Tumor detection using K-Mean clustering algorithm method.

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ABSTRACT

Thresholding is a simple but effective tool for image segmentation. The purpose of this operation is that objects and background are separated into non-overlapping sets. Multilevel thresholding technique has been applied into two types of images which is normal bone marrow and Acute Lymphoblastic Leukemia (ALL). A multilevel thresholding method is used in the segmentation of the white blood cells (WBC) from its complicated background. This method is only suitable for normal images. However, we in this paper mainly concentrate on the segmentation method which gives best results for the dark or brighter images. We in this paper use three different segmentation techniques to segment the brighter and darker images.

Keywords; image segmentation; multilevel tresholding; image histogram; bone marrow image.

I. INTRODUCTION

An image may be considered to contain sub-images sometimes referred to as regions-of-interest, ROIs, or simply regions. This concept reflects the fact that images frequently contain collections of objects each of which can be the basis for a region. Thus one part of an image (region) might be processed to suppress motion blur while another part might be processed to improve color rendition. It is converted into a digital form. Digitization includes sampling of image and quantization of sampled values [3]. After converting the image into bit information, processing is performed. This processing technique may be Image enhancement, Image reconstruction, and Image compression.

II.BONE MARROW IMAGES

In this paper, two types of bone marrow images are used, which is normal and abnormal bone marrow with Acute Lymphoblastic Leukemia (ALL) type as illustrates in Figure 1.Leukemia is cancer of the blood and develops in the bone marrow. The bone marrow is the soft, spongy center of the long bones that produces the three major blood cells which are white blood cells, red blood cells and platelets [5].

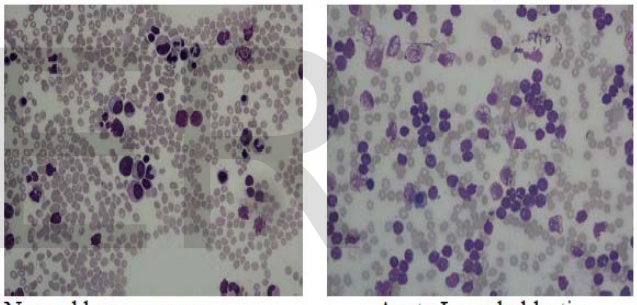

Figure 1. Images of normal Bone Marrow and abnormal bone marrow.

III. SEGMENTATION

Segmentation refers to the process of partitioning a digital image into multiple regions. The goal of segmentation is to simplify or to change the representation of an image into something that is more meaningful and easier to analyze [7]. Some of the practical application of image segmentation is used in medical imaging to study of anatomical structure, diagnosis and other pathologies.

The purpose of segmentation is that objects and background are separated into non-overlapping sets and only remains the object of interest.

Nowadays, numerous algorithms and techniques have been developed for image segmentation [3, 4, and 7].

A. Multilevel Tresholding Segmentation

Thresholding is an important technique for image segmentation. Because the segmented image obtained from thresholding has the advantage of smaller storage space, fast processing speed and ease in manipulation, compared with a gray level image containing 256 levels. The aim of an effective segmentation is to separate objects from the background and to differentiate pixels having nearby values for improving the contrast.

Thresholding techniques can be divided into bi-level and multi-level category, depending on number of image segments. In bi-level thresholding, image is segmented into two different regions. The pixels with gray values greater than a certain value T are classified as object pixels, and the others with gray values lesser than T are classified as background pixels. Otsu's method is one of the better threshold selection methods for general real world images with regard to uniformity and shape measures.

Multilevel thresholding is a process that segments a gray-level image into several distinct regions. This technique determines more than one threshold for the given image and segments the image into certain brightness regions, which correspond to one background and several objects. The method works very well for objects with colored or complex backgrounds, on which bi-level thresholding fails to produce satisfactory results. A number of multilevel thresholding methods have been proposed for segmentation [11]. Multilevel thresholding classifies a point (x, y) as belonging to one object class if T1 < (x, y) <= T2, to the other object class if f(x, y) > T2 and to the background if f(x, y) <= T1.

