ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 7, Issue 5, May 2018

Blood Cancer Detection Using Image processing

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Abstract— **Determining The aim of the project is to detect the leukemia at earlier stage with the help of image processing techniques. Leukemia means blood cancer which is featured by the uncontrolled and abnormal production of white blood cells (leukocytes) by the bone marrow in the blood. Acute Lymphoblastic Leukemia (ALL) is atype of leukemia which is more common in children. The term „Acute" means that leukemia can progressquickly and if not treated may lead to fatal death within few months. Due to its non specific nature of the symptoms and signs of ALL leads wrong diagnosis. Even hematologist finds it difficult to classify the leukemia cells, there manual classification of blood cells is not only time consuming but also inaccurate. Therefore, early identification of leukemia yields in providing the appropriate treatment to the patient. Detection through images is fast and cheap method as there is no special need of equipment for lab testing. We have focused on the changes in the geometry of cells like area, perimeter and statistical parameters like meanand standard deviation which separates white blood cells from other blood components using processing tools like MATLAB. After recognizing its statistical properties, types of leukemia will be identified based on the irregularities in the shape**

Keywords—Acute Lymphoblastic Leukemia (ALL); Blood Cancer; Leukemia; Statistical Parameters

I.INTRODUCTION

LEUKEMIA is the most critical blood disease, common in children and adults. A majority cancer cell begins in body parts but leukemia is the type of cancer which begins and grows in blood cells .Blood is crucial content without which metabolic functions of bodyseverely affects. Human system is like, cell grows and multiply into new cells. Old cells are destroyed and so that new cells can take their place. In cancer, an old cell does not die and remains in the blood so that new cells which are produced cannot get enough space to live. In this way, functioning of blood disturbs and white blood cells production is abnormal and uncontrolled.

1.1. Components of Human Blood Cell

Blood cells are produced from the stem cells present in bone marrow. Blood consists of following components.

- Red Blood Cells (Erythrocytes): RBCs has a capacity to carry oxygen to and take back CO2 away from tissues.
- White Blood Cells (Leukocytes): WBCs are the cell which fights with the foreign bodies and prevents from infection.

There are different types of WBCs like lymphocytes, monocytes, eosinophile, basophilsand neutrophils. According to WBCs types there are different types of leukemia.

- Blood Platelets: It helps for the clotting of blood an controls bleeding.

1.2. Types of Leukemiaa

A. Acute Lymphocytic Leukemia (ALL)
It occurs in children of age 1-12 years and adults of age 40 years. Here lymphocytic cell of WBCs gets affected. all Is also known as Acute Lymphoblastic Leukemia. ALL most common in men compare to women [Sindhu & Meera, 4].

B. Acute Myeloid Leukemia (AML*)*
It occurs in children of age 1 year and old age patient. Enlargement of spleen and bone pain these are the prime symptoms of acute myeloid leukemia. In this myeloid line of stem cells are affected.

1.2.2. Chronic Leukemia
Human body does not show any symptoms at early stages. Means at early stage abnormal cells does not affect the working of normal cells. It progresses slowly and affects large area of blood cells and getting symptoms last stage. Atlast stage, it is incurable.

A. Chronic Lymphocytic Leukemia (CLL)
It occurs in senior citizen patients who suffer from old agediseases. Lymphocytes are affected. It does not show any symptoms at early stage.

B. Chronic Myeloid Leukemia (CML)
It occurs in middle age patients of age 35 45 years. Genetic changes occur at early stage of myeloid cells.

II. RELATED WORK

2.1. Counting of RBC's and WBC's using Image Processing Technique

The measure of WBC and RBC Cells are very important for the doctor to diagnose various diseases such as anemia,leukemia etc. So, precise counting of blood cells plays very important role. The old conventional method used in hospital laboratories involves manual counting of blood cells using a device called Haemocytometer. But this process is extremely monotonous, time consuming, and leads to inaccurate results.Even though hardware solutions such as the Automated Hematology Counter exits, they are very expensive machines and unaffordable in every hospital laboratory. In order to overcome these problems, this paper presents an image processing technique to detect and to count the number of redblood & white blood cells in the blood sample image using circular Hough transform and threshold techniques.

i. Morphological Operations

2.2. White Blood Cells Segmentation and Classification to Detect Acute Leukemia

In order to improve patient diagnosis various image processing software are developed to extract useful information from medical images. Hematologist makes the microscopic study of human blood which led to a need of methods, including microscope color imaging, segmentation, classification, and clustering that can allow the identification of patients suffering from leukemia. Leukemia is related with blast White Blood Cell (WBC). The nonspecific nature of the signs and symptoms of ALL often leads to wrong diagnosis so hematologist also find difficulty for blast cell classification hence manual classification of blood cells is time-consuming and susceptible to error. Therefore fast, accurate and automatic identification of different blood cells is required. This paper has proposed automatic Otsu‟s threshold blood cell segmentation method along with image enhancement and arithmetic for WBC segmentation. KNN classifier has been utilized to classify blast cells from normal lymphocyte cells.

