APPLIED PHYSICS 157

Activity 5

FEATURE EXTRACTION PART 1 OF 3: IMAGE SEGMENTATION

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WFY-FX-2

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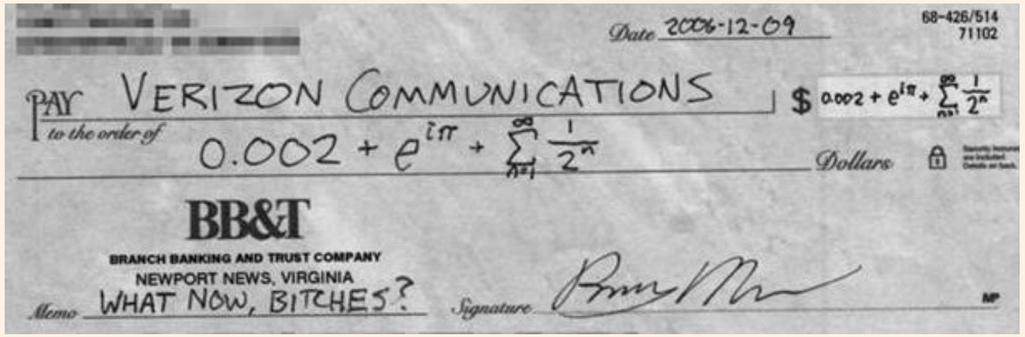
The outputs presented in the succeeding pages are created using MATLAB. Moreover, the codes are uploaded in Github.

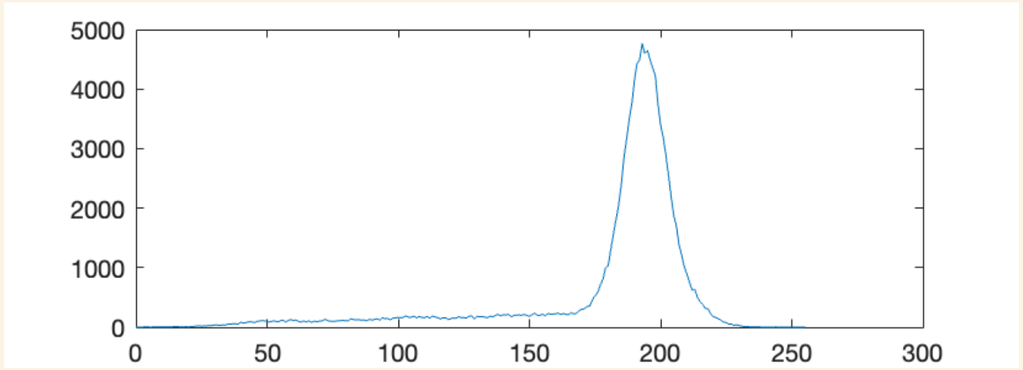
GRAYSCALE IMAGES

Objectives:

