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Leukemia Detection Using Image Processing

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Abstract*—There are different technique used of image processing in the field of medical science for detecting various disease in earlier stages so that they can be cured in initial stage. This study aims to develop a system that will apply different technique of image processing and genetic algorithm, specifying in automating the detection of leukemia. In this concept we have used various blood sample images and examine them with sample affected with leukemia using watershed algorithm in MATLB. Using Naive Bayes Classifier in detection process this will help in creating a system that will take a blood sample image and examine it using said method.*

Keywords—Feature extraction, image classification, image color analysis, image processing, leukemia.

I. INTRODUCTION

Leukemia ranks 5th in the overall killer disease in the Philippines .One of the keys to solving this problem is by early detection with the help of software (MATLAB) for this purpose. Detection of leukemia using image processing by using microscopic image of blood sample can be a contribution to the medical field. The main objective is to detect the disease by studding and examine human blood sample images during their earlier stages to prevent them from worsening. For image quantitative analysis and image recognition the separation overlapping cells is important. For good image detection overlapping cells is divide by using Watershed algorithm.

An image is defined as an array or a matrix of square pixels (elements of picture) arranged in rows and columns .By using Image processing we can convert image into digital form to get improved image and take out many helpful information from it. Image processing is the analysis of a picture using techniques that can identify shades, colors and relationships that cannot be perceived by the human eye. It is used to solve problems such as in creating weather maps from satellite pictures and in forensic medicines. It also deals with images in bitmapped graphics format that have been scanned in or captured with digital cameras. It is also widely used in the field of science and technology by getting a clearer view of a given picture to be used as a sample data to get more accurate results.

1.1 Need

A more effective, easier and eco-friendly method to detect a person is suffering from Leukemia or not. This process requires a zoomed blood cell image of a blood sample for processing of the image dedicating software (MATLAB). These three components when put all together and doing the require algorithm step by step based on image processing .there is no need of costly medical devices .it works only by using mat lab and runs using sample images provided at low cost and less human source This technology can be used in detection of many other diseases.

II. LITERATURE REVIEW

The purpose of this paper was to implement image processing in deciding presence of leukemia in white blood cell images. In this algorithm, colored microscopic blood cell images are converted into the greyscale images so that nucleus part in the images will be darkest of all which will be helpful in removal of noise .The paper mainly focuses on the detection of Leukemia and provides a broader range of Leukemia classification into its four main types. Three segmentation algorithms were used. A large number of features were extracted to make the detection process more accurate and precise. The three contrast enhancement techniques were partial contrast, bright stretching .This paper has studied about leukemia-cell-detection. These blood cells are undeveloped as well as they does not operate properly. Due to lack of proper treatment, leukemia could be a fatal-disease. This badly disturbs the development along with the general function of blood- tissues in addition to cells. So it must be diagnose at

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early stage .This paper introduce a high throughput screening algorithm for leukemia cells. The algorithm starts with conventional edge detection. Then, the image is recursively segmented to separate foreground from background. 1D intensity summation plots are further used to categorize single cells from intensity summation plots are further used to categorize single cells from hem cytometer. The cell count using the proposed algorithm matched the cell count .In this paper, segmentation and classification of lymphocytic cells using watershed transform is used for the purpose of acute lymphoblastic differentiate between normal and blast lymphocytic cells with a good level of accuracy. It will also be necessary to expand the size of the dataset in order to utilize the classification model for practical purpose. The main aim of this paper is nucleus segmentation followed by feature extraction to detect Leukemia. Shape features of nuclei such as area, perimeter, etc. are considered for better accuracy of detection. The results show that the proposed statistical parameter such as mean and standard deviation based image segmentation and Otsu's thresholding based produced good segmentation performance.

