Fruit Spoilage Detection

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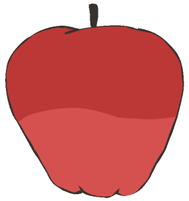
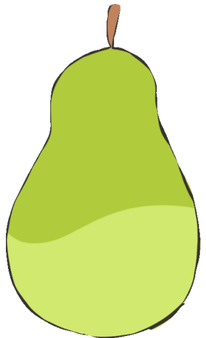
https://youtu.be/ajaTUQeH2dQ

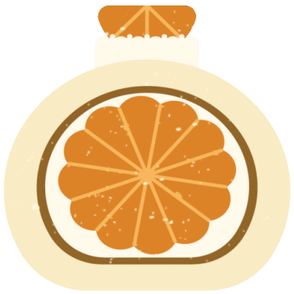
Problem Background



- Fruits are a very good source of minerals and vitamins and they contains high fiber. Despite having a lot of benefits, their shelf life is short and this condition usually called as rottenness of fruits.

- Rottenness is a serious defects on fruits. It can be caused by several factors and it usually happens in the postharvest process.



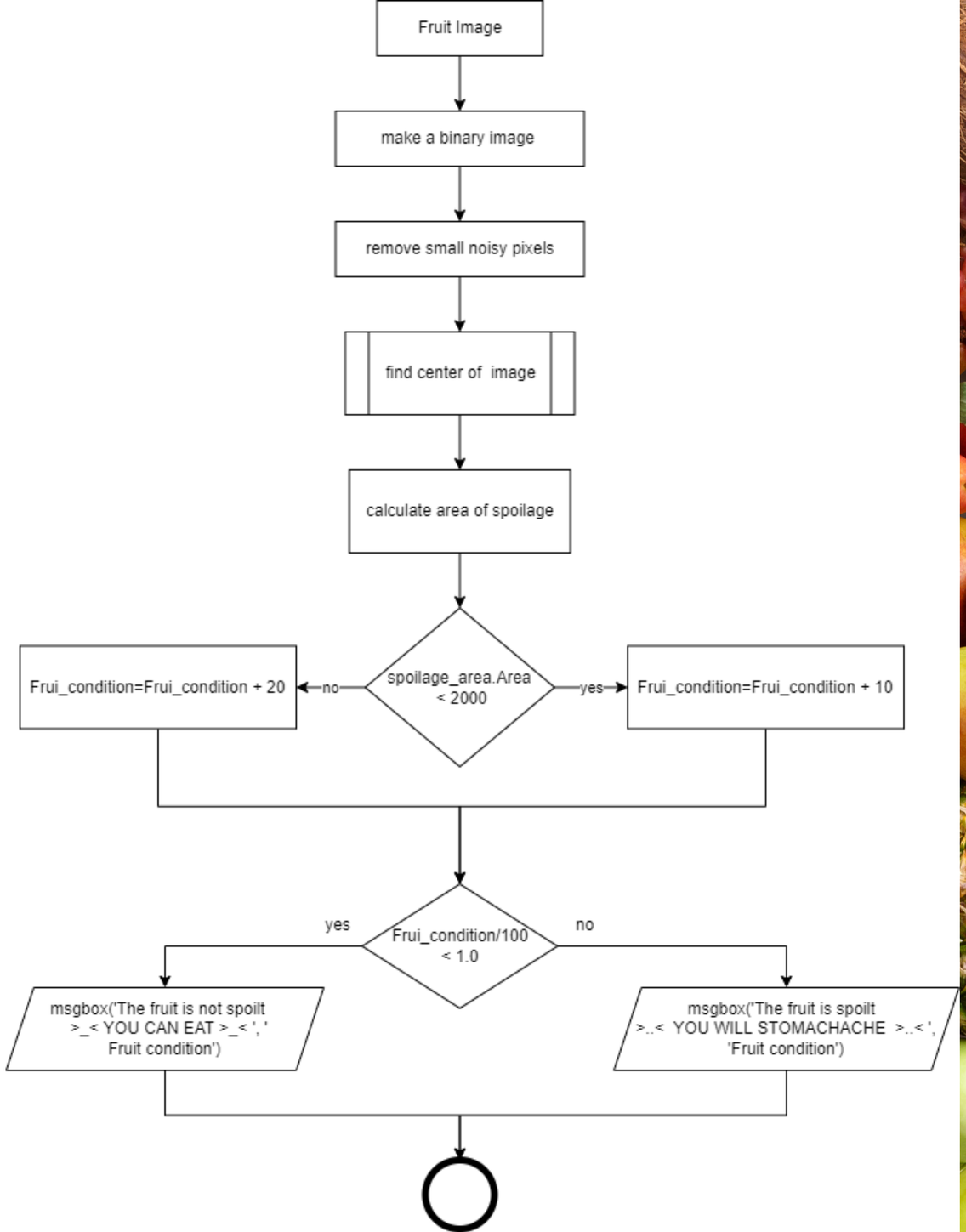


Problem Background

- Fruit spoilage detection that is handled manually usually takes a lot of time.
- So, the objectives of this project is
  - to use automatically fruit spoilage detection so the inspection on fruits that are already spoiled will be less time-consuming.
  - Spoiled fruits can be detected at an early stage so it will not affect the whole patch and cause great economic losses.
- In this project, we use segmentation and enhancement where segmentation is used to divide an image into meaningful regions. Region-based segmentation is suitable for this project because it can classifies a group of connected pixels exhibiting similar properties.
- Enhancement is used to remove noise from the image

Methodolody

- Fruit image is read by the system by using the imread function in matlab
- The image has converted into rgb2gray for the matlab to read the image and display the image using imshow
- The image has converted into binary image using roicolor to test lighter and darker pixels
- We remove the small noisy pixels to help ease the proses of detecting spoilt or unspoilt area and alll pixels will be in 1 for white and 0 for black and display the image using imshow
- Find the center of the image to find how many object is in the image
- Calculate area of spoilage to determine each image area and display the image using imshow
- When the spoilage area are less than 2000, fruit condition will + 10
- When the spoilage area are more than 2000, fruit condition will + 20
- The fruit condition will be divided by 100 to get the final total
- If the final total is less than 1.00 the message box will display the fruit condition "The fruit is not spoilt >_< YOU CAN EAT >_<"
