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Automatic Diagnosis of Acute Lymphoblastic Leukemia Using Duplex Method

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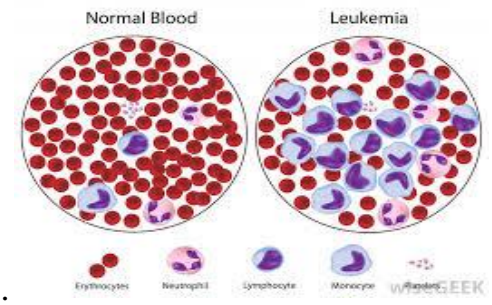
Abstract: **In this paper, Health care services play a vital role in the transformation of traditional cities into smart cities. In this work, we present a ubiquitous and quality computer aided blood analysis service for the detection and counting of white blood cells (WBC) in blood samples. WBCs also called leukocytes or leucocytes, are the cells of the immune system that are involved in protecting the body against both infectious disease and foreign invaders. Analysis of leukocytes provides valuable information to medical specialists, helping them in diagnosing different important hematic diseases such as AIDS and blood cancer (Leukaemia). However, this task is prone to errors and can be time consuming. In Proposed system, the image is pre-processed and then the images are segmented using otsu based Threshold method. After that ANFIS (Artificial Neural Fuzzy Inference System) is used to classify the disease types.**

Keywords: **Acute Lymphoblastic Leukemia, White blood cells (WBC), OTSU based Threshold method, ANFIS.**

I. INTRODUCTION

The term leukemia comes from the Greek word "leukos" meaning "white" and "aim" meaning "blood". It refers to the cancer of the blood or the bone marrow (where blood cells are produced). The Leukocytes which play a major role in the diagnosis of different diseases. The Extracting information from WBC is valuable for hematologists as in. Diagnosing leukemia is based on the fact that white cell count are increased with immature blast cells (lymphoid or myeloid), and neutrophils and platelets are decreased. Therefore, hematologists routinely examine blood smears under microscope for proper identification and classification of blast cells. The presence of the excess number of blast cells in peripheral blood is a significant symptom of leukemia. There are four main types of leukemia: acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL) and chronic myeloid leukemia (CML), as well as a number of less common types. Approximately every 3 minutes one person in the United States (US) is diagnosed with a blood cancer. An estimated combined total of 156, 420 people in the US are expected to be diagnosed with leukemia, lymphoma or myeloma in 2014. Annually, nearly 500, 000 people die of cancer in India. The WHO said this number is expected to rise to 700, 000 by 2015.



