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A survey on Image Processing Techniques used for Detection of leukemic Cells

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Abstract: In medical diagnosis systems, classification of blood cell is most important to evaluate and diagnosis the disease. The diseases that are related to blood can be classified only after the classification of blood cell. Leukemia is a blood cancer that begins with bone marrow. It should be treated at earlier stage, and leads to death if left untreated. This paper describes a study of detecting leukemia from blood microscopic image using different image processing algorithms.

Keywords: Leukemia, blood cell, classification, image processing algorithms, Detection.

I.INTRODUCTION

Leukemia is a type of cancer that affects the bone marrow causing increased production of white blood cells which influx the blood stream These are an important, infection-fighting part of your immune system, made in bone marrow. . In orders for myelogenous leukemia to be correctly diagnosed a physician will orders a complete blood count bone mellow biopsy and cytogenetic tests. Leukemia can be identify with the variation in following tests:

A.Complete Blood Count (CBC)
The results of a CBC describe all aspects of the blood stream including WBC count, RBC count,Hemoglobin platelet count, Hemotocrit, and red blood cell distribution when diagnosing leukemia these results are mostly important.

B.Wbc Count:
It is the total no of white blood cells found in the blood. WBC is usually helpful since it breaks down foreign matter in the blood that may cause infections or disease. Incase in WBC, it is either due to serious illness or leukemia.

C.Rbc Count:
It is the total no of RBC found in blood. In leukemia patients, test results should reveal a decrease in total amount of RBC.

D.Hemoglobin:
It is protein found in the RBC which carry oxygen to various parts of body. Leukemia patients has declared no of RBC, the hemoglobin should also lower than normal.

E.Platelet Count:
It is total no of platelets found in blood platelets are used to help clot the blood when the skin is scraped and opened to outside. In leukemia patients no of platelets should be lower than normal.

F.Hematocrit:
It is the volume of space taken up by packed red blood cells , measuring the size and no of total RBC. The results are shown as percentage of total red blood cells a low hematocrit would signify leukemia.

Acute leukemia comes suddenly, progresses quickly and needs to be treated urgently.

Chronic leukemia develops more slowly over months or years.

G.Myeloid And Lymphoid Leukemias
Leukemia's are also named for the type of white blood cell that is affected:

Myeloid: Leukemia that starts in myeloid cells is called myeloid, myelogenous, or myeloblastic leukemia.

Lymphoid: Leukemia that starts in lymphoid cells is called lymphoid, lymphoblastic, or lymphocytic leukemia.

Lymphoid leukemia cells may collect in the lymph nodes, which become swollen.

H.Types Of Leukemia
- Acute myeloid leukemia (AML) - affects around 2600 adults a year in UK people over 65 can get it
- Acute lymphoblastic leukemia (ALL) - Affects mostly children.
- Chronic myeloid leukemia (CMC) – Rare condition affects all.
- Chronic lymphocytic leukemia (CLL) – Most common and over 60 can get it and rare below 40.

I.Risk factors:
Some of the risk factors of leukemia include
- Family history

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- Smoking (AML)
- Chemical exposes
- Cancer treatment
- Radiation
- Congenital cyndrome such as down syndrome.

Symptoms of leukemia include:

- Excessive sweating at night
- Fatigue
- Weight loss
- Bone pain and tenderness
- Swollen lymph nodes
- Enlargements of the liver or spleens
- Fever frequent infections

