COUNTING OF WBC USING DIGITAL MICROSCOPIC CAMERA IN IMAGE PROCESSING

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Abstract - The differential counting of white blood cell provides invaluable information to pathologist for diagnosis and treatment of many diseases manually counting of white blood cell is a tiresome, time-consuming and susceptible to error procedure due to the tedious nature of this process, an automatic system is preferable in this automatic process, segmentation and classification of white blood cell are the most important stages. The objective of the present study is to develop an automatic tool to identify and classify the white blood cells namely, lymphocytes, monocytes and neutrophil in digital microscopic images. We have proposed color based segmentation method and the geometric features extracted for each segment are used to identify and classify the different types of white blood cells. The experimental results are compared with the manual results obtained by the pathologist and demonstrate the efficacy of the proposed method. This paper approaches methods to segment the blood cells from microscopic thin blood images. This data is the premise to perform higher level tasks for example, automatic differential blood counting.

Keywords - Digital Image Processing, White blood cells, segmentation, image analysis, leukocytes, lymphocyte, monocyte, neutrophil, color segmentation.

I. INTRODUCTION

There are three types of cells in normal human blood: red cells,or white cells and blood platelets. Generally, red cells are simple and similar. While white cells contain nucleus and cytoplasm and there are different types of them. White cells arecategorized into five groups: neutrophil, eosinophil, basophil,monocyte and lymphocyte. The texture, colour, size and morphology of nucleus and cytoplasm make differences among theses groups. In our paper we are considering only the nucleus.In blood smear, number of red cells is many more than white 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. In laboratories, haematologists analyse human blood by microscope. Their main tasks in this area are: red cell count, white cell count and blood disorder detection. It is tedious task to locate, identify and count these classes of cells.Due to the importance of these processes, an automated system seems necessary and helpful. White cells are clinically more important than red cells and many of blood disorders are related to them.

II. LITERATURE SURVEY

White blood cell composition reveals important diagnostic information about the patients. Substituting automatic detection of white blood cells for manually locating identifying and counting different classes of cells is an important topic in the domain of cancer diagnosis. A manual counting method is an alternate way to count WBCs, but with much lower throughput. The manual WBC counting method can be performed on either a blood smear sample or a haemocytometer using a standard microscope system. The

specimen can either be viewed directly through the microscopes eyepiece or captured into image files. For a blood smear sample, the monolayer regions are mechanically scanned for counting the total number of WBCs. Microscopic differential white blood cell count is still performed by haematologists, being indispensable in diagnostics with malignance suspicious. While value as a reference method for blood samples containing abnormal cells remains indisputable, it is slow and subjective and its reproducibility is poor.

Drawbacks of traditional method:

_ It is time-consuming and laborious.

_ Counting overlapping blood cells is a major problem.

_ It is difficult to get accurate results from visual inspection.

III. RELATED WORK

Automatic recognition of white blood cells in light microscopic images usually consists of four major steps, including: preprocessing, image segmentation, feature extraction and classification. The pre-processing stage usually includes image enhancement of acquired image and is essentially performed in order to prepare the image for the vital segmentation stage. Individual objects of interest are separated from the background in the segmentation process. This is followed by a labelling operation (post-processing) in which, segmented objects of interest are tagged with unique labels that can be used to count the number of objects in the image. These labels along with spatial information of the segmented objects are used for the subsequent feature extraction procedure. The geometrical features are used to identify and classify the leukocyte cells, namely, lymphocyte, monocyte and neutrophil.

IV. PROPOSED WORK

A. Image Pre-Processing

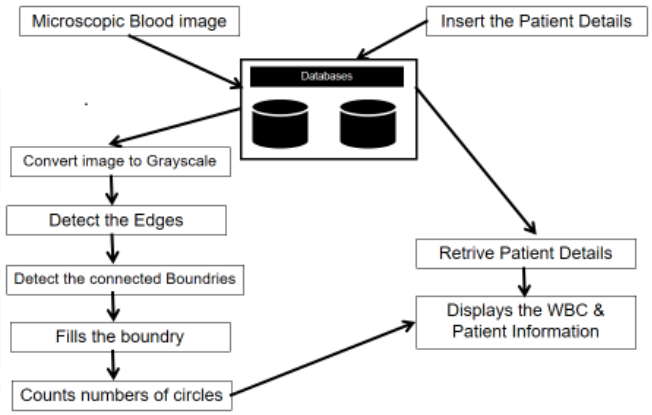
It is a technique of adjusting images, improving the quality of image and making them suitable for the next step of process. Image pre-processing usually includes removing noise, contrast enhancing, isolating regions and use of different color models grayscale image and HSV image, Binarization. Grayscale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

B. Image PostProcessing

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.

V. METHODOLOGY

A. System Block Diagram



B. Algorithm

1) Input the leukocyte colour cell image.

2) Convert the colour image into grayscale image.

3) Apply histogram equalization on grayscale image.

4) Perform pre-processing by using morphological operations, namely, erosion, reconstruction and dilation.

5) Segment the image of Step 3 using global thresholding and obtain resulting binary image.

6) Remove the border touching cells obtained in binary image and then perform labelling the segmented binary image.

7) For each labelled segment, compute geometric shape features ai, i=1,2,3,4 .

8) Apply rule for classification of the leukocyte cells; if ai lies in the range [akimin, akimax], for i=1,2,3,4 then the cell (labelled segment) belongs to Kth class, where k=1,2,3

corresponds to lymphocyte, monocyte and neutrophil respectively.

9) Repeat the Steps 7 and 8 for all labelled segments and output the classification of identified leukocyte cells.

VII. CONCLUSION

In this paper, we have proposed an automated image segmentation and classification of electron microscope images and extracting geometric features of leukocyte cells. The experimental results are compared with the manual results obtained by pathologist. The proposed method is more reliable and computationally less expensive and yet yields comparable classification rate in the range 92% to 98% for different leukocyte cells based on feature set F1, and still better rates in the range 98% to 99% in case of feature set F4. It could be improved further by better pre-processing methods and feature sets, which will be taken up in our future work. This method of identification and classification of leukocytes can also be extended to two other cell types, namely, eosinophil and basophil.

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