III. PROCESS OVERVIEW

3.1 System Development Architecture

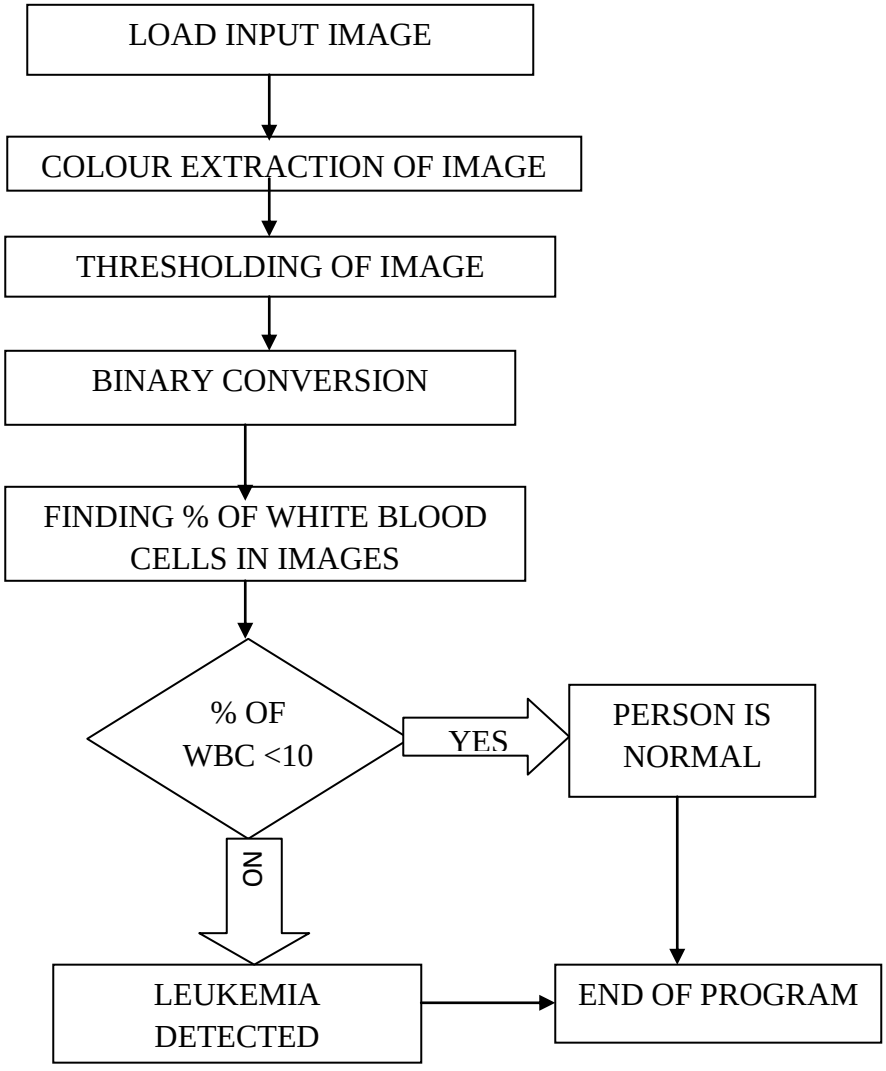

FIG. 1 Flowchart of Process of leukemia detection

The flow chart which describes the steps followed in the system. The input image will be loaded from the database in the GUI display window. The color extraction will be performed on the image. The very next step will be thresholding of the image to

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remove the background of image and retaining the white blood cell area. The white blood cell area will be represented by the high intensity pixels. The area covered by the white blood cells will be calculated by adding all the high level pixels. The decision of leukemia detection will be made by setting a percentage level. If the calculated percentage would be more than this level then the leukemia will be detected else the person is considered to be normal.

3.2 Naïve Bayes Classifier

This step first formulates a prior probability of the classified objects (Leukemic or Normal), then having formulated, next it classifies the new object, which is the processed input image, where it belongs to that particular category, by calculating the likelihood of the new object given that these are the prior probability of the classified objects.

3.3 Hough Transform

Feature extraction is most challenging tasks in Computer Vision. Usually objects of interest may come in different shapes and sizes, not pre-defined in an arbitrary object detection program. A solution to this problem is to provide an algorithm which is used to find any shape within an image. Then classify the objects accordingly to parameters needed to elaborate the shapes. A commonly used technique to obtain this is the Hough Transform. Invented by Richard Dude and Peter Hart in 1992, the HT was originally used to detect arbitrary shapes of for different objects. The Hough Transform which was later extended is identify circular objects in low-contrast noisy images. Then it referred to as Circular Hough Transform. This method probably depends on converting gray-scale images to binary images using edge detection techniques such as Canny or Sobel. The goal of this technique is to find irregular instances of objects within a pre-defined set of shapes by a voting process. In the following, now we will analysis the Hough Transform, Circular Hough Transform, and their limitations

Implementation is unlike the linear HT, the CHT relies on equations for circles. The equation of the a circle is,

$$r^2 = (x - a)^2 + (y - b)^2 \quad \text{..... (1)}$$

Here, co-ordinates for center represent by a & b. Radius of circle represented by r. The parametric representation of this circle is,

$$x = a + r*\cos(\theta)\ y = b + r*\sin(\theta) \quad \text{..... (2)}$$

In contrast to a linear HT, a CHT relies on 3 parameters, which requires a larger computation time and memory for storage, increasing the complexity of extracting information from our image.

