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AUTOMATED SYSTEM FOR COUNTING BLOOD CELLS

A. Sivasangari
School of Computing, Sathyabama Institute of Science and Technology, Chennai, India.

R. M. Gomathi
School of Computing, Sathyabama Institute of Science and Technology, Chennai, India.

Ananthi
School of Computing, Sathyabama Institute of Science and Technology, Chennai, India.

Ajitha.P
School of Computing, Sathyabama Institute of Science and Technology, Chennai, India.

Indira. K
School of Computing, Sathyabama Institute of Science and Technology, Chennai, India.

ABSTRACT

The measure of blood cells of red blood and white blood plays a important role for the diagnostic to analyze and look at various illness such as anemia, leukemia etc. Accurate counting of blood cells plays a very important role in diagnosing diseases. Exiting methods took more time for processing and produced in accurate result. Hardware device such as Hematology counter is very expensive and every hospital can't afford it. In order to overcome these problems, we are creating an android application with OpenCV libraries in Android Studio for a mobile device, the device can be connected to a microscopic camera via USB to take an image of the blood sample, this blood sample is later analyzed by implementing image processing approach of the blood using circular Hough transform and thresholding techniques. These separates the RBC and WBC by marking them, so that the algorithm can easily, detect and the counting of blood cells will be done on two microscopic blood images of each patient which will result in nearly accurate results than the present available methods. Accuracy and time consumption can be improved by using the proposed method of well-structured circle detection algorithm.

Keywords: WBC, RBC, Hough Transform

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1. INTRODUCTION

Complete blood cell count is the important parameter to evaluate the health of the person and detect any disorders present in the body. Blood cells are categorized in to red blood cell (RBCs), White Blood Cell (WBCs), platelets and plasma. These can be differentiated by using color, texture, size and morphological features When the white blood cell count is low, it will indicate any illness or infection. A complete blood cell count is needed for overall health evaluation of the patient. Existing techniques still require guidance of an expert to operate to use this and cost also very expensive. The RBCS and WBCs are differentiated using the nucleus. WBCS has a nucleus and RBCs has a nucleus.

WBCs are important part in our body immune system. It protects us from viruses and bacteria. The amount of the leukocytes presents in the human diseases or an infection, whereas a high WBC counts indicates that the person might be having an infection, tissue damage or leukemia.

Red blood cells, additionally called blood cell are the foremost necessary cells within the build. Blood cell count is based on segmentation of images, number of cell count and their distribution. Segmentation is applied for the images which is used as a input to the system. Accuracy and precision of the result depends upon the segmentation result. But, it is a challenging task for microscopic images.

Segmented images are used as a input for computer diagnosis system. The precision of the result depends upon the segmented regions of the cell. But segmentation is a challenging task due to the nature of microscopic images. The process of blood cell count system involves four major steps such as pre-processing, image segmentation, feature extraction and counting cells in the blood image. Various methods have been described in exiting literature work. But there is need for identifying various diseases using RBC structure and WBC structure.

2. RELATED WORK

Berge [1] et al proposed a method of unique which is based on the iterative threshold method and segmentation using morphological operators. They presented an algorithm which calculates the number of red blood cells in the blood image.

They used images from a manual microscope which are prepared in the laboratory. Their approach was unable to find faded blood cells. They produced the results with absolute error of 2.8% between the manual and automated counting method. Khan et al [2] proposed the method for counting the blood cells and platelets. It was fast and cost-effective software-based method for counting the blood cells. But this will require many preprocessing methods needed for conversion of image into binary format. The analysis is performed through optimum threshold value. But it is not useful for detecting the overlapping in the blