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Segmentation and Automatic Counting of Red Blood Cells Using Hough Transform

V. Antony Asir Daniel[1], J. Surendiran[2], K. Kalaiselvi[3]
Assistant Professor, Francis Xavier Engineering College, Tirunelveli [1]
Associate Professor, Francis Xavier Engineering College, Tirunelveli [2]
PG Scholar, Communication Systems, Francis Xavier Engineering College, Tirunelveli [3]

***Abstract*- Red blood cells are specialized as oxygen carrier RBC plays a crucial role in medical diagnosis and pathological study. The blood samples are collected using the smear glass slide. These samples are taken under the test using the image of the blood. Filtering process are carries out to remove the noise. Morphological operation are applied on the blood image and using Hough transform method the RBC are counted which is the effective segmentation process.**

***Index Terms*— RBC, blood samples, segmentation**

I. INTRODUCTION

Red blood cells RBC also called erythrocytes, are the most common type of blood cell and the vertebrate organism's principal means of delivering oxygen to the body tissues. The cytoplasm of erythrocytes is rich in hemoglobin, an iron-containing bio molecule that can bind oxygen and is responsible for the red color of the cells. In humans, mature red blood cells are flexible and oval biconcave disks. They lack a cell nucleus and most organelles, in order to accommodate maximum space for hemoglobin. Approximately 2.4 million new erythrocytes are produced per second.

The cells develop in the bone marrow and circulate for about 100-120 days in the body before their components are recycled by macrophages. Each circulation takes about 20 seconds. . Approximately a quarter of the cells in the human body are red blood cells. The red blood cells are functioned to carry oxygen throughout our body. In health, the red blood cells vary relatively little in size and shape. In well-spread, dried and stained films the great majority of cells have round, smooth contours and diameters within the comparatively narrow range of 6.08.5m.

Counting of red blood cells in a blood sample can give the pathologists valuable information regarding various hematological disorders. In the classical method for diagnosis of red blood examination in a blood sample, it is counted by manpower; hence it has deficiencies such as poor reliability, low efficiency and strong subjectivity. The diagnosis is the process of finding out what kind of disease a certain patient has and those diagnosed must always be accurate. A wrong diagnosis may lead the situation and condition of a patient become worst and some case, patient dies due to wrong dosage of drugs given. In order to overcome that weakness, some researchers

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have done some useful works especially in classifying blood cells from other cells, for example, classifying white blood cells from other cells such as red blood cells and platelets. Anemia Sickle-cell Thalassemia Spherocytosis pernicious anemia are the blood diseases

A complete blood count (CBC), also known as full blood count (FBC) or full blood exam (FBE) or blood panel, is a test panel requested by a doctor or other medical professional that gives information about the cells in a patient's blood. A scientist or lab technician performs the requested testing and provides the requesting medical professional with the results of the CBC. The cells that circulate in the bloodstream are generally divided into three types: white blood cells (leukocytes), red blood cells (erythrocytes), and platelets (thrombocytes).

Most of the researchers have concentrated on the classification of white blood cells since most of the diseases are easy to determine by analyzing the change in white blood cells. However, by counting the red blood cells, it also provides some information about the abnormal condition in our body. Analysis of microscopic images is used in many fields of technology and medicine. In some medical experiments, some drugs, with known effects in red blood cells membranes, are used to find out their activity.

II. System Model

A normal blood cell is primarily one of two major particles: a RBC with a normal Probability Distribution Function (PDF) around 6.08.5 m or a WBC (7-18 m) which includes a nucleus and cytoplasm is about 1-3 times bigger than normal and mature RBCs. Morphological closing on the image we have an image with some broken edges and filled cells. We remove the broken edges from the image so that we are left with the filled cells only.

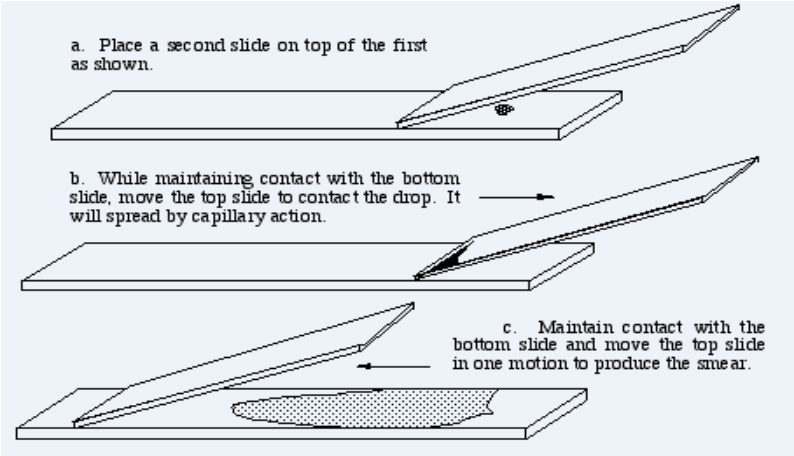

Fig.1 Smear Glass

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III. PROPOSED METHOD

Now the actual size extraction algorithm starts. some cells whose edge is not completely detected are left out. This happens because the imfill function fills the regions which are bounded completely, without a gap of even a single pixel. To count such cells we apply the Circular Hough transform on the edges of the remaining cells.A single blood smear image can be processed multiple times for various detections of blood components unlike an original blood sample. the aim of this project and related work is to automate the process of red blood cell counting, develop and validate the necessary image processing steps to quantify and count peripheral blood particles on blood smear slides, ease the working of the pathologist, to help the doctor make a better diagnosis.