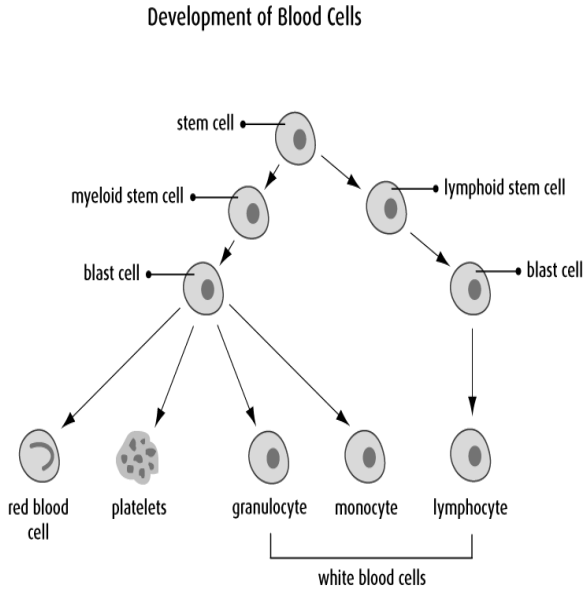


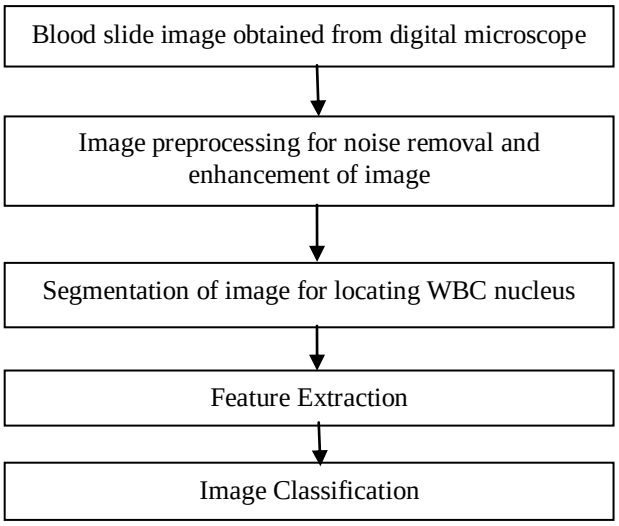
Fig 1.The Formation of Myeloid and Lymphoid series of cells.

As the stem cells of the blood develop, they become blast cells (blasts), which are immature blood cells. In leukemia, there is an overproduction of blast cells. These blast cells develop abnormally and don't develop into mature blood cells. Over time, the blast cells crowd out normal blood cells so that they can't do their jobs. When leukemia is diagnosed, these blast cells may be called leukemia cells.

J.MAIN COMPONENTS OF IMAGE PROCESSING

1. **Image Acquisition**: It deals with capturing images or samples.
2. **Image Enhancement**: It deals with the improvement of quality of images.
3. **Image Representation**: It deals with different ways in which image can be represented mathematically, graphically, and statistically.
4. **Image Transformation**: It is used to transform the input image from one domain into another e.g an image in spatial domain can be converted into frequency domain by using Fourier transform.
5. **Image Restoration**: It deals with the analysis and modeling of different types of noise mixed in images.
6. **Color image processing**: Various color spaces and formats are converted in it.
7. **Image compression**: It is used to reduce the size of image or reduce redundancy without any significant change in the inherent content of the image.
8. **Morphological image processing**: It is used to represent or convert into suitable forms so that edges can be easily recovered. These operations are generally used with image segmentation.
9. **Image segmentation, representation and description** : The selected region of interests can be extracted and various boundaries, edges and other similar information could be obtained.
10. **Object recognition:** It deals with the pattern recognition and matching.

STEPS FOR PROCESS OF AUTOMATING BLOOD RECOGNITION



II.LITERATURE REVIEW

Niranjan Chatap, Sini Shibu proposed Iterative Thresholding algorithm is used for segmentation purpose especially from noisy images.[1] This algorithm overcomes the problem of cell extraction and segmentation from heavy noisy images. Morphological approach to cell image segmentation is more precise than the classical watershed-based algorithm. a simple thresholding approach is applied and the algorithm is derived about blood smear images from priori information.

S.Jagadeesh, Dr.E.Nagabhooshanam, Dr.S.Venkatachalam proposed segmentation of the image of bone marrow aspirate using watershed algorithm,[2] the extraction of individual cells from the image, automatic generation of different features of the cell, assessment of the feature quality of the cells using analysis of distribution, correlation and principal component analysis, application of support vector machine for final recognition and classification of cells.

T. Markiewicz, S. Osowski, B., Marianska, L., Moszczynski use Support Vector Machine (SVM)

classifier[3] and exploit features in blood cell images that related to texture, geometry and statistical analysis. They stress on generation and selection of features to get the best recognition.

W., Qiang, Zhongli, Z., proposed a reinforcement learning algorithm.[4] The RL approach will classify the types of leukemia into ALL, AML, CLL and CML.

Jamali Firmat Banzi, Xue Zhaojun proposed a framework.[5] The first step is to acquire the images then they performed median filter to remove the noise without blurring the image then next step contrast between the cytoplasm, and nuclei and extracellular components were enhanced using an unsharp filter is done. Then thresholding is done and they performed fourier transform and then log transform is done. Then mean filter is applied and in final stage line plot is done. MATLAB is used to perform this work.

Ms. Sneha Dhakne, Ms. Kumudini K. Borkute, Ms. Priyanka Ikhar presented two techniques such as Watershed algorithm and Combine clustering along with filtering for determination of cell[6].

Monika Mogra , Vivek Srivastava., proposed watershed transform and morphological image processing technique[7] to identify affected White Blood Cell and applied this technique in MATLAB.

Subhan, Ms. Parminder Kaur., discussed KNN and Hough Transform algorithms to detect abnormal cells that cause leukemia[8].