For simplicity, most CHT programs set the radius to a constant value (hard coded) or provide the user with the option of setting a range (maximum and minimum) prior to running the application.

For each edge point, a circle is drawn shown as origin and radius r. The CHT also uses an array with the first two dimensions representing the coordinates of the circle and the last third specifying the radii. The values in the accumulator are increased every time a circle is drawn with the desired radii over every edge point. The accumulator kept counts of how many circles pass through coordinates of each edge point. Then proceeds to a vote to find the highest count. The center co-ordinates of the circles in the images are the coordinates with the highest count.

FIG. 2 Input image – after edge detection

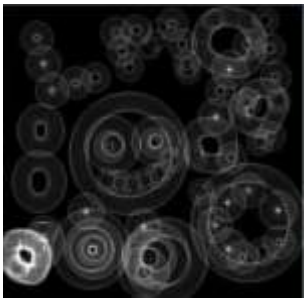

FIG. 3 Image after voting

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3.4 Watershed Algorithm

Watershed transformation also known, as watershed method which is a powerful mathematical morphological tool for the image segmentation. It is popular in the fields like biomedical and medical image processing, and computer field. In geography, watershed means the field that divides areas drained by different river systems. If image is viewed as geological landscape, the watershed lines determine boundaries which separates image regions. The watershed transform represents catchment basins and ridgelines. Catchment basins related to image regions and ridgelines relating to region boundaries. Segmentation by watershed embodies is the concepts of the three techniques such as threshold based, edge based and region based segmentation. Watershed algorithms based on watershed transformation have 2 classes. The first class contains the flooding based watershed algorithms and it is a traditional approach whereas the second class contains rain falling based watershed algorithms. Many algorithms have been proposed in both classes but connected components based watershed algorithm shows very good performance compared to all others. It comes under the rain falling based watershed algorithm approach. It gives good segmentation results, and gives the criteria of less computational complexity for hardware implementation.

3.5 Block Diagram of Watershed Based Segmentation:-

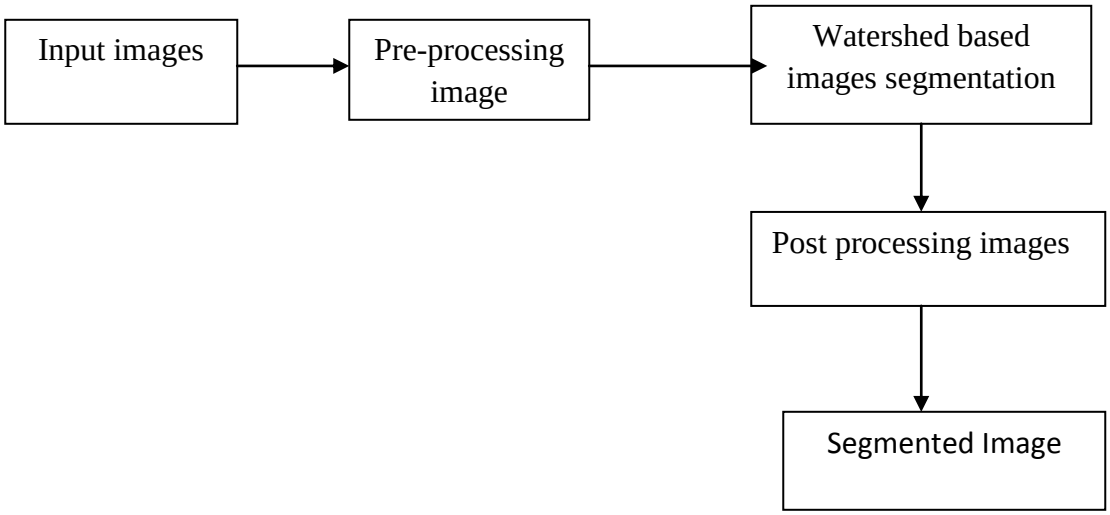

FIG. 4 Block diagram of watershed based image segmentation

For watershed based image segmentation approach there are mainly three stages as shown by Figure. First stage is defined as pre-processing, second stage as watershed based image segmentation and last stage as post-processing. Input image is first processed by the pre-processing stage, and then given to watershed based segmentation stage. The image is post processed by the final state to get a segmented image. Pre-processing and post- processing are important to reduce the problem of over-segmentation in watershed based image segmentation. Pre-processing stage is discussed in detail in this chapter. Overview of the post processing stage is given in last section but it is not used for software and hardware implementation in this thesis. So to detect leukemia in very less time this automated process is very important.

