LEUKEMIA BLOOD CANCER DETECTION UNING IMAGE PROCESSING

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Abstract:

Leukemia occurs when lot of abnormal white blood cells produced by the bone marrow. Hematologist makes use of microscopic study of human blood, which leads to need of methods, including microscopic color imaging, segmentation, classification, and clustering that can allow identification of patients suffering from Leukemia. The microscopic images will be inspected visually by hematologists and the process is time-consuming and tiring. The automatic image processing system is urgently needed and can overcome related constraints in visual inspection. The proposed system will be on microscopic images to detect Leukemia. The early and fast identification of Leukemia greatly aids in providing the appropriate treatment. Initial segmentation is done using Statistical parameters such as mean, standard deviation which segregates white blood cells from other blood components i.e. erythrocytes and platelets. Geometrical features such as area, perimeter of the white blood cell nucleus is investigated for diagnostic prediction of Leukemia. The proposed method is successfully applied to many images, showing promising results for varying image quality. Different image processing algorithms such as Image Enhancement, Thresholding, Mathematical morphology and Labelling are implemented using Lab view and matlab.

I. INTRODUCTION

THE important part of any human body is blood as it keeps one alive. It performs many important functions such as to transfer oxygen, carbon dioxide, mineral and ete. to the whole body in order to maintain metabolism.Blood consists of three main components which RB, WBCand very dangerous if earlytreatment is not taken. One of the common blood disorders isLeukemia.Leukemia is the common typeof cancerinchildren. All cancers begin in body cells ,most and leukemiais acancer that begins in blood cells. Generally, cells grow andmultiply to form new cells as the body needs them. When cellsgrow oldtheydie and newcells taketheir place.Sometimes,this cycle does not work correctly. In cancer, newcells are formed when the body does not need them, and oldcells do not die when they should[1].

Leukemia is a cancer that involves the blood-formingtissues of the bone marrow, spleen any lymph nodes. It ischaracterized by an uncontrolled production of immatureblood cells.

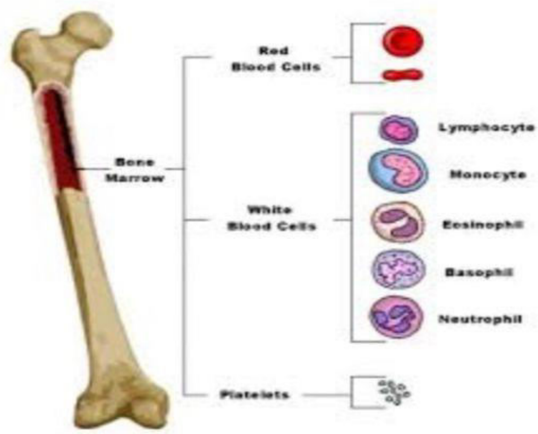

Fig.1 Production of blood cells.

The bone marrow is the site where lymphocytes and other blood cells are made. It is a spongy tissue found inside many large bones of the body. The bone marrow produces three types of blood cells: RBCs contain hemoglobin and carry oxygen and other materials to the tissues throughout the body; Platelets help to form clots; WBCs help fight off infections in the body. When a person has leukemia, the bone marrow does not work properly. The bone marrow produces abnormal, immature cells, called leukemia cells. Leukemia cells are mostly referred to as "blasts". These immature cancer cells crowd out other blood-forming cells in the bone marrow. If a bone marrow is not able to make enough RBCs to carry oxygen, the child may develop anemia, and feel very tired. If sufficient platelets are not produced, the blood will not clot properly, and the patient may bleed easily. When WBCs are not plentiful enough, the body cannot fight off germs and the person may develop a frequent infection Leukemia can be either acute or chronic in type[1].

The paper is organized as follows: section II consists of literature survey, section III describes proposed method, section IV contains results and discussion and section V is conclusion.

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II. LITERATURE SURVEY

The diagnosis of leukemia frequently follows a routine blood test that results in an abnormal blood cell count. Once leukemia is suspected, the doctor may take samples of bone marrow and blood to examine cell shape. Samples are also sent to the pathology lab to identify proteins located on the surface and chromosomal and changes. This information is important for diagnosis of individual patients.