B.PROCEDURAL STEPS

i. The first step is image capturing of bone marrow slide under digital camera.
ii. Then, save the images under .JPEG extension.
iii. The RGB images then converted into gray level images
iv. Images histogram is used to find the threshold value by using OTSU method and Fuzzy C-Mean clustering algorithm and applying multilevel tresholding to the image.
v. Segmented of object interest.
vi. Colour segmentation using K-Mean clustering algorithm is used to segment the object interest.

Here the OTSU method does not give exact result for all types of image (brighter or darker images),whereas the FCM and K-Mean method gives the best result.

C. Object of Interest and Background

Figure 2 shows bone marrow images that has been diagnosed as Acute Lymphoblastic Leukemia and Figure 3 shows the image of normal bone marrow smear.

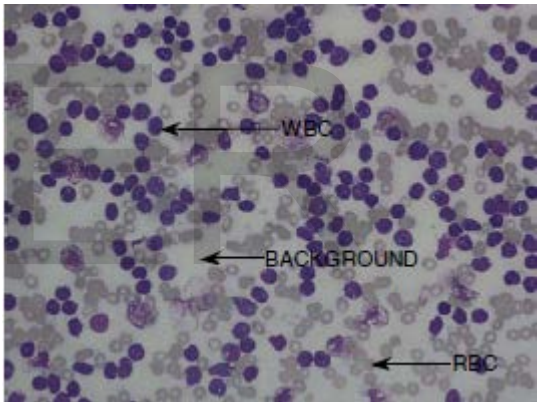

Figure 2. Images of Bone Marrow With 40 x magnifications (ALL)

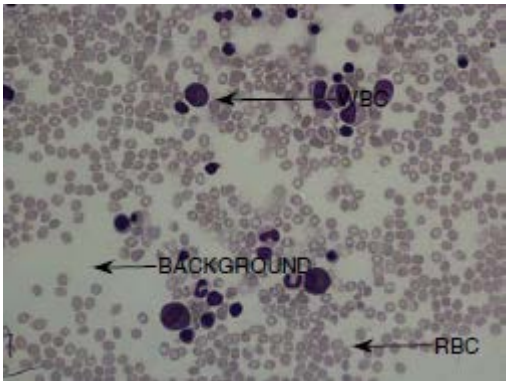

Figure 3. Images of Bone Marrow With 40 x magnifications (Normal)

D. Segmented White Blood Cell

Multilevel thresholding serves as method that helps to choose the object of interest that lay in

specified intensity of gray level. Furthermore, by manipulating the values of T1 and T2 accordingly, we can segment any object of interest from its background as desired object.

The main drawback of manually selecting the threshold value is that it is not suitable for dark or brighter images. So we in this project overcome the drawback by using different segmentation techniques. Different segmentation techniques used are K-Mean clustering algorithm, OTSU method and Fuzzy c-mean clustering algorithms.

E. K-Mean clustering algorithm

K-means clustering treats each object as having a location in space. It finds partitions such that objects within each cluster are as close to each other as possible, and as far from objects in other clusters as possible. K-means clustering requires that you specify the number of clusters to be partitioned and a distance metric to quantify how close two objects are to each other. It uses the K cluster centroid locations values, which are sometime called as 'seed' is used to calculate the distance from each point. this process repeats number of times, each with a new set of initial centroids(seeds).

F. OTSU method

Otsu's thresholding method involves iterating through all the possible threshold values and calculating a measure of spread for the pixel levels each side of the threshold, i.e. the pixels that either fall in foreground or background. The aim is to find the threshold value where the sum of foreground and background spreads is at its minimum.

G. Fuzzy c-mean clustering algorithms

This algorithm works by assigning membership to each data point corresponding to each cluster center on the basis of distance between the cluster center and the data point. More the data is near to the cluster center more is its membership towards the particular cluster center. Clearly, summation of membership of each data point should be equal to one.

