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LEUKEMIA CANCER CELLS SEGMENTATION AND DETECTION USING BRADLEY THRESHOLDING

P. Bhavani[1], G. Umamaheswara Reddy[2], T.Venkatakrishnamoorthy[3]

[1] *M.Tech Student,* [2] *Professor,* [3] *Research Scholar*
Department of Electronics and Communication Engineering, Sri Venkateswara University College of Engineering, Tirupati, Andhra Pradesh, India-517502.

Abstract- ***Blood malignancy chiefly assaults the blood, bone marrow or lymphatic framework. It is determined to have a blood test in which nearness of white platelets is checked by the hematologists which is an exceptionally tedious and dull and for the most part prompts late recognition. Therefore, this field is required to beat the impediments of manual audited process and early and quick identification. Beforehand unique strategies utilized as a part of request to diminish the many-sided quality of the framework. Along these lines need of program's location is required to defeat the confinements of manual checked to process and early and quick discovery. In the present work applying the method of Bradley thresholding with a specific goal to section the white platelets. The proposed calculation includes distinctive advances, for example, shading space transformation, shading thresholding, sifting, marker controlled watershed and diverse morphological activities. This strategy yields favored execution over the other existing methodologies. This method gives the exact and legitimate results.***

Keywords: White platelets;division;leukemia;morphological task;Bradley thresholding.

I. INTRODUCTION

Blood tests can explore numerous infections like malignancy, HIV/AIDS, diabetes, weakness, and coronary illness. Thus the blood tests are of high significance for conclusion of numerous ailments and furthermore to examine elements of body organs, for example, kidney, liver, thyroid, and heart. Manual minute examination is an undeniable necessity when there is an uncertainty of abnormality in the blood test yet it is monotonous,dull and subjective. Cell division is a hard issue because of both the puzzling idea of the cells and the vulnerability display in video microscopy. Manual strategies that existing are difficult, loose and deeply subjective, subsequently requiring computerized techniques that play out this undertaking in a focused and effective way. Computerized recognition and characterization of white platelets[2][6] is a noteworthy advance in the determination of a few disorders like Acute Lymphoblastic Leukemia[8]. The conventional method requires a hematologist to physically count and group the phones with the assistance of a magnifying lens.

A computerized conclusion framework will reduce the workload and the impact of subjective variables. Robotized discovery includes the distinction of red platelets and platelets[1][4][5] from the foundation. The principle disadvantage of the current techniques is their wastefulness in dealing with cell pictures beginning from various sources and condition. There are three sorts of cells in typical human blood: red platelets, white platelets and blood platelets. If the visual example assessment is computerized then it will help the pathologists to expand profitability and decrease costs. The computational procedure incorporates picture procurement, picture preparing and division, include extraction, and grouping. Division is viewed as the most vital and basic advance in the process as it influences whatever is left of the accompanying advances[3][7]. In this paper principle center is around the division step[9][10]. We propose a proficient strategy for white Blood cell cores programmed division. In this examination, the calculation proposed by Madhloo metal. Is adjusting to represent more broad circumstances. The proposed alteration is to lessen reliance on the picture starting complexity. This difference reliance prompts the catching of all protests that have an indistinguishable dim level form of the WBCs. To conquer this drawback we propose to utilize a few limitations to kill the false protest

II. METHODOLOGY

The normal WBCs are separated with each other and the leukemia affected WBCs are connected with each other due to the blast of cells. By using proposed technique WBCs can devided (segmented) which is affected by leukemia. The normal WBCs not affected by this process. The MATLAB is used to get proposed technique. Fig1 shows flow chart of proposed technique

Lab Conversion

The RGB input picture[Fig.2a] is converted into L*a*b[Fig.2b] for this RGB input picture is transferred into XYZ matrix to get normalization of RGB input picture which is shown in equation 1.

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 0.412453 & 0.357580 & 0.180423 \\ 0.212671 & 0.715160 & 0.072169 \\ 0.019334 & 0.119193 & 0.950227 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} \quad (1)$$

Where , X is response of mix of cones, Y is the luminance and Z is the response of S cone. By using equation 2,3,4 XYZ color image is converted into L*a*b color picture.

$$L^* = 116f(Y/Y_n) - 16 \quad (2)$$

$$a^* = 500 \left(f(X/X_n) - f(Y/Y_n) \right) \quad (3)$$

$$b^* = 200 \left(f(Y/Y_n) - f(Z/Z_n) \right) \quad (4)$$

Where, $f(s) = s^{1/3}$ for $s > 0.008856$ and $f(s) = 7.787 + (16/116)$ for $s \leq 0.008856$

The Lab shading space portrays scientifically all noticeable hues in the three estimations L for culture and a and b for the shading parts green– red and blue– yellow. The phrasing Lab starts from the Hunter 1948 shading space. These days Lab is much of the time mis-utilized as a shortened form for CIEL*a*b* 1976 shading space the bullets/stars recognize the CIE adaptation from Hunter's unique rendition.

