DETECTION OF LEUKEMIA USING IMAGE PROCESSING

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Abstract: In a manual method of leukemia detection, experts check the microscopic images. This is lengthy and time taking process which depends on person's skill and not having a standard accuracy. In this proposed approach of leukemia detection process Image j is a tool which is used here for understanding the process of entire detection. And this tool has an in built procedure for pre-processing and segmentation. Using this tool there is a facility of converting RGB image to gray colour image and converting grey colour image to binary image directly. In this tool installing macros for each step facilitates the process of detection of leukaemia. Macros may be in java or python or mat lab or Inbuilt macros. In this process using cell count and some other parameters like area and perimeter leukemia can be detected and can classify whether it is ALL (or) CLL (or)Not.

Keywords: leukemia, segmentation, CLL, ALL, Thresholding

I. INTRODUCTION

"The Acute Lymphoblastic Leukemia Image Database for Image Processing," Ruggero Donida Labati, Vincenzo Piuri, Fabio Scotti proposed a new public and free dataset of microscopic images of blood samples, specifically designed for the evaluation and the comparison of algorithms for segmentation and image classification. The initiative is focused on Acute Lymphoblastic Leukemia (ALL), a serious blood pathology that can being fatal in as little as a few weeks if left untreated, most common in childhood with a peak incidence at 2-5 years of age [2]. Acute leukemia is a disease of the leukocytes and their precursors. It is characterized by the appearance of immature, abnormal cells in the bone marrow and peripheral blood and frequently in the liver, spleen, lymph nodes, and other parenchymatous organs. The paper presents the pre-processing methods of the leukemic blast cells image in order to generate the features well characterizing different types of cells. The solved problems include: the segmentation of the bone marrow aspirate by applying the watershed transformation, selection of individual cells, and feature generation on the basis of texture, statistical and geometrical analysis of the cells [3]. **A** WBC count is blood test to measure the number of white blood cells [6]. Various image processing techniques has been developed by researchers to detect the blood cancer in biomedical images of human blood samples. Some of them are [7], uses a technique in determining the ratio of blood cells for cancer cells detection. [8], uses two methods of image segmentation i.e. thresholding and watershed to detect the cancer infected cells. The segmentation accuracy using thresholding and watershed techniques are 81.24% and 85.27% respectively. [9], has proposed segmentation framework that consists of an integration of several digital image processing.Algorithms which is called Zack Algorithm. A sample oftwenty microscopic blood images were tested. [13], in this paper image segmentation is done using wavelet transform and its results are compared with the conventional techniques and the results obtained using wavelet transforms. In this paper we are going to discuss about the detection of leukemia using matlab code. It is based upon the number of blood cells present in the particular volume of the blood sample. In a manual method of detection, experts check the microscopic images. This is lengthy and time taking process which depends on person's skill and not having a standard accuracy. Leukemia, is a type of cancer in which abnormal white blood cells increases in a large number at a very fast rate in bone marrow, due to which normal White Blood Cells could not perform its functions properly and the count of abnormal WBC's increases rapidly, so it needs a quick detection.

Its cure rate and prognosis depends mainly on the early detection and diagnosis of the disease. So detection of leukemia using image processing is a better and an easy way because images are cheap and do not require expensive testing and lab equipment and gives faster output which overcomes the disadvantages in manual testing. Leukemia is a cancer of early blood-forming cells, most frequently of the white blood cells although some leukemia begins on other blood cell types. Leukemia can be described as fast-growing (acute) or slow growing (chronic). The different types of leukemia have varied outlooks and treatment options. There are four main types of leukemia. The cancer experts at Cancer Treatment Canters of America (CTCA) have extensive experience in properly staging and diagnosing the disease, and developing a treatment plan that's tailored to your specific type of leukemia.