- Else, if the final total is more than 1.00 the message box will display the fruit condition "The fruit is spoilt >..< YOU WILL STOMACHACHE >..<"



Program codes (function)

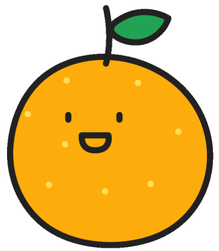
```
clear all, close all, clc
I = imread('jambu4.jpg'); %read image from file
I=rgb2gray(I);%convert image to grayscale
figure, imshow(I);
figure, imhist(I); %look at the hist to get a threshold, e.g., 110

BW=roicolor(I, 90, 255); % makes a binary image
BW = bwareafilt(BW,[100 Inf]); %removing small noise pixels
figure, imshow(BW) % all pixels in (110, 255) will be 1 and
white
% the rest is 0 which is black
figure, imhist(BW);
L = bwlabel(BW); % label each object
%Label each image by searching for center of image
s = regionprops(L, 'Centroid');
imshow(BW)
hold on
```

Program codes (function cont)

```
%Label each image by searching for center of image (cont.)
for k = 1:numel(s)
c = s(k).Centroid;
text(c(1), c(2), sprintf('%d', k), ...
'HorizontalAlignment', 'center', ...
'VerticalAlignment', 'middle');
end
hold off
% Step 3: find the area of the object you want using its label
Frui_condition=0;
Area_1=0;
figure
for k = 1:numel(s)
Obj = (L == k); % is the label number of the first object.
spoilage_area = regionprops(Obj,'Area') % determine each
spoilage area
```

Program codes (function cont).

```
for (k=1)
imshow(Obj);
end
if (spoilage_area.Area < 2000)
Frui_condition=Frui_condition + 10;
else
Frui_condition=Frui_condition + 20;
end
end
close
Final_total=Frui_condition/100
if(Final_total<1.00)
 h = msgbox('The fruit is not spoilt >< YOU CAN EAT >< ', 'Fruit condition')
else
 h = msgbox('The fruit is spoilt >..< YOU WILL STOMACHACHE >..< ', 'Fruit
condition')
end
```



Output 1: Spoilt

- Figure 1 show the histogram equalization of the image which shows the intensity values of image pixels. This takes in an image and shows the intensity of the pixels in the image.
- Figure 2 shows the original image (left), the image converted into grayscale (middle) and the binarized form of the image (right). The reason the image needs to be converted into grayscale is so that the histogram could detect the difference in pixel intesity easily. The image is then binarized in order to enhance the difference in hues of the image. This helps ease the detection of spoilt fruit areas on the fruit. If there is a higher area of spoilage(dark area) detected on the fruit, the code will denote the fruit as spoilt as shown in the message box in Figure 3.

