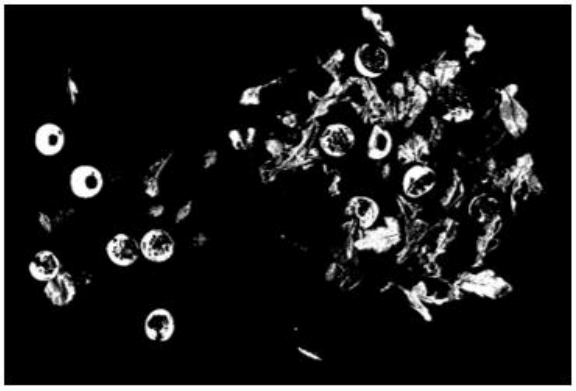
Our scripts main shortcoming as of testing is the inability to classify white/light yellow vegetables like garlic, to some extent corn. In addition to these colors the script also struggles with very dark parts of some vegetables for example darker parts of onions or bell peppers. Given more time and experience we might have been able to implement machine learning to classify these types of vegetables but as it stands the script is unable to notice these types of vegetables.

When testing we tried to pick a variety of images, the bottom three are included to specifically highlight the shortcomings and struggles of our script. The images will be structured like the image below:

The base image



Processed image

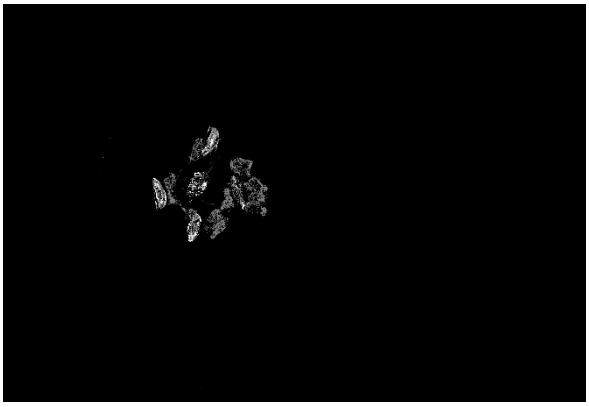


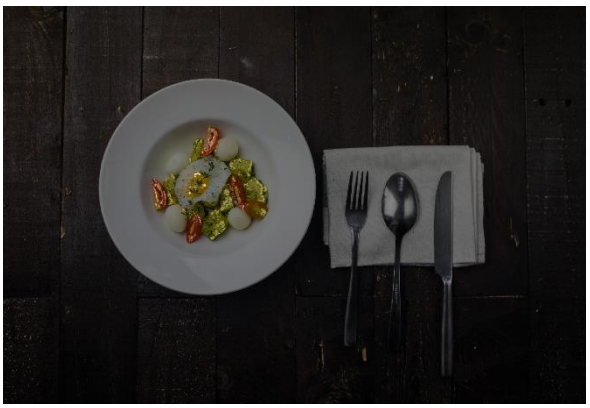
Post processed image

Combined image

Innhold

Test image 1

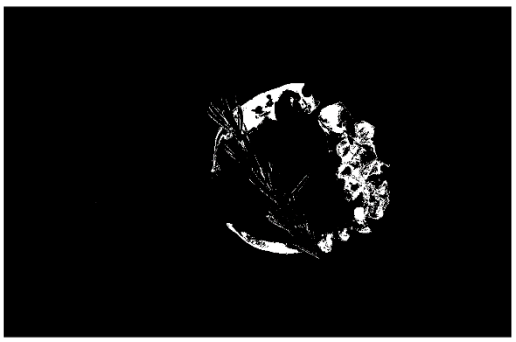
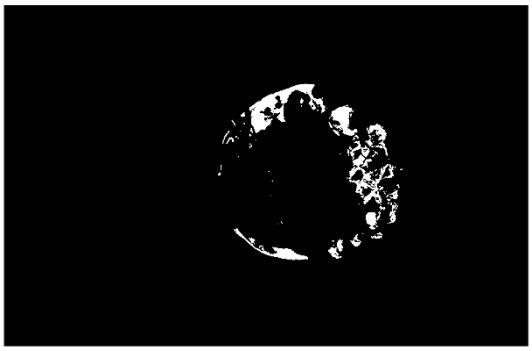
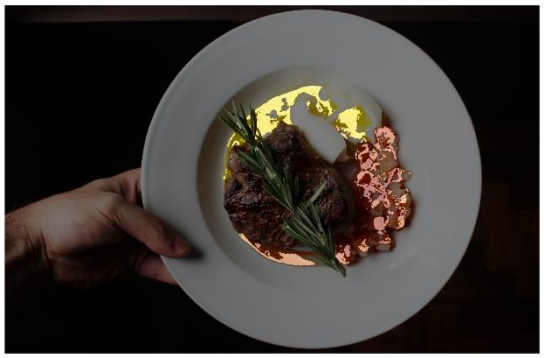




Test image 2

5

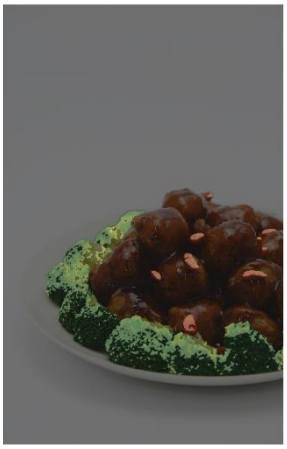
Test image 3

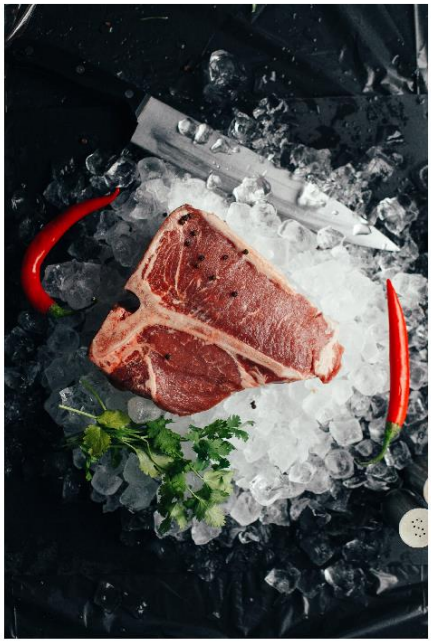
5

Test image 4

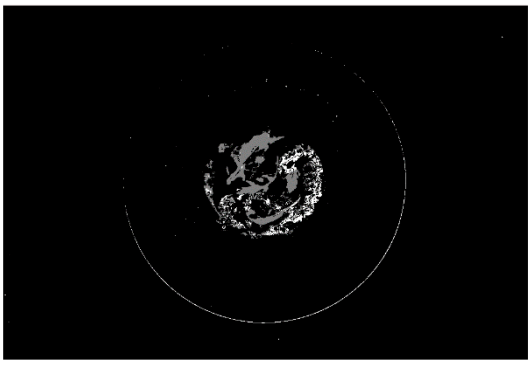
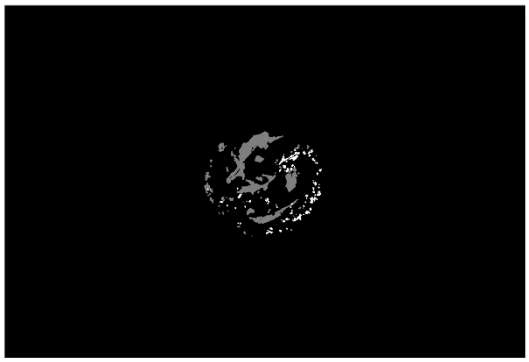