Color Thresholding:

The above matrix equation is done on L*a*b color picture all the pixels which have the below the required threshold value is eliminated and the resultant picture is called L*a*b veil picture[Fig.3b]. The same matrix operation is repeated on RGB input picture a pixels values which is zero in L*a*b color picture and the resultant picture is called RGB VEIL PICTURE[Fig.4a]

$$0.2928*R + 0.5870*G + 0.1140*B \quad (5)$$

The RGB veil picture is converted into gray cover picture[Fig.4b] and highlighted the all the objected in gray cover picture[Fig.5a] the histogram technique is taken by gray cover picture. Thresholding is the most straightforward strategy for picture division. From a grayscale picture, thresholding can be utilized to make matched the pictures. Thresholding is speedy and computationally compelling method yet does not think about the spatial properties of a photo. Thusly thresholding is sensitive to tumult and power in homogeneities. In low-separate pictures it has a tendency to convey scattered social events of pixels rather than related districts and requires organize estimations as a post dealing with step. Generally speaking, edge based division procedures are not reasonable for completed pictures. This is in light of the fact that the perceptual qualities of completed pictures rely upon higher demand relationship between picture parts or dissents in the scene. In any case, at the highest point of the need list MRI division, thresholding can be used to isolate foundation voxels from the cerebrum tissue or to instate the tissue classes in iterative division strategies, for example, fluffy - implies bunching. An overview on thresholding procedures is given.

Water Segmentation:

The watershed calculation incorporates the three fundamental division approaches like edge based, edge discovery and area based division and subsequently it gives more steady outcomes than these strategies exclusively. It utilizes morphological activities also to define legitimate limits between contiguous locales and morphological tasks. The watershed lines are those single minimum regards to which a drop of water falls with confirmation. The slant of the photo is to be found before applying watershed. The typical for a pixel will be differentiated and the neighboring pixel and if found similar, the pixels are added to shape a zone. The technique is finished till the edge of the region is found or the neighboring regions are above to mix. At this stage a dam is worked to dodge the converging of two distinct districts. In thusly, in the wake of testing each one of the pixels simply the most elevated purpose of the dam is obvious and is the resultant of division of different districts in the test picture.

Generally by using watershed the connected WBCs are seperated[Fig.8a]. The seperated WBCs are damaged so it is necessary to reconstruct the damaged WBCs. The WBCs are reconstructed by morphological reconstruction. continue until the the damaged cells are reconstructed by adding some pixels to WBCs called opening [Fig.8b,Fig.9a]. By removing some cells from the WBCs called closing operation[Fig.9b,Fig10a]. The closing operation equation is shown below. Finally after closing and opening operation the reproduced picture is produced[Fig.10b].

During segmentation and reconstruction the background pixel is taken as 0 and 1 is taken as watershed line. Eventhough after segmentation some platelets are in picture, that can be eleminated by area removal technique[Fig12a]. Now only WBCs are present. After segmentation also some WBCs are not seperated and again segmentation process is used and again marker, gradient size is used. The marker picture is superimposed of the picture and hued watershed matrix is produced[Fig.14a]. The Hued water shed matrix is superimposed on the color picture. Then the required final output picture is produced[fig.14b].

Average Filtering:

The mean channel is a direct sliding-window spatial channel that replaces within the propelling power in the window with the predictable (mean) of all the pixel respects in the window. The window, or piece, is for the most part square yet can be any shape. An instance of mean isolating of a singular 3x3 window of attributes. Average filter is used to remove the random noise the gaussian filter is also used for this purpose only. The average and gaussian filtered pictures is shown in Fig.6(b) and 7(a).

