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An Exploration of the Image Processing Techniques for the Detection of Leukemia

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***Abstract* - In the pathological diagnostic method, categorization of blood cell has more essential to detect and analyze the disease. The complications that are connected with blood can be distributed only after the blood cell classification. The illness that begins with the bone marrow is the Leukemia. Therefore, it must be handled at the beginning step and proceeds to death if continuing untreated. This present research elucidates an investigation of diagnosing leukemia from microscopic blood image exhausting various image processing algorithms.**
***Keywords:* Image Processing, Leukemia, Blood Cell, Noise Removal, Feature Extraction, Segmentation, Classification**

I. INTRODUCTION

Leukemia is a kind of cancer [1] that marks the bone marrow causing the better fabrication of white blood cells which inflow the bloodstream which is more essential, infection-fighting part of your immune system, made in bone marrow. Hence, diagnose myelogenous leukemia has perfectly analyzed a physician will edict a comprehensive blood count bone mellow biopsy and cytogenetic tests. Leukemia is a malignancy (cancer) of blood cells. In leukemia, atypical blood cells have formed in the bone marrow. White Blood Cells (WBC) are the cells accountable for fighting infections. Leukaemia comprises the fabrication of the abnormal WBC.

II. IDENTIFICATION OF LEUKEMIA

Leukemia can be identified [2] with the discrepancy in the subsequent tests

Complete Blood Count (CBC): The effects of a CBC define all characteristics of the bloodstream comprising WBC count, RBC count, Hemoglobin platelet count, Hematocrit, and red blood cell dissemination when examining leukemia these outcomes are most important.
White Blood Cell (WBC) Count: It is a whole number of white blood cells originates in the blood. WBC is often supportive as it breaks down alien staple in the blood that may cause toxicities or disease. In the circumstances of WBC, it is either due to severe illness or leukemia.
Red Blood Cell (RBC) Count: It is the total no of RBC found in blood. In leukemia patients, investigation outcomes must expose a drop in the total amount of RBC.
Haemoglobin: It is the protein originates in the RBC which transmits oxygen to different measures of the body. A leukemia patient has affirmed the number of RBC, and the hemoglobin out to be lesser than average.
Platelet Count: It is the total number of platelets originates in blood is deployed to assist the clotted blood when the skin has tattered and disclosed outside. In leukemia patients, the number of platelets ought to be lesser than usual.
Hematocrit: It is the size of space engaged by crammed red blood cells, assessing the size and number of total RBC. The outcomes have been displayed as the ratio of total red blood cells a small hematocrit would connote leukemia. Moreover, Acute leukemia comes suddenly, progresses quickly and the requirements have canned urgently. Chronic leukemia advances gradually over months or years.
Myeloid and Lymphoid Leukemias: In addition, Leukemia's are named for the kind of white blood cell that is infected: *Myeloid:* Leukemia that initiates in myeloid cells are known as myeloid, myelogenous, or myeloblastic leukemia. *Lymphoid:* Leukemia that begins in lymphoid cells is called lymphoid, lymphoblastic, or lymphocytic leukemia. Lymphoid leukemia cells may gather in the lymph nodes, which turn swollen.

A. Kinds of Leukemia

The following are the types of leukemia [3].

1. *AML (Acute Myeloid Leukemia):* This type of leukemia disturbs around 2600 adults a year in UK people over 65 can get it.
2. *ALL (Acute Lymphoblastic Leukemia):* It affects mostly children.
3. *CMC (Chronic Myeloid Leukemia):* Rare condition affects all.
4. *CLL (Chronic Lymphocytic Leukemia):* Most common and over 60 can get it and rare below 40.

III. STEPS IN IMAGE PROCESSING FOR DETECTION OF LEUKEMIA

Image processing is an effort taken to simplify the various diagnosis and make the process more accurate and prompt in delivering required test reports and to eradicate or minimize manual errors. This will ensure precise reports and help in the treatment of leukemia patients. It not only helps the process to be in a quick and speedy manner with perfection in the clinical diagnosis. The following are the main steps involved in the Image Processing.

A. Image Acquisition: It discusses the catching images or samples.

B. Image Enhancement: It deals with the improvement of the quality of images.

C. Image Representation: It presents with the various methods in which image has signified mathematically, graphically, and statistically.

D. Image Transformation: It is used to transform the input image from one field into another, e.g., an image in the spatial domain can be transformed into the regular domain by deploying Fourier transform.

E. Image Restoration: It compacts with the examination and modeling of various types of sound mixed in images.

F. Color Image Processing: Various color spaces and formats are transformed in it.

G. Image Compression: It is employed to minimize the size of an image or less redundancy without any major change in the unique content of the image.

H. Morphological Image Processing: It is deployed to exemplify or transform into appropriate methods since the edges can be quickly recovered. These operations are employed with image dissection.

I. Image Segmentation, Features and Description: The particular region of interests can be dug out, and different borders, edges and other comparable facts could be attained.

J. Object Recognition: It deals with the pattern recognition and matching

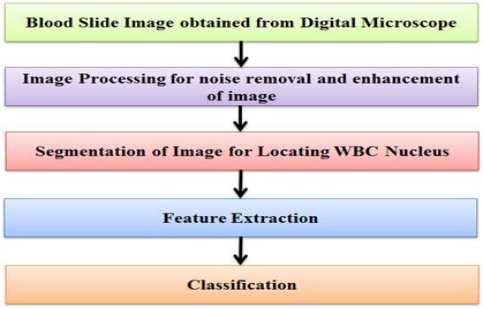

Fig. 1 Steps for Process of Automatic Blood Recognition

IV. LITERATURE SURVEY

The following table I represent the literature survey on the Image Processing techniques used for the detection of the Leukemia.