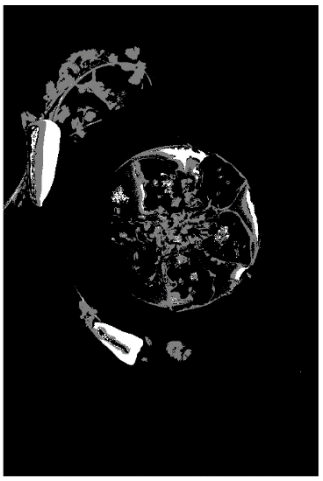
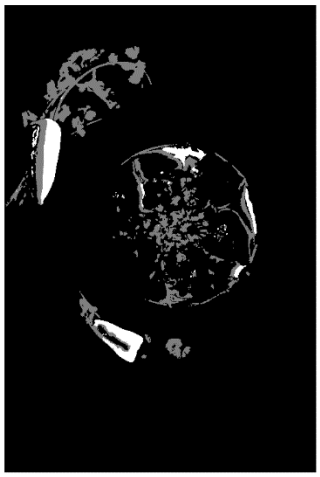
Test image 5



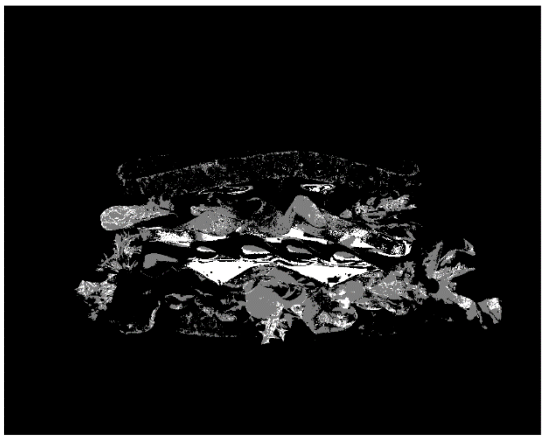
Test image 6

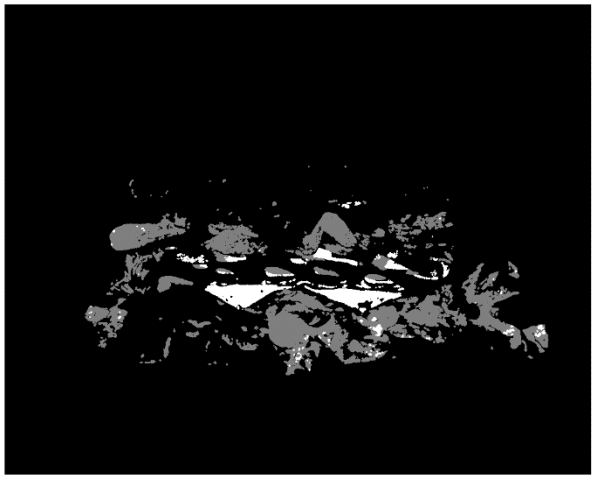





Test image 7

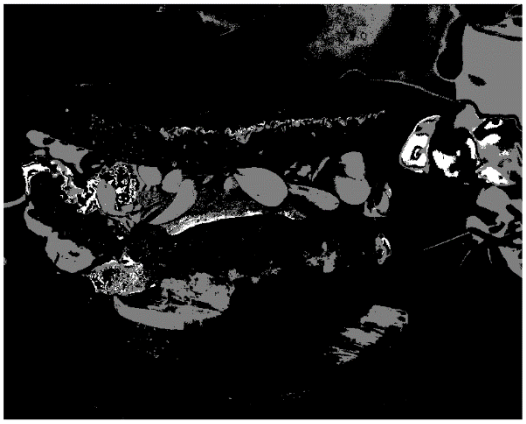




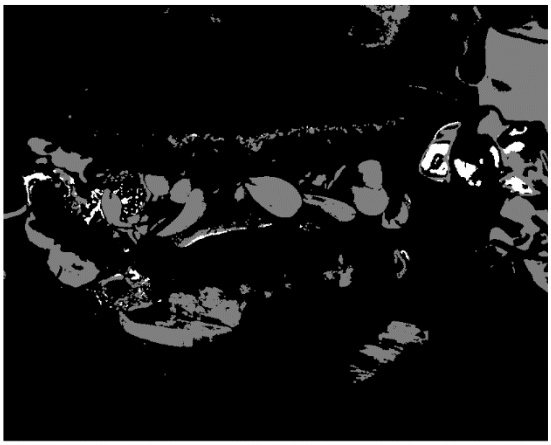

Test image 8





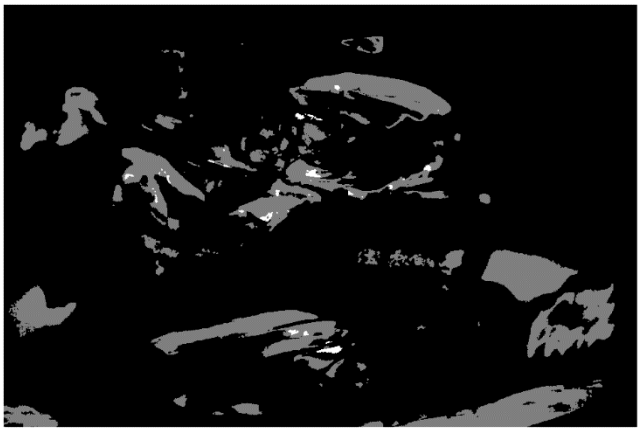
Test image 9





Test image 10

F



Conclusion Easy image section

For the easy images, we tried to pick out images which had little to no reflection and had simple structure. The images we tested showed that our scripts struggle with darker colors. Vegetables like spinach, broccoli and other dark vegetables were ignored by our scripts. This was an expected outcome given that we focused on the greener vegetables like lettuce when creating our green binary mask.

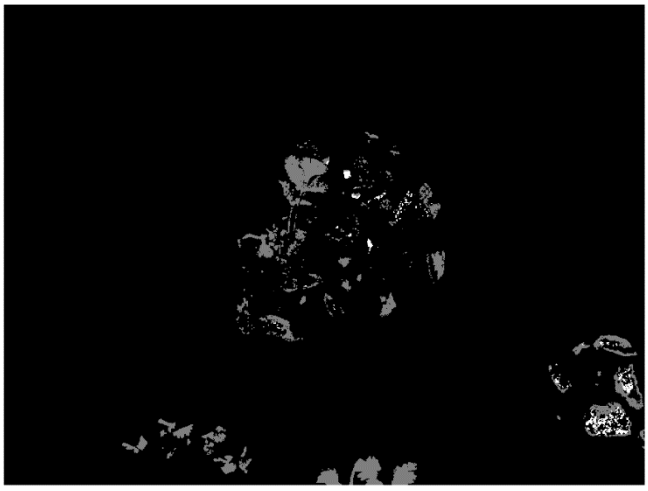
Given that the image we use has a large resolution, a lot of colorful vegetables and minimal reflection. Our script gives a very satisfying result (see testing image 10 and 9).