III.THRESHOLDING

Otsu Thresholding:

Otsu's thresgolding mathematical equation is.

$$\sigma_w^2(T) = v_1(T)\sigma_1^2(T) + v_2(T)\sigma_2^2(T) \quad (6)$$

Where, σ_w is the within class variance, σ_i is the class variance of foreground or background, T is the optimum thresholding value to binarize the image and class probabilities, v_1 and v_2 are estimated from histogram. By using equation 2 gray image is converted in binary image.

$$I_{bin}(x,y) = \begin{cases} 1, \text{ if } I_{gray}(x,y) \geq T \\ 0, \text{ otherwise} \end{cases} \quad (7)$$

In PC vision and picture setting up, Otsu's system, named after Nobuyuki Otsu, is utilized to thusly perform gathering based picture thresholding, the decreasing of a diminish level picture to a twofold picture. In PC vision and picture dealing with, Otsu's system, named after Nobuyuki Otsu is utilized to regularly perform pressing based picture thresholding, or, the decrease of a lessen level picture to a consolidated picture. The figuring recognize that that the photo contains two classes of pixels following bi – secluded histogram, it by then registers the ideal edge restricting the two classes with the target that their joined spreaded thresholding or the lessening of a diminish level picture to a matched picture. The estimation acknowledges that the photograph contains two classes of pixels following bi-specific histogram, it by then processes the perfect edge secluding the two classes with the objective that they're joined spread is insignificant, of indistinguishably, so their between class vacillation is maximal. Along these lines, Otsu's are around a one-dimensional, discrete crucial to Fisher's Discriminant Investigation.. The Otsu's technique is additionally especially identified by the Jenks change system.

Bradley Thresholding Method:

Bradley Thresholding Method proposed a system for flexible thresholding using the central image of the data. Flexible thresholding is used as a piece of demand to think about spatial assortments in edification. Proposed method is the extended version of the previous one. Regardless, this system is more solid to edification changes in the photo that is more standard and easy to wrap up. To process the fundamental picture saved in all regions *I(x, y)*, the whole of all *f (x, y)* terms in reality side or dependably the pixel (x, y). This is good at straight time employing the state for each pixel.

$$I(x, y) = f(x-1, y) + I(x, y-1) \quad (8)$$

In the process of altering the specified image into required image, the whole purpose of restriction concerning a rectangle with upper left corner.*(x1 , y1)* and minimize right corner *(x2 , y2)* can be shaped in fixed period using the following state, This thresholding system is the enhanced version of Wellner's procedure. The basic notion of Wellner's system is that each pixel is appeared differently in relation to or on the other hand base category. Bradley's structure for picture binarization functions more for distorted light images and sensible for managing current video streams at a fixed limit, it is a productive device for instinctive purpose, for instance , broadened reality. It is like, way covers the vicinity of each pixel, refine to glow dim if the pixels intensity is t percent less than the typical sparkle of enveloping pixels.

