Detection of Leukemia And Dengue Using Image Processing: A Study

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Abstract- *There are many diseases related to blood which can affect one or more parts of the human body, they can be acute or chronic. The process for detecting diseases is time consuming because in laboratory it takes longer and If the process takes longer time this may be life threatening. In this paper we have described initial study of developing detection of leukemia as well as dengue using image processing techniques such as Segmentation, Feature extraction, Thresholding, Classification, etc. The model in this paper will focus on diseases related to blood such as leukemia and dengue. The proposed model present in this paper is focusing on the changes in features of microscopic image such as size, perimeter, area etc. The features of image will be input to the classifier. KNN classifier algorithm is used for leukemia detection and C5.0 decision tree classifier algorithm is used for detection of dengue.*

Keywords- C 5.0 decision tree classifier, dengue, KNN classifier, Leukemia, WBC.

I. INTRODUCTION

Blood is important fluid of the body. It has four main components: Plasma, Red Blood Cell (RBC), White Blood Cell (WBC), Platelets. It supplies essential substances throughout the body such as sugar, oxygen and hormones. Hence blood is very important element in our body. White Blood Cells is also called leukocytes. They plays important role for the immune System of a body and they also helps to fight infections caused by bacteria, viruses and germs that enters in the body. One white blood cell is present between 1000 red cell i.e. the ratio of WBC to red cell

TABLE I. WBC TYPES

No.	Name	Image	Description
1.	Neutrophils		The size of Neutrophils is usually 10-15 microns and it is presents within the range of 40%-70%.
2.	Eosinophils		The size of Eosinophils is usually 12-17 microns and it is presents within the range of 40%-70%.
3.	Basophils		The size of Basophils is usually 10-14 microns and it is presents within the range of 0-2%.
4.	Monocytes		The size of Monocytes is usually 10-20 microns and it is presents in the range of 29%.
5.	Lymphocytes		It presents in the range of 20-50%. There are two characteristics of Lymphocytes such as Small and Large Lymphocyte. Size of small Lymphocyte is 6-9 microns & size of large lymphocyte is 10-17 microns.

II. BACKGROUND

A. Leukemia

Leukemia is the blood disease which can cause death henceforth, it is important to diagnose it as soon as possible to be on a safer side. Leukemia is the cancer of the blood cells in which number of white cells increases immaturely and those immature cells destroys other cells. Leukemia is generally divided into two types known as acute leukemia or chronic leukemia depending upon how quickly the immature cell blasts. Further leukemia gets divided into two types each namely, acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL) and chronic myeloid leukemia (CML).

B. Dengue

Dengue is one of the viral disease whose carrier is aedesaegypti mosquito. There are three major forms in dengue, which are as follows:-

- Break bone fever
- DHF
- DSS

One of the major difficulties included with dengue is lower platelets count because of which clotting of the blood is opposed. In this white blood cells count also decreases which are produced by bone marrow. During this disease platelets count can be go down as low as 20,000 to 40,000 and WBC count can also decreases below 4000.

III. GUI DESCRIPTION

The system will deliver 2 options at beginning and those options are:-

- Leukemia test
- Dengue test

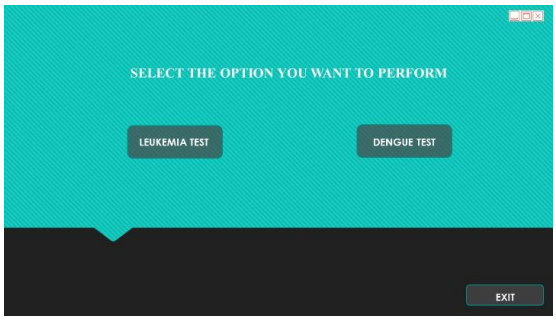


Fig 1. GUI Interface

If LEUKEMIA TEST is selected then that particular microscopic image will undergo through some steps which are included in algorithm for detection of leukemia and if DENGUE TEST is selected then that particular microscopic image will undergo through another steps included in algorithm for detection of dengue.