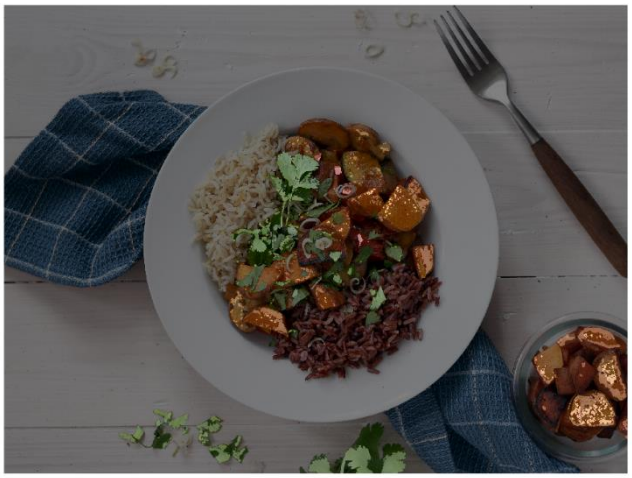
Another problem we encountered when testing these images was classification of the color yellow: We created our yellow binary mask with corn and yellow bell peppers in mind, resulting in a binary mask which has a hard time differentiating between egg yolk, yellow gravy and the vegetables we based the mask on.

In terms of post processing we used a size value between four and eight, depending on the image and the classification result. We found it hard to pick out one size value which resulted in desirable post processing results for every image we tested however, five is the value we ended up choosing since it removes most of the noise in the image while still leaving the main parts of the mask.

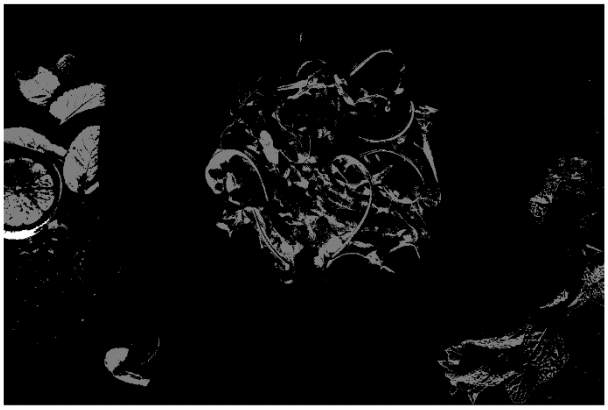
Lastly our script is largely dependent on images with a high resolution: Since our script consists of functions which compare RGB values of pixels to create binary masks, the accuracy of our script is heavily correlated with the number of pixels in the image. Because of this, using images where the picture is taken far away from the food results in a poor classification result since there are fewer pixels in the food section of the image.

