

ACTIVITY 7

IMAGE SEGMENTATION

Sheenah A. Ancheta

Image Segmentation

- Grayscale image segmentation
 - Thresholding
 - Colored image segmentation
 - Parametric segmentation
 - Non-parametric segmentation
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Objective of the activity:

To determine which among the image segmentation techniques is/are the best one/s to use on certain images.

Images to be segmented



Figure 1. Grayscale check image

Grayscale image segmentation will be applied to all three images. Only the images in Figure 2 will be segmented using the parametric and non-parametric segmentation techniques since Figure 1 is not a colored image.

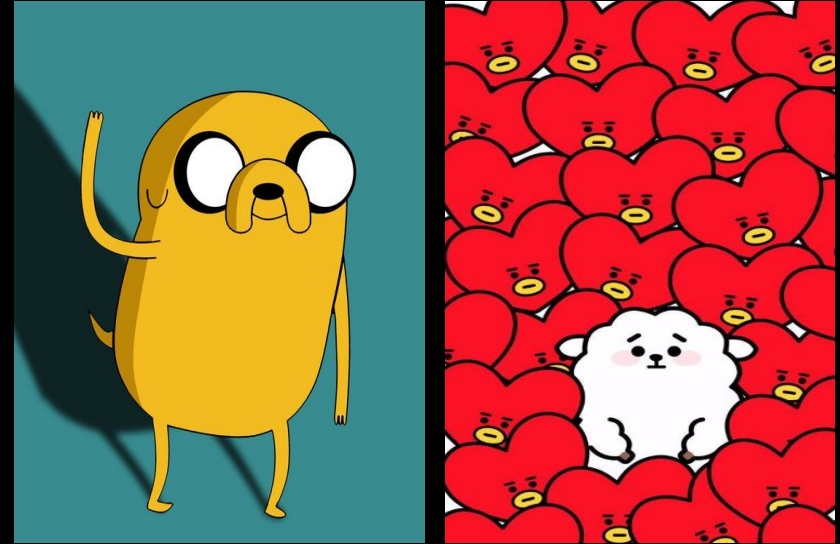


Figure 2. Colored cartoon images

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- [1] AP187 Activity 7 - Image Segmentation (M. Soriano)
[2] Image from <https://pinterest.com>. Accessed 4 Sep 2019.

Grayscale Image Segmentation

Segmented images

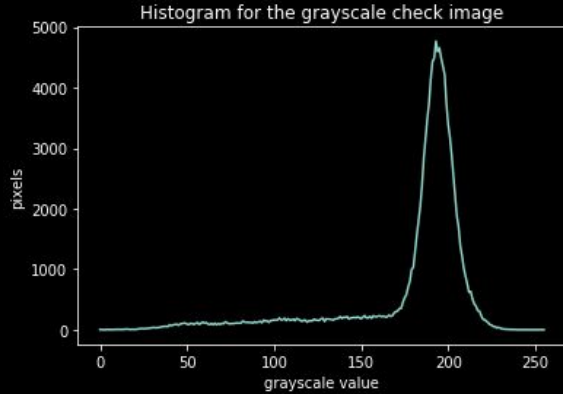


Figure 3. Histogram of the grayscale image

The histogram shows that the most prominent pixel values in the original grayscale check image in Figure 1 are at around 200, which is expected because of the whitish background of the check. When the image was segmented by choosing pixel values less than 125 (the black parts), the said values were converted to white while the other pixel values beyond the thresholding condition became black. The same process happens to when the pixel values more than 125 was chosen.