- Segment grayscale imagess

GRAYSCALE IMAGES





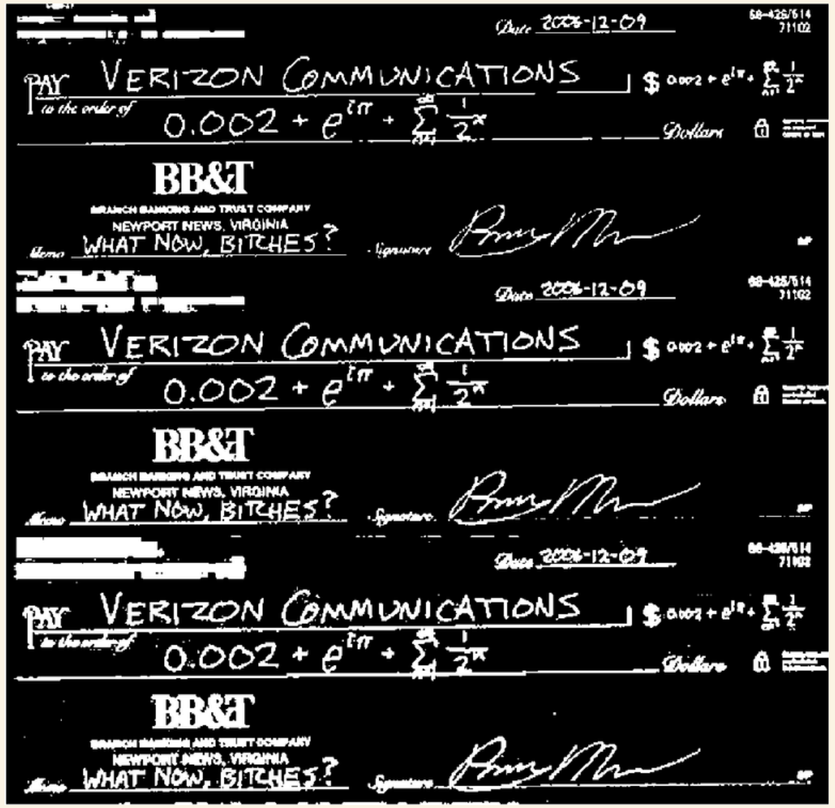


Figure 1. From top left to bottom right (a) grayscale image, (b) its corresponding histogram and (c) results of thresholding wherein those that are below 125, 150, and 170 respectively are shown.

Although it worked well for this image, this is not always the case for other images especially colored ones. With that, we proceed with segmenting colored images through different means.

PARAMETRIC AND NONPARAMETRIC SEGMENTATION

Objectives:

- Use parametric and nonparametric segmentation to segment images
- Compare the results of the two

PARAMETRIC VS NONPARAMETRIC SEGMENTATION

Figure 2. From left to right: Thresholding using (a) parametric (b) nonparametric with 20 bins (c) nonparametric with 32 bins, and (d) nonparametric segmentation with 50 bins.

From the results, we can see that Figure 2c produced the best segmented image compared to the rest of the segmentation process. Although Fig. 2a also produced a good result, there are still more missing pixels within the edge than Fig. 2c.

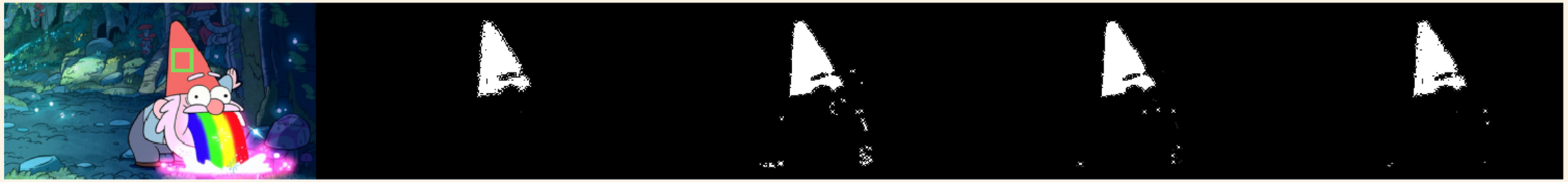


Figure 3. From left to right: Thresholding using (a) parametric (b) nonparametric with 20 bins (c) nonparametric with 32 bins, and (d) nonparametric segmentation with 50 bins.

From the results, we can also see the same pattern from Fig 2. However, we can see some included pixels that are not originally part of the expected results. One suggestion is to masked the said excluded pixels to further enhance the segmentation.