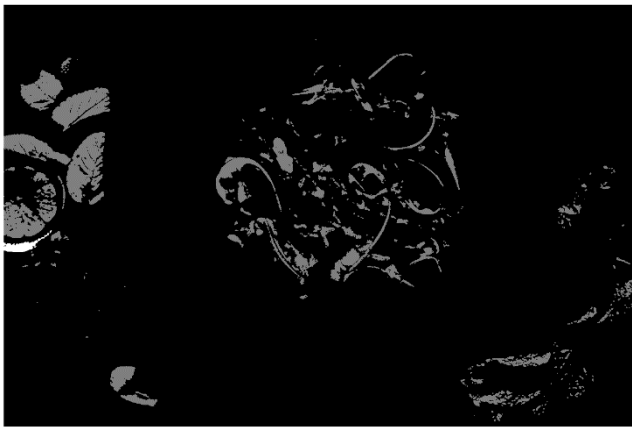
Test image 11



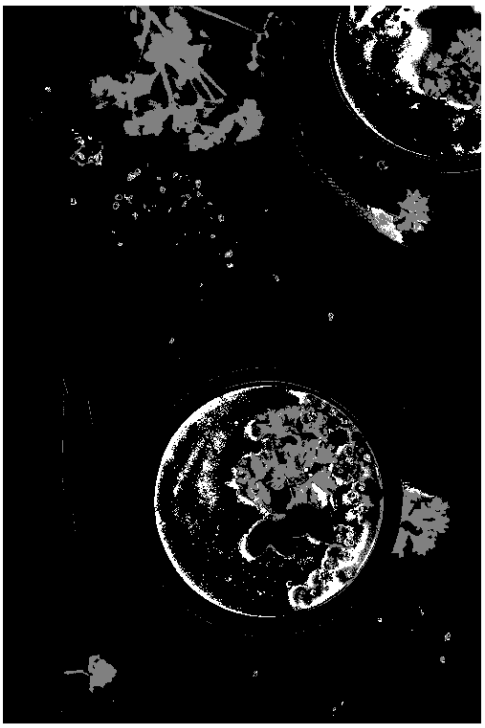


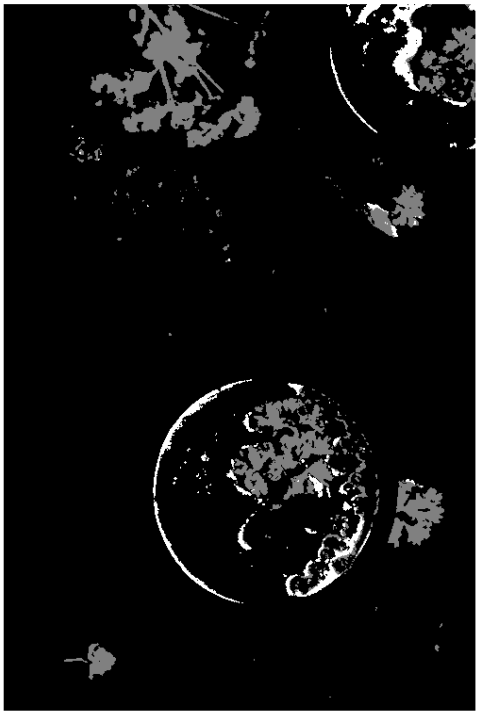
Test image 12

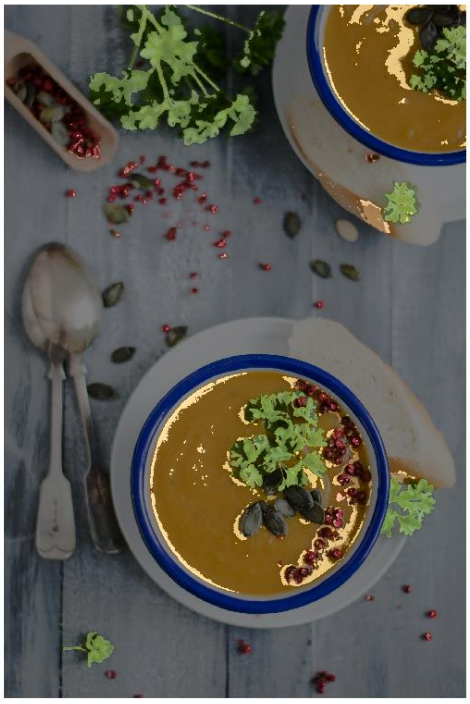




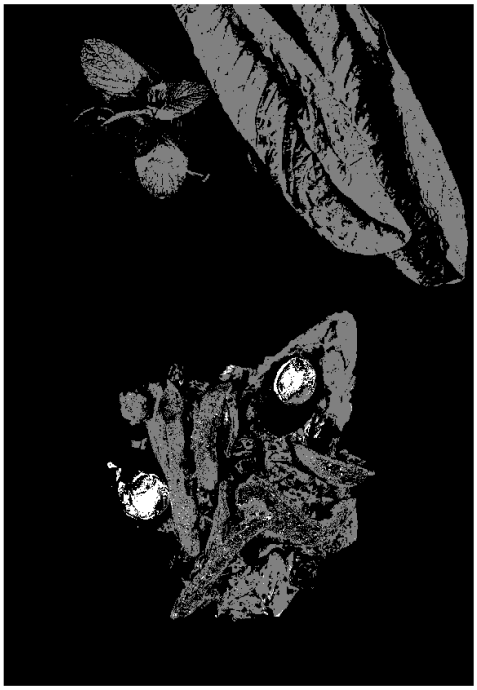
Test image 13



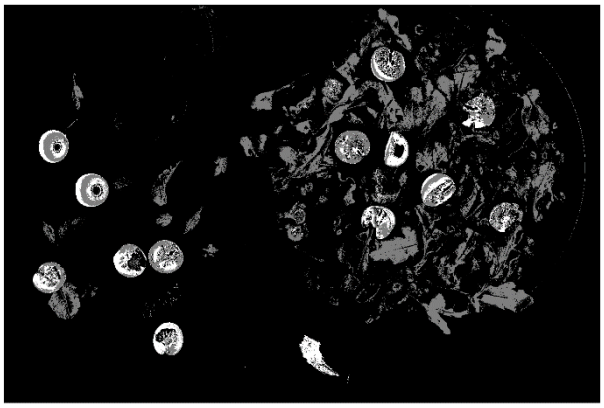
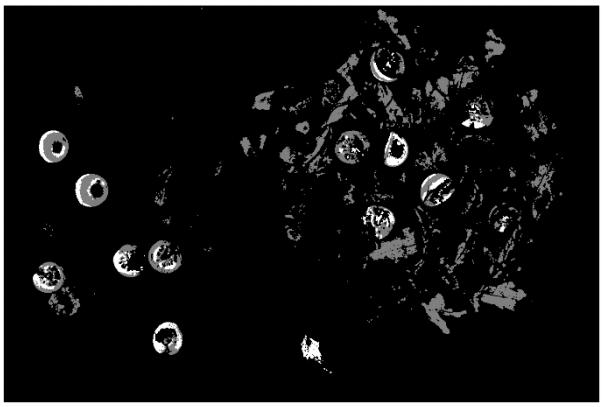




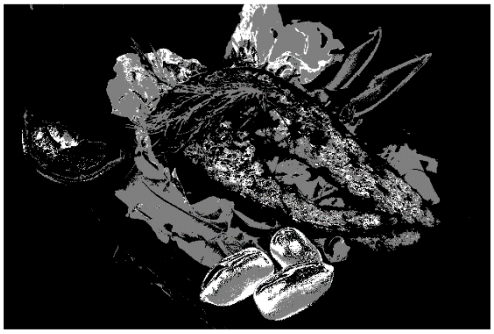
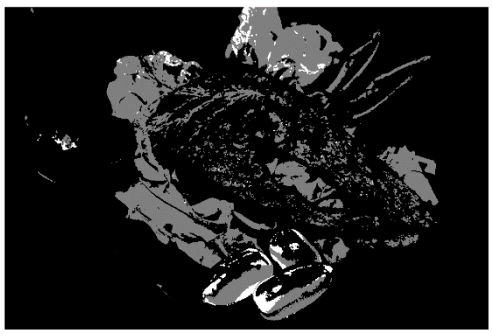
Test image 14



