AUTOMATIC RBC AND WBC COUNTING USING WATERSHED SEGMENTATION ALGORITHM

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Abstract - Medical imaging brings up the methods and techniques which enable us to take and analyze images of different disease in human body parts for diagnosis purpose. The old conventional methods used in hospital laboratories to detect and diagnose becomes problem as they are very slow and they had greater change of error in it but medical imaging through different image processing techniques opened new, fast and cost -effective ways to detect and recognize different diseases and make it easy to examine and diagnose the actual problem. Now a day s' researches are working on different computer vision applications for healthy industry. Such as image segmentation of kidney from ultrasound images, Cancer Detection Using pattern Reorganization Technique, segmentation of brain images, etc. Fast and cost effective blood cell counting has major importance in the medical world. The old conventional methods of blood cell counting under the microscope render unreliable and unacceptable amount of strain on the clinical laboratory technicians. Even so there are latest hardware solutions such as the HEMATOLOGY analyzer, but they are widely unavailable and expensive machines to provide such an expensive solution of blood cell counting in every hospital laboratory. As a solution regarding this problem this research based proposed a fast and cost effective software-based alternative method to count accurate blood cells.

Key Words: watershed, acquisition, segmentation, magnitude calculation, filtering enhancing, Erosion of an image, Dilation of an image,

1. INTRODUCTION

Image processing techniques are widely used in the domain of medical sciences for detecting various diseases, infections, tumors, cell abnormalities and various cancers. Detecting and curing a disease on time is very important in the field of medicine for protecting and saving human life. Mostly in case of high severity diseases were the mortality are more, the waiting time of patient for their reports such as blood test; Magnetic resonance imaging (MRI) is more. The time taken for generation of any of the test is from 1-10 days. In high risk disease like hepatitis B, it is recommended that the patient waiting time should be as less as possible and the treatment should be started immediately. The current system used by the pathologist for identification of blood parameter is costly and in the time involved in generation of the reports is also more sometime leading to loss of patience life. Also the pathological tests are expensive, which are sometime are not affordable by the patience. This project deals with an image processing technique used for detecting the classification of blood cells such as White Blood Cell (WBC) and Red Blood Cell (RBC). The proposed technique helps in segregating the blood cells in different categories based on the form factor.

1.1 Existing System

In the field of biomedicine, because of cell's complex nature, it still remains a challenging task to segment cells from its background and count them automatically .Among all of the body's tissues, blood is unique due to its existence as the only fluid tissue. A blood cell can be any type of cell normally found in blood which falls into four categories which are RBC, WBC, platelet and plasma [6]. The differences between these groups lie on the texture, color, size and morphology of nucleus and cytoplasm. In blood smear, number of red cells is many more than white blood cells. For example an image may contain up to 100 red cells and only 1 to 3 white cells. Platelets are small particles and are not clinically important. Blood cells form in the bone marrow, the soft material in the centre of most bones. Leukocytes or WBC are cells involved in defending the body against infective organisms and foreign substances. Leukocytes cells containing granules are called granulocytes (composed by neutrophil, basophil, and eosiphil). Cells without granules are called a granulocytes (lymphocyte and monocyte) [6].These cells provide major defence against infections in organisms and their specific concentrations can help specialists to discriminate the presence or the absence of very important families of pathologies. When infection occurs, the production of WBCs increases [6]. Abnormal high or low counts may indicate the presence of many form of disease, since blood counts are amongst the most commonly performed blood test in medicine.

PROCEDURE VIEW OF OLD CONVENTATION BLOOD CELL COUNTING METHOD

Fig -1.1: Taking blood from human body.
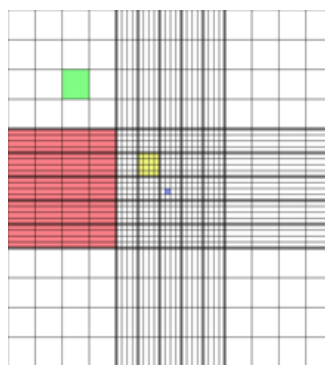

Fig-1.2: Blood pipe pet

Fig-1.3: Haemocytometer grid.

Fig-1.4: Cells obtained pattern

Fig-1.5: Microscopic view.

2 Proposed System

The overall methodology of image processing techniques in the proposed method is described in the figure below. First of all an input image of already prepared slide is taken from the camera attached to the microscope, then through different image processing techniques and image filters the extra unwanted information is removed from the input image. After removal of noise the area of the interest that is the area where we need to count the blood cells are cropped from the image and by labeling algorithm of connected pixels blood cell can be count to put in different equations to abstained cell count report.