TABLE I LITERATURE SURVEY ON THE IMAGE PROCESSING TECHNIQUES FOR THE DETECTION OF LEUKEMIA

S.No.	Author Name	Methods Used	Application of the Paper
1	Niranjan Chatap, Sini Shibu [5]	Classical watershed-based algorithm	It overcomes the problem of Cell extraction and segmentation from massive, noisy images.
2	A. Arputha Regina [6]	K- Means Clustering, Hausdorff Dimension, Local Binary Pattern	To detect leukemia using segmentation, Feature Extraction, and Classification
3	Tejashri G. Patil, V. B. Raskar [7]	Contour Signature, Otsu's Segmentation	To detect acute leukemia using feature extraction
4	C.Vidhya, P. Saravana Kumar, K. Keerthika, C. Nagalakshmi, B.Medona devi [8]	K-Means Clustering, SVM Classifiers	The input image is resized and CIELAB color conversion. Extraction of nuclei from the leukocytes.
5	Mrs. Trupti A. Kulkarni-Joshi, Prof. Dilip S. Bhosale [9]	Otsu's Thresholding Algorithm	It is used for segmentation
6	Himali P. Vaghela, Hardik Modi, Manoj Pandya, Manoj Pandya [10]	K-Means Clustering, Histogram	The shape-based feature finding is more accurate than watershed transform
7	Sonal G. Deore Prof. Neeta Nemade [11]	Adaptive Pre-Filtering and Segmentation Algorithms	It extracts morphological indexes from those cells, and finally, it classifies the presence of leukemia.
8	Subrajeet Mohapatra, Dipti Patra and Sanghamitra Satpathy [12]	K-Means, KMedoid, Fuzzy C-Means (FCM), Gustafson Kessel (GK), Fuzzy Possibilistic C Means, Hausdorff Dimension, Contour Signature, SVM Classifier	WBC nucleus segmentation of stained blood smear images followed by relevant feature extraction for leukemia detection
9	Sos Agaian, Monica Madhukar, Anthony T. Chronopoulos [13]	K-Means Clustering	The segmentation is performed to extract the leukocytes' nuclei using color-based clustering
10	Emad A. Mohammed, Mostafa M.A.Mohammed, Christopher Naugler, Behrouz H. Far [14]	Otsu's Method, Canny Edge Detector	Isolated pixels are removed, and a segmented nucleus mask is obtained for the detection of leukemia
11	Ms. Minal D. Joshi, Prof. Atul H. Karode, Prof. S.R.Suralkar [15]	Histogram, Global Thresholding Otsu Method, KNN	Based on the feature extracted, classifier classifies the affected cells or healthy cells and with the accuracy of 93%. kNN classification is used

12	Khot S.T, Sneha Bhalekar, Divya Jaggi and Dolly Rani [16]	Support Vector Machine	The features are extracted from the image and applied to classifier to detect the leukemia cell
13	Subhan, Ms. Parminder Kaur [17]	K-NN, Hough Transform	Detection of Abnormal cells that cause leukemia.
14	Monika Mogra, Vivek Srivastava [18]	Watershed Transform and Morphological Image Processing Technique	To identify the affected white blood cells
15	Ms. Sneha Dhakne, Ms. Kumudini K. Borkute, Ms. Priyanka Ikhar [19]	Watershed Algorithm and Clustering Algorithm	For the determination of the cells.
16	Jamali Firmat Banzi, Xue Zhaojun [20]	Fourier Transform and Mean Filtering Technique	To acquire the images then they performed median filter to remove the noise without blurring the image. To find out the contrast between cytoplasm, nuclei and extracellular components
17	W., Qiang, Zhongli, Z [21]	Reinforcement Learning Algorithm	To classify the types of leukemia
18	T. Markiewicz, S. Osowski, B., Marianska, L., Moszczynski [22]	Support Vector Machine, Texture, Geometry and Statistical Analysis	Generation and selection of features to get the best recognition
19	S.Jagadeesh, Dr.E.Nagabhooshanam, Dr.S.Venkatachalam [23]	Watershed Algorithm, Distribution Analysis, Correlation Analysis and Principal Component Analysis, Support Vector Machine	For the final recognition and classification of cells.
20	Abdul Nasir, K. S., Mustafa, N., Mohd. Nasir, N. F [24]	Removing Pixels Techniques and Gaussian Filter	Using this technique, they found out that the ratio range is 0.2 to 2.5 for ALL and 0 to 14 for AML.
21	Aimi Abdul Nasir, Mohd Yusoff Mashor, Roseline Hassan [25]	Artificial Neural Network, Snake Baloon algorithm, MLP using Conjugate Gradient Descent, Linear Vector Quantization, K-Nearest Neighbour	This paper utilized the potential use of MLP and SFAM networks for categorizing WBC as lymphoblast, myoblast, and normal cell
22	N. H. Harun, M. Y. Mashor, A.S. Abdul Nasir, H. Rosline [26]	Artificial Neural Network	A neural network was capable of differentiating the blast cells from acute leukemia blood samples.

VI. CONCLUSION

The objective of the present research is to identify leukemia in an initial phase with the support of various algorithms. The outcome created by hematologist will not be precise while they do physically. The mechanized method is to detect leukemia to deliver an accurate result. Support Vector Machine is employed commonly for categorization and Otsu's thresholding algorithm is used frequently by researchers for segmentation. Some of the systems discussed which offer respectable exactness for identifying leukemia.

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