STEP 1:

- In the first step, the image is read using the cv2 library.

STEP 2:

- By default, the cv2 assumes image as BGR. So, I am converting it to RGB
- This step is just done for the image visualization

STEP 3:

- Normally coloured images will have 3 channels. To make our process easy, we are converting the image channel from 3 to 2.
- The above thing, can be done by changing the colour to Gray

STEP 4:

Thresholding

Here we will convert the image into binary image by using a threshold. In my project, I have used binary threshold to do this.

- If the pixel value > threshold, then pixel value = max value
- If the pixel value < threshold, then pixel value = 0

STEP 5:

Morphological transformation

Morphology - dealing with shapes
It is basically used for segmentation and feature extraction
There are 2 basic morphological operations,
1.Erosion
2.Dilation

1.Erosion

It basically removes pixels on object boundaries. Since it adds pixels to the boundaries, using this we can reduce the size of an image.

2.Dilation

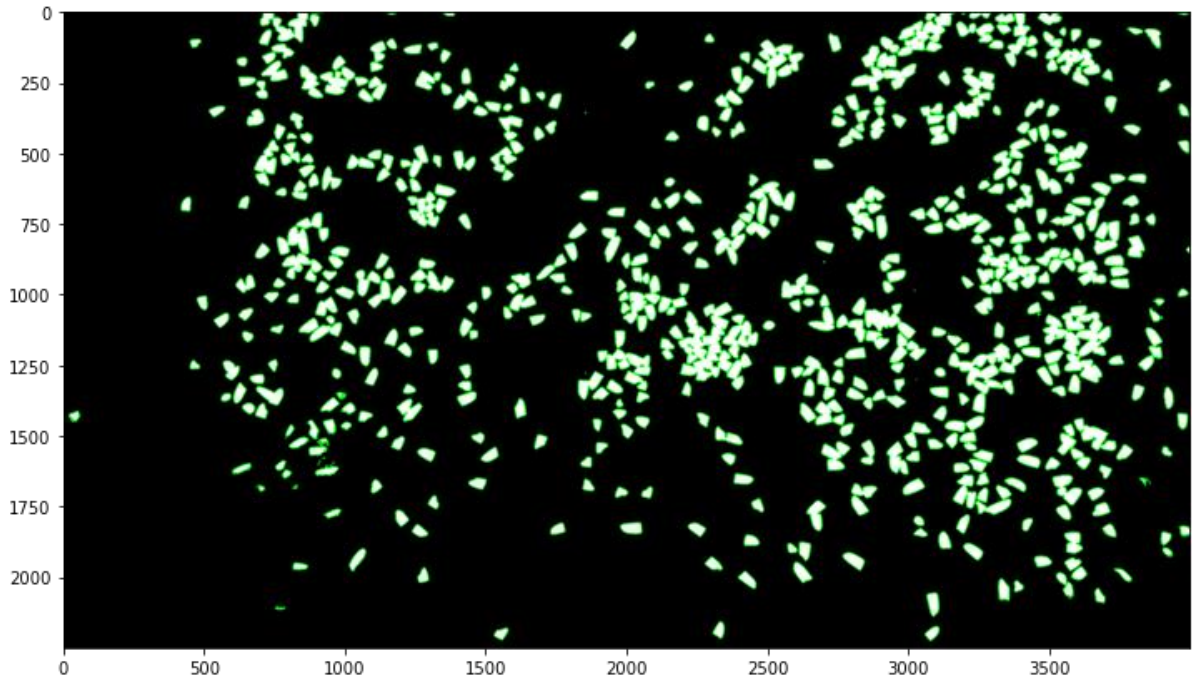
It adds pixels inside and outside the boundaries of the objects present in the image. Since it adds pixels to the boundaries, some of the real time examples are expanding object shapes. Since, It adds pixel inside the boundary, we can use this for filling gaps, holes and smoothening the boundary.

STEP 6:

Contour

Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same colour or intensity. The contours are a useful tool for shape analysis and object detection and recognition.

-



- No of contours will be equal to the total number of rice grains in image.
- But there is one problem, if two rice touch each other , it will consider the 2 rice as a single rice.
- To overcome this solution, I have used watershed model.

STEP 7:

Watershed model

- Any grayscale image can be viewed as a topographic surface where high intensity denotes peaks and hills while low intensity denotes valleys.
- You start filling every isolated valley (local minima) with different coloured water (labels). As the water rises, depending on the peaks (gradients) nearby, water from different valleys, obviously with different colours will start to merge.
- To avoid that, you build barriers in the locations where water merges. You continue the work of filling water and building barriers until all the peaks are under water. Then the barriers you created gives you the segmentation result. This is the "philosophy" behind the watershed

By using the watershed model, we can able to even separate the touching objects.

Finally, the no of rice in the given image is calculated.

PROBLEMS FACED:

- While trying to count the number of broken rices, I have used area as a criterion. But it fails, because some full rice grains are small in size. So, if we calculate the area of small full rice , It will be almost similar to the broken rice.
- Using the shape as a criterion for counting full and broken rice grains using the watershed algorithm have some limitations.

- This algorithm may struggle to accurately distinguish between full and broken grains if there are significant variations in the size of the grains, as the shape feature may not be robust enough to distinguish these variations.

- Also, the algorithm may be sensitive to noise and other image artifacts that can affect the shape of the grains. Another limitation is that the algorithm is not able to consider other features like texture or colour to distinguish between full and broken grains, which can make the algorithm less robust

SUGGESTIONS TO OVERCOME THE PROBLEM

- In order to improve the accuracy of the segmentation and counting, it may be necessary to use a more advanced image processing technique or to pre-process the image to enhance the contrast between the grains and the background.

- Convolutional Neural Networks (CNNs): CNNs are a type of deep learning algorithm that are commonly used for image classification and object detection tasks. They can be trained to recognize the shapes and patterns of full and broken rice grains, and then used to count the number of grains in an image.

- Object Detection Neural Networks: Object detection neural networks, such as Faster R- CNN, YOLO, Retina Net etc, can be trained to detect and locate the rice grains in an image, and then count the number of grains present. They can be used to detect both full and broken grains.

- Semantic Segmentation Neural Networks: This type of neural networks can be used to segment the image into different regions of interest and then classify each region as either full or broken rice grain. The counts can be obtained by counting the number of regions of a particular class.

- Generative models like GANs and VAEs: These models can be used to generate synthetic images of full and broken grains, and then used to train a classifier to differentiate between the two.

Reference: The information in this section is based on OpenCV document