IV. RESEARCH METHODOLOGY

In this method we focused on detection of two blood diseases that is Leukemia and Dengue using image processing. We can get the result for leukemia test or dengue test depending on which option is selected. It is found that there are number of methodologies are present for detection of leukemia cells and list of some of the methods with their merits/demerits and its accuracy percentage is given as follows:-

TABLE II. METHODOLOGIES

METHOD	MERIT/DEMERIT	ACCURACY
K-Means Clustering Techniques	Merits: This method is mainly useful for clustering as well as on the basis of value of K it can separate the data. Demerits: Without labelled data it provides and it is not applicable on data which is incremented.	72%
Watershed Transform	Merit: For detection of white blood cells it is comparatively easy method. Demerits: It provides less accuracy.	72.2%
Shaped Based Features	Merit: This method is useful and less complicated for the WBC detection, its size as well as overlapped cells. Demerit: Can get approximate result because it is based on statistics.	97.8%
Histogram equalization and Linear Contrast Stretching	Merit: In the case of contrast enhancement this method is very useful. Demerit: complicated in detection of overlapping WBCs.	73.7%

From TABLE II, It is cleared that shape based feature method gives best result with maximum accuracy. In this methodology shape, size, area, perimeter, roundness of WBC is detected and according to that leukemia is detected. In detection of leukemia size and shape of WBC plays important role as in leukemia size and shape of WBC changes. Therefore to detect shape and size of WBC this shape based feature algorithm is useful.

In the case of Dengue our focus is on counting the WBCs more than its features, therefore after detecting boundary of each cell counting of WBCs is done and depending on that count dengue is detected.

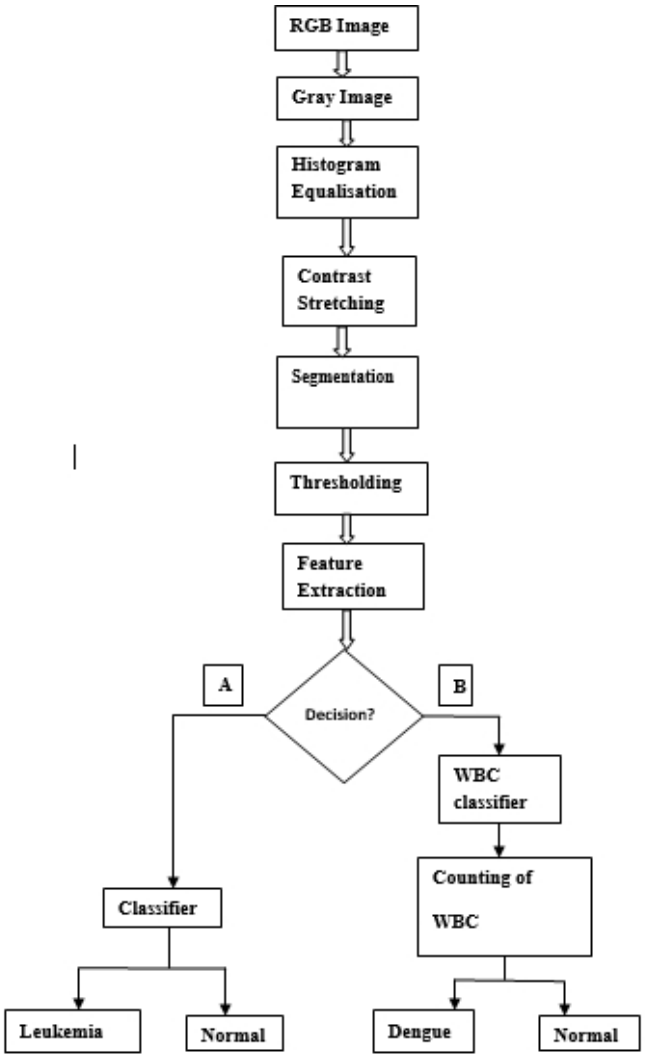


Fig 2. Flowchart of Algorithm

In Table I algorithm is given, in this algorithm there are various types of image processing operations and by using these operations we have tried to find leukemia as well as dengue with less time and more accuracy.