PARAMETRIC VS NONPARAMETRIC SEGMENTATION

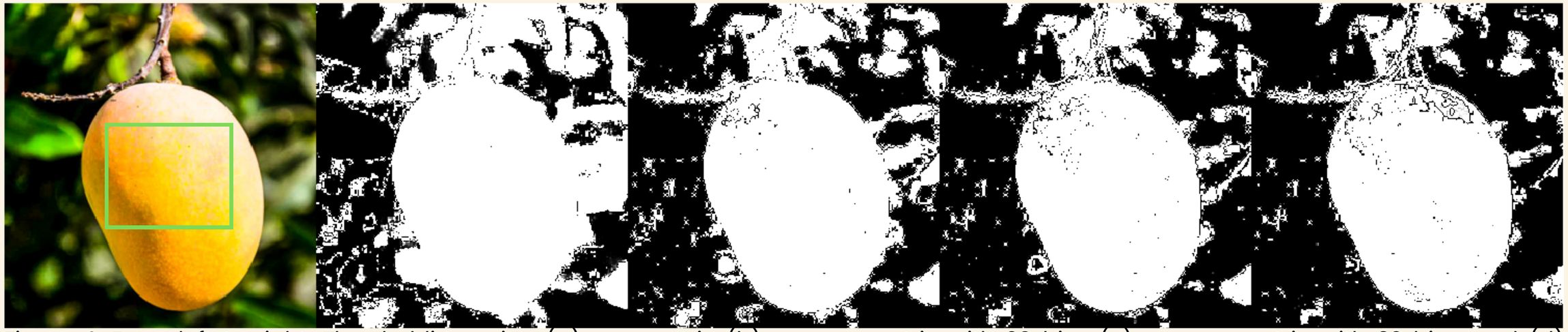


Figure 4. From left to right: Thresholding using (a) parametric (b) nonparametric with 20 bins (c) nonparametric with 32 bins, and (d) nonparametric segmentation with 50 bins.

All results included background pixels which may indicate a not-so-effecitive segmentation for this image. Fig 4a can not exclude the mango from the background. However in nonparametric segmentation, the mango becomes more segmented when the bin size is higher. This indicates that the mango can be further be segmented if the bin size is increased.

Increasing bin size is more appropriate to use in images with **low contrast** or **high level of noise** wherein the smaller variation in pixel values are not that important.

PARAMETRIC VS NONPARAMETRIC SEGMENTATION

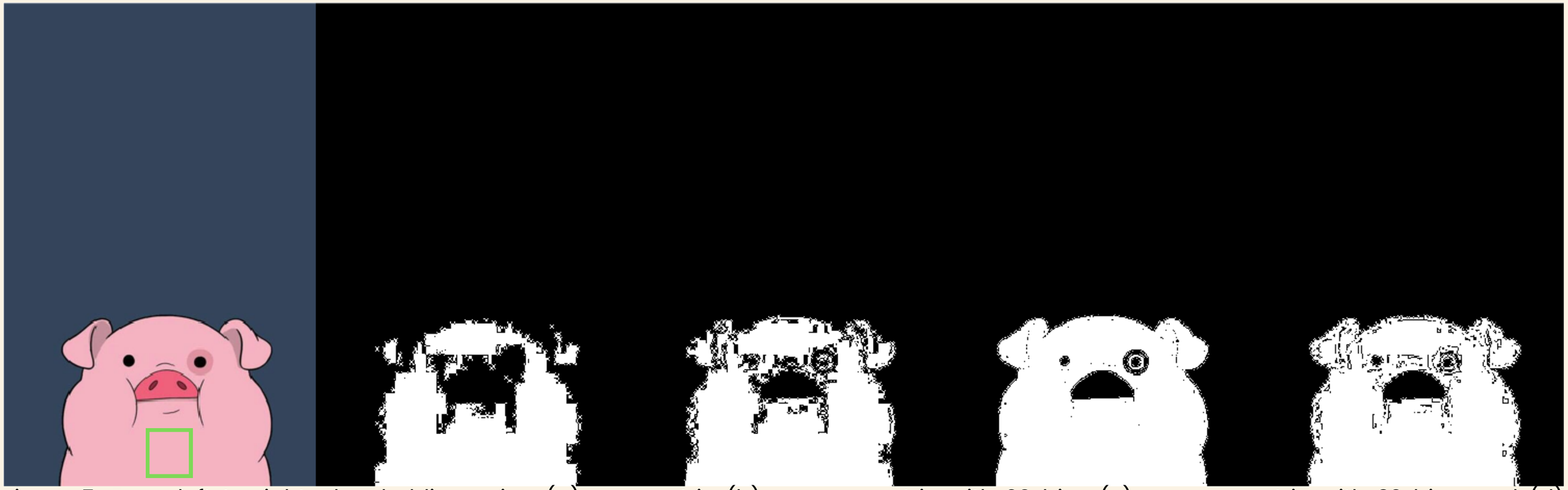


Figure 5. From left to right: Thresholding using (a) parametric (b) nonparametric with 20 bins (c) nonparametric with 32 bins, and (d) nonparametric segmentation with 50 bins.

