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Disease Diagnosis Using RBCs & WBCs Cell Structure by Image Processing

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ABSTRACT

The human blood consists of the RBCs, WBCs, Platelets and Plasma. The complete blood count defines the state of health. Blood is a health indicator therefore segmentation and identification of blood cells is very important. Complete Blood Count (CBC) includes counting of all the cells which determines person's health. The RBC and WBC count is very important to diagnose various diseases such as anemia, leukemia, tissue damage, etc. Old conventional method used in the hospital laboratories involves manual counting of blood cells using device called Hemocytometer and microscope. But this method extremely monotonous, laborious, time consuming, and leads to the inaccurate results due to human errors. Also there are some expensive machines like Analyzer, which are not affordable by every laboratory. The objective of this paper is to produce a survey on an image processing based system that can automatically detect and count the number of RBCs and WBCs in the blood sample image. Image Acquisition, Pre-Processing, Image Enhancement, Image Segmentation, Image Post-Processing and Counting algorithm these are six steps involved in an image processing algorithm. The objective of this research is to diagnosed the different diseases of the blood cells.

Keywords: RBC, WBC, Platelets, Digital Image Processing, Morphology, Hough Transform.

I. INTRODUCTION

The complete blood count (CBC) is the blood test used to evaluate the health of person and to detect the disorders like anemia, infection and leukemia. In medical diagnosis Complete blood count is very important. There are mainly four categories of cells. Red Blood Cells (RBCs), White Blood Cells (WBCs), Platelets and Plasma. These groups can be differentiated using texture, color, size, and morphology of nucleus and cytoplasm. Cells count is important to determine the immunity and capability of the body system. The abnormal count of cells indicates the presence of disease and person needs medical help. Current research is on an implementation of image processing based automated counting of RBCs and WBCs from blood image. WBCs are also called leukocytes. These cells are an important part of immune system. These protect body by removing viruses and bacteria in a body. Medical term use to describe low count is Leukopenia. Leukopenia indicates the presence of infection. Medical term use to describe high count is Leukocytosis. Leukocytosis indicates an existence of infection, leukemia or tissue damage. RBCs are also known as erythrocytes. The function of RBC is to carry oxygen and collects carbon dioxide from a lung to the cells of body. They contain protein called hemoglobin. The presence of inner and outer layers of protein gives red color to blood. Hemoglobin do the work of carrying oxygen. An abnormal count of RBCs leads to anemia which results in mental tiredness, illness, weakness, dizziness. If it is not treated immediately it results into more serious symptoms like malnutrition and leukemia. RBC indices give information about size and shape of cells and are also useful in differentiating types of anemia. Platelets are also called as thrombocytes. The function of the platelets is to stop bleeding by clumping and clotting blood vessel injuries. A low platelet count is called thrombocytopenia. It avoids blood clotting and causes a person to bleed. High platelet count is called thrombocytosis. It clots blood inside blood vessel and

stops blood from flowing properly. Therefore for proper blood flow platelets count must be in normal range.

II. METHODS AND MATERIAL

A. Literature Review

Diagnosis method is a tourniquet test which has sensitivity 33.5-34%, specificity 84-91%, and positive predictive values 85-90% and negative predictive values 32.5-34%. This testing has low sensitivity and relatively little value to the diagnosis of suspected dengue[7].

Previous research used image processing and image segmentation methods to classifY white blood cells based on the edges of cells. The focus is selection of feature extraction and classification method.Alfred R. J. Katz [8] did a research for classification offive major types of white blood cells. The best accuratetechnique for classification of supervised learning is a neuralnetwork technique.

Ms. MinaI D. Joshi, Prof Atul H. Karode, and Prof S. R. Suralkar [9] did a research and studied white blood cell detection and classification of acute Leukemia by image of blood cells. And classification using a K-nearest neighbour (kNN), with 93% of accuracy. Monica Madhukar and colleagues [10] research decision support tools for the classification of acute lymphoblastic leukemia. They used K-means Clustering techniques of the Lab colormodel for image segmentation at accuracy 93.5%. A white blood cells classification was done using image processing to apply the detection of dengue virus.