A. RGB to GRAY conversion

First we have to select microscopic image of blood cell and convert it into gray as image is captured by digital microscope and it is based on RGB color model. Each pixel in the image contains red, green, blue color. These RGB image is high dimensional image therefore to reduce dimension we have to convert it into gray.

B. Histogram Equalization

This method is used where contrast adjustment needs to be done. It increases global contrast of many images. Here as we have to detect WBC from microscopic image of blood this method is used so that we can get better details from the image that are over or under are exposed. It is straight forward and this is one of the advantage of this method.

C. Linear Contrast Stretching

Unlike histogram equalization, Contrast stretching is used to map input and output values linearly. This method is used to increase the difference between maximum intensity and minimum intensity of the image and all remaining values of intensities are spread between this ranges.

D. Segmentation

Segmentation is the process which includes partitioning of an image into multiple segments. It is the method in which various mathematical operations such as addition, subtraction and multiplication etc. are included and with the help of these mathematical it gets easy to extract the particular cell of leukemia from the image accurately.

E. Thresholding

We can create binary image from gray scale image by using technique named Thresholding. If the image intensity Ij,j is less than some fix constant T(that is Ij,j < T), it replace each pixel in an image with black pixel and if the Image intensity is greater than that constant T (i.e. Ij,j >T)), it replace each pixel in an image with white pixel.

F. Canny Edge Detector

To detect edges, present in the images it uses multi stage algorithm hence it also called as an edge detection operator. So basically it is useful for extracting the useful structural information. The general criteria for edge detection include:

- Edge detection: It means it should catch maximum edges present in the image.
- The edge point which is detected from the operator should be localized accurately on the center of the edge.
- In the image a given edge should only be marked once and where possible, image noise should not create false edges.

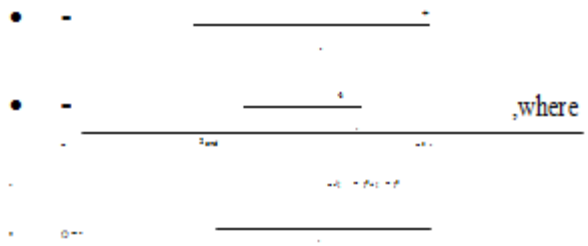
G. Morphological Operation

Erosion is one of the two basic operator in the area of mathematical morphology other is dilation. It is typically applied to binary image. The basic effect of operator is to erode away the boundaries of regions of foreground pixels.

Thus area of foreground pixels shrinks in size and holes within those areas and therefore as we have to focus on WBCs more than the background we used erosion which is one of the operator from morphological operations.

H. Feature extraction

In the case of leukemia detection feature extraction plays important role. After erosion operation it is easy to find area, perimeter, roundness, standard deviation etc. of WBC as it becomes noticeable. To extract the features first we need to find the centroid, major axis, minor axis so that it becomes easier to find above mentioned features by using below formulae:



I. Classification

Classification of image includes a range of decision-theoretic approaches to the identification of images. Algorithm of classification is divided into two parts:

- Training
- Testing.

In the case of detection of leukemia, KNN (K-Nearest Neighbors) algorithm of classification is proposed due to less calculation time. With the help KNN accuracy of 93% is achieved.

In case of detection of dengue there are two cases where classification is needed & in both cases C5.0 decision tree algorithm is used. A decision tree is a tree structure algorithm where:-

- Each node denotes a test on an attribute.
- Each branch represents outcome of test.
- Leaf node represents classes or class distribution.

By using decision trees we can classify the data so that they can be simple to understand and interpret.

V. CONCLUSION

With the advancement in the field of medical technology, everything is on verge of being automated. This paper puts forward the method of detection of blood diseases using Image processing, by which infected cells can be detected efficiently. In this method two such diseases are covered, one is blood cancer called Leukemia and another is mosquito-borne tropical disease caused by the dengue virus called Dengue. Method discussed in paper provides the accuracy of 93% for the detection of cells and provides the less time consuming method for treating both the disease.

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