COMPUTER-ASSISTED ALL(Acute lymphoblastic leukemia),AML(Acute myeloid leukemia) DETECTION AND COUNTING FOR DIAGNOSIS OF BLOOD CANCER

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Abstract— Leukemia can be a cancer of white blood cells (WBCs) which damages blood and bone marrow of shape. It will be a fatal illness if not diagnosed at an earlier stage. Typically complete blood count (CBC) or morphological image analysis is used to manually diagnose the malignant neoplastic disease cells. These ways are time-consuming and fewer correct that has got to be mounted. during this paper, we have planned an automatic technique for the detection of acute leukemia (ALL), acute chronic myelocytic leukemia (AML) by microscopic blood image analysis. This approach initially sections out the varied styles of cells from the image i-e. White blood cells, red blood cells and platelets. then the Lymphocytes are separated from white blood cells. Then form and color features are extracted from these lymphocytes that are then SVM classifier to classify the cells into traditional and blast. afterward the counting of the WBC cells also is detected for an accurate diagnosis. This automated malignant neoplastic disease detection system found to be more practical, fast and proper as compare to manual identification ways.

Keywords— Leukemia, White blood cells, Blood count, Acute Lymphocytic Leukemia, Acute Myeloid Leukemia.

I. INTRODUCTION

Acute lymphocytic leukemia may be a variety of cancer related to blood within which leukocytes (WBCs) start growing abnormally. These abnormal cells strike the blood and bone marrow thanks to which the system of the body becomes vulnerable. Furthermore, it suppresses the assembly of normal red blood cells and platelets hence lead towards anemia, blood deficiency. Moreover, these abnormal leukocytes predominantly spread into the human blood swiftly and may also capture other different body parts like kidney, liver, spleen, brain and lymph nodes. Leukemia is classed as either Lymphoblastic or Myelogenous looking on the sort of white blood cells being infected. If the infected cells are granulocytes and monocytes, then leukemia is classified as Myelogenous (AML) and if the infected cells are lymphocytes, then leukemia are classified as Lymphoblastic (ALL). in keeping with French American British (FAB) classification, ALL is further categorized into 3 subtypes, which are L1, L2 & L3. L1 type cells are normally small in size and are homogeneous with little cytoplasm. Their nucleus is discoid and well structured.L2 type cells have shape dissimilarity and are over-sized as compared to L1. Their nucleus isn't regular and contains variations in their cytoplasm. L3 type cells are identical in shape and normal size with a round or oval nucleus. they need an adequate amount of cytoplasm which has vacuoles. they're usually larger than L1.

A blood cardiovascular system is one of the foremost significant processes within the body of a person. this method has the aim of transporting blood across the body. this method consists of blood vessels that are arteries, nerves, and capillaries, a heart that acts as a pumping mechanism, and blood that acts because of the mechanism medium. The flow of blood is incredibly necessary for supplying our body with oxygen, carries CO2 for gaseous exchange, minerals, nutrients, and ensures healthiness. White blood cells (WBCs), red blood cells (RBCs), platelets, and plasma. Five kinds of WBC are monocytes,

lymphocytes, neutrophils, basophils, and eosinophils. Each part of the blood cells plays its role in sustaining health and living activities. the amount of every item plays a crucial role in safeguarding health.Lack of severe blood cell count, and RBC's form in the body can cause illness like leukemia or anemia, and other medical problems. The number of WBCs is essential to infer the state of health for humans. This is due to the number or quantity of this cell which established the individual health condition and indicates potential diseases.WBCs are specifically active in the protection mechanism of the human body. Awareness of the normal range of WBC counts in African-Caribbean adults would be of immediate clinical benefit to doctors and the counts of WBC in Jamaicans are equivalent to those of African descent.

The findings obtained are influenced by many ecological factors, which are widespread diseases, migrant populations living in developing countries, and social factors. For accurate analysis in cell counting, the orientation value of WBC must, therefore, be obtained from its native habitat population. The following point distinguishes this work from other recent works.

- To detect Acute lymphoblastic leukemia, Acute myeloid leukemia and specifying the number of blood cells from microscopic blood images by using color space conversion and WATERSHED segmentation algorithm to segment the size and shape of the WBC cells more accurately.