Fig-2: Proposed method diagram.

Advantages

- Highly efficient and user friendly design.
- Easy to design.
- Low power consumption.
- Reduces deployment of man power.
- Reports are generated quickly as compared to old method.

3. DESIGN AND ALGORITHMS

3.1 Watershed segmentation algorithm

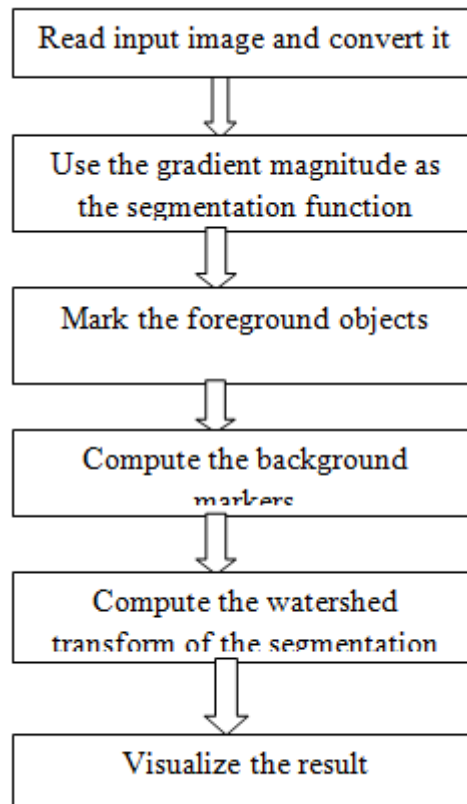Steps for counting RBC & WBC cell counting using watershed algorithm are as follows:-

Fig-3.2: Flow diagram for watershed algorithm

Step1:-Read the color Image and convert it to gray scale.

Step2:- Use the gradient magnitude as the segmentation function and also Sobel edge masks, imfilter () and some arithmetic to compute the gradient magnitude.

Step3:- Mark the foreground objects a variety of procedures could be applied here to find the foreground markers, which must be connected blobs of pixels inside each of the foreground objects. In this example you'll use morphological techniques called "opening-by-reconstruction" and "closing-by-reconstruction" to "clean" up the image. These operations will create flat maxima inside each object that can be located using imregionalmax ().

Step4:- Compute background markers now you need to mark the background. In the cleaned-up image, Iobrcbr ( ), the dark pixels belong to the background, so you could start with a thresholding operation. The background pixels are in black, but ideally we don't want the background markers to be too close to the edges of the objects we are trying to segment. We'll "thin" the background by computing the "skeleton by influence zones" (SKIZ), of the foreground of BW. This can be done by computing the watershed transform of the distance transform of BW, and then looking for the watershed ridge lines (DL = 0) of the result.

Step5:- Compute the watershed transforms of the segmentation function the function imimposemin ( ) can be used to modify an image so that it has regional minima only in certain desired locations. Here you can use imimposemin ( ) to modify the gradient magnitude image so that its only regional minima occur at foreground and background marker pixels. Finally we are ready to compute the watershed-based segmentation.

Step6:- One visualization technique is to superimpose the foreground markers, background markers, and segmented object boundaries on the original image. You can use dilation as needed to make certain aspects, such as the object boundaries, more visible. Object boundaries are located where L = 0. This visualization illustrates how the locations of the foreground and background markers affect the result. In a couple of locations, partially occluded darker objects

3. Simulation Results

The system has implemented the segmentation part and after testing this system it is concluded that, it is more timely efficient than the existing systems. It is reliable and cost effective than automated method. The aim of this system is to provide complete automatic blood cell count, which has been achieved by using the powerful Image processing technique. This system is more efficient in reducing the valuable time than manual system. The system is user friendly so that the pathologist can observe the blood cell sample image in different views. Also pathologist can get the result of blood cell test within 20 seconds to 1 min. as tested.
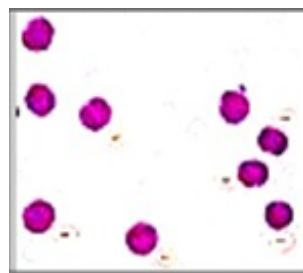
3.1 Obtained Results

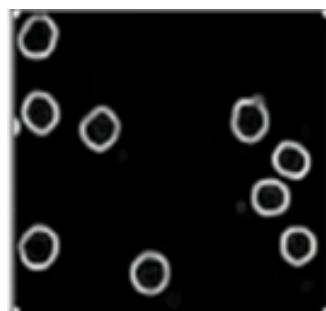Fig-3.1: Image acquisition   Fig-3.2: Grayscale image
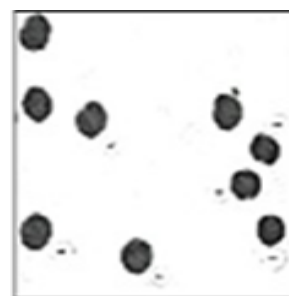