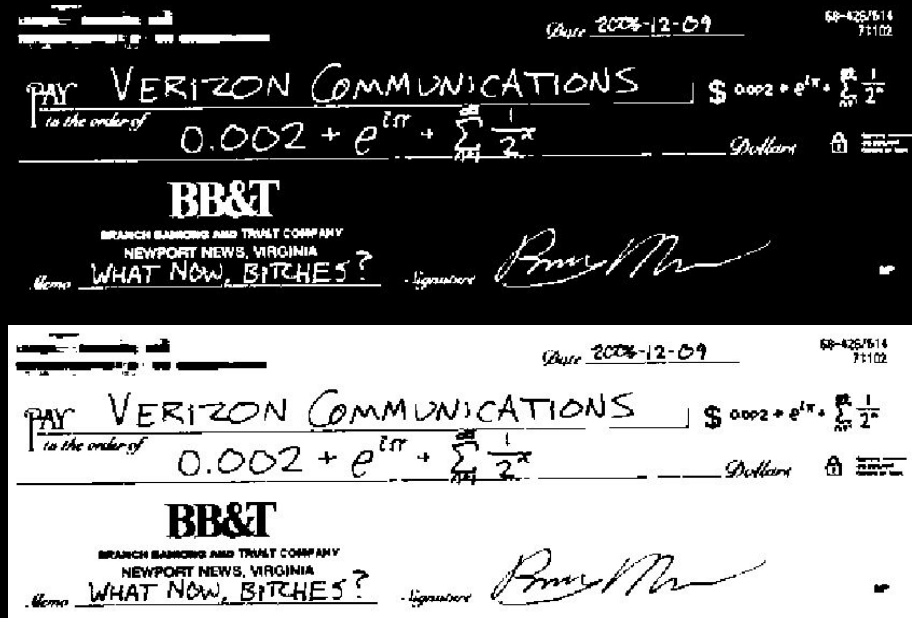


Figure 4. Segmented images at threshold value of 125.
(Top: pixel values less than 125; Bottom: pixel values more than 125)

Segmented images

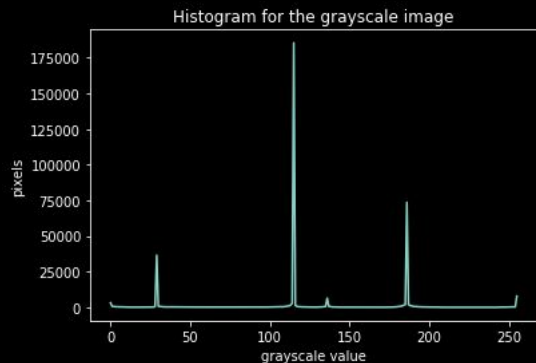


Figure 5. Histogram of the grayscale image

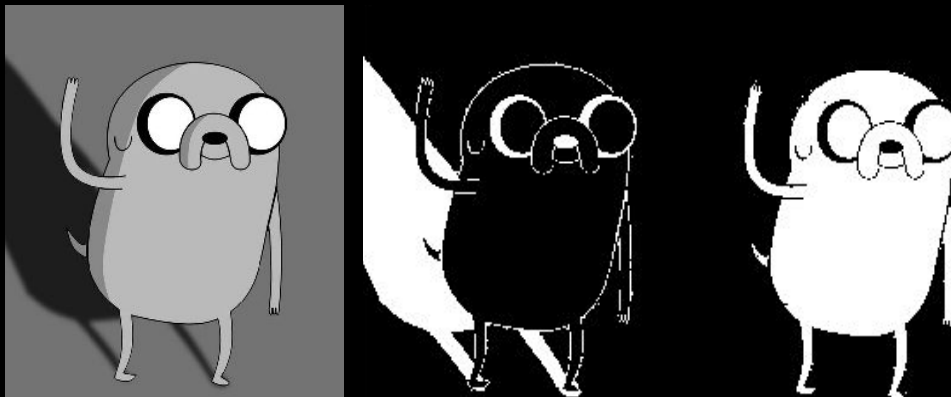


Figure 6. Segmented images of the original grayscale image (left) at threshold value of 110.
(Middle: pixel values less than 110; Right: pixel values more than 110)

The grayscale image shows prominent gray color with a little white and black parts, as depicted also on the histogram. When the black parts of the image was chosen by setting the desired pixel values to less than 110 for the segmentation, these became white while the other parts of the image became black. Same goes to the last image on the right which has an inverse thresholding condition.