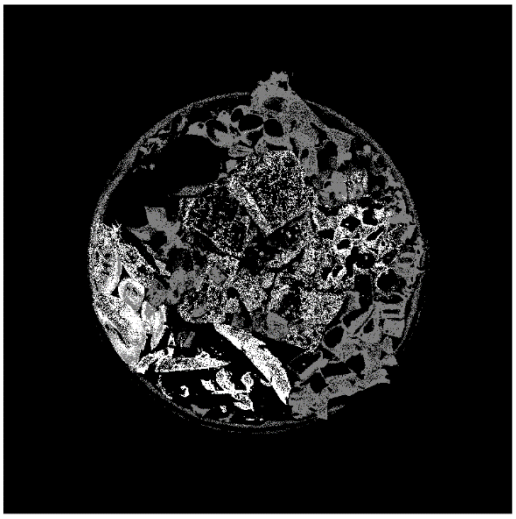
Test image 15

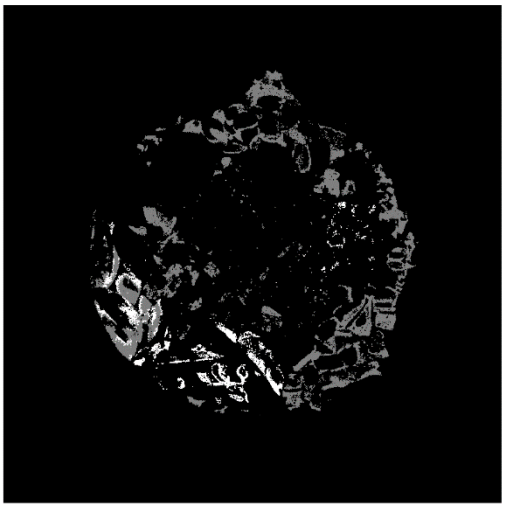





Test image 16

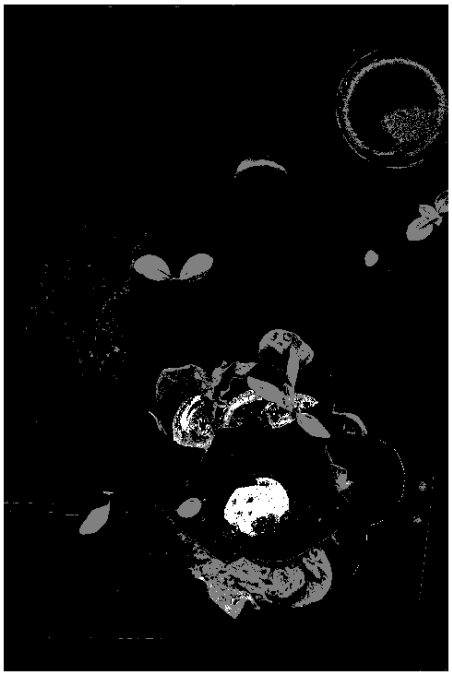




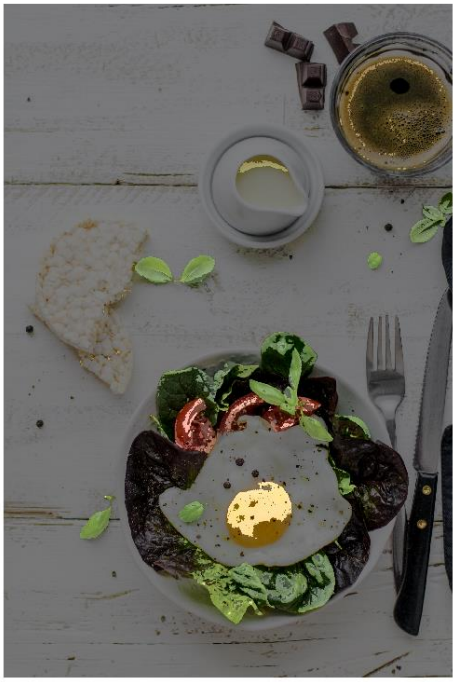

Test image 17



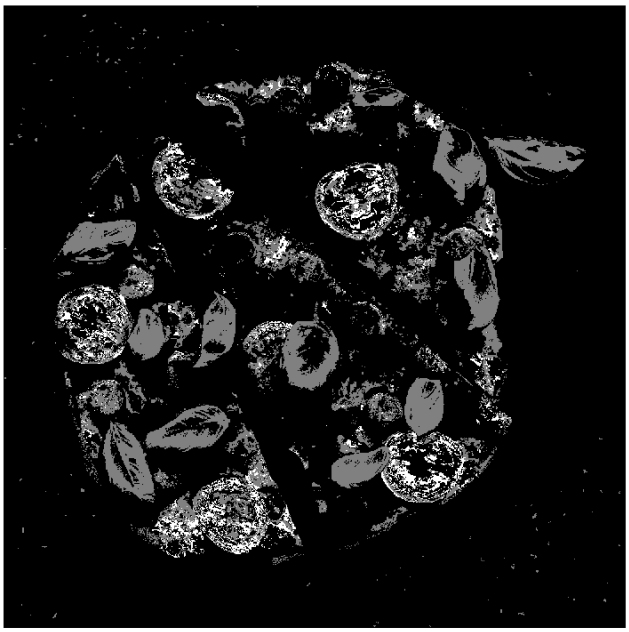


Test image 18





Test image 19



Test image 20

Conclusion normal images

For the normal category of images we tried to find images with more complex structure, plates of food where there were less clear sections (see image 19). We also tried to find some images with a lot of different colored vegetables and some reflection.

The main problem our script encountered when trying to classify these more complex images was post processing accurately: Unlike most of the easy images these pictures were more cluttered making it hard for our morphology function to differentiate between the lone pixels we wanted and the ones we didn't want: Image 19 is a picture of a pizza, it contains some tomatoes and some lettuce, the initial result of our script found all the vegetables in addition to some orange/yellow dough, after post processing however the tomatoes are gone.

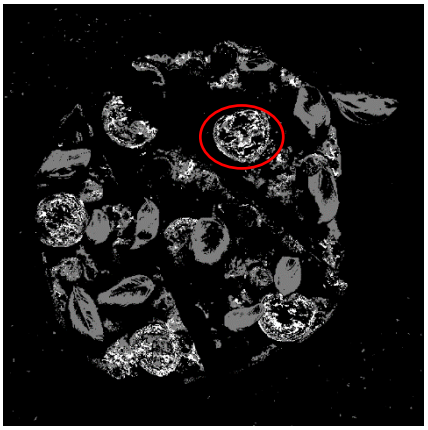


Image 19 before post processing

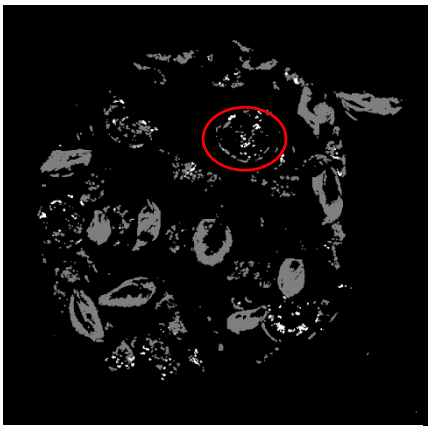


Image 19 after post processing

Testing images with the colors yellow and orange yielded results like the ones in the easy images section, since orange is a very popular color among meat, bread and other types of cooked food, our script cannot differentiate between orange vegetables and orange foods making this color problematic, although in some images post processing solved this problem.

Reflection and bright colors were the scripts biggest problems throughout testing. To illustrate the problem we will be looking at image 17. This image has a lot of different colors and clear sections. Since the colors of this image are quite intense so this image should not be any problem for our script however, the result ends up being lackluster.

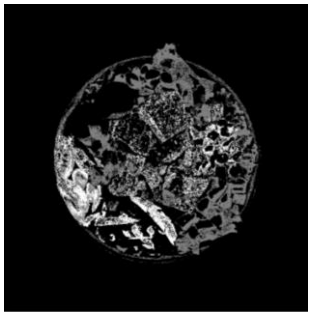


Image 17 before post processing

Image 17 result

The initial result has a lot of noise, especially around the chicken in the middle (illustrating our problem with orange colors). After post processing the orange colors are gone however, the trade of is that a lot of the lighter colors and reflecting parts gets removed, resulting in little to no classification.

One of the best results we got from the script was image 16. This image has a variety of colors, textures and some reflection. As seen in the image below the script picks up almost all the vegetables save for some of the light green avocado.