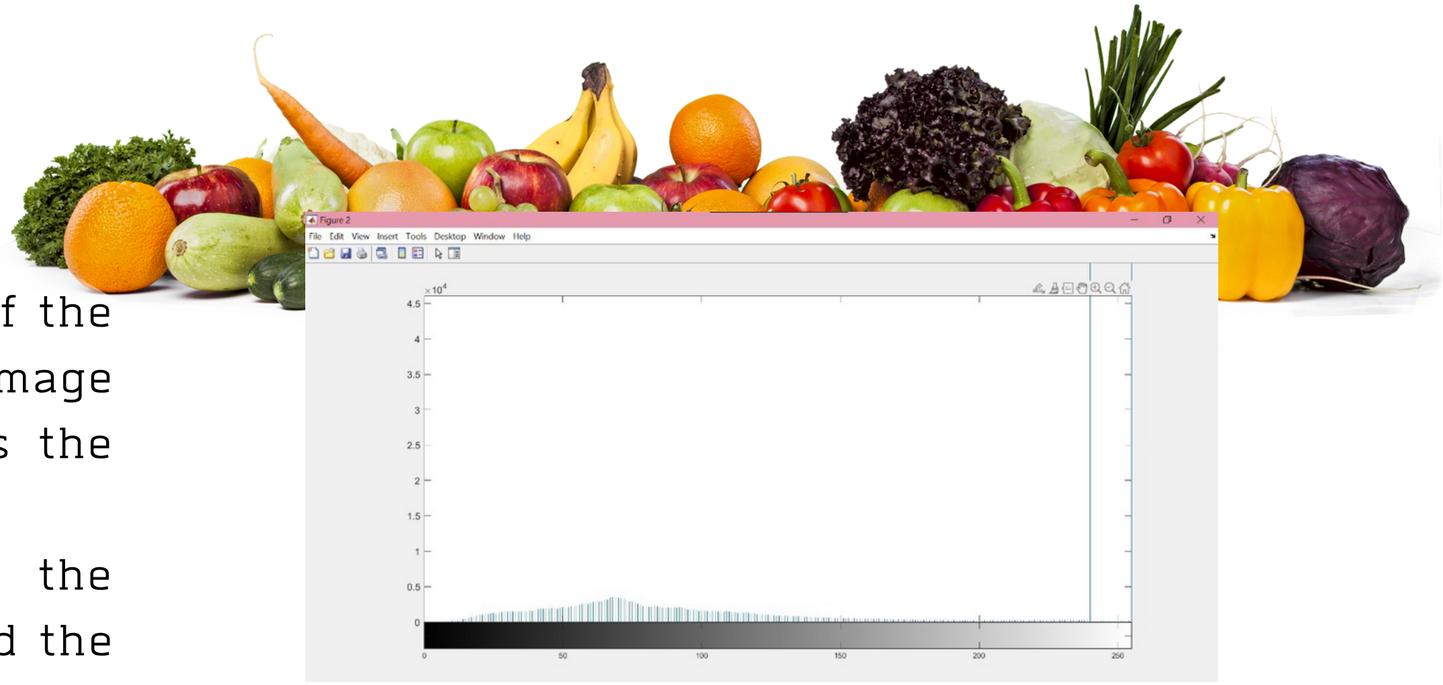


Figure 1: Histogram equalization of the image used

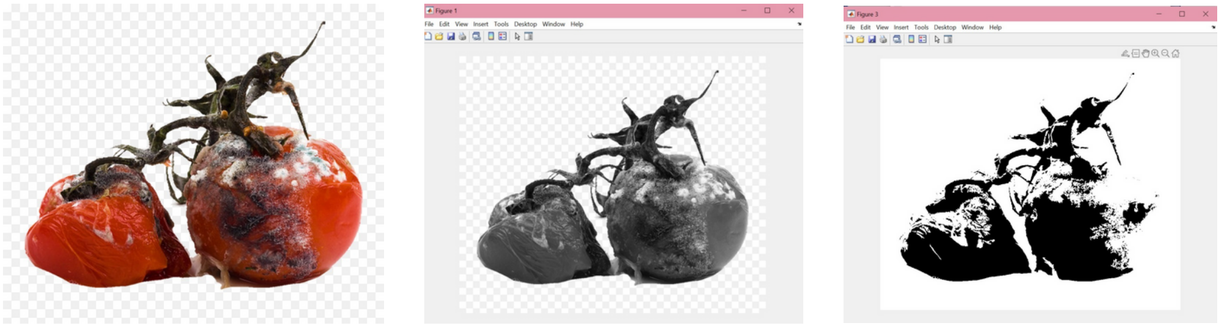


Figure 2: The original image (left), the image in grayscale (middle) and the image in binary

Figure 3: Message displayed to tell user the condition of fruit

Output 2: Not spoilt

- Figure 4 shows the histogram equalization of the middle image in Figure 5. The system detects the difference in the area of pixel intensity and calculates it to determine whether a fruit is spoilt or not. Based on the graph we can see that the area of distribution on the left side of the histogram is small.
- Figure 5 shows the original image (left), the image converted into grayscale (middle) and the binarized form of the image (right).
- Figure 6 shows a message that tells us that the fruit is not spoilt. As we can visibly see in the leftmost image in figure 5, this is correctly interpretted. Thus this shows that this method can be used to determine whether a fruit is spoilt or not.