The primary differences between the four main types of leukemia have to do with their rates of progression and where the cancer develops. "Chronic" leukemia cells do not mature all the way, so they are not as capable of defending against infections as normal lymphocytes. "Acute" leukemia cells begin to replicate before any immune functions have developed. They are

1. Acute myeloid leukemia (AML)
2. Chronic myeloid leukemia (CML)
3. Acute lymphocytic leukemia (ALL)
4. Chronic lymphocytic leukemia (CLL)

Acute myeloid leukemia (AML): AML is the most common type of acute leukemia. It occurs when the bone marrow begins to make blasts, cells that have not yet completely matured. These blasts normally develop into white blood cells. However, in AML, these cells do not develop and are unable to ward off infections. In AML, the bone marrow may also make abnormal red blood cells and platelets. The number of these abnormal cells increases rapidly, and the abnormal (leukemia) cells begin to crowd out the normal white blood cells, red blood cells and platelets that the body needs. One of the main things that differentiate AML from the other main forms of leukemia is that it has eight different subtypes, which are based on the cell that the leukemia developed from.

Chronic myeloid leukemia (CML): chronic myeloid leukemia (CML) is a form of cancer that affects the bone marrow and blood. It begins in the blood-forming cells of the bone marrow and then, over time, spreads to the blood. Eventually, the disease spreads to other areas of the

body. Typically, being categorized as chronic indicates that this type of leukemia spreads and grows slowly. However, CML can change from slow progressing into a rapidly growing, acute form of leukemia that can spread to almost any organ in the body. Unlike the three other main types of leukemia, CML has a significant difference that sets it apart from the rest. It has been shown that CML is associated with an abnormal chromosome known as the Philadelphia chromosome.

Acute lymphocytic leukemia (ALL): Acute lymphocytic leukemia (ALL), also called acute lymphoblastic leukemia and acute lymphoid leukemia, is a blood cancer that results when abnormal white blood cells (leukemia cells) accumulate in the bone marrow. ALL progresses rapidly, replacing healthy cells that produce functional lymphocytes with leukemia cells that can't mature properly. The leukemia cells are carried in the bloodstream to other organs and tissues, including the brain, liver, lymph nodes and testes, where they continue to grow and divide. The growing, dividing and spreading of these leukemia cells may result in a number of possible symptoms. ALL is typically associated with having more B lymphatic cells than T cells. B and T cells play active roles in preventing the body from infections and germs and destroying cells that have already become infected. B cells particularly help prevent germs from infecting the body while T cells destroy the infected cells.

Chronic lymphocytic leukemia (CLL): Chronic lymphocytic leukemia (CLL) is a typically slow-growing cancer which begins in lymphocytes in the bone marrow and extends into the blood. It can also spread to lymph nodes and organs such as the liver and spleen. CLL develops when too many abnormal lymphocytes grow, crowding out normal blood cells and making it difficult for the body to fight infection. The term "chronic" means that the disease develops slowly. The abnormal lymphocytes take longer to develop and multiply. A disease like CLL, therefore, may take several years before it becomes serious. Comparatively, the progression of acute lymphocytic leukemia (ALL) is very quick. ALL may advance in a much shorter period. The most common symptoms in children are easy bruising, pale skin, fever, and an enlarged spleen or liver. Damage to the bone marrow, by way of displacing the normal bone marrow cells with higher numbers of immature white blood cells, results in a lack of blood platelets, which are important in the blood clotting process. This means people with leukemia may easily become bruised, bleed excessively, or develop pinprick bleeds (petechiae). White blood cells, which are involved in fighting pathogens, may be suppressed or dysfunctional. This could cause the patient's immune system to be unable to fight off a simple infection or to start attacking other body cells. Because leukemia prevents the immune system from working normally, some patients experience frequent infection, ranging from infected sores in the mouth, or diarrhea to life-threatening pneumonia or opportunistic infections. Finally, the red blood cell deficiency leads to anemia which may cause dyspnea and pallor

II. METHODOLOGY

Detection of leukemia uses the following steps for the further processing. Those are given below.

Read cell image: In this step input sample image is taken from the microscope. This is in the jpeg format image which is given as input image. The sample is taken from the microscope which converts the input blood sample to a readable image. Fig 1. is the one of the simplest example of input image.