B. Objectives

We implement low cost disease diagnosis method using RBC & WBC cell structure. To detect the cell structure we use Hough transform algorithm in which the purpose of this technique is to find imperfect instances of objects within a certain class of shapes. The classical Hough transform was concerned with the identification of lines in the image. But, later the Hough transform has been extended to identifying positions of arbitrary shapes, most commonly circles or ellipses.We use Sobel algorithm for segmentation. This algorithm is use to separate object from background.For the result we use K-means clustering for data base comparison.

C. Proposed Work

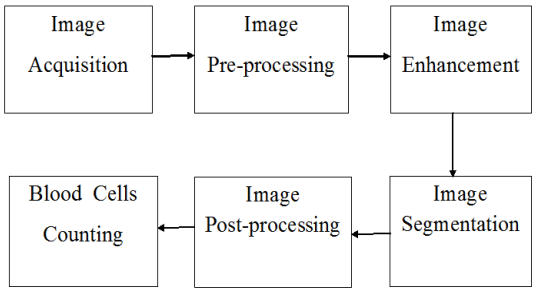

Figure 1. Block Diagram of Blood Cells Counting

D. Working

As shown in above fig. there are six major steps involved in blood cells estimation.

1. Image Acquisition

Image acquisition acquires digital images of blood samples in either .jpeg or .png format. These images are in RGB color plane. These are microscopic image that are obtained from hospitals or from laboratories using digital microscopes or using a digital camera placed at the eye piece of a microscope. Images are also available on online medical library. To examine the RBCs and WBCs stained blood images may be captured with the help of thin glass slides and Digital microscope. Giesma stained thin blood film image should be taken so that platelets, RBCs and WBCs can be easily distinguished. In to differentiate RBCs from WBCs and Platelets, RBCs are less stained as compare to WBCs and platelets leaving a bright patch with intensity value similar to background value. These images are digital images in either .jpeg or .png format and are in RGB color plane.

2. Image Pre Processing

It is a technique of adjusting images, improving the quality of image and making them suitable for the next step of process. Image pre-processing usually includes removing noise, contrast enhancing, isolating regions and use of different color models grayscale image and HSV image, Binarization. Grayscale represents the intensity of the image.

As acquired images have low contrast and due to clustered white blood cells noise get included. To overcome and reduce these effects contrast enhancement is done. After contrast stretching image is converted into grayscale, noise get added into resultant image is salt n

paper noise. Also at the time of capturing the microscopic blood images noise get added into it, Median filtering is used to remove noise. After observing various sample images it was found that median filter would be the best noise removal filter.

3. Image Enhancement

Enhancement techniques improves the quality, contrast and brightness characteristics of an image, also sharpen its details. Histogram plotting, histogram equalization, image negation, image subtraction and filtering techniques, etc. are basic Image enhancement techniques.

To enhance the image, its contrast is adjusted by plotting its histogram. In canny edge detection and connected component labeling is used as image enhancement techniques. The goal of edge detection is to extract the important features like line, corners, curves etc. from the edge of animas.

4. Image Segmentation

The segmentation is used to separate object from the background. Different segmentation methods are segmentation by using Histogram Thresholding, Otsu Adaptive Thresholding, Global Thresholding, Hough Transform and Watershed transform algorithm, as well as by K- Means Clustering, nucleus segmentation by Gram-Schmidt Orthogonalization and a snake algorithm.

The Circular Hough Transform detects some unnecessary circles due to overlapping, therefore removing one of the overlapping circles and then taking average of the count of both the method provides very accurate results.

Circular Hough transform is a frequently used method for detecting circles in an image, it often suffers from degradation in performance, especially in terms of speed, because of the large amount of edges given by complex background or texture.

5. Image Post Processing

Image post processing includes Feature extraction and morphological operations. Morphology includes dilation, erosion, granulometry and morphological filtering. Closing operation is used to fill the holes and gaps and opening operation is used to smoothen an image. Different types of structuring of elements are there for dilation and erosion. In the concentric ring is used for dilation and a disk for erosion.

Morphological operations eventually removes platelets and other stained parasites. In author used morphological area closing to lower pixel value image and dilation and area closing to higher pixel value image.

6. Blood Cells Counting

Counting algorithm is applied to measure number of RBCs and WBCs. The most popular method used for counting is connected component labeling. Counting of RBCs and WBCs is done by finding number of connected components in segmented image. It labels the connected objects in an image used these labels for the subsequent feature extraction procedure. CHT is also a popular method for counting RBCs in an image. CHT counts number of circular objects i.e. RBCs in an image.