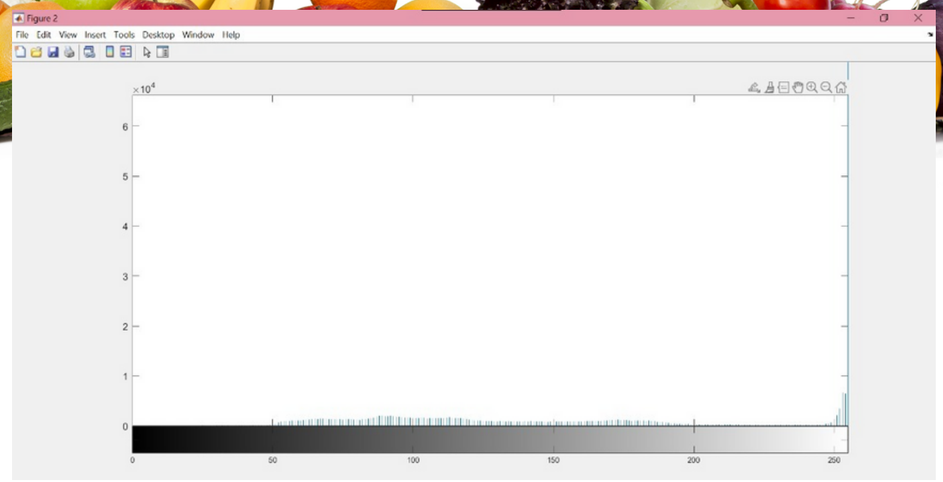


Figure 4: Histogram equalization of the image used

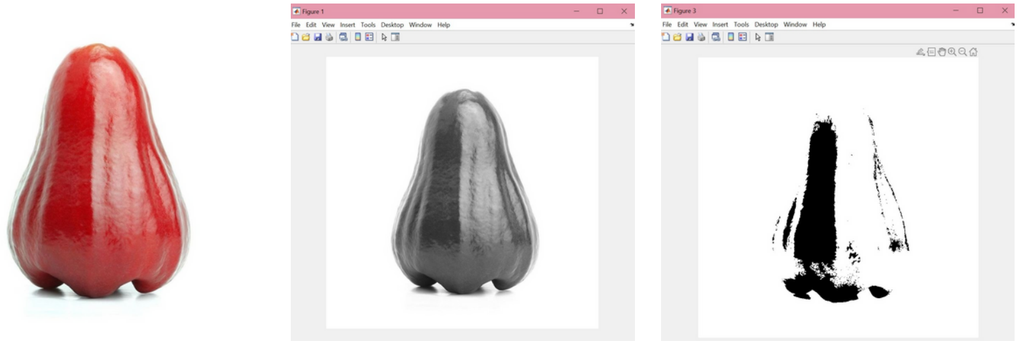


Figure 5: The original image (left), the image in grayscale (middle) and the image in binary

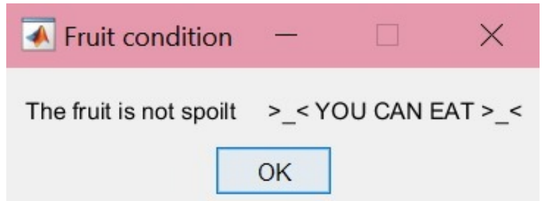


Figure 6: Message displayed to tell user the condition of fruit

Conclusion

- In this study, we have learnt that food spoilage detection system can be done using enhancement and segmentation. Using these two techniques, it will help us to detect whether the fruit is spoiled or not.
- This system will help producers to sell more fruits at a higher quality as the detection is done more easily without hassle. On the other hand, the disadvantage of this system is that it will detect the shadow of the fruit and assume the fruit as spoiled even though the fruit is in good condition.
- We came through several constraints while doing this project. The first constraint was that the research paper was hard to find. However we manage to find a research paper that similarly to our project. As stated in the disadvantage, that is also one of our constraint for this project.

References

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Thank You