Automated Red Blood Cells Counting using Image Processing Techniques

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Abstract— In traditional terms, blood cell analysis i.e. complete blood cell count (CBC) is done as a "convention". In which it determines the red blood cells, white blood cells and blood group usually assesses the size and shape of blood sample as per old delayed procedures. Today in this busy hectic schedule; pathologists need some help in terms of software for blood cell analysis. Thus, the idea of our paper is to serve the pathologists, medical technicians for the same, by using Image Processing technique. The image captured after the slide test is processed and detects the occurrence of agglutination, the classification algorithm determines the blood group. Similarly in case of blood cells counting microscopic smear images are preceding in MATLAB simulation tool is been used. Finally, all the information is stored in a database. Thus, the system allows determining the blood group and blood cell counting automatically.

Key words: Blood Groups, Slide Test, Image Processing Techniques, MATLAB, Blood Cell, Segmentation, Image Smoothing, Edge Detection

I. Introduction

Now a days in medical field for human health care so many new technologies have come up. As Blood is one of the important parts of human being to be alive so it is necessary to study in details about the blood. Determining blood group is an essential before administering a blood transfusion in emergency situations. Blood is a connective tissue consisting of cells suspended in plasma. Blood's major functions are to transport various agents such as oxygen, carbon dioxide, nutrients, wastes, and hormones. Blood cells are composed of erythrocytes (red blood cells, RBCs), leukocytes (white blood cells, WBCs) and thrombocytes (platelets). The estimation of RBC's, WBC's plays a crucial role in medical diagnosis and pathological study. Automation plays a vital role in all medical applications. Presently, the blood group analysis and blood cell determination is carried out by the technicians in the laboratories. The proposed idea to identifying the blood group and counting the blood cells will replace the manual work in clinical laboratories. This work aims to develop an automatic system to perform these tests in a short period of time in an emergency situation. As the so many Image processing techniques are available for blood group detection and blood cell extraction. In blood group determination technique, the image captured from the slide test is used to detect the occurrence of agglutination. The classification algorithm will be used to determine the blood group. This information will be stored in a database. Along with that the system of blood cell determination blood image taken from blood smear microscope. The composition of blood image consists of red blood cells, white blood cells and sickle red blood cells. In this method an image processing is done to extraction of single blood cell and processing on it. Each single blood cell is analysed by using a neural network. Counting of RBC's WBC's in a blood sample gives the pathologist valuable information regarding various diseases.

II. Related Work

A. *Method of Segmentation for blood sample [6]:*

In this method authors represent the segmentation of blood cells is made by morphological operations. The features are extracted from segmented blood cells by estimating first, second order gray level statistics and algebraic moment invariants. The analysis of extracted features is made to quantify their potential discrimination capability of blood cells as normal and abnormal only, but they are not determining the number of cells.

B. *Scattering Method [9]:*

The proposed method gives the blood cell counting and classification from stationary suspensions by laser light scattering method. The blood cell is simulated by an isotropic sphere and Mie scattering theory is used to describe the scattering of blood cells. They are made their focus only on size of blood cell. Further classifications of cells are done only by size factor while others parameters are need to be taken in account.

C. *Knowledge Based Analysis[8]:*

In this analysis authors investigates automated diagnosis of red blood cell disorders and describes a method to detect malarial parasites and thalassaemia in blood sample images acquired from light microscopes. A medical consultation system has been jointly used with this system to provide clinical decision making ability. A questioning and answering dialog on the basis of patient history, physical examination and routine diagnostic test has been conducted. These include the combination of knowledge-based methods with data-based methods. This model always requires the expert system for database collection and it is tough to manage expert's time at each situation.

D. *Extraction of Overlapping Cells [11]:*

The cells splitting with high degree of overlapping in peripheral blood smear. Their study presented a method for extracting overlapped cells into individual cell. They mainly focused on rapidly detecting central point using the distance transform value and boundary covering degree of each center point is applied to select the best potential center points. Single cell extraction is employed in order to estimate the average size of cell. An effective algorithm is designed split correctly and speedily. The system is focus only on overlapping blood cells.

III. Proposed System

A. *Red Blood Cell (RBC) Counting:*

The proposed system will follow the following steps

1) Image Processing:

1) Histogram equalization and contrast adjustment: This process adjusts intensity values of the image by performing histogram equalization. Contrast adjustment is done by manipulating the display range of the histogram by keeping data range same.
2) Image dilation: Binary gradient mask is dilated using the vertical structuring element followed by the horizontal structuring element. The dilation morphological operator has been used to better connect separated points of the membrane.
3) Cell Detection: Blood cell detection detects cells which differentiate themselves from the background in terms of contrast. Changes in contrast can be detected by image processing operators that calculate the gradient of an image. Then a threshold can be applied to create a binary mask containing the segmented cell. The edge detection is done by using the Sobel operator.
4) Erosion: The broader of the blood membranes were enhanced. The objects in the processed image can be smoothed by eroding the image.