Hough Transform Method

The Hough transform is a feature extraction technique used in image analysis, computer vision, and digital image processing. The purpose of the technique is to find imperfect instances of objects within a certain class of shapes by a voting procedure. Mitigate problems posed by different conditions such as noisy and degraded images, differing blood staining techniques, various types of microscope illumination, overlapping and adjacent cells, to get an efficient result,

to get an accurate result to find reasons that are not completely clear, a greater number of errors tends to occur at the boundaries of the input domain rather than in the ”center.”.

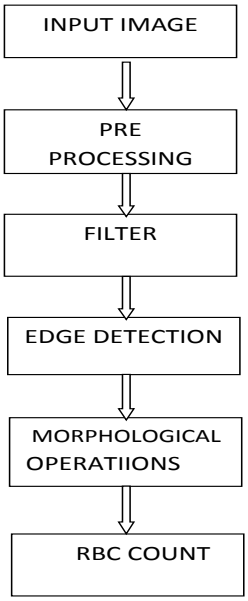

Fig 2.Flow chart for counting red blood cells

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Circle Detection Process

The process of identifying possible circular objects in Hough space is relatively simple, First we create our accumulator space which is made up of a cell for each pixel, initially Each of these will be set to 0. For each (edge point in image(i, j): Search for the local maxima cells, these are any cells whose value is greater than every other cell in its neighborhood. These cells are the one with the highest probability of being the location of the circle(s) we are trying to locate.

$$(\text{i-a})^2 + (j-b)^2 = r^2$$

The problems we will know the radius of the circle we are trying to locate beforehand, however if this is not the case we can use a 3 dimensional accumulator space, this is much more computationally expensive. This method can also detect circles that are partially outside of the accumulator space if enough of its area is still present within it. The Hough transform can be used to determine the parameters of a circle when a number of points that fall on the perimeter are known.

IV. Result and Discussion

The counting and detection of red blood cells are done here by using Hough transform method by Matlab program. A count for the WBC can also be conducted after thorough research. Further, classification of the different types of WBC present in the blood can be done by using various image processing techniques. Using the morphology various diseases that affect the shape and size of the cells can be detected by examining the cells for the particular variation. For example, certain red blood cells of a patient affected by anemia turn to sickle shape. On examining the blood smear of a patient suspected of anemia, the sickle shaped cells can be detected by edge detection techniques and then be counted. The RBC count only helps in partial diagnosis of blood, the counting of white blood cells will improve it further.

Applications

It is applicable for Pregnancy tests Dengue fever tests Anemia Differential counts.

Advantages

More effective than manual count Reliable and reproducible. Efficient and cost effective (it can sample 120-150 samples per hour).Easy to distinguish tiny clumps of platelets and

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nucleated red blood cells. The automated hematology analyzers also may produce cell counts which are falsely increased or decreased.

Limitations

Large or unidentifiable atypical cells, toxic immature neutrophils, and markedly reactive lymphocytes can also be misclassified. Reactive lymphocytes can also be misclassified Here are the outputs which show the segmented image which are undergone for the RBC COUNT