Segmented images

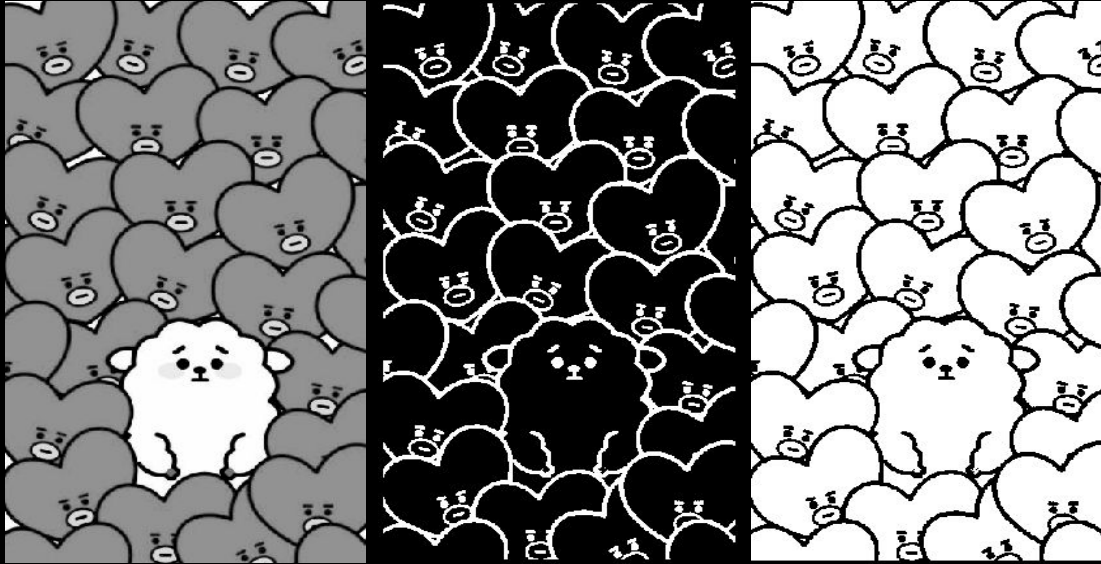


Figure 7. Segmented images of the original grayscale image (left) at threshold value of 110.
(Middle: pixel values less than 110; Right: pixel values more than 110)

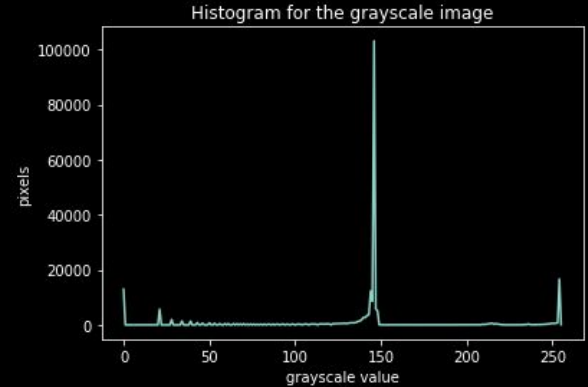


Figure 8. Histogram of the grayscale image

Almost the entire grayscale image is gray, as can also be seen on its histogram. Again, it can be seen that the selected pixel values for segmentation turned to white while the remaining values turned to black.

Colored Image Segmentation

Parametric and non-parametric segmentation techniques

Segmented images

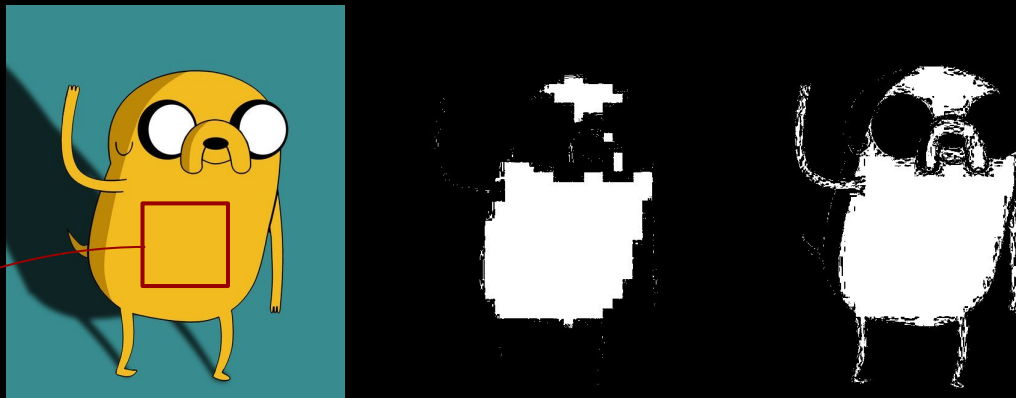


Figure 9. The original image showing the ROI (left) and the segmented images using parametric (middle) and non-parametric segmentation (right)

ROI

The resulting segmented images converted the region of interest to white while the other regions to black. The non-parametric segmentation showed a better result as it returned more white parts on the ROI. As there is a shadow on the left side of Jake, that region does not have the same shade of yellow as the one I picked from his belly. This therefore resulted to a segmented image (non-parametric) of showing only the exact same yellow shade as the one I picked for the ROI.