Pre-processing step: In this step given input RGB image is converted into the grey colour image as shown in Fig 2 using the code provided in the mat lab . This is the step for identifying the cells present the given blood sample and to show the difference with the other cells. In this step all the cells present in the blood.

Thresholding process: In this step we are going to process the thresholding the converted grey image. This image is converted to binary image for the further detection of leukemia. This conversion makes the use of rounding the cells in the image and this variation in intensities differs lymphocytes and other cells. And then the next process is to detect the some of the parameters like area and perimeter and number of blood cells present in the given input sample image. The final thresholded image is as shown in Fig 3.

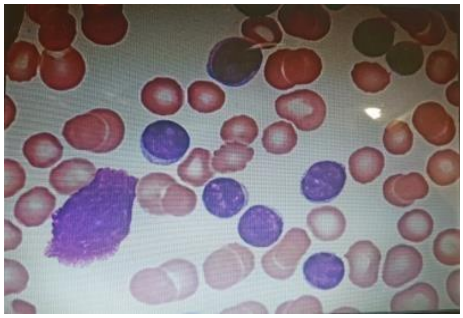

Fig. 1. Input Image

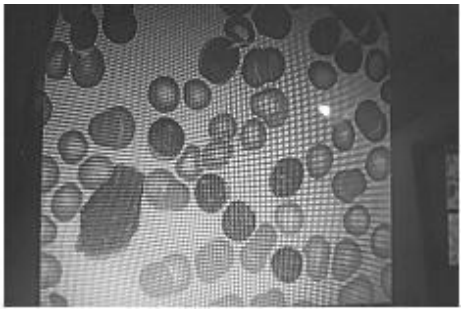

Fig. 2. RGB to Grey converted Image

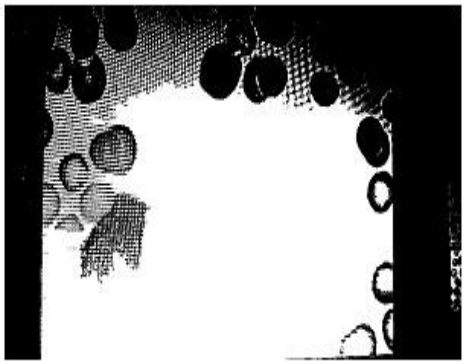

Fig. 3. Threshold image

Declaration: In this step we declare whether the person has the leukemia or not on the basis of white blood cell count and can identify which type of leukemia it is. The identification can be done as shown below.

- < 1700-**leukopenia**
- 1700–3500 - **no leukemia**
- >3500-**leukemia**

III. COUNT AND OTHER PARAMETERS:

After the thresholding process we obtain the parameters for which the mat lab code is written. Based upon the count of cells present in the blood sample image, we can decide the leukemia is present or not. If the count of cells is rapidly increasing it is
the type of CLL. The other parameters are also calculated for the another type of leukemia. And the area of the damaged cells is also varied and can be seen in the result obtained as shown in Fig 5.

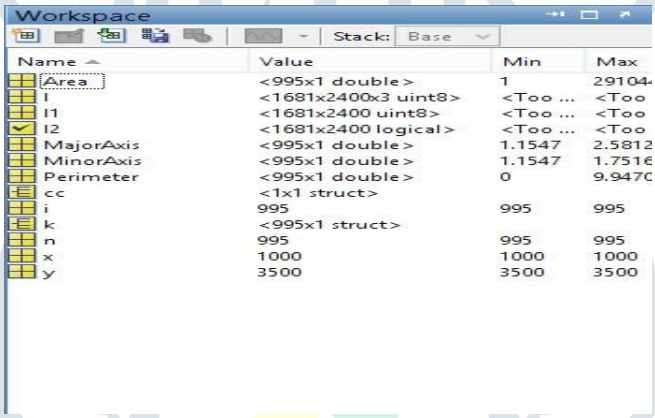

Fig. 4. Parameters obtained for input Image

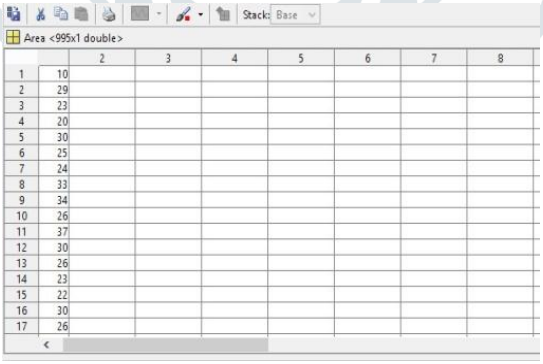

Fig. 5. Output Obtained (Area)