Fig-3.3: Magnitude calculation   Fig-3.4: Filter Enhancing
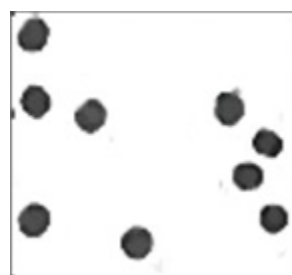

Fig-3.5: Opening of an image.   Fig-3.6: Erosion of an image.
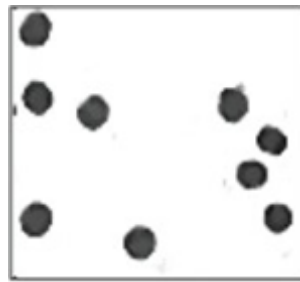
Fig-3.7: Closing of an image.

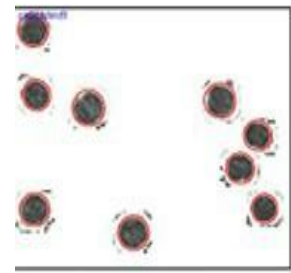**Fig-3.8: Dilation of an image.**

Fig-3.9: Output Image.

4 Overall results

Below graphical representing in BLUE graph shows that manual way of blood cell counting has greater chance of error in it while RED graph of our proposed method cell counting gives accurate result.
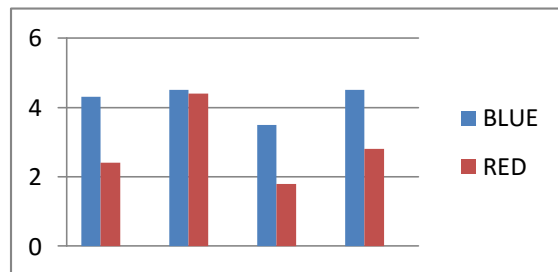

Chart-1: Graph representing manual and proposed system.

4.2 Verifying results

We had been collected some samples for experiments a finally tested these samples by all method of cell counting including our proposed method and we have found that our results are 95 plus % accurate.
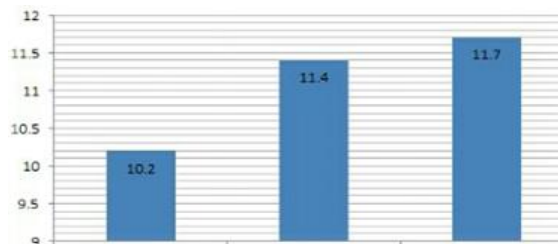

Chart-2: Sample result in graph.

1) MANUAL COUNTING= 10.2K Per micro liter

   2) Hematology analyzer=11.4k per micro liter

   3) Counting of propose method=11.7k per micro liter
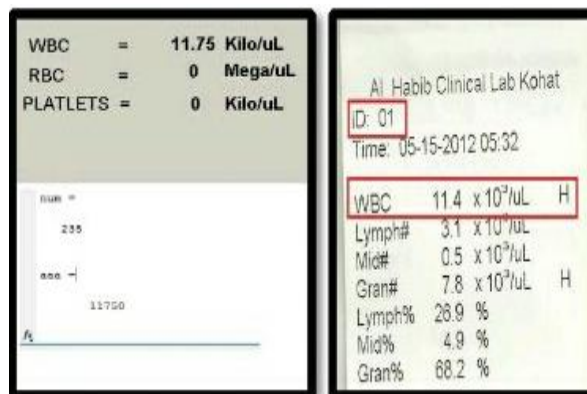
4.3 Print of results by two methods

Fig 4.3 print of results by two methods

From these results we have seen that the proposed method is working and results very close to the counting results by hematology analyzer.

5. CONCLUSIONS

Calculate the blood cells using the manual method; the procedure takes nearly one hour to do so. Even now a days, if the automatic cell counter calculates irregular amount of cells in patience blood, the doctor counts with the manual method to analyze the count. Using the image processing method to calculate the blood cell count helps to do it faster within a fraction of few seconds. In this project we have taken images of 8 patients, each 4 images to calculate WBC and RBC of each patient. The average time required and the average accuracy of the proposed system we got is 14.43 seconds and 94.58%. This shows the proposed system calculate the results fast and even more accurate than the manual method.

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