Segmented images

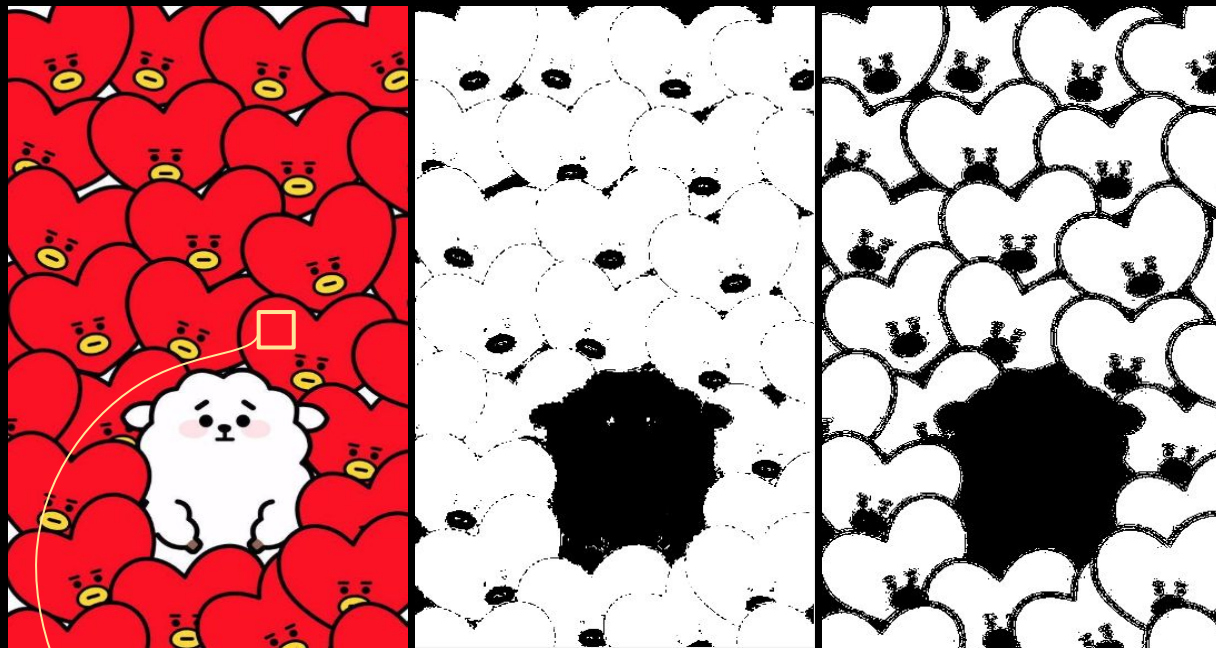
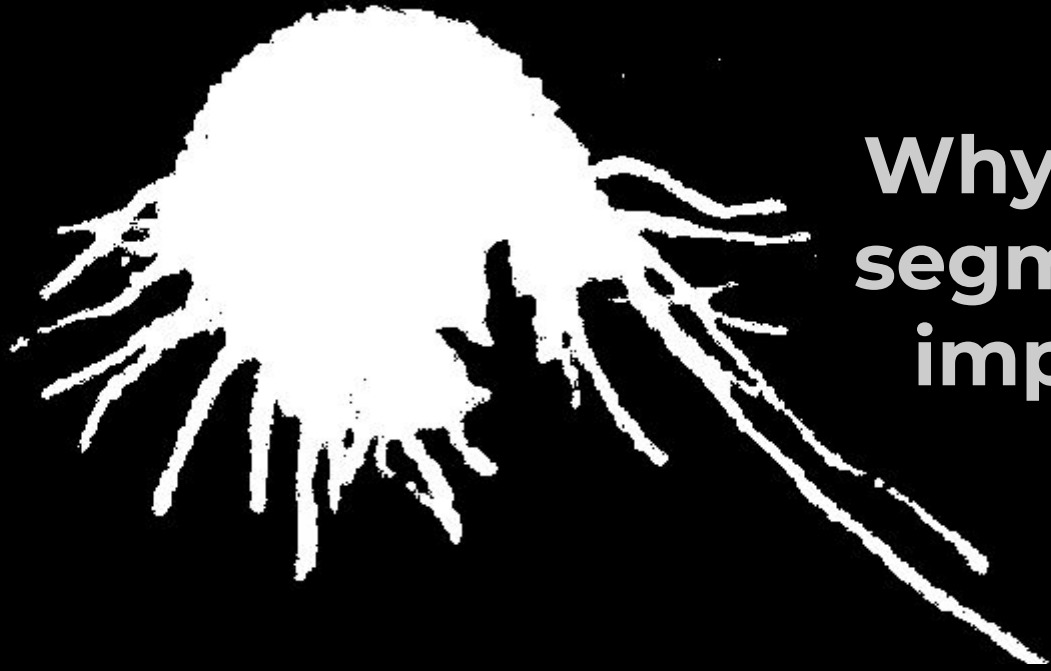