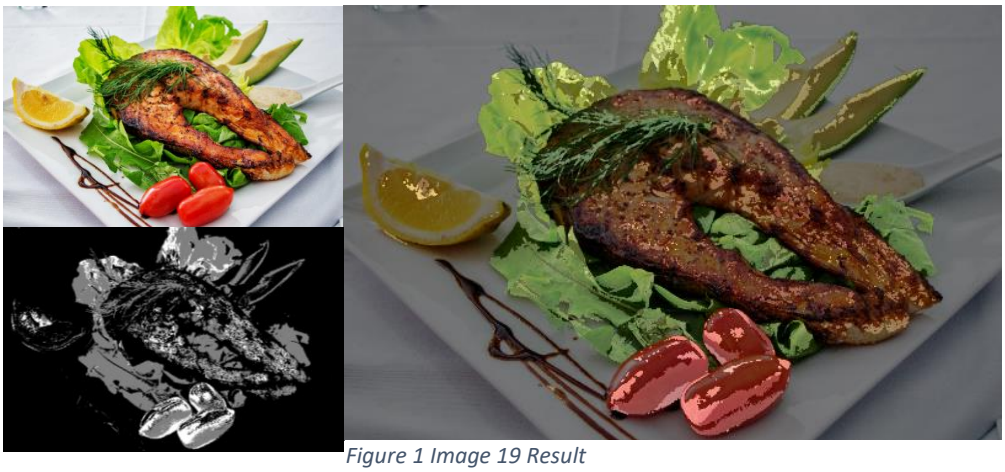
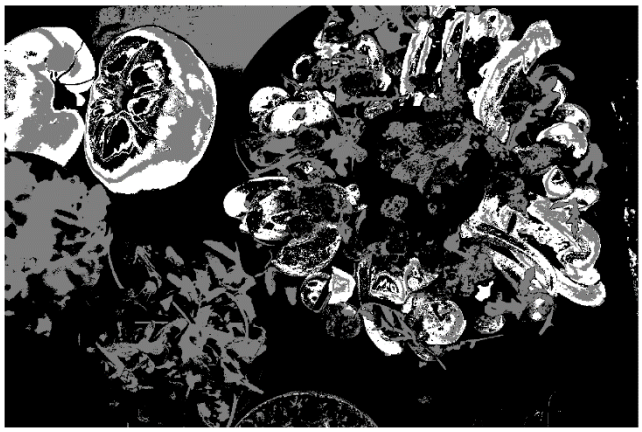
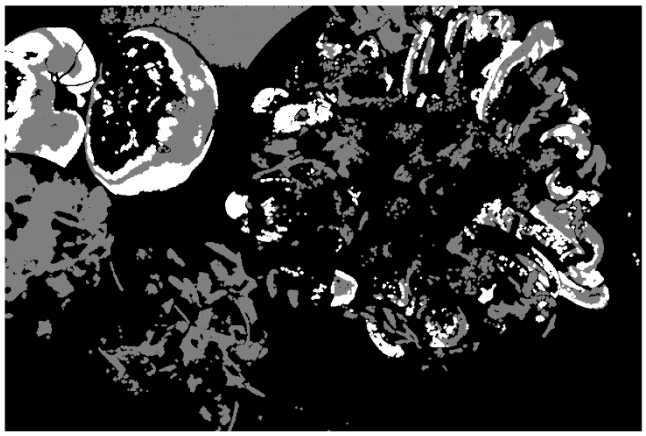