The paper is organized as follows: Section II reviews the background study of resource allocation algorithms. Section III discusses the proposed system model with results. Section IV summarizes the current work.

II. RELATED WORK

Past work has been carried out on the identification and processing of leukemia diseases. Several methods have been established by other researchers, i.e. color space method, electrochemical immunoassay based on a single-wall carbon nanotube, segmentation and classification, texture classification based on a microscopic blood smear, local pixel detail, gray level co-occurrence matrix and random forest based. A PES-nanofiber electrospun reinforced ternary composite cytosensor, Related translocations, leukocyte classification using image processing techniques, nanomedicine approaches, Omics technique and biobanks, Deep-sequencing method, Fuzzy-based image segmentation, Nucleus segmentation technique, Local binary pattern, Watershed transformation technique Arif Muntasa et al.[2019].

A few automated Acute cancer of the blood (ALL) detection systems are proposed that involves extracting features from blood images using MATLAB and implementing different classifiers to supply results that provided remarkable accuracies but not sufficient for practical use. The proposed method further strengthens the accuracy of the classification. It uses OpenCV and skimage for image processing to extract specific features from the image of the blood and not just a sheer number of features and further classification is achieved using different classifiers: CNN, FNN, SVM and KNN of which CNN gives the foremost effective accuracy of 98.33 percent Subhash Rajpurohit et al.[2018]

An automated method for detecting and classifying acute lymphoblastic leukemia is introduced using image processing to analyze morphological, textural and color features from the microscopic images in the blood. The proposed device is planned and now ready for realistic medical use with 93% accuracy in the identification of white blood cells and 93.6% accuracy in malignancy classification and 108 blood microscopic images of ALL-IDB are checked on the device. The proposed system is implemented successfully in MATLAB R2016a and is called CAD-SFA (Computer Assisted Diagnostic System for ALL) Ashikur Rahman et al.[2018].

This paper aims at early detection of leukemia and is made possible in image processing using newly emerging technology where various algorithms and methodologies can be used to digitally process medical images. The upgrades to a blue-ribbon input dataset in optical devices such as microscopes and digital cameras have been guided. Firstly, pre-processing of the blood smear image of the patient. Third, the white blood cells are observed, the lymphocytes segmented, the lymphoblasts marked and counted. The goal here is to establish a basis for a device that detects the dangerous cancer cells, allowing an early diagnosis of these hematological conditions Blessy Thomas et al.[2018].

Amid development, microscopic examination of blood smear remains normal and therefore economical approach for the diagnosis of leukemia. But this manual diagnostic approach depends on the user, that is, his background, fatigue, personal problems, and so on. Those variables therefore would have a huge effect on the outcome.So, there should be some efficient and robust automated leukemia screening system through which performance results can be significantly improved without operator intervention effect. In addition, automated systems can increase the precision and speed of diagnosis as opposed to manual diagnosis.This would allow the doctors to more efficiently treat leukaemia. Such approaches can also play a critical role in rural and deprived areas where there is no benefit of medical experts.

From the discussion above, most of the works specialize in either histogram equalization and median filtering to perform pre-processing of blood images. Then fuzzy c-means were applied for the segmentation of their

white blood cells. After extracting features using the Gabor texture extraction method, classification was applied using support vector machine (SVM). They classified ALL and its l1,l2,l3 of ALL. And also, Fuzzy c-Means generalizes the hard c-means algorithm to permit some extent to partially belong to multiple clusters. It produces a soft partition for given dataset. The FCM clustering algorithm could be a soft segmentation method that has been widely used for microscopic image segmentation. Therefore, the challenges are the fuzzy c-means technique doesn't segment the WBC cells alone. the dimensions and shape of the WBC cells are only identifying the healthy and cancer cells. Finally, manually fixing blood slides was a good challenge in microscopic image study. Therefore, there's a desire for better work, hence we use color space conversion and WATERSHED segmentation algorithm so as to segment the dimensions and shape of the WBC cells more accurately. By using the accurate shape and size of the WBC cells we've to differentiate the healthy and cancer cells.

