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Automated Differential Blood Count System

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Abstract

Differential Blood Count is a time consuming task that requires expert examination. Automated differential blood counter system is an attempt for performing Differential Blood Count automatically by the aid of statistical and pattern recognition based classification methods. The process of counting blood cells on smear images requires four steps. These steps are acquisition, segmentation, feature extraction, and classification. The first aim of this system is detect White Blood Cell by means of an automatic thresholding based on a morphological approach. A major requirement of the whole system is an efficient method to segment cell images. The proportion of counts of different types of white blood cells in the bone marrow, called differential counts, provides invaluable information to doctors for diagnosis. Due to the tedious nature of the differential white blood cell counting process, an automatic system is preferable.

1. Introduction

White cell composition of the blood reveals important diagnosis information about the patients as well as patient follow-up. The hematologist requires two types of blood count for diagnosis and screening. The first one is called the Complete Blood Count (CBC) and the second one is called the Differential Blood Count (DBC). CBC could be done by instruments called cytometer and could successfully be performed automatically. On the other hand, DBC is more reliable but currently it is a manual procedure to be done by hematology experts using microscope. In DBC, an expert counts 100 white blood cells on the smear at hand and computes the percentage of occurrence of each type of cell counted. The results reveal important information about patient's health status.

Apparently, DBC is a time consuming task that requires expert examination. Automated differential blood counter system is an attempt for performing DBC automatically by the aid of statistical and pattern recognition based classification methods. The process of counting blood cells on smear images requires four steps. These steps are acquisition, segmentation, feature extraction, and classification. The images are ready for analysis. Labeling is proposed in [l] for locating the white blood cells. Then, the nucleus centers are detected by variance map and it is followed by a snake-based segmentation. In [2], used contour following to segment the cell groups and then used the curvature to separate the overlapping cells. In [3] , combined snakes with balloons for segmenting cells . In feature extraction step, intensity-based features are used in common [4]. However, prefer to use texture-based features, and or shape descriptors [4]. In order to conduct an automated counter, methods performing well for segmentation, feature extraction, and classification are needed. Current system, segmentation is done by morphological preprocessing . Several types of features such as intensity and color based features, texture based features, and shape

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based features are utilized for a robust representation of the objects. Classification methods used in this work includes pattern recognition.

The organization of the paper is as follows:

In section ***2,*** the blood cell image database that are collected. In section ***3,***the architecture of the system is given. In section 4, the segmentation procedure is represented. The last section concludes the study.

2. Blood Cell Image Database

All the cell classes are evolved from a single young cell produced in bone marrow due to different bio-chemical reactions. In that sense, cell classes form a family tree.

The following cell classes are important in terms of DBC.

It is in peripheral blood: Lymphocyte, Neutrophil, Basophil, Eisonhould be noted that eritrocytes, which appear in peripheral blood.

Figure 1 Samples of white blood cells. There are two mediums in which the white cells can be analyzed. Bone marrow is the production and maturing place for the cells. After the cells reach certain maturity level, they are released to blood to perform certain tasks. Detection of immature cells in peripheral blood signals problem in an individual's health status **.**

Most of them being bone marrow images.

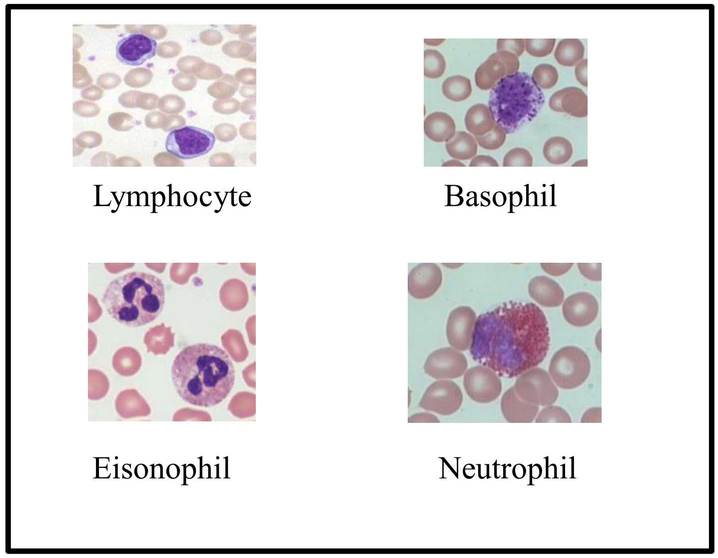

Figure 1:Samples of white blood cell

3. System Architecture

The architecture of system is as follows:

As the input device supplies an image, cell segmentation procedure is carried out. Segmentation yields ***to*** a number of cell contours and their nuclei. Then, the feature extraction engine analyzes each segmented cell and its nucleus to form a feature vector from color, shape, and texture features. Feature vectors are stored to constitute the dataset. Training and testing sets are chosen to be mutually exclusive. Classifiers are constructed by using the training set as input to the given classification methods. After a classifier is constructed, test images are analyzed and each object in these images are labeled by the classifier according to their feature vectors.

4. Segmentation

The steps of segmentation procedure are given in Figure 2**.** In order to segment the cells, used gradient operator, obtaining the gradient of an image requires computing the partial derivatives $\partial f/\partial x$ and $\partial f/\partial y$ at every pixel location in the image. Consider 3×3 region in fig. 2

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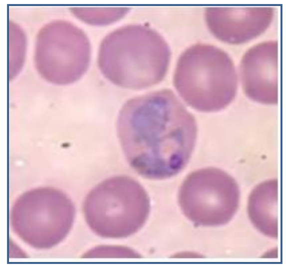
Fig.2 A 3×3 region of an image

In Sobel operators difference between the third and first rows of the 3× 3 region approximates the derivative in the x-direction, and the difference between the third and first columns approximate the derivative in the y-direction.

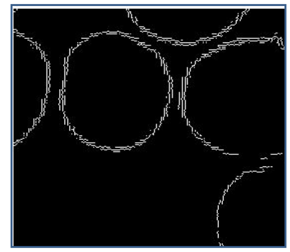
$$g_x = \partial f/\partial x = (z_7 + 2z_8 + z_9) - (z_1 + 2z_2 + z_3) \quad (1)$$

$$g_y = \partial f/\partial y = (z_3 + 2z_6 + z_9) - (z_1 + 2z_4 + z_7) \quad (2)$$

Sobel operator have shown in equation 1and 2 better noise-suppression ,because noise-suppression is an important issue when dealing with derivatives. Coefficients of all masks sum to zero, thus giving a response of zero in areas of constant intensity, as expected of a derivative operator.

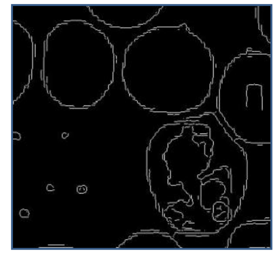


Original Image



Binary Image

Filled Image



Dilated Image

Segmented Image

7.Conclusion

Proposed a methodology to implement automatic counting of blood cells in microscopic images. The acquired images are poor in quality ,are difficult to segment from background. The methodology used for segmentation comes in two stages image processing. First stage is the image enhancement and noise reduction. Second stage is segmentation based on edge detector. Currently improving cell segmentation techniques to include the detection of cells within clusters.

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References

[1]Guclu Ongun,Ugur Halici,Kemal Leblebicioglu,Volkan Atalay, Feature extraction and classification of blood cells for an automated differential count system, Turkey.

[2]Xiong,S.H.Ong,J.H.Lim,N.N.Tung,J.Liu, D.Racoceanu,K.Tan,A.Chong, Automatic working area classification in peripheral blood smears using spatial distribution features across scales, Singapore.

Figure 2 Segmentation Steps

[3] Cecilia Di Ruberto,Andrew Dempster,Shahid Khan, Bill Jarra, Analysis of infected blood cell images using morphological operators,National institute for medical research , London, UK.

[4] Hazem Refai ,Lun Li, Segmentation and border identification of cells in images of peripheral blood smear slides,Australia