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Experiment – 6: To implement Global and Adaptive Thresholding

Date: _____

1. **Aim : Write a program to implement Global and adaptive Thresholding**

2. **Requirements:** Python :

3. **Pre-Experiment Exercise**

3.1 Brief Theory

As the fact that we need only the histogram of the image to segment it, segmenting images with Threshold Technique does not involve the spatial information of the images.

Basic Global Thresholding: As the fact that we need only the histogram of the image to segment it, segmenting images with Threshold Technique does not involve the spatial information of the images. Therefore, some problem may be caused by noise, blurred edges, or outlier in the image. That is why we say this method is the simplest concept to segment images.

When the intensity distributions of objects and background pixels are sufficiently distinct, it is possible to use a single (global) threshold applicable over the entire image.

The following iterative algorithm can be used for this purpose:

1. Select an initial estimate for the global threshold, T.
2. Segment the image using T as

$$g(x,y) = \begin{cases} 1 & \text{if } f(x,y) \geq T \\ 0 & \text{if } f(x,y) \leq T \end{cases}$$

This will produce two groups of pixels: G_1 consisting of all pixels with intensity values $> T$, and G_2 consisting of pixels with values $\leq T$.

3. Compute the average intensity values m_1 and m_2 for the pixels in G_1 and G_2.
4. Compute a new threshold values:

$$T = \frac{1}{2}(m_1 + m_2)$$

5. Repeats Step2 through 4 until the difference between values of T in successive iterations is smaller than a predefined parameter.

Basic Adaptive thresholding technique: Images having uneven illumination make it difficult to segment using the histogram. In this case we have to divide the image in many sub images and then come up with different threshold to segment each sub image. The key issues are how to divide the image into sub images and utilize a different threshold to segment each sub image. The major drawback to threshold-based approaches is that they often lack the sensitivity and specificity needed for

accurate classification. Fig. 1 shows the comparison between adaptive and global thresholding and adaptive thresholding. Since the threshold for each pixel depends on its location within an image this technique is said to adaptive.

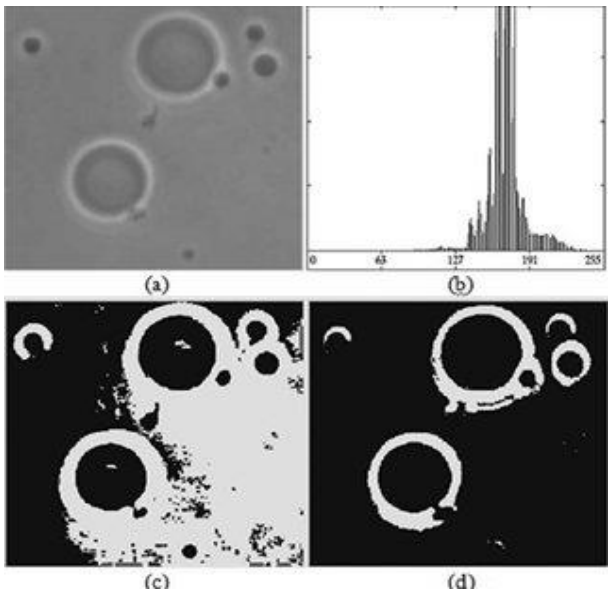

Fig. 1:. a) Original Image, b) Histogram of original image.
c) Global Thresholding d) Adaptive Thresholding

4. Laboratory Exercise

4.1. Algorithm :

1. Read the grayscale image and find the histogram.
2. Select initial estimate threshold T from histogram
3. Segment the image using T as a threshold as per the above steps of basic global thresholding algorithm and display the output binary image.
4. For basic adaptive thresholding, divide image into four sub-images apply global thresholding in each sub-image.
5. Connect all segmented sub-images according to their initial position to get full binary image, display final image.

5. Post Experiment

5.1 Conclusion

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5.2 Questions

i. What is the need of adaptive thresholding?
ii. What is the role of illumination in image segmentation?