Figure 10. The original image showing the ROI (left) and the segmented images using parametric (middle) and non-parametric segmentation (right)

Again, the better technique implemented based on the results is the non-parametric segmentation. The parametric segmentation was not able to discard (convert to black) all the image parts beyond the ROI. The non-parametric segmentation, however, discarded all regions not included in the ROI.



**Why is image
segmentation
important?**

Importance in medical imaging

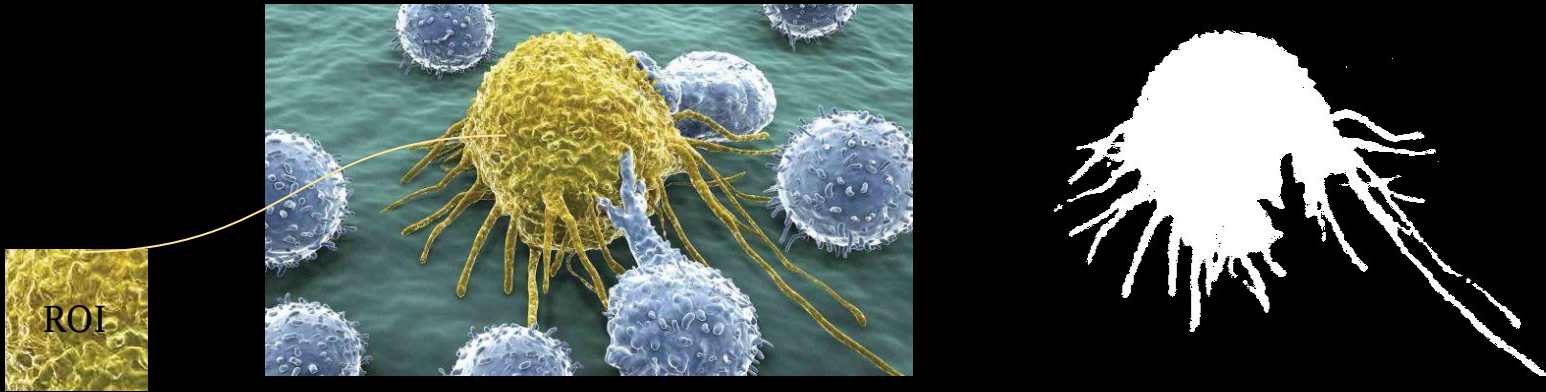


Figure 11. The original image (left) and the segmented image using non-parametric segmentation (right)

The image shown in the left is a snapshot of a group of T-cells (purple) fighting a cancer cell (yellow-green).^[3] Through image segmentation, when there are a couple of cancer cells attacking a certain region, the T-cells can easily be distinguished from the cancer cells. This would be really useful in the field of medicine. The segmented image was obtained using non-parametric segmentation and it can be seen that it perfectly highlighted the cancer cell and turned all the other entities to black.

[3] https://www.diamond.ac.uk/Home/News/LatestFeatures/02_09_15.html. Accessed 4 Sep 2019.

Doing this activity made me realize how important image segmentation is, especially on fields where object detection is commonly used-- for example, medical imaging.

Summary

Among the two colored-image segmentation techniques demonstrated, the non-parametric segmentation worked on me better as it perfectly segmented the image to the desired regions of interest. The grayscale segmentation through setting a threshold value also worked perfectly although the disadvantage here is as its name stands, it can only be applied on grayscale images.

Self- evaluation

Technical correctness	4
Quality of presentation	5
Initiative	2
Total	11