IV. ANALYSIS AND DISCUSSION

The result will be displayed in GUI window by using different push button in the display. The image inserted by user in insert image tab will be processed through given algorithm. Then images will be processed in gray scale image binary conversion, image filling and using Hough transform the percentage of WBC is calculated by comparing it with total area covered by all cells in insert image of Hough transform. The result in percentage is shown which range from curable, not curable to blank which person doesn't have leukemia. The accuracy of result can be calculated by successful result divide by total result *100. The accuracy level 95 to 100 percent is considered best. But if 85 to 95 is also obtained its good.

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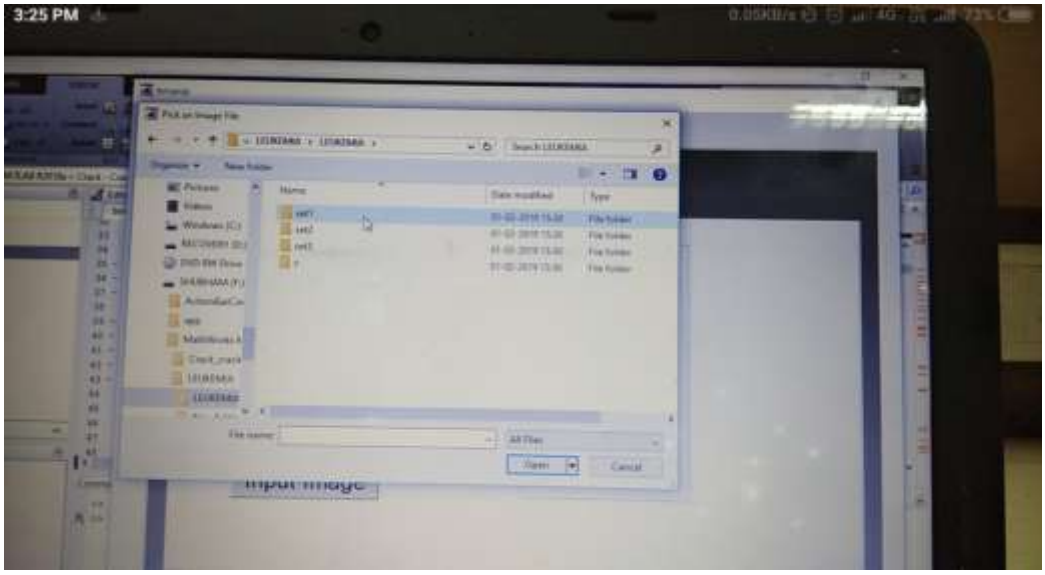

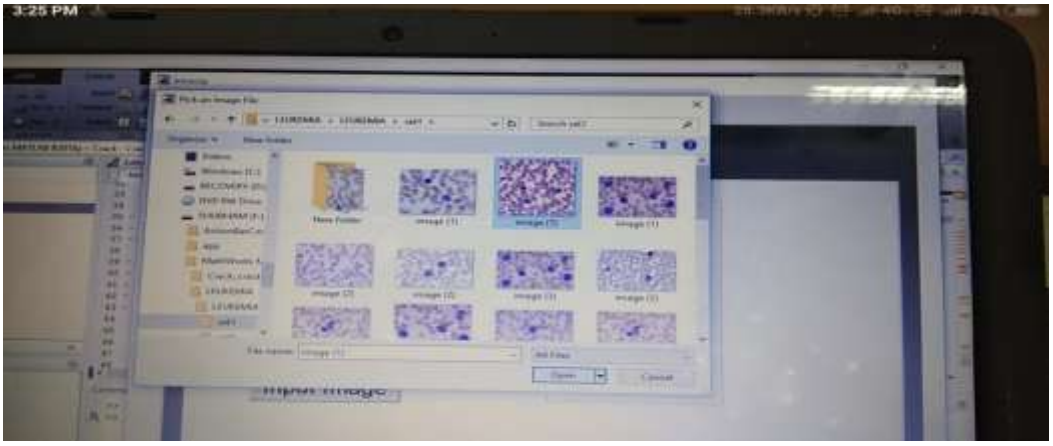

Here, we are taking blood sample images for detection and put that images in detection window where we can detect leukemia cells.

V. CONCLUSION

The paper is about to detect leukemia using image processing with the help of watershed algorithm, Hough transform and naive Bayes algorithm using MATLAB. This system user friendly and can be made at low cost without using costly medical system. So to detect leukemia in very less time this automated process is very important. This require less cost and it is time consuming.

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