III. PROPOSED METHODOLOGY

The proposed system uses image processing techniques to detect acute lymphoblastic leukemia, acute myeloid leukemia and determine the number of blood cells from microscopic blood photographs.

ALGORITHMS USED

SUPPORT VECTOR MACHINE (SVM)

SVM may be a machine learning algorithm that outputs a map of the sorted data with the margins between the 2 as far apart as possible. SVMs are utilized in text categorization, image classification, handwriting recognition and within the sciences.

WATERSHED SEGMENTATION

The watershed is a classic algorithm used for segmentation, i.e. to distinguish different objects in an image that divides neighboring drainage basins. It treats the image on which it works as a topographical map, with the brightness of each point reflecting its height, and finds the lines running along the ridge tops.

KNN (K-NEAREST NEIGHBOUR)

K-nearest-neighbor algorithm is a data classification approach which estimates the likelihood of a data point being a member of one group or another based on which group of data points are closest to that group.

LOCAL BINARY PATTERN

Local Binary Pattern (LBP) may be a texture operator that labels an image's pixels by thresholding each pixel's neighborhood and considers the result as a binary.

IV. PROPOSED PROCEDURE

●Read and Display an input Image. Read a picture into the workspace, using the imread command. it's the primary step within the workflow sequence because, without a picture, no processing is feasible. The image that's acquired is totally unprocessed.

●In preprocessing, the distorted pixels can often be restored as a mean value of neighboring pixels. All the input images are resized into the identical dimensions. If the desired size doesn't produce the identical ratio because the input image, the output image are going to be distorted.

●In image segmentation, the digital image is subdivided into multiple segments (sets of pixels, also referred to as superpixels.

●Morphological operations apply a structuring element to an input image, creating an output image of the identical size. the chosen features are expected to contain the relevant information from the input file in order that the specified task may be performed by using this reduced representation rather than the entire initial data.

●In feature selection, the chosen features are expected to contain the relevant information from the input file, in order that the specified task may be performed by using this reduced representation rather than the entire initial data. Here we use LBP (LOCAL BINARY PATTERN) for feature analysis.

●The resulting raster from image classification may be accustomed create thematic maps. The recommended thanks to perform classification and statistical method is thru the Image Classification toolbar.

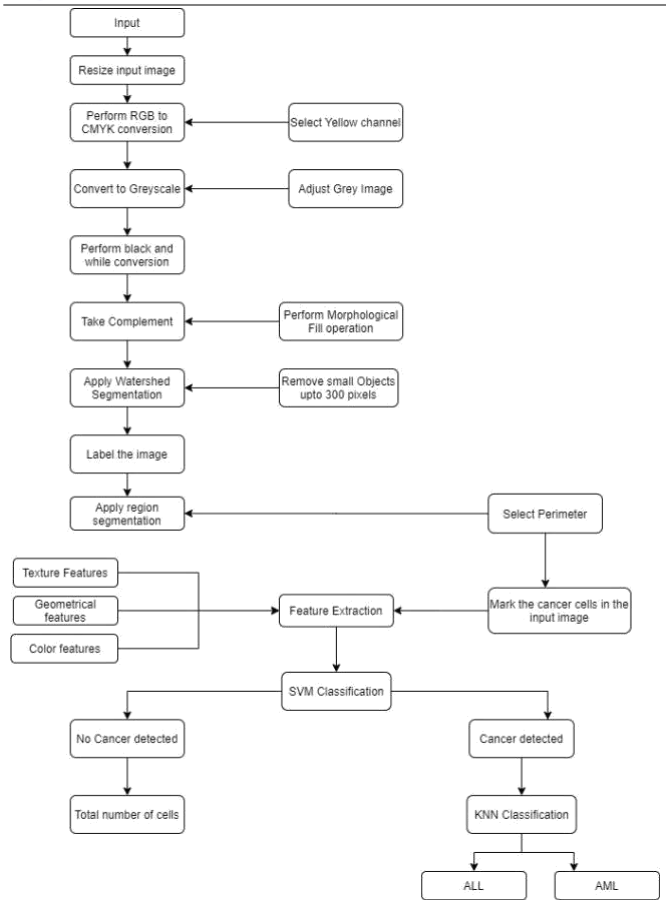

Figure 1. Proposed Architecture

Preprocessing is applied to eliminate any noise over the images, and segmentation is then performed to distinguish lymphocytes from the picture. Watershed is used to distinguish grouped lymphocytes for cell counting after the shape, color and texture characteristics have been extracted.