2.1 Existing Methods for DiagnosisMedical history and physical examination: Thepanda to pre us Map main and problems a Personal family also helps in diagnose leukemia.

2.Complete blood count (CBC): Blood is taken andchecked under the microscope for the number ofRBCs, WBCs and platelets.

3. Bone marrow aspiration: Bone marrow is removedwith the help of a needle from breastbone. Theremoved sample is observed under a microscope tolook for abnormal cells.Cytogenetic analysis: Cytogenetic test takebloodor bone marrowto help identify individualchromosomes. Showsabnormalitiesinchromosomes, which help to diagnosis and identifythe type of leukemia. Results are usually availablewithin 3 weeks.Immunohistochemistry: Blood sample of cells aretreatedWithspecialantibodiesinimmunohistochemistry. Under the microscope thechange in color can be seen. It helps in determining 4the types of cells that are present

2.2 Image processing techniques

1. Hossein Ghayoumi Zadeh, et al. [2] In this work, animage analysis approach for automated detection,preprocessing- smoothing, enhancement, segmentation,feature extraction- morphological and calorimetric andthen detection and classification of particular cells,especially the cancer cells from normal cells is done.

2. Minal D. Joshi, et al.[3] This paper has proposedautomatic Otsu's Thresholding for bloodcellsegmentation method along with image enhancementand arithmetic for WBC segmentation. K-NN classifierhas been utilized to classify blast cells from normallymphocyte cells.

3. N.Z. Supardi, et al. [4] This paper presents the study onblasts classifying in acute leukemia into two majorforms which are ALL and AML by using K-NN. 12main features that represent size, color-based and shapewere extracted from blood images. The k values anddistance metric of k-NN were tested inorder to

findsuitable parameters to be applied in the method ofclassifying the blasts.

4. FauziahKasmin, et al.[S] This paper describespreliminary study of developing a detection of leukemiatypes using microscopic blood sample images. It willuse features in microscopic images and examinechanges in texture, geometry, color and statisticalanalysis. Changes in these features will be used as aclassifier input.

5 .Lim Huey Nee, et al.[6]In this paper, the gradientmagnitude, Thresholding, morphological operations andwatershed transform to perform cell segmentation isdone. 50 images were used to test the proposed methodand the result showed that the method managed toobtain qualitatively good segmentation results.

6. N.H. Abed Halim, et al.[7] In this paper, a globalcontrast stretching and segmentation based on HIScolor space is used to improve the image quality. Imageenhancement procedure is used to extract the nucleusregion in the WBC image sample by using samethreshold value, for both ALL and AML images.

7. RuggeroDonidaLabati, et al.[S] In this paper, theyproposed a new public dataset of blood samples,specifically designed for the evaluation and thecomparisonof algorithms for segmentationandclassificationFor each image in the dataset, theclassification of the cells is given, as well as a specificset of figures of merits to fairly compare theperformances of different algorithms. The number ofcounting blood cells will then be used to calculate theratio of blood cells for leukemia detection.

PROPOSED METHOD:

From the literature survey, it is found that typical steps fopautomatic leukemia cell detection are as in Figure 2.