Khot S.T, Sneha Bhalekar, Divya Jaggi and Dolly Rani used Support Vector Machine classifier to detect leukemic cells.[9] The features are extracted from the image and applied to classifier.

Ms. Minal D. Joshi, Prof. Atul H. Karode, Prof. S.R.Suralkar proposed a method to detect acute leukemia. By histogram equalization method ,[10] enhance contrast of the grayscale image. Applied global thresholding Otsu method and then feature extraction is done. Based on the feature extracted ,classifier classifies the affected cells or normal cells and with the accuracy of 93%. kNN classification is used.

Emad A. Mohammed, Mostafa M. A. Mohammed, Christopher Naugler, Behrouz H. Far proposed a technique for chronic leukemia cell segmentation.[11] In the proposed approach for segmenting a nucleus first an optimal threshold value is obtained using Otsu's method. Canny edge detector is applied followed by erosion and dilation. Isolated pixels are removed and a segmented nucleus mask is obtained.

Sos Agaian, Monica Madhukar, Anthony T. Chronopoulos, approach presented in is used to detect AML (Acute Myelogenous Leukemia) in microscopic images of blood.[12] Three clusters are identified which represent nucleus, background and other cells like erythrocytes, leukocytes etc. Every pixel of the image is assigned to one of these clusters based on the cluster property. The technique performs some preprocessing followed by k-means clustering for segmentation purpose. The segmentation is performed to extract the leukocytes' nuclei using color based clustering.

Subrajeet Mohapatra, Dipti Patra and Sanghamitra Satpathy proposed Color based clustering for WBC nucleus segmentation of stained blood smear images followed by relevant feature extraction for leukemia detection.[13] Few standard clustering techniques, viz., K-Means, KMedoid, Fuzzy C-Means (FCM), Gustafson Kessel (GK) and Fuzzy Possibilistic C Means (FPCM) were employed for color based segmentation and their performance were compared. Nucleus boundary irregularities are measured using hausdroff dimension and contour signature. Results were obtained by using SVM classifier with proposed features.

Sonal G. Deore Prof. Neeta Nemade proposed a system that individuates in the blood image the leucocytes from the others blood cells, then it extracts the lymphocyte cells (the ones interested by acute leukemia), it extracts morphological indexes from those cells and finally it classifies the presence of the leukemia.[14] The Single-cell Selector module firstly enhances the input image and identifies the single cells. It has been composed by adaptive prefiltering and segmentation algorithms. Secondly, the White-cells Identifier module selects the white cells present into the image by separating them from others blood‟s components (red cells and platelets). The third module (the Lymphocyte Identifier) can recognize a lymphocyte with respect to the other selected white cells. The three presented modules can recognize leucocytes in a blood film image with an accuracy of about 93.6364%.

Himali P. Vaghela, Hardik Modi, Manoj Pandya, Manoj Pandya presented shape based features finding is more accurate than watershed transform, K means clustering, and histogram equalizing methods for counting leukemic cells and it also gives highest accuracy 97.8%.[15] To detect different types of geometrical shape of cells like basophils, eosinophil, lymphocytes, monocytes etc. shape based features are used and according to count of immature cells, disease can be diagnosed.

Mrs. Trupti A. Kulkarni-Joshi1, Prof. Dilip S. Bhosale proposed method to segment blood cells to find normal cells, ALL lymphocytes from other blood components to find out nuclei of blast cell.[16] Otsu'thresholding algorithm is used for segmentation and all the work done in MATLAB environment.

C.Vidhya, P.Saravana kumar, K.Keerthika, C.Nagalakshmi, B.Medona devi proposed a method for classifying acute leukemia in four stages such as Preprocessing stage, segmentation stage, Feature

extraction stage and Classification stage.[17] In Preprocessing stage the input image is resized and it is converted by CIELAB color conversion. Kmeans clustering algorithm is used to extract nuclei from the leukocytes. Transforming the input data into the set of features is called feature extraction. Feature is extracted from the image. SVM classifier is used to classify the leukocyte cells.

Tejashri G. Patil, V. B. Raskar proposed a Otsu's segmentation method and result of contour signature is used for feature extraction and based on the result acute leukemia can be detected[18].

A.Arputha Regina proposed a method to detect leukemia and used k means clustering for segmentation and Hausdorff dimension (HD) and Local Binary Pattern used for feature extraction and support vector machine is used for classification[19].

III.CONCLUSION

The aim of this paper is to detect leukemia at earlier stage with the help of different algorithms. The result produced by hematologist will not be accurate when they done manually. The automated system to detect leukemia will provide accurate result. Support Vector Machine is used mostly for classification and Otsu's thresholding algorithm is used mostly by researchers for segmentation. Some of the discussed method gives good accuracy for detecting leukemia.

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