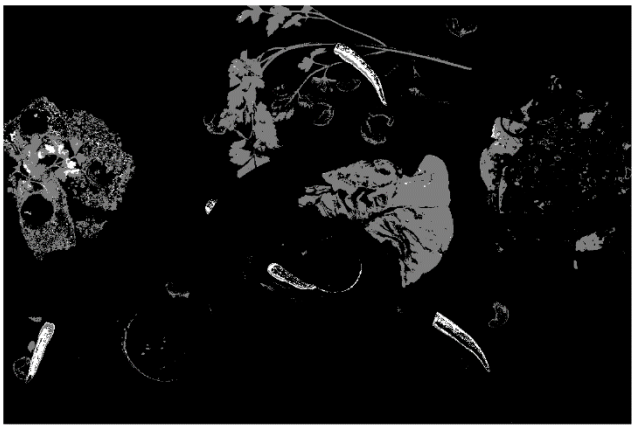
Figure 1 Image 19 Result

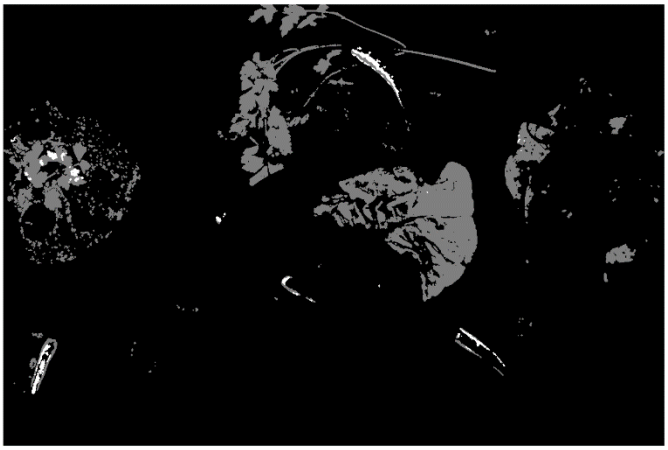
Test image 21

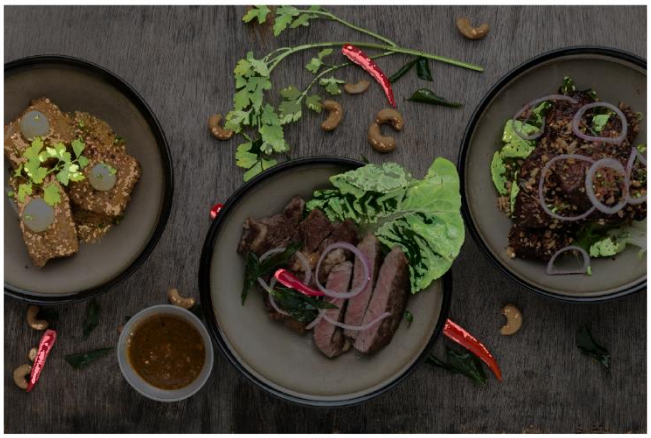




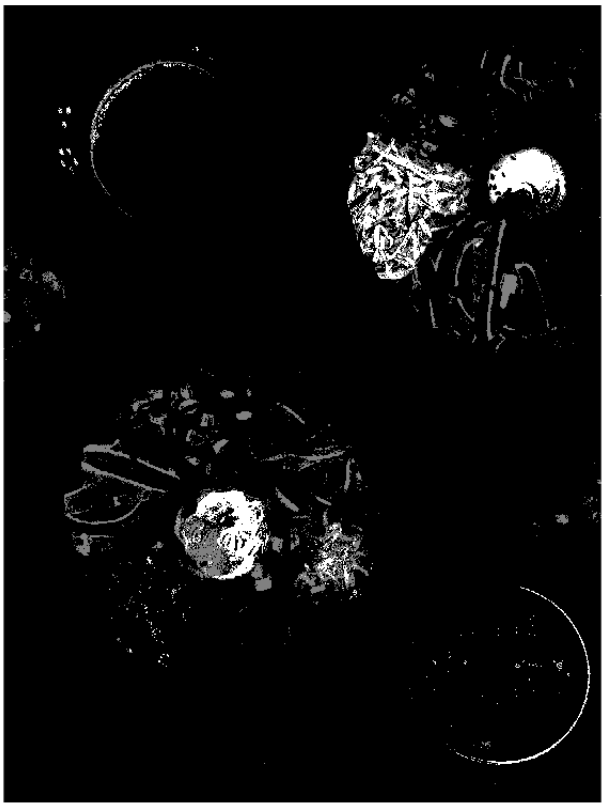
Test image 22



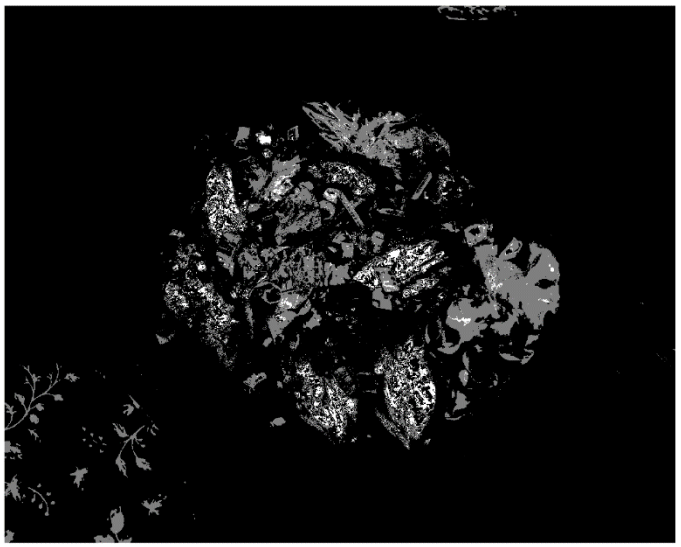


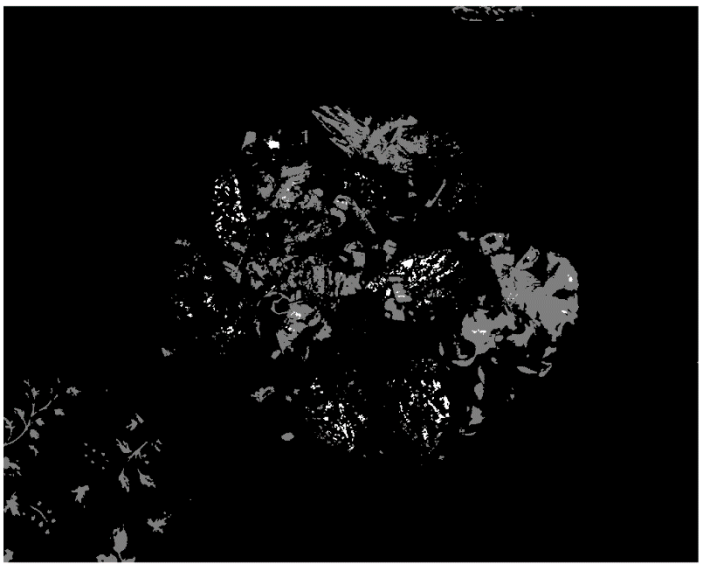


Test image 23



Test image 24

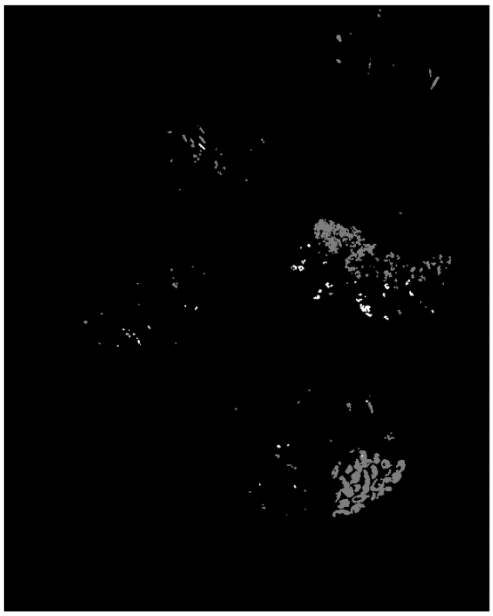


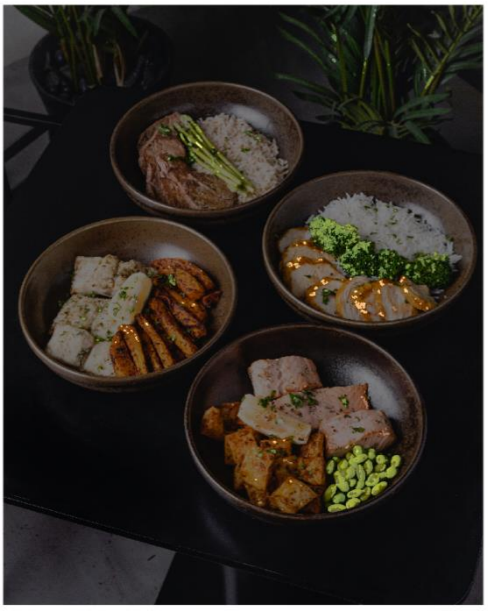


Test image 25

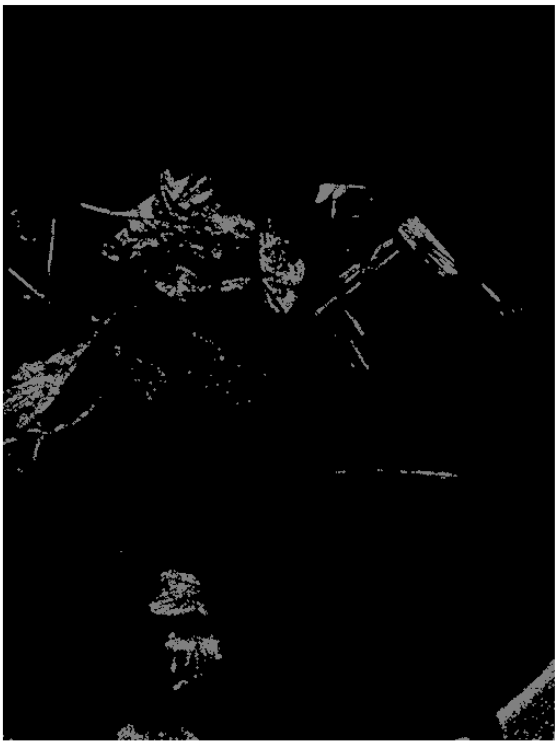
Test image 26

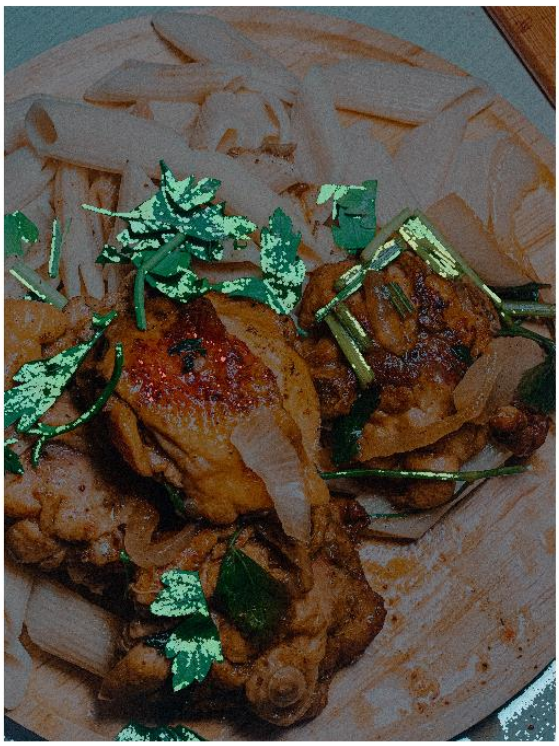
Test image 27



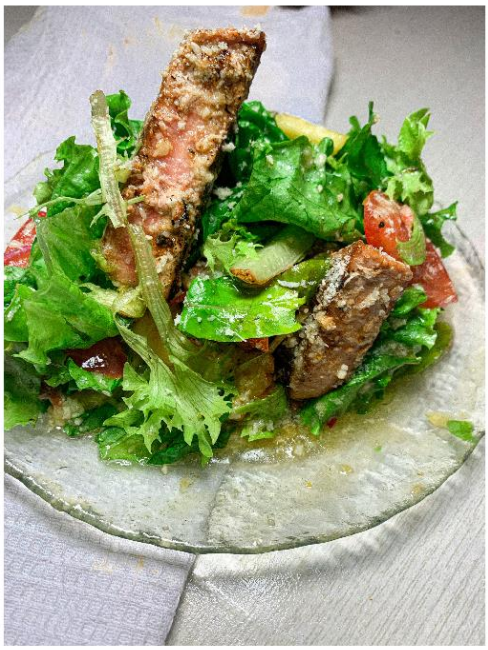


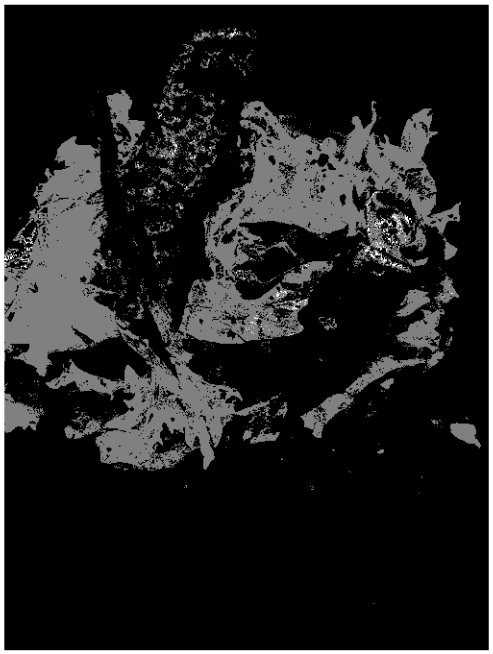
Test image 28

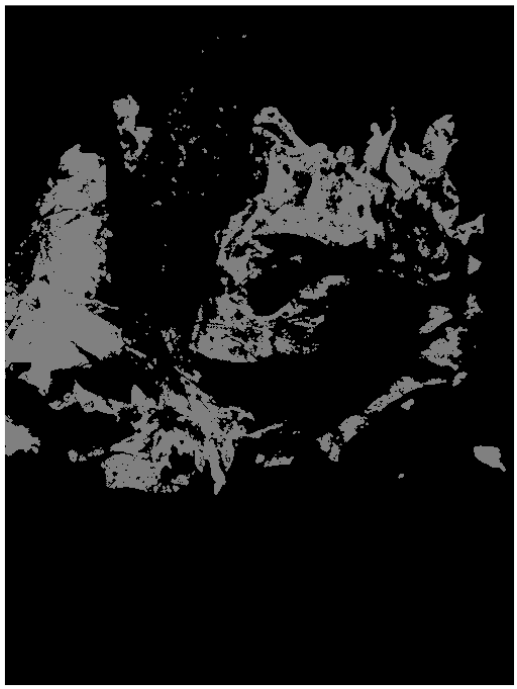




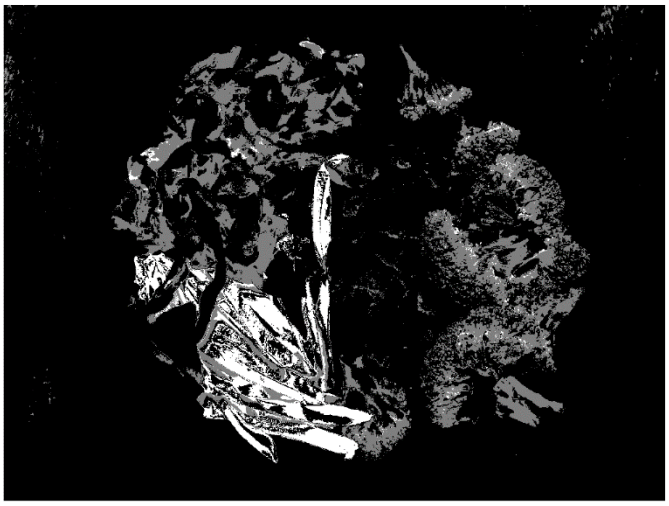
Test image 29







Testing image 30



Conclusion hard images

For these harder images we tried to find images which highlights the problems we experienced in the easy and normal images: Images containing large amount of reflection, cluttered plates, different variants of green, orange and yellow.

The results we got coincided with the ones for easy and normal images, our script struggles with dark and light green: image 23 contains bowls with different types of food and vegetables, we can see from the post processed image that almost no green vegetables are picked up. This illustrates our light and dark green problems well.