NORMAL BLOOD CEL VS LEUKEMIA BLOOD CELL

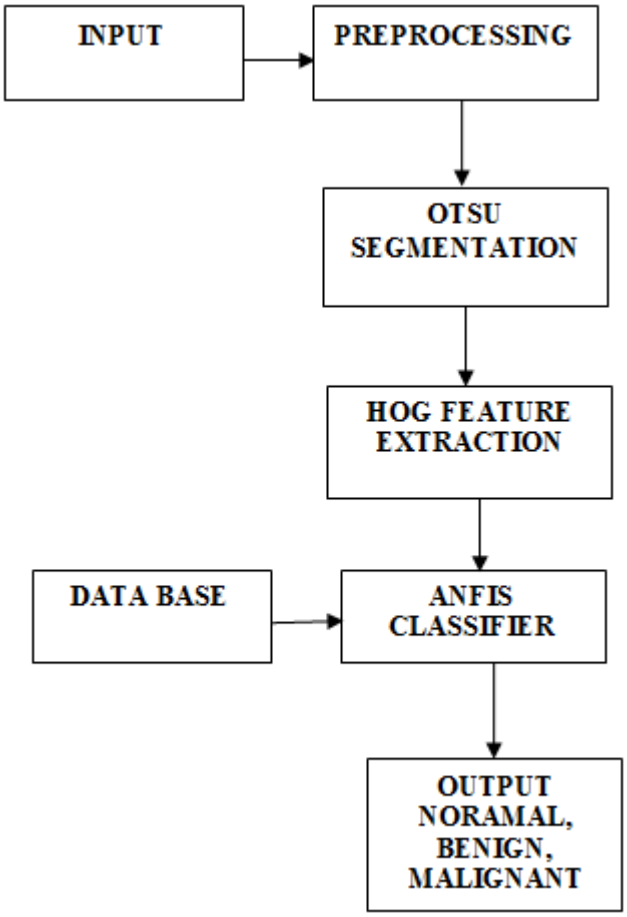
II. RELATED WORK

Numerous efforts have been taken in order to study leukemia. The cell composition and locations plays a vital role in this process. White blood cell composition reveals important diagnostic information about the patients and substituting automatic detection of white blood cells for manually locating are more helpful and accurate this procedure was introduced by P. S HIREMATH. The WBCs identification was made possible thanks to the conversion in the CMYK color model. In fact, we have observed that leukocytes are more contrasted in the Y component of CMYK color model, this is because the yellow color is present in all the elements were identified by Lorenzo Putzu. TRUPTI, concluded that image acquisition may contain noise and other disturbances so all the images are subjected to median filtering for better enhancement of the image. The image is normalized in brightness and the background noise is remove to element the redundant information. The Eigen space for the image is set to built by computing biggest Eigen values in-order to increase the resolution of position as estimated by OVIDU GHITA , we connected these points in Eigen space and unknown positions can be approximated .

III. PROPOSED APPROACH

In Proposed system, the image is pre-processed and then the images are segmented using otsu based Threshold method. More number of features trained through in Histogram of oriented features, angle, magnitude and gradient parameters takes to implement. After that ANFIS (Artificial Neural Fuzzy Inference System) is used to classify the disease types.

BLOCK DIAGRAM

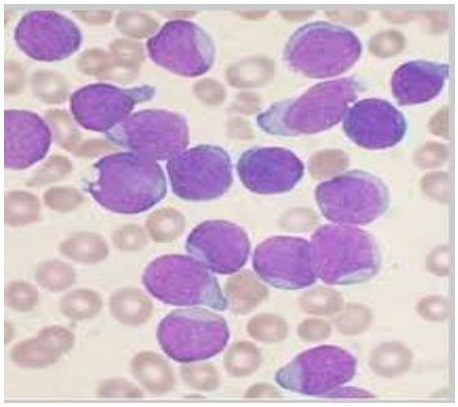


BLOCK DIAGRAM EXPLANATION:

1. INPUT:

Image called as a group or collection of pixels in the arrangement of rows and column manner. the total rows and column vaules of multiplied only presence in a image. here the image first considered as RGB format. Pixel: - a small particle of

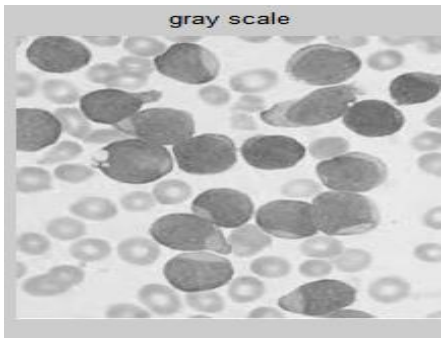
an image. size: images are taken from bioinformatics laboratory format of images *. jpg and *. bmp all available, size of image like 211x239.



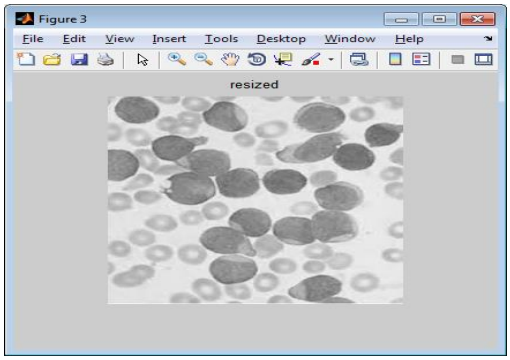
2. PREPROCESSING:

Pre-processing the beginning implementation of to regularize the taken input image for following process. Regularize process are, Re-sizing Gray scale conversion, Noise cancellation.