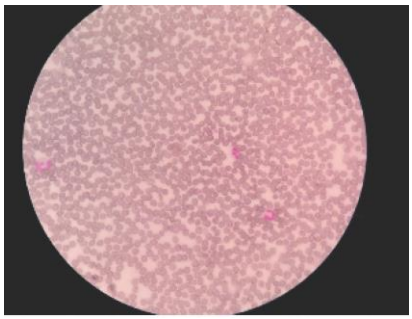

Figure 2. The original image of red blood cell

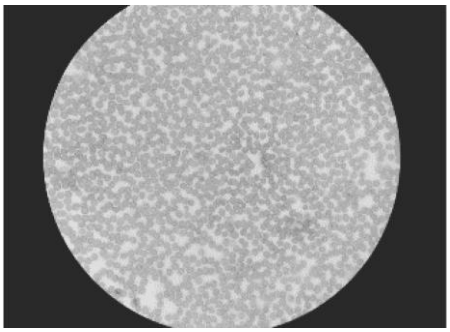

Figure 3. The gray scale image of red blood cell

Figure 3. RGB color image of sickle cell

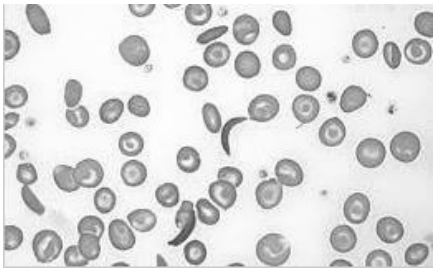

Figure 5. Gray scale image of sickle cell

As the above fig.4 shows the RGB color image of sickle cell and fig.5 shows gray scale image of sickle cell. Digital Image Processing provides various techniques for the identification of shape, edge and size of cells present in blood. This method deals with designing an automated system for detecting the shape of deformed blood cells within seconds with higher accuracy. The highest, lowest and mean distance from centre of mass of the blood cell to its perimeter is calculated.These parameters confirm whether the blood cell is circular or sickle shaped. The effectiveness of an automatic image processing method to detect normal red blood cells (RBCs) by peripheral blood smear microscope image. When single RBCs were extracted from sickle RBCs component, its blood cell images were analysed.

III. RESULTS AND DISCUSSION

In this project various diseases are diagnosed using RBCs and WBCs cell structure by image processing with the help of hough transform, K-mean clustering, morphological. In this method we calculated RBCs in the blood cell of image by applying hough transform to detect the circles of RBCs i.e. RBC count is 513.

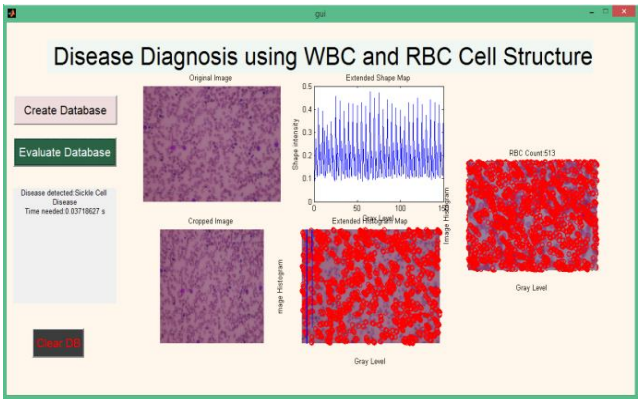

Figure 6. Disease diagnosis method to detect disease.

As the above fig.4 shows the sickle cell disease is detected within 0.03718 seconds and as shown in the fig.4 the histogram graph shows the shape of intensity and the gray level in the blood sample image.In this method we used the required 600x800 image size and the main feature is it runs in real time. In old conventional methods costly machines like Analyzer, which are unaffordable by every laboratories.Therefore this method is less expensive and calculated cell count and diagnosis disease quickly.

IV. CONCLUSION

Image processing techniques are helpful for cell counting and reduce the time of cell counting and disease diagnosis effectively. Proper recognition of cell is important for cell counting. According to this detects the disease and diagnosis. Using this method detect and diagnosis the disease in less time consuming, no used of chemicals, no human error, and easily diagnosis. The accuracy of the algorithm depends on camera used, size of cells, whether or not cell touching and illumination condition.

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