Here, we can see that the nonparametric with 32 bins produced the best segmentation among the rest. Unlike in Fig 4, there is no need to further increase the bin size when there is already a **high contrast** and **little to no noise** in the image background.

PARAMETRIC VS NONPARAMETRIC SEGMENTATION

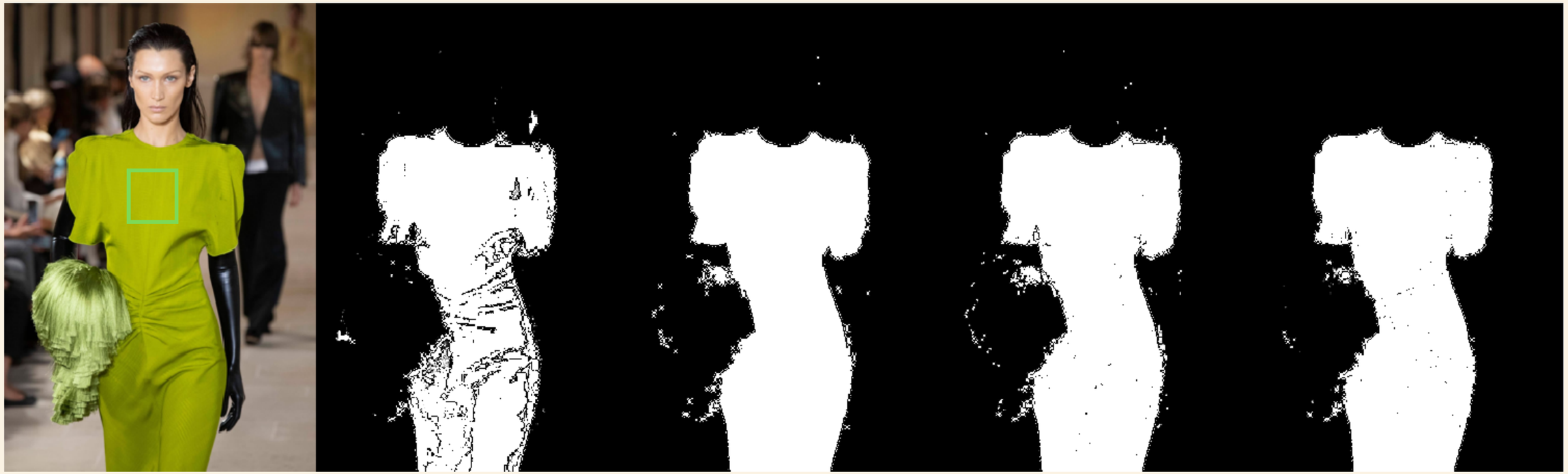


Figure 6. From left to right: Thresholding using (a) parametric (b) nonparametric with 20 bins (c) nonparametric with 32 bins, and (d) nonparametric segmentation with 50 bins.

Here, we can see that the nonparametric with 20 bins produced the best segmentation among the rest even if there are some pixels outside the area of interest. Although Fig.6d may also be a good segmentation results, there are holes inside the area of interest as well as in the edges.