IV. SIMULATION RESULTS:

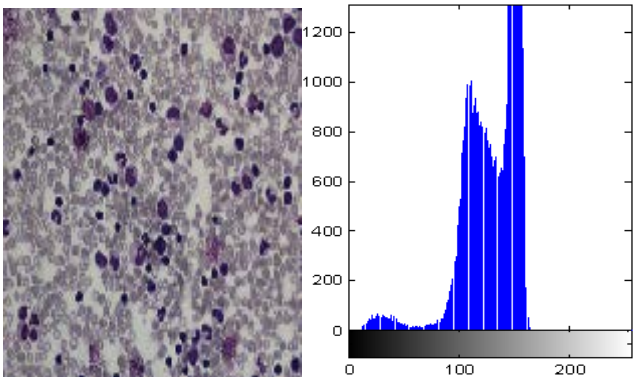

Figure 4.Histogram of abnormal bone marrow.

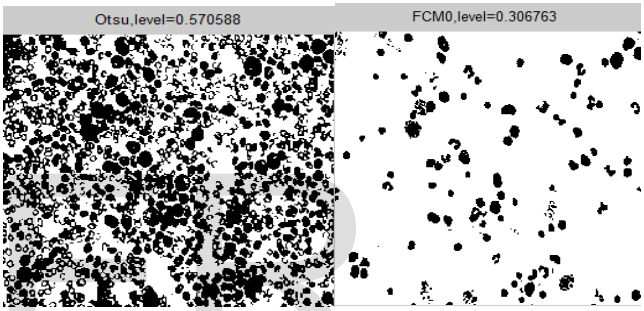

Figure 5.multilevel thresholding by OTSU and FCM method for normal image.

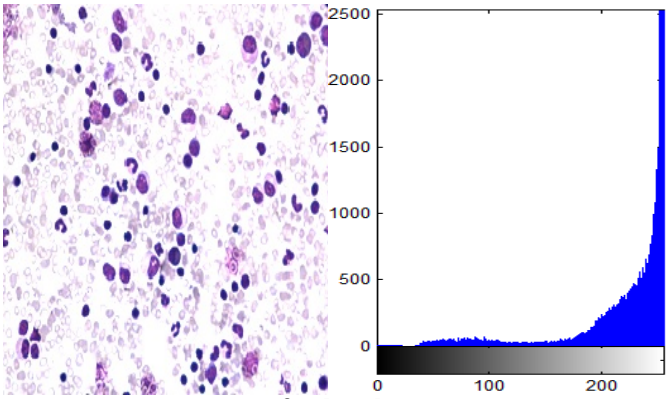

Figure 6. Histogram for brighter image.

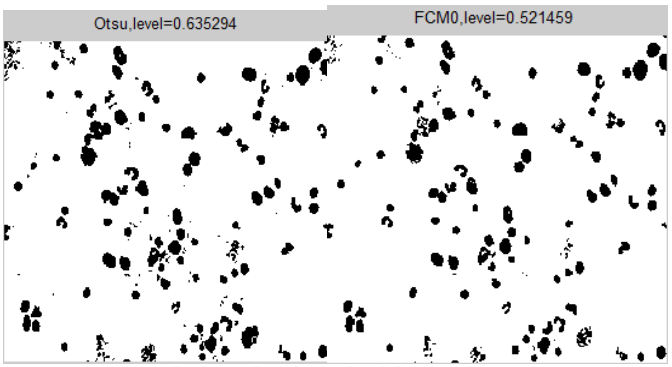

Figure 7.multilevel thresholding by OTSU and FCM method for brighter image.

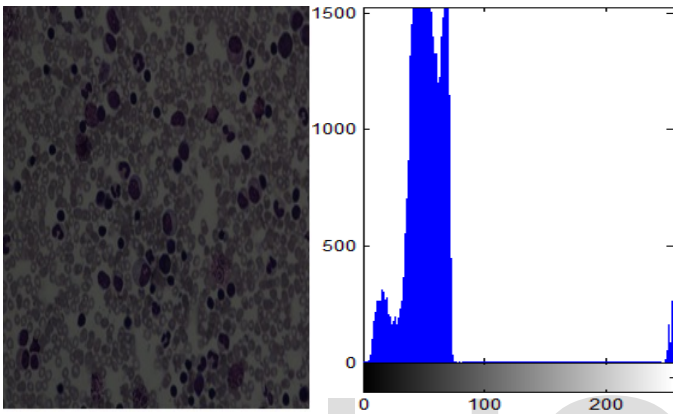

Figure 8. Histogram for darker image.