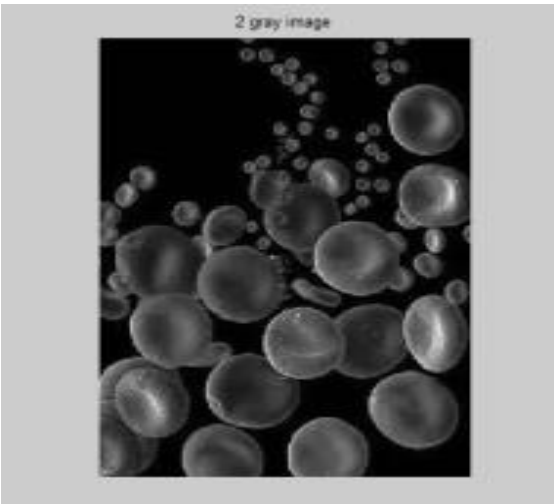

Fig 3. Gray Scale Image

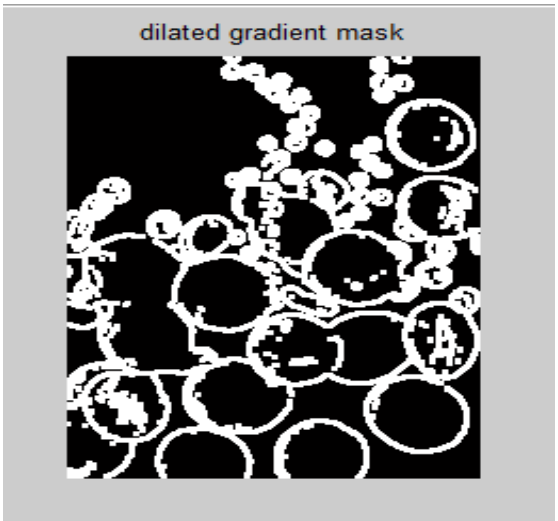

Fig 4. Dilated Gradient Mask

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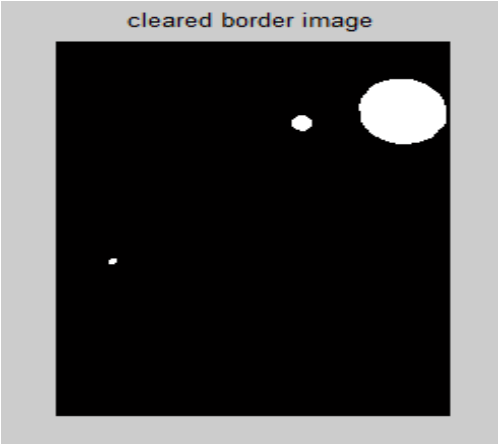

Fig 5. Cleared boarder image

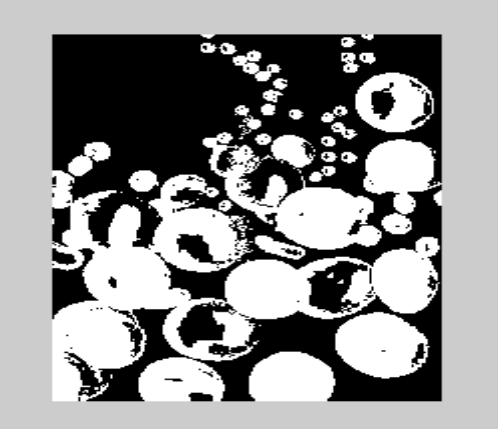

Fig 6. Isolated red blood cells

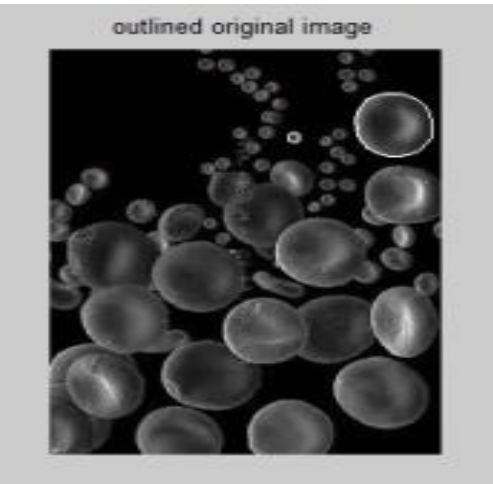

Fig 7. Outlined original image

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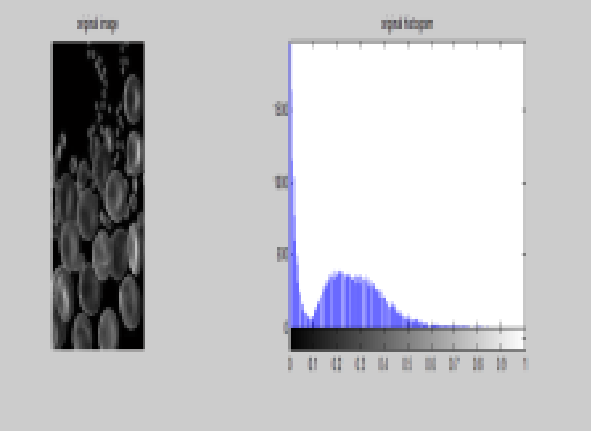

Fig 8. Histogram graph

V. CONCLUSION

As a conclusion, this research successfully uses various image processing techniques for Red Blood Cell Estimation. It utilizes morphological approaches for segmentation, extraction and estimation in order to solve problem in image processing of the red blood cells. The results of the image act as an accurate outcome of determining the number of red blood cells by using Hough transform technique. It proposes an image processing system that uses MATLAB software for blood cell counting.

In future the count for the WBC can also be conducted after thorough research. Further, classification of the different types of WBC present in the blood can be done by using various image processing techniques. Using the morphology various diseases that affect the shape and size of the cells can be detected by examining the cells for the particular variation. For example, certain red blood cells of a patient affected by anemia turn to sickle shape. On examining the blood smear of a patient suspected of anemia, the sickle shaped cells can be detected by edge detection techniques and then be counted. The RBC count only helps in partial diagnosis of blood the counting of white blood cells will improve it further.

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