2) Single blood cell extraction:

This method extracts the single blood cell from the derived binary image to obtain cell's position. The single blood cells extraction involves several steps as described below:

1) Border padding**:** As the neighborhood operator block slides over the entire image, some of the pixels around the border may be missing, if the center pixel is on the border of the image. The missing pixels will be padded using 0 values (black) to complete the image.
2) Centroid finding**:** The centroid of the converted binary image is measured by finding the center of mass of the binary image region. The centroid coordinates are defined as x-coordinate and y coordinate. All other elements of centroid are in order of dimension.
3) Single blood cell isolation window**:** Each type of blood cell is isolated by using its centroid coordinates. The isolated blood cells are contained in windows of size 31x30. Window's corners positions are right top, left top, right bottom and left bottom.
4) Transfer window to original RGB image: Any position of each single blood cell windows were transferred to the original RGB image. Then we get single cell in the format 31x30 pixel RGB image.

3) Blood Cell Separation and Counting:

Firstly, red blood cells, the white blood cells are separating from the target image. There are several steps involved in white and red blood cells such as pre-processing analysis, classification and counting. The most important step is applying neural network (NN) to classification of cells.

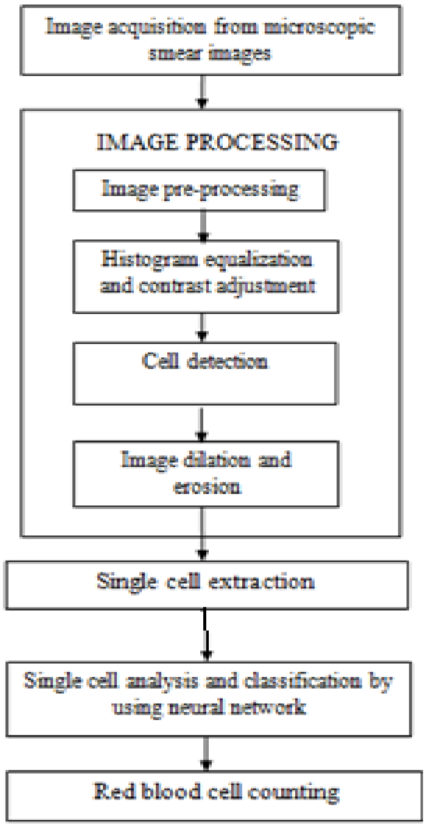

Fig. 1: Methodology of RBC counting

IV. RESULT AND CONCLUSION

A. RBC Input Images:

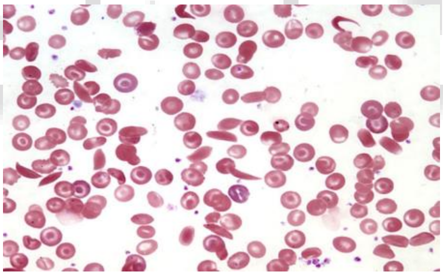

Fig. 2: RBC Smear image

B. RBC Output Images:

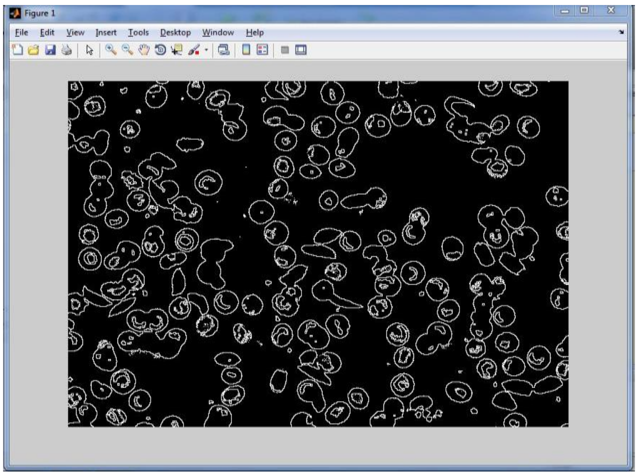

Fig. 3: Segmented Images

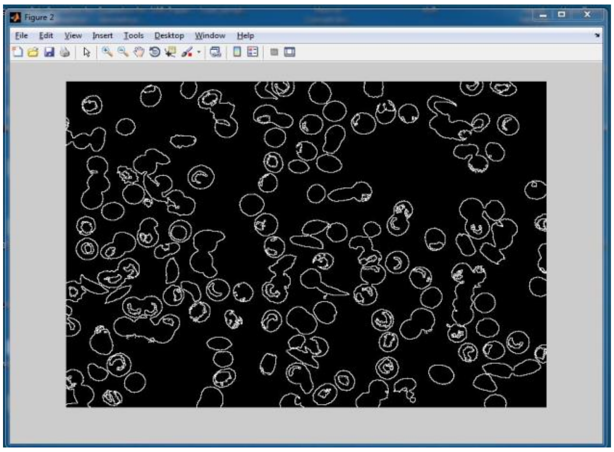

Fig. 4: strengthen the edges of RBC

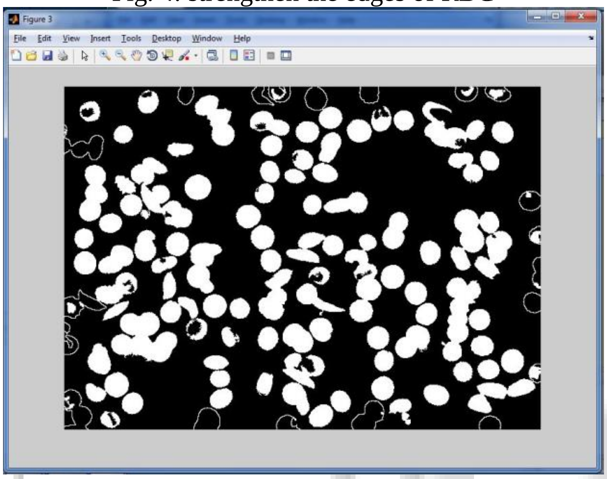

Fig. 5: Calculation of RBC

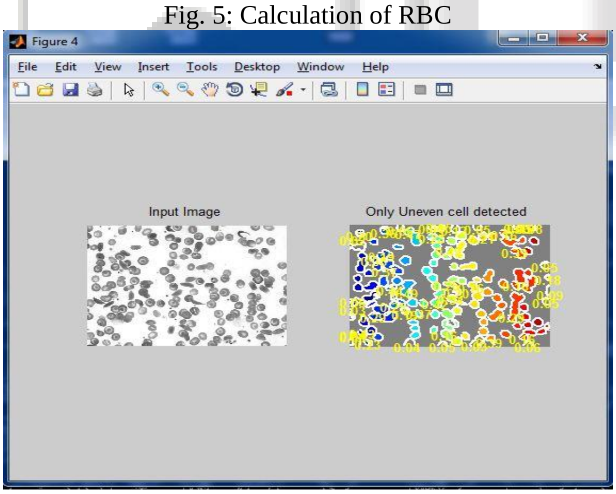

Fig. 6: Overall schemas

REFERENCES

[1] ”Red Blood Cells Estimation Using Hough Transform Technique”, Signal Image Processing Nasrul Humaimi Mahmood and Muhammad Asraf Mansor, An International Journal (SIPIJ Vol.3,) No 2 April 2012.