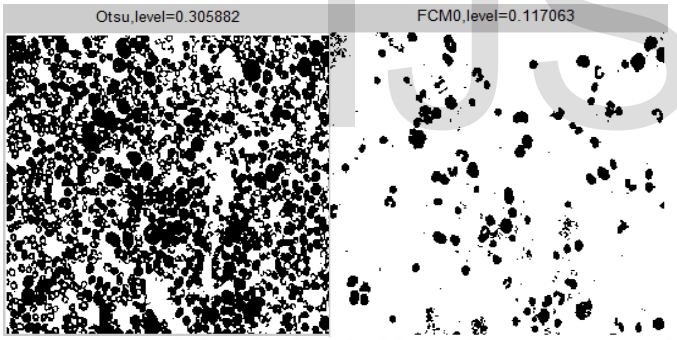

Figure 9.multilevel thresholding by OTSU and FCM method for darker image.

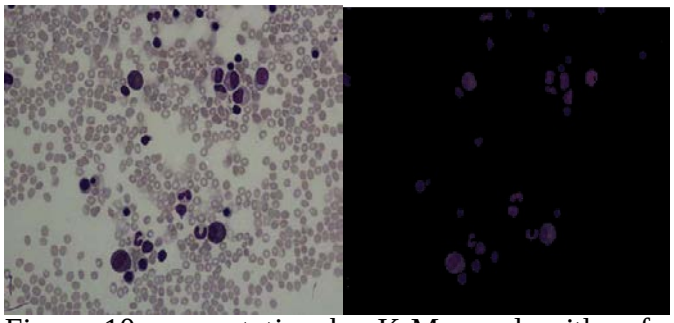
Figure 10.segmentation by K-Mean algorithm for normal image.

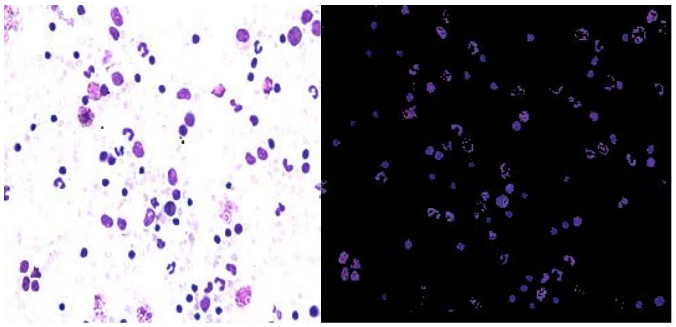
Figure 11. segmentation by K-Mean algorithm for brighter image.

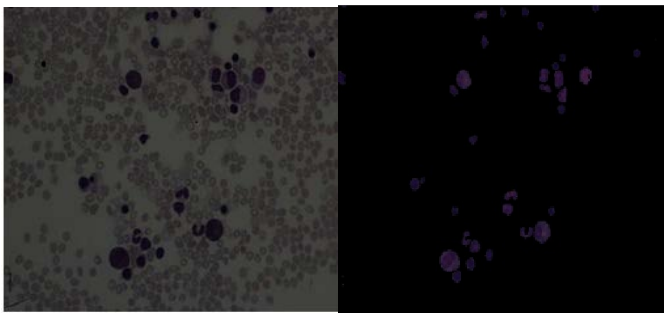
Figure 12. segmentation by K-Mean algorithm for darker image.

DISCUSSION

Multilevel segmentation by OTSU method gives best result only for the brighter images but not for the darker images,for example in figure 4,5,8&9 the OTSU method does not give the exact result whereas FCM method give the result. whereas the multilevel segmentation by fuzzy c-mean clustering method gives better results for all types of images(brighter or darker images), for example in figure 6&7 the OTSU method and FCM method give the result.

In this paper ,we another segmentation method i.e,colour segmentation method using K-Mean clustering algorithm which gives best result for all types of images. For example from figure 10,11&12 (brighter or darker images).

Conclusion

In this paper, a multilevel thresholding method was introduced by using OTSU and FCM method which segments based on the intensity gray level histogram of the image in order to segment the object of interest. Finally, the color segmentation using K-Mean algorithm technique is utilized to segment the WBC from its complicated background.

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