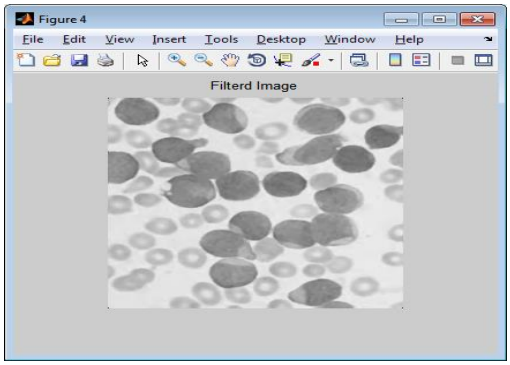
Conversion to Gray Scale: A Gray-scale Image is supposed To Contain Only 'gray' color where the Red, Green and Blue Color Components are said to Have Same Intensity Values and so Processing Becomes Flexible When we Specify only a Single intensity Value for Each Pixel, Instead of taking Three Intensity Values needed to be Specified for each Pixel in a Color Image. Microscopic Images are found to possess the Primary Color(RGB). So, for further processing, it must be Converted to Gray-scale Images.



Resize: Resize the Images to a New width and Height. To Make the Image Scale Proportionally, use 0 as the value for the wide or high parameter. For, instance, to Make the Width of an image 150 Pixels, and change the Height using the same Proportion, use Resize(150, 0).



Filtering: Median Filtering is a Nonlinear Method Used to Remove Noise from Images. It is widely used as it is very Effective at Removing Noise While Preserving Edges. It is Particularly Effective at Removing 'Salt and Pepper'type Noise. The Median Filter Works by Moving Through the Image Pixel by Pixel, replacing each Value with the Median Value of Neighbouring Pixels. The Pattern of Neighbours is Called the 'Window', which Slides, Pixel by Pixel, Over the entire Image.



3. SEGMENTATION: Image Segrnentation Is the Process of Dividing an Image into Multiple Parts. This is Typically Used to Identify Objects or Other Relevant information in Digital Images.

OtsuThreshold:

Threshold based segmentation it takes actual intensity and reflection intensity values by weighted vector and class variance. output of image like black and white.

1. weighted (intensity)

2. class variance

3. mean

4. final step is threshold (foreground and background separation).

The most Common way to convert a Gray –Level Image Into a Binary Images is to Select a Single Threshold Value(T). Then all the Gray Level Values Below T will be Classified as Black(0)i. e. Backgrounds and those Above T will be White(1)i. e. Objects.

The Thresholding Operation is Defined By

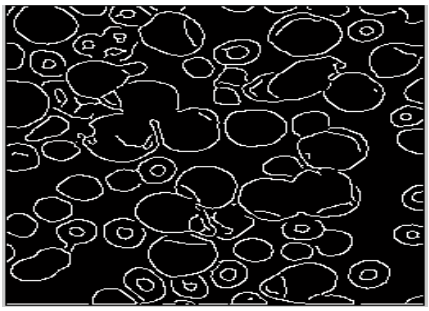
$g(x,y) = 0\ if\ f(x,y)$<T

$1\ if\ f(x,y) > T$

Where (x, y)=>Represent Gray value

g(x, y)=>Represent Threshold Image

f(x, y)=>Represent Gray Level Image



4. HOG FEATURE EXTRACTION:

The histogram of oriented gradients (HOG) is a feature descriptor used in computer vision and image processing for the purpose of object detection. Histogram: the graphical representation of pixel intensity of an given image. The intensity level is gradually changes based on three parameters like,

Angle, magnitude and gradient features.