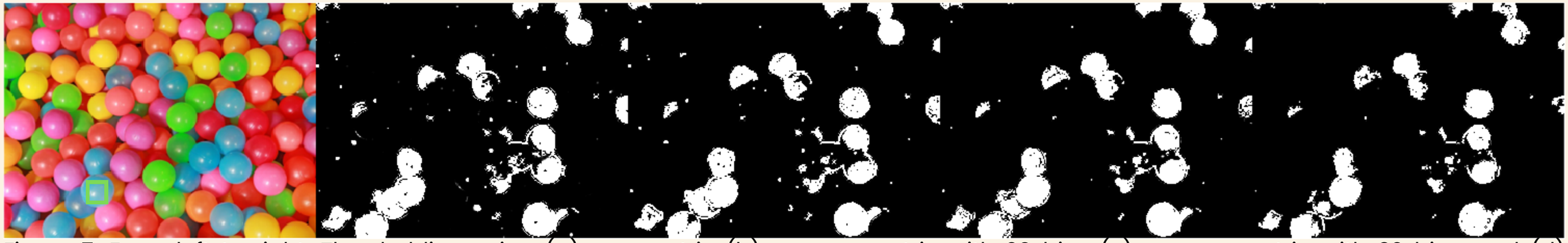


Figure 7. From left to right: Thresholding using (a) parametric (b) nonparametric with 20 bins (c) nonparametric with 32 bins, and (d) nonparametric segmentation with 50 bins.

Here, the parametric and nonparametric segmentation both presented a good result. They are almost similar with one another.

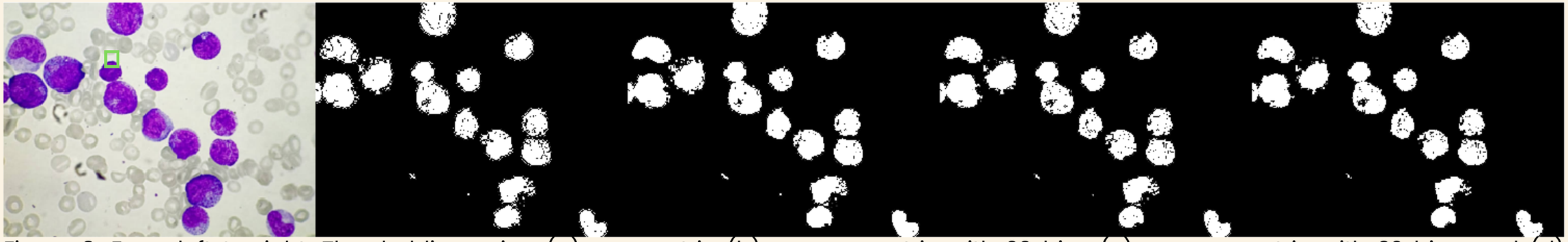


Figure 8. From left to right: Thresholding using (a) parametric (b) nonparametric with 20 bins (c) nonparametric with 32 bins, and (d) nonparametric segmentation with 50 bins.

From Fig. 8, we can see the same observation from Fig. 7. But, we can still say that nonparametric segmentation is still better than parametric segmentation.

TAKEAWAYS AND IMPORTANCE

- Grayscale segmentation is not always applicable to colored images since it does not take into account the color information of the image.
- Nonparametric segmentations shows better segmentation results than parametric segmentations
- In nonparametric segmentation, increasing the bin size groups together pixel values which can help in images with low contrast or high noise.
- Image segmentation is helpful in a wide range of applications including remote sensing wherein it can be used to identify characteristics of interest [1-2].

REFLECTION

RATING: 110 / 100

Doing this activity excited me as image processing is part of my research interest. Being able to do stuff like this makes me realize the vast application of Physics in the society.

I would like to thank my Video and Image Processing laboratory classmates for helping me in generating ideas regarding this activity. They made me realize that collaboration is better than working alone.

I'd give myself 110/100 since I was able to enhance my codes by making it more efficient. I'm getting more and more confident with my programming skills and I am looking forward to doing more (personal) projects soon.

References

[1] Schiewe, Jochen. (2012). Segmentation of high-resolution remotely sensed data - Concepts, applications and problems. International Archives of Photogrammetry and Remote Sensing. 34.

[2] Mapping New Informal Settlements for Humanitarian Aid through Machine Learning. (2020). https://stories.thinkingmachin.es/mapping-new-informal-settlements/. Accessed on 12 May 2023.