2.3. Image Analysis of Blood Microscopic Images for Acute Leukemia Detection

Acute Lymphoblastic Leukemia (ALL) is a serious hematological disease of childhood which is characterized by abnormal growth and development of immature white blood cells (lymphoblasts). ALL makes around 80% of childhood leukemia and it mostly occur in the age group of 3-7. The non specific nature of the signs and symptoms of ALL often leads to wrong diagnosis. Diagnostic confusion is also posed due to imitation of similar signs by other disorders. Careful microscopic examination of stained blood smear or bone marrow aspirate is the only way to effective diagnosis of leukemia. Techniques such as fluorescence insitu hybridization (FISH), immune phenotyping, cytogenetic analysis is also employed for leukemia detection. The need for automation of leukemia detection arises since the above specification tests are time consuming and costly. Morphological analysis of blood slides are influenced by factors such as hematologists experience and tiredness, resulting in non standardized reports. A low cost and efficient solution is to use image analysis for quantitative examination of stained blood microscopic images for leukemia detection. A fuzzy clustering based two stage color segmentation strategy is employed for segregating leukocytes or white blood cells (WBC) from other blood components. Discriminative features i.e. nucleus shape, texture are used formal detection of leukemia. In the present paper two novel shape features i.e., Dimension and contour signature is implemented for classifying a lymphocytic cell nucleus. Support Vector Machine (SVM) is employed for classification. A total of 108 blood smear images were considered for feature extraction and performance evaluation is validated with the results of a hematologist.

2.4. Existing Work

Various image processing techniques has been developed by researchers to detect leukemia in microscopic images of human blood samplesSome of them are uses thresholding techniques in determining the ratio of blood cells for cancer cells detection. In thresholding technique, [Abdul Nasir et al3] image processing techniques has been used to count the number of blood cells in the biomedical image. With this counted value of blood cell, the ratio of blood cell for leukemia is calculated. The original image which is converted to grayscale image for which a threshold value of intensity is set in order to differentiate WBC to RBC (thresholding converts a gray scale image to binary image). If results are not satisfied the process is repeated by setting a new threshold value. The results acquired using thresholding technique shows that the ratio of RBC and WBC for normal image to the abnormal image has different range of ratio. For normal images the ratio is 0 to 0.1 whereas for abnormal images its ratio ranges 0.2 to 2.5 for ALL and 0 to 14 for AML. The disadvantage of this technique is setting of proper threshold value would be difficult and time consuming.

III. Proposed Work

From the literature review, the following are the steps to be followed for automatic detection of blood cancer shown in figure 1.

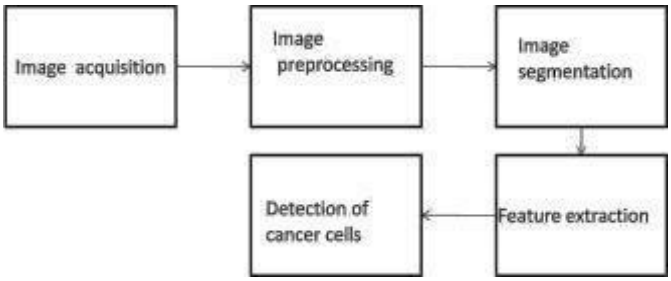


Figure 1: Sequence of Steps for Automatic Blood Sample Image Recognition

3.1. Modules

- Image acquisition.
- Image preprocessing.
- Image segmentation.
- Feature extraction.

3.1.1. Image Acquisition

Microscopic images of blood cells are acquired with the help of digital microscope. Digital microscope which has inbuilt camera inside it is in trend to acquire digital images of cell.

3.1.2. Image Preprocessing

Due to excessive stains and manual intervention microscopic images which are acquired possesses noise. Here noise present are mainly shadows of nuclei. Our region of interest is blood cell nucleus, so we process images to remove unwanted noises and recover important one. Some previous studies proved that the image enhancement technique like

contrast enhancement can improve medical image quality. In this enhancement process, images are improved to make it suitable for further stages of processing. Blood cell images are enhancement with the help of linear contrast enhancement technique. Popular contrast enhancement technique is histogram equalization which adjusts the contrast and image intensity as per required.

3.1.3. Image Segmentation

Image segmentation of microscopic blood cell images are done to locate the WBCs structure which are abnormal. Segmentation of images means partitioning the image into a set of pixels. A novel cell detection method which uses both intensity and shape information of blood cell to improve the nucleus segmentation. Accuracy of feature extraction of images is depends of proper segmentation of white blood cells. WBCs segmentation means segmentation of nuclei of abnormal cells. In leukemia patient white blood cells possesses abnormal structure of nuclei.