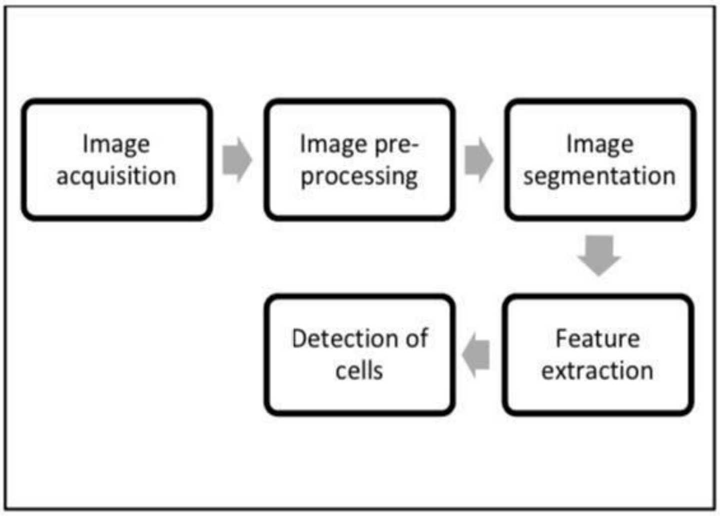

Fig.2 Typical steps for automatic leukemia cell detection

A. Nucleus segmentation - using LabviewThe quality of the microscopic image depends on theexposure of the microscope staining process. Over andunder exposure setting may cause difficulty in detection.Image enhancement processes consist of a collection oftechniques that attempt to convert the image into theform better suited for analysis by human or machine.

The algorithm used to develop the nucleus segmentationtechnique is as follows:

Step1: Input the color blood slide image to thesystem.

Step2: Convert the color image into grayscaleimage.

Step3: Enhance contrast of the grayscale image byusing histogram equalization method.

Step4: Calculate the statistical parameters such asthe mean and standard deviation of theimage.

Step5:Calculate the average values of mean andstandard deviation.

Step6: Apply multi-threshold method of keepingstandard deviation as a lower limit, mean asmiddle limit and 255 as the upper limit ofthreshold.

Step7: To removesmall pixel groupsusemorphological erosion.

Step8: Apply sobel edge detector.

Step9: Calculate the geometrical features such asarea and perimeter of segmented cells.

Step10: Based on the features extracted in abovestep, classify cell as blast or normal cell.

B. Nucleus segmentation - using Matlab (5)
Step1:Input the color blood slide image to the system.
Step2: Convert the color image into grayscale, sothat the nucleus part of the cell will appearas the darkest part of the image.
Step3: Perform linear contrast enhancement(L.) andHistogram equalization(H).
Step4: Perform Al:addition of L and H.
StepS: Perform A2: subtraction of L and H.
Step6: Perform A3 addition of Al and A2.
Step7: Apply Otsu's Thresholding.
Step8: Apply removal of small particles and Sobeledge detection
Step9: Feature extraction
Step10: Classification of cell.

IV. RESULTS AND DISCUSSION

In the algorithm of nucleus segmentation using Labviewthe image is enhanced using histogram equalization methodand nucleus segmentation of enhanced image is done usingstatistical parameters such as mean and standard deviation.The proposed technique has been applied on 128 microscopicblood slide images. Fig. 3 and 4 represent the block diagramand front panel of Labview.In the result, geometrical features such as area andperimeter of each cell are calculated. Depending on thepleature values cell is classified into blast or normal cell.

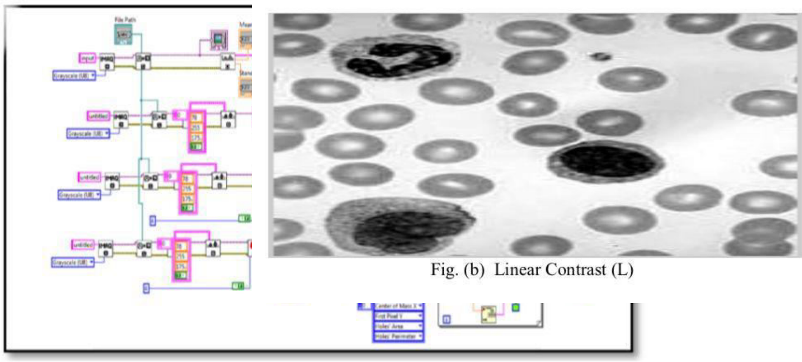

Fig. (b) Linear Contrast (L)