Experimental Analysis

The Proposed experiment includes additional features which make the system model be more efficient

by comparing to other existing prior. The process of the proposed work is graphically represented for the illustration below.

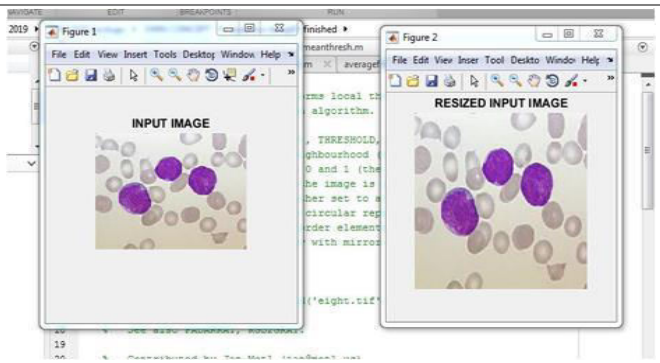

Figure 2. Resized Image

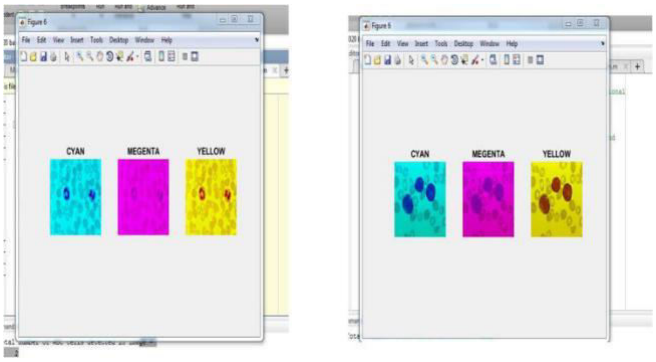

Figure 3. RGB TO CMYK COLOR SPACE IMAGES

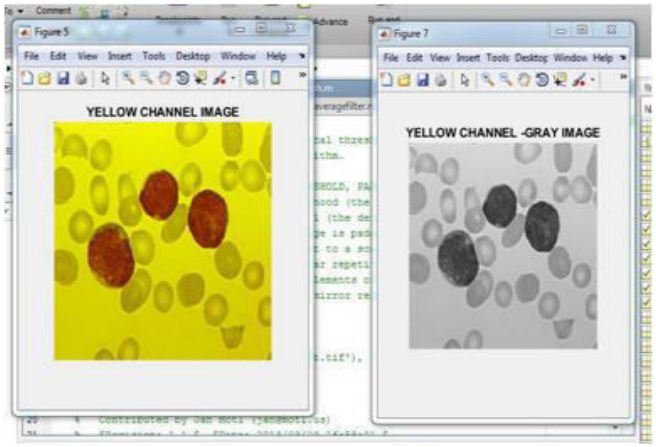

Figure 4 Grey Converted Image

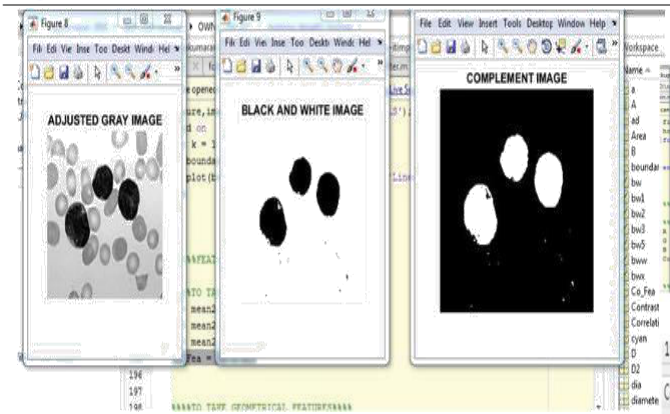

Figure 5 Cancer Cell- Black and White Complement Image

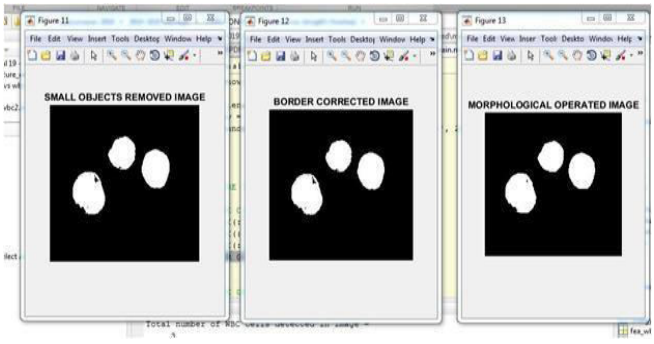

Figure 6 Morphology operated Cancer Cell Image

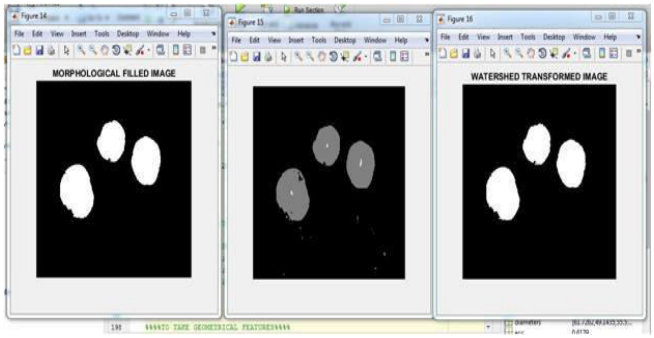

Figure 7. Watershed Transformed Image- Cancer Cell

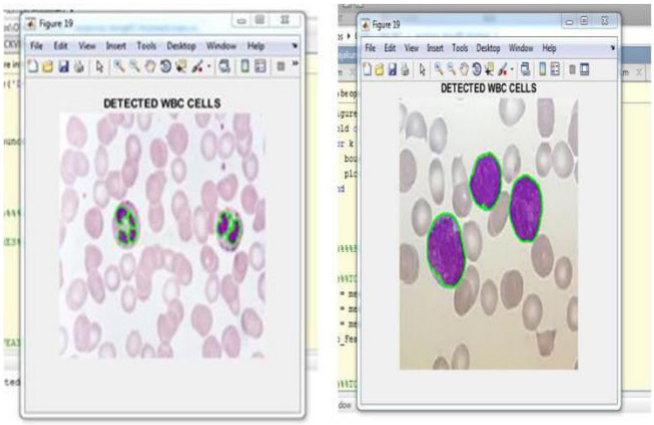