IV. RESULTS

After all the steps of processing of input image, we can declare which type of leukemia it is. Some of the parameters obtained for the detection of leukemia in the input image is shown in Fig 4.

Cell count: 23165

Declaration**: leukemia**

Type of leukemia**: ALL**

The different cases are considered in this process of detection. And these cases are described below

CASE 1:

Here Fig 6 is case of Chronic Lymphocytic Leukemia and the rgb to grey converted and thresholded images of Fig 6 are shown in Fig 7 and Fig 8**.**

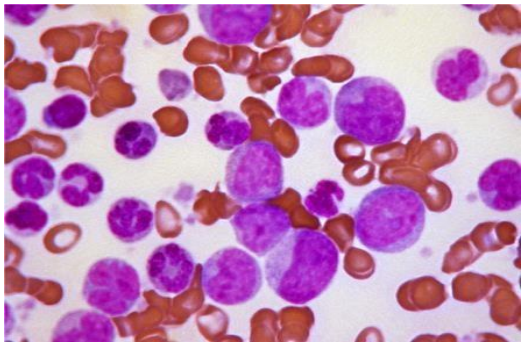

Fig. 6. Input RGB Image

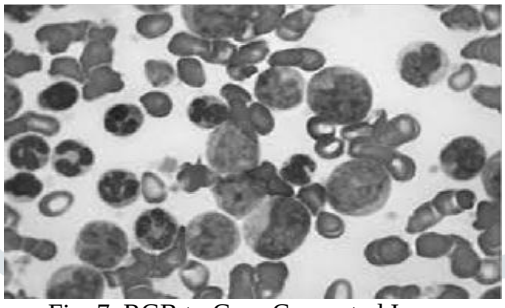

Fig. 7. RGB to Grey Converted Image

Fig. 8. Thresholded image

Result:
Cellcount:15268
Declaration: Leukemia
Type: CLL

CASE 2:
Here Fig 9 is case of normal image without cancer and the rgb to grey converted and threshold images of Fig 9 are shown in Fig 10 and Fig 11**.**

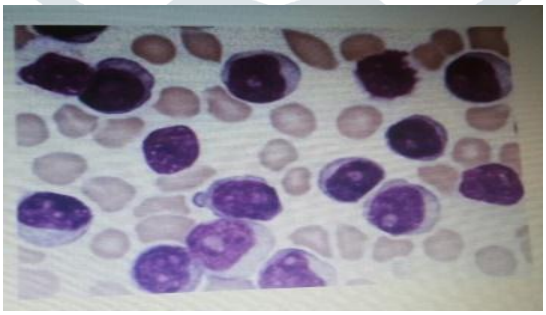

Fig. 9.Normal blood sample (No Leukemia)