3.1.4. Feature Extraction

Features of WBCs are extracted to decide whether the cell is blast or normal [Xu Gongwen et al., 8]. Following are the features which are considered while detection of leukemia.

- **Statistical:** Statistical parameters like mean, variance, standard deviation and skewness of histogram of image matrix of cell and gradient matrix are acquired.
- **Textural:** Textural features of WBCs cell include cell homogeneity, correlation factor, entropy, contrast and energy.
- **Geometrical:** It includes geometrical features like area of cell, perimeter, radius, eccentricity,symmetry and concavity.

IV. SIMULATION ENVIRONMENT

4.1. Algorithm

Nucleus Segmentation using MATLAB:

1) Original microscopic image of blood cell is acquired and entered into the system.
2) Conversion of colored RGB blood cell image into grayscale image.
3) Perform operation like linear contrast enhancement C and histogram equalization H on image.
4) L1: Addition of image C and H.
5) L2: Subtraction of image C and H.
6) L3: Addition of image L1 and L2.
7) Use Otsus thresholding method for conversion of grayscale image into binary image.
8) Image filtering using median filter which removes noise.
9) Edge detection using sobel operator.

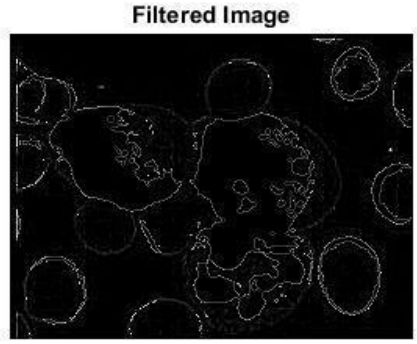
10)Blood cancer Detection .

4.2. Otsus Thresholding

Main purpose of thresholding is to create binary image (black and white). In Otsus method, we find threshold value that minimizes weight within class variance or maximizes weight. This method directly operates on gray level histogram of image.

4.3. Edge Detection by Sobel operator

Sobel operator is prominent edge detection operator which creates images emphasizing the edges and transitions. Technically sobel operator is 3*3 image gradient operators. In edge detection technique we compute approximation of gradient S of image intensity values [Minal D. Joshi et al., 7]. Following is the 3*3 matrix of sobel operator on x-axis and



y-axis.

Figure 2: filtered Gray Scale Image of Normal Blood Image

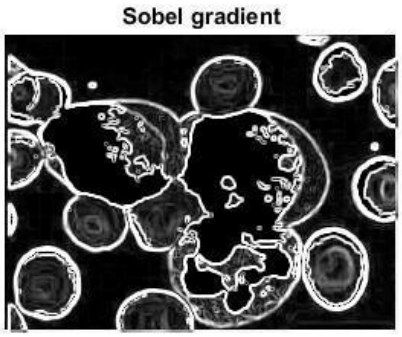


Figure 3: Gray Scale Image after sobel gradient operation.

V.SIMULATION RESULT

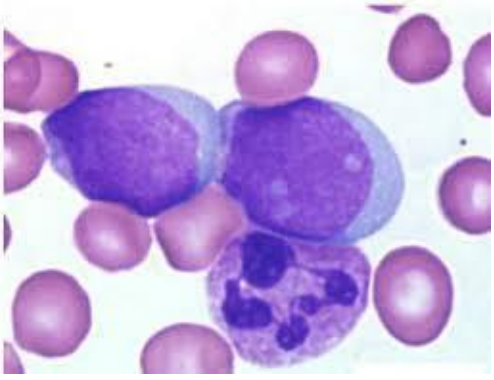


Figure 4: **Original Image.**

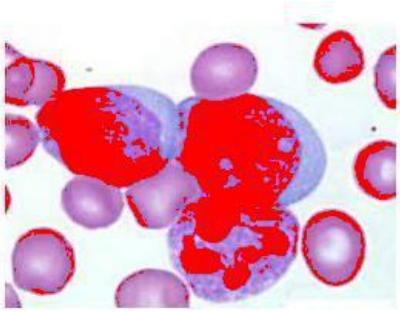


Figure 5:Final Image showing infeccted area.

VI. CONCLUSION

The purpose of this paper was to implement image processing techniques in deciding presence of leukemia in white blood cell images. Image segmentation of various leukemia types such as Acute Lymphocytic Leukemia (ALL), Chronic Lymphocytic Leukemia (CLL) are covered using MATLAB which is 91 accurate. Image processing technique for leukemia diagnosis is time saving and cheaper as compare to ***the old laboratory testing method.***

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