Fig.3 Block diagram

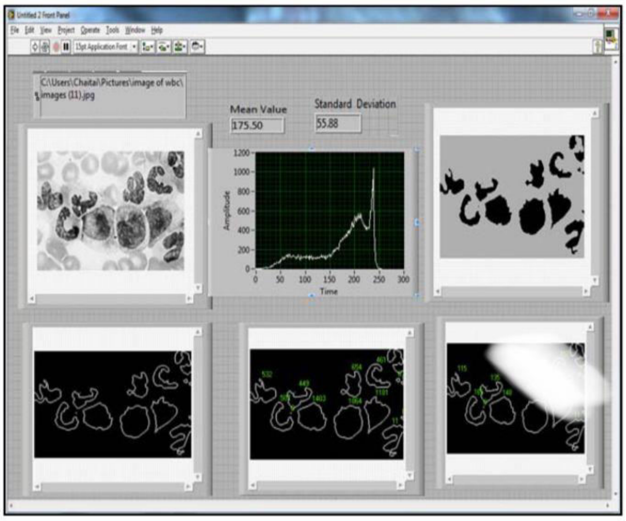

Fig.4 Front panel

In the second algorithm, nucleus segmentation using Matlab, all the images are converted into grayscale images sothat the nucleus part of the cell will become the darkest part ofthe image.

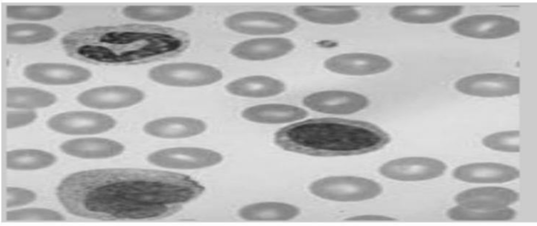

Fig. (a) Grayscale Image

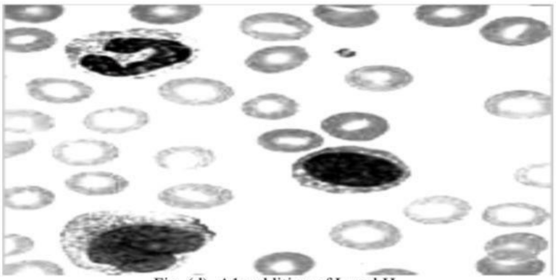

Fig. (d) A1: addition of L and H

Fig. (c) Histogram equalization (H)

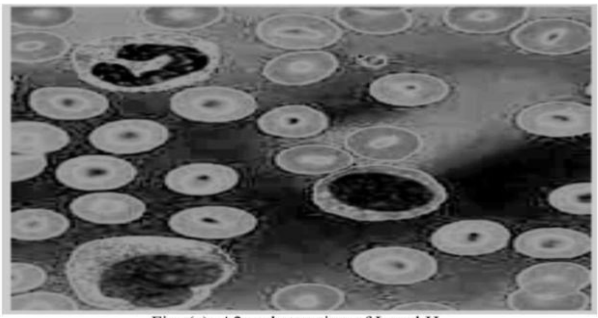

Fig. (e) A2: substraction of L and H

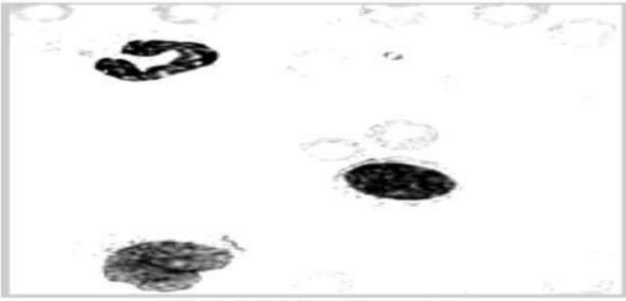

Fig. (f) A3: addition of A1 and A2

Fig. (g) Otsu's Thresholding

CONCLUSION:

The main aim of this paper is nucleus segmentation followed by feature extraction to detect Leukemia. Shape features of nuclei such as area, perimeter, etc. are considered for better accuracy of detection. The results show that the proposed statistical parameter such as mean and standard deviation-based image segmentation and Otsu's thresholding based produced good segmentation performance. In addition, the fully segmented nucleus can be better achieved by using lab view based algorithm because it is less sensitive to input image variations.

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