Angle is defined as in image in two directional views . . X and Y directions.

X represents in Ix

Y represnts in Iy

Angle is =atan(Ix/Iy);

Magnitude & Gradient: The samples of pixels varied in two types same intensity level and different values of intensity.

Represents, sqrt(Ix2 + Iy2)

Saturation of contrast level among different region in image. . It can be obtain through angle and magnitude values . For that we take 8 x 8 patch and analyze the values.

The most important problem in generation of features of blood cells that characterize them in a way enabling the recognition of different blast types with the highest accuracy . The features to be used are for nucleus of lymphocytes and myelocytes:

- Geometrical Features – which includes area, radius, perimeter, symmetry, concavity, compactness, solidity, eccentricity, elongation, form factor will be obtained.
- Texture Features – which includes homogeneity, energy, correlation, entropy [18], contrast, angular second momentum will be obtained.
- Color Features – the RGB color spaces will be transformed into HSV or L*a*b color spaces. Their mean color values will be obtained.
- Statistical Features – the mean value, variance, skewness, kurtosis of the histograms of the image matrix and the gradient matrix for RGB or HSV or L*a*b color space (whichever appropriate) will be obtained.

5. ANFIS CLASSIFIER:

A neuro-fuzzy approach as a combination of neural networks and fuzzy logic has been introduced to overcome the individual weaknesses and to offer more appealing features. The ultimate goal of applying such a system is to get rid of imprecise information present in an image such as pixel grayness ambiguity, geometrical segmentation of the image and the uncertain interpretation of a scene. This exploits, respectively, the learning capabilities and the descriptive power of systems, thus providing results characterized by a high interpretability and good degree of accuracy.

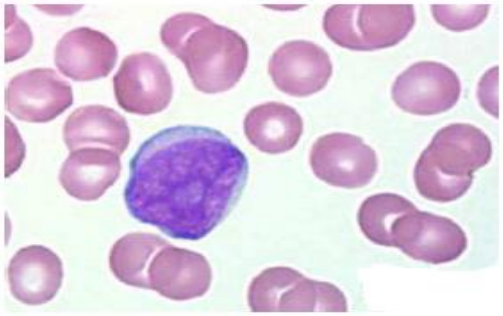
The types of Leukemia are,

✓ **ACUTE MYELOID LEUKEMIA**

Acute myeloid leukemia (**AML**), also known as **acute myelogenous leukemia** or **acute nonlymphocytic leukemia**(**ANLL**), is a cancer of the myeloid line of blood cells, characterized by the rapid growth of abnormal white blood cells that accumulate in the bone marrow and interfere with the production of normal blood cells. AML is the most common acute leukemia affecting adults, and its incidence increases with age. Although AML is a relatively rare disease, accounting for approximately 1. 2% of cancer deaths in the United States, Patients with AML often have several non-specific (general) symptoms. These can include:

- Weight loss
- Fatigue

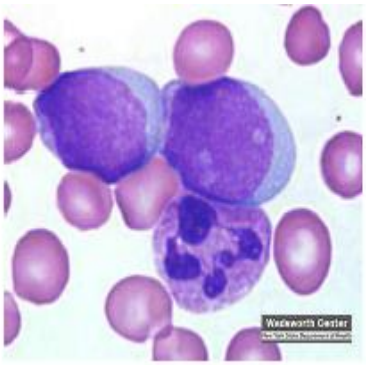
- Fever
- Night sweats
- Loss of appetite



✓ **CHRONIC MYELOGENOUS LEUKEMIA:**

Chronic myelogenous (or myeloid or myelocytic) leukemia (**CML**), also known as **chronic granulocytic leukemia (CGL)**, is a cancer of the white blood cells. It is a form of leukemia characterized by the increased and unregulated growth of predominantly myeloid cells in the bone marrow and the accumulation of these cells in the blood. . In Western countries it accounts for 15-20% of all adult leukemias and 14% of leukemias overall (including the paediatric population). Symptoms can include the following:

- Weakness
- Feeling tired
- Weight loss
- Fever
- Night sweats



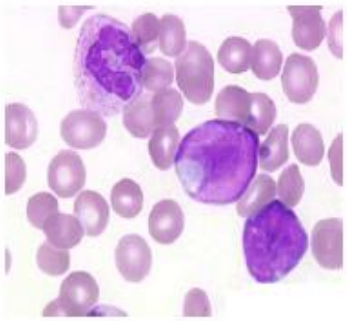
✓ **ACUTE LYMPHOBLASTIC LEUKEMIA:**

Acute lymphoblastic leukemia (**ALL**) or **acute lymphoid leukemia** is an acute form of leukemia, or cancer of the white blood cells, chacterized by the overproduction of cancerous, immature white blood cells—known as lymphoblasts. In persons with ALL, lymphoblasts are overproduced in the bone marrow and continuously multiply, causing damage and death by inhibiting the production of normal cells—such as red and white blood cells and platelets—in the bone marrow and by spreading (infiltrating) to other organs. ALL is most common in childhood with a peak incidence at 2–5 years of age, and another peak in old age. [2]

The signs and symptoms of ALL are variable but follow from bone marrow replacement and/or organ infiltration. [1]

- Generalized weakness and fatigue
- Anemia

- Dizziness
- Frequent or unexplained fever and infections
- Weight loss
- Excessive and unexplained bruising
- Bone pain, joint pain
- Breathlessness



6. DATABASE:

A **database** is an organized collection of data It is the collection of schemas, tables, queries , reports, views, and other objects. The data are typically organized to model aspects of reality in a way that supports processes requiring information.

7. OUTPUT:

Normal

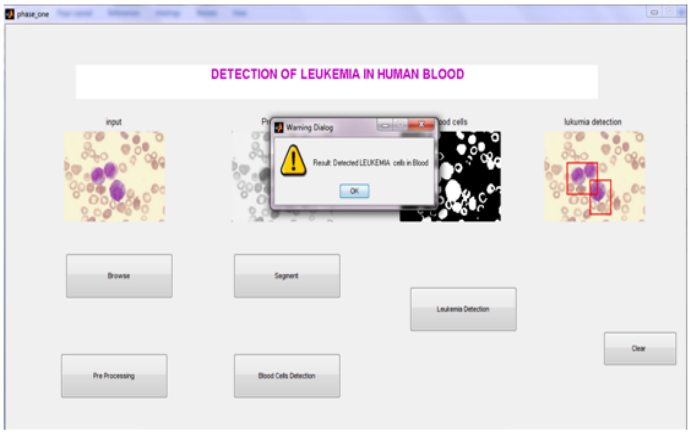
Benign

Malignant

GRAPHICAL USER INTERFACE (GUI)

As the process of handling MATLAB script for each and every image separately is problematic and hazardous, a userinterface is designed to make the process of identification fastand user friendly. With the help of the GUI, the operator cannot only load, segment and classify the lymphocytic cell, butalso the data for the particular cell can be saved for future

reference. Here flexibility is provided in the case of choosingintensity for any image. The contrast of the image can beadjusted automatically as well as manually. For the imageselected in the GUI image space, have to be segmented first, then parameters are to be calculated and stored, next withthe help of Manual check, the data will be classified and the result will be displayed.



IV. CONCLUSION

In this diagnosis, we have proposed an image segmentation and classification of electron microscope images and extracting geometric features of leukocyte cells. The experimental results obtained by gray level thresholding and ROI. The proposed method is more reliable and computationally less expensive and yet yields comparable classification. It could be improved further by better pre-processing methods and feature sets, which will be taken up in our future work. This method of identification and classification of leukocytes can also be extended in neural network based diagnosis which helps to improve the identification performance.

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