[2] ”Automated morphological processing for counting the number of red blood cell”;AMT Nasution, EK Suryaningtyas,Proceeding of the 2008 International Joint Conference in Engineering IJSE2008, Jakarta, Indonesia, August 4-5.

[3] ”A Comparison of Binarization Methods for Historical Archive Documents”;J. He, Q. D. M. Do, A. C. Downton and J. H. Kim,Proceedings of the 2005 Eight International Conference on Document Analysis and Recognition (ICDAR05).

[4] ”Adaptive Binarization Method for Document Image Analysis”,AlSharafMeng-Ling Feng and Yap-Peng Tan, 2004 IEEE International Conference on Multimedia and Expo (ICME).

[5] ”Red Blood Cell Segmentation Using Masking and Watershed Algorithm”, J.M. Sharif, M. F. Mis-wan, M. A. Ngadi, Md Sah Hj Salam,A Preliminary Study, 2012 International Conference on Biomedical Engineering (ICoBE), Penang, Malaysia, 27-28 February 2012

[6] ”Cell Splitting with High Degree of Overlapping in Peripheral Blood Smear”,Ngoc-Tung Nguyen, Anh-Duc Duong, and Hai-Quan Vu,International Journal of Computer Theory and Engineering,Vol. 3, No. 3, June 2011.

[7] MagudeeswaranVeluchamy, KarthikeyanPerumal and ThirumuruganPonuchamy “Feature Extraction and Classification of Blood Cells Using Artificial Neural Network” American Journal of Applied Sciences 9 (5): 615-619, 2012 ISSN 1546-9239 © 2012 Science Publications.

[8] Navin D. Jambhekar” Red Blood Cells Classification using Image Processing”, Science Research Reporter Nov. 2011 ISSN: 2249-7846.

[9] Ms. Y M Hirimutugoda, Dr. GaminiWijayarathna” Image Analysis System for Detection of Red Cell Disorders Using Artificial Neural Networks” Sri Lanka Journal of Bio-Medical Informatics 2010;1(1):35-42 DOI: 10.4038/sljbmi.v1i1.1484.

[10] Ye Yang “The blood cell counting and classification from stationary suspensions by laser light scattering method”,International Conference of the IEEE Volume 4 29 Oct 1998-01 Nov 1998. Biomedical Engineering (ICoBE), 2012 International Conference on 27-28 Feb. 2012

[11] Huey Nee Lim” White blood cell segmentation for acute leukemia bone marrow images”, IEEE.

[12] Ngoc-Tung Nguyen, Anh-Duc Duong, and Hai-Quan Vu” Cell Splitting with High Degree of Overlapping in Peripheral Blood Smear”, International Journal of Computer Theory and Engineering, Vol. 3, No. 3, June 2011.

[13] ”Getting Started With MATLAB”,Rudra Pratap, Oxford University Press. Rizvi