Figure 8. Segmented Output Image- Healthy Cell Vs Cancer Cell

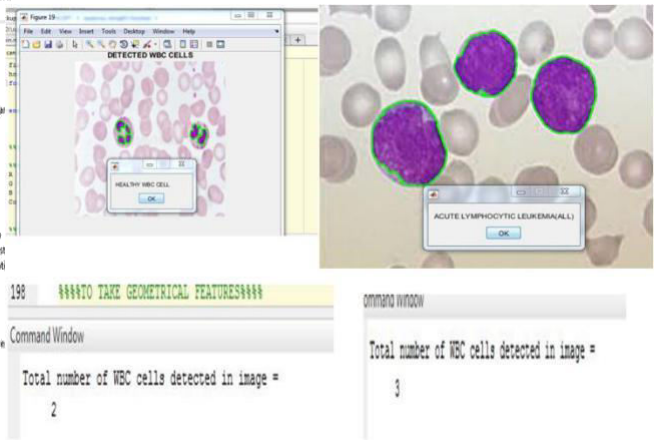

Figure 9. WBC Count- Healthy Cell Vs Cancer Cell

V. CONCLUSION

In this paper, attempts were made to identify and count acute lymphoblastic leukemia from microscopic images of the blood using techniques for image processing. Preprocessing was applied to eliminate any noise over the images, and segmentation is then performed to detect lymphocytes from the image. Watershed is used after extracting shape and color features to distinguish the grouped lymphocytes; SVM is used to classify both regular and blast cells. We will further develop this method to detect different forms of leukemia and other blood-related diseases in the future.

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