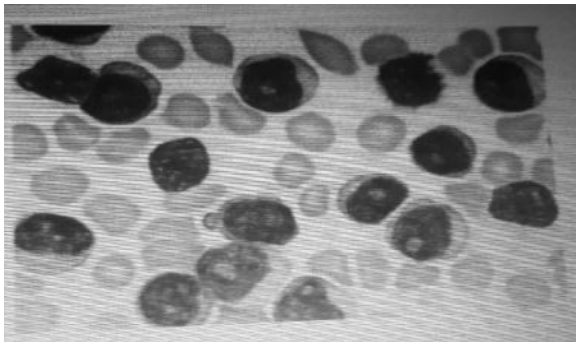

Fig. 10. RGB to Grey Converted Image

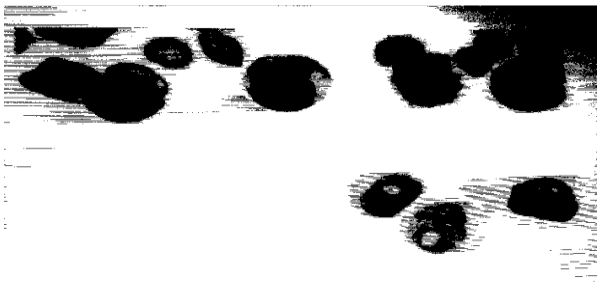

Fig. 11. Threshold Image

Result:
Cell count: 3124
Declaration: No leukemia

Therefore these are the different cases in this process of detection

V. TOOLS REQUIREMENT

1. Image processing tool box:

Image Processing Toolbox provides a comprehensive set of reference-standard algorithms, functions, and apps for image processing, analysis, visualization, and algorithm development. You can perform image analysis, image segmentation, image enhancement, noise reduction, geometric transformations, and image registration. Many toolbox functions support multicore processors, GPUs, and C-code generation.

Fig.12. Lawrence and mayo microscope

Lawrence and mayo microscope with attached camera shown in Fig 12 is used for obtaining the blood sample images.

VI. CONCLUSION AND FUTURE SCOPE

Above explain method use only detection of leukemia in human blood cells. In this method blood cell image processing segmentation, deletion, fill hole operations are used to obtain the edge of the cancerous blood cell. Pathological tests are costly and timely, so this process is not use for every month or short duration. Using this method process of testing is easy cheap, if suspected cells are obtain then go for the diagnosis under the doctors observation. This project can be extended by identifying other different types of leukemia instantly at a very faster rate and that will help us in finding better ways for the diagnosis of disease.

VII. REFERENCES

[1] Fauziah Kasmin, Anton Satria Prabuwono, Azizi Abdullah, "Detection of Leukemia in Human Blood Sample Based on Microscopic Images: A Study," Journal Of Theoretical and Applied Information Technology, vol. 46 no 2, 2012.

[2] Ruggero Donida Labati, Vincenzo Piuri, Fabio Scotti, "The Acute Lymphoblastic Leukemia Image Database for Image Processing," Universita Degli Studi Di Milano, 10.1109/ICIP.2011.6115881, 2011.

[3] S.Jagadeesh, Dr. E.Nagabhooshanam, Dr. S.Venkatachalam, "Image Processing Based Approach to Cancer Cell Prediction in Blood Samples, "International Journal of Technology and Engineering Sciences, vol.1, ISSN: 2320-8007, 2013

[4] Medline Plus, The U.S. National Library of Medicine [Online] http://www.nlm.nih.gov/medlineplus/ency/article/003643.htm

[5] Abdul Nasir, Mustafa N, Mohd Nasir, " Application of Thresholding in Determing Ratio of Blood Cells for Leukemia Detection" in the Proceedings of International Conference on Man-Machine system (ICoMMS) oct 2009 ,Batu Ferringhi, Penang, Malaysia.

[6] Bhagyashri G Patil, Prof. Sanjeev N.Jain , "Cancer Cells Detection Using Digital Image Processing Methods" in International Journal of Latest Trends in Engineering and Technology".

[7] Farnoosh Sadeghian, Zainina Seman, Abdul Rahman Ramli, Badrul Hisham Abdul Kahar, and M-Iqbal Saripan, "A Framework for White Blood Cell Segmentationin Microscopic Blood Images Using Digital Image Processing" in Shulin Li (ed.), Biological Procedures Online, Volume 11, Number 1 to the author(s) 2009

[8] R., Adollah, M.Y., Mashor, N.F.M, Nasir, H., Rosline, H., Mahsin, H., Adilah, "Blood CellImage Segmentation: A Review", Biomed 2008, Proceedings 21, 2008, pp. 141-144.

[9] XuGongwen, Zhang Zhijun, Yuan Weihua, XuLi Na, "OnMedicalImage Segmentation Based on Wavelet Transform" in IEEE ,ISBN978-1-4799-4262-6, June 2014