Image 23

Image 23 after post processing

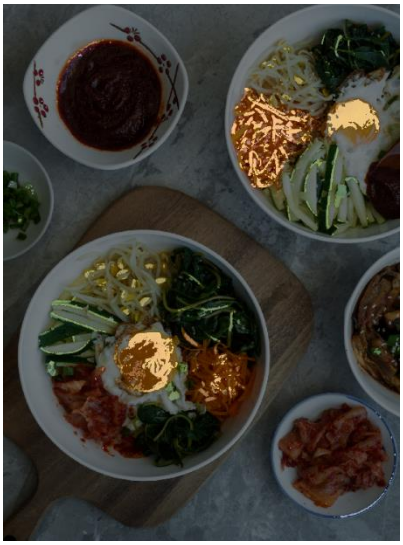


Image 23 Result

The scripts problem with orange is also prevalent here. Looking at image 25, it contains a lot of green vegetables in addition to orange salmon. And looking at the result before post processing we can clearly see the scripts struggle with orange and lighter green colors.

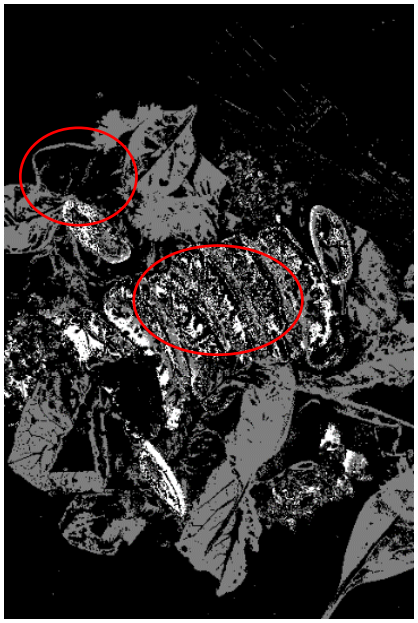


Image 25 before post processing

Image 25

For these types of images the post processing had to be rough in order to remove the non vegetable sections picked up by the script.The end result looks okay, some of the green is still present however through post processing a lot of the vegetables are lost.

Image 25 after post processing

Image 26 result

The result when classifying green colors does vary a lot depending on the amount of illumination on the plate. Looking at the results of image twentysix and twentynine, both have a lot of green lettuce scattered around however, image twentynine has yielded a marginaly better result than twentyfive.

We suspect this is due to the difference in illumination, more light gives us more intense colors which are easier for our script to detect.

Image 26 result

Image 29 result