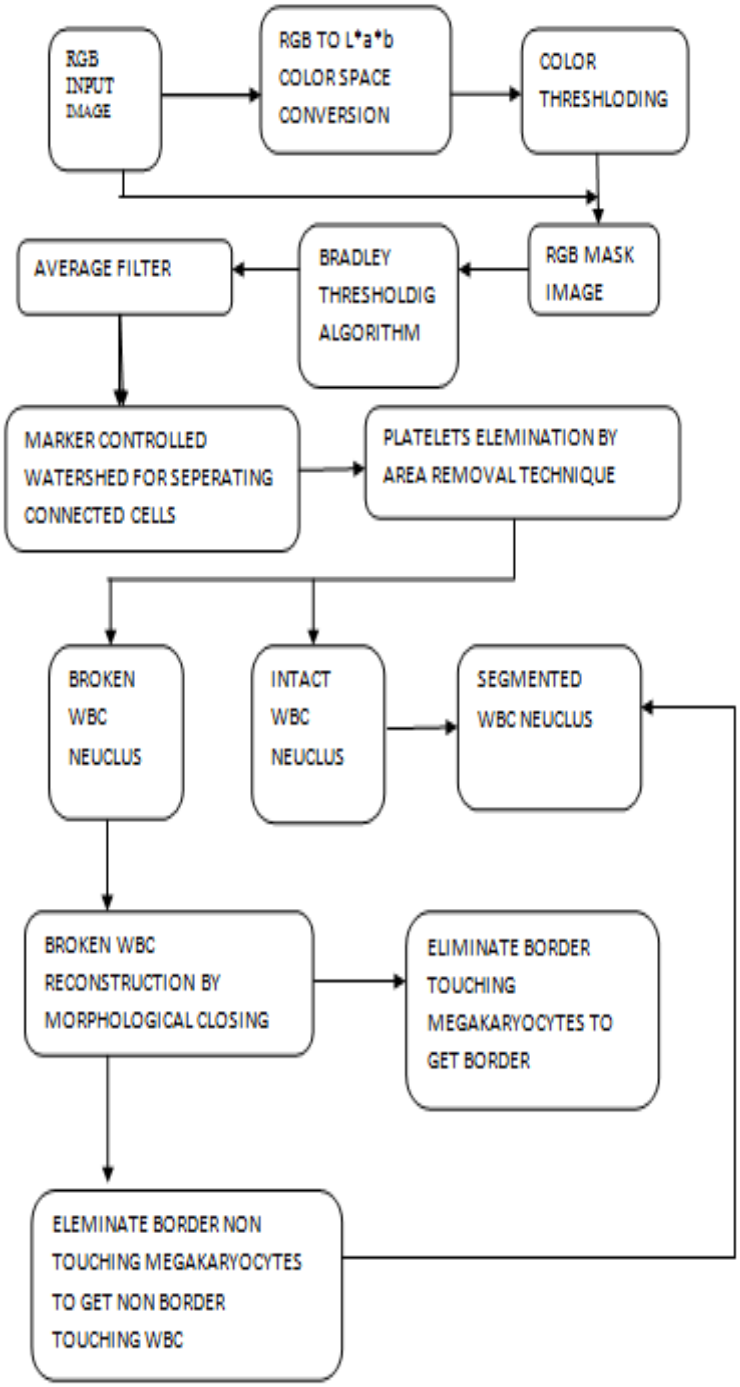


Fig.1 Flow chart for proposed method

Bradley general thresholding technique is related to a general thresholding evaluation of the dull scale image. The numerical condition of Bradley common thresholding method. Where, σw is in the class flux, σi is the standard segment of closer vision or establishment, *T* is the ideal thresholding appealing force to binarize the photo and class possibilities, v_1 and v_2, are explored from histogram. Likewise, by using this technique consider the dim scale image is altered into fixed image by running the procedure. A standard channel is joined with the parallel picture to wipe out any sort of sporadic turmoil. By then marker controlled watershed is associated with pull back related WBC in the midst of leukemia. The marker controlled watershed entails two images one is marker and other is cover. The marker image can be formed by Euclidean division change. The most ousted point picks the partition from each nil pixel to its nearest existing pixel. coming to fruition organize platelets can be removed by zone discard technique and the non edge touching and edge touching megakaryocytes are removed to obtain the image which contain only white blood cells. At that point finally the segment WBC can be disengaged among the leukemia state.

IV.RESULTS AND DISCUSSIONS

Figure 2(a) shows the input image (given picture) and it is converted into L*a*b image which is shown in Figure 2(b). The L*a*b image is subjected to color thresholding and shown in Figure 3(a). Corresponding L*a*b mask image (L*a*b changed over veil picture) is shown in Figure 3(b). The L*a*b mask image is superimposed on the RGB input image and got an RGB mask image(RGB veil picture). Figure 4(a), Figure 4(b) shows RGB mask image (RGB veil picture) and its gray scale image (gray cover picture). All the objects from the gray mask are highlighted (tinted). Figure5 (a) shows highlighted objects(tinted objects) and Figure 5(b) shows corresponding histogram. By using a Bradley thresholding binary image is obtained which is shown in Figure 6(a). Figure 6(b) shows average filtered image, Figure 7(a) shows a Gaussian filtered images for binary image to remove random noise. Figure 7(b) shows the gradient magnitude of the filtered image.

The filtered image is marked and segmented by using marker controlled watershed, platelets are eliminated by using area removal technique, the broken white blood cells can be reconstructed by using morphological closing which is shown in Figure 8 to Figure 13. The completely reconstructed white blood cells image is shown in Figure 14.

(a) *(b)*

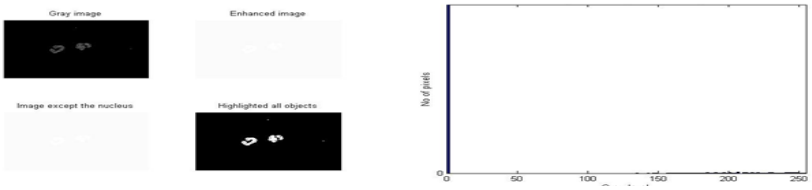
*Fig. 2 (a) Given picture (b) L*a*b changed over picture*

(a) *(b)*

*Fig. 3 (a) Shading edge picture (b) L*a*b changed over veil picture*

(a) *(b)*

Fig . 4 (a) RGB veil picture (b) Gray cover picture



(a) *(b)*

Fig. 5 (a) Tinted all objecats (b) Histogram prior to display picture

(a) *(b)*

Fig. 6 (a) Bradley binary picture (b) Avg filtered picture

(a) *(b)*

Fig. 7 (a) Gaussian filtered picture (b) pitch slope

(a) *(b)*

Fig. 8 (a) Watershed segmentation (b) Opsening

(a) *(b)*

Fig. 9 (a) Opening-by-reassemble (b) Opening-shutting

(a) *(b)*

Fig. 10 (a) Opening-shutting by remaking (b) Provincial maximum of opening-shuttingby reproduction

(a) (b)

Fig. 11 (a) Neighbourhood maxima superimposed on astounding picture

(b) Adjusted maxima super imposed on remarkable picture

(a) *(b)*

Fig. 12 (a) Picture after removal platelets (b) Disturbed watershed

(a) *(b)*

Fig. 13 (a) Gradient size (b) Marker and items superimposed on unique picture

(a) *(b)*

Fig. 14 (a) Hued watershed lable matrix (b) Required picture

$$MSE=\frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}\left[I(i,j)-K(i,j)\right]^2 \tag{9}$$

The PSNR (in db) is defined as:

$$PSNR=10\times\log_{10}\left(\frac{MAX_I^2}{MSE}\right) \tag{10}$$

Table.1: Comparison of PSNR for Otsu and Bradley thresholding Blood Samples

Blood Samples	Otsu Thresholding	Bradley Thresholding
L1	48.1785	55.4677
L2	48.1728	55.4610
L3	49.2623	55.5606
L4	48.2463	55.5767
L5	48.1835	55.5767

Table.2: Comparison of MSE for Otsu and Bradley Thresholding Blood Samples

Blood Samples	Otsu thresholding	Bradley Thresholding
L1	0.9969	0.7668
L2	0.9982	0.7682
L3	0.7767	0.7485
L4	0.9814	0.7453
L5	0.9957	0.7644

V.CONCLUSION

In exisisting method otsu thresholding is used it is good for thresholding a histogram with bimodal and multimodal distribusion. But this technique fails if the histogram is unimodal. This method works for images whose histogram shows clear bimodal distribution. The otsu thresholding is come under the global thresholding. Proposed technique uses bradley thresholding which is well suited for scenes with strong spatial changes in illumination are also handeled automatically, which is not possible for global thresholding method. The proposed algorithm highlighted the input image objects. The isolated picture can be further portrayal and group the leukemia influenced and ordinary white platelets. Utilizing the Bradley thresholding the segmentation strategy gets improved. The strategy gives precise and legitimate outcomes than the other condition of workmanship approaches.

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About The Authors:

P. Bhavani, M.Tech student in Electronics and Communication Engineering, specialization in Signal Processing, Sri Venkateswara University, Tirupati. She has completed B.Tech in Electronics and Communication Engineering from Narayana Engineering College, Nellorre. Her areas of interests are image processing and communication.

Dr. G. Umamaheswara Reddy is currently working as a Professor in the Department of Electronics and Communication Engineering at Sri Venkateswara University, Tirupati, Andhra Pradesh, India. He has completed B.Tech in Electronics and Communication Engineering, M.Tech in Instrumentation& Control Systems, and obtained Ph.D. from Sri Venkateswara University,Tirupati, India. He is a member of ISTE, IE, and BMSI. He has a teaching experience of more than 20 years and has 16 technical publications in National & International Journals.His areas of interest include Signal Processing and Biomedical Signal Processing.

T. Venkata Krishnamoorthy is a Research Scholar in the Department of Electronics and Communication Engineering at Sri Venkateswara University, Tirupati, Andhra Pradesh, India. He has completed B. Tech in Electronics and Communication Engineering from JNT University, Hyderabad, India and M.Tech in Communication and Signal Processing from Sri Krishnadevaraya University, Anantapur, India. He has Teaching & Industrial Experience of 8 years. His areas of Interest are Image and Signal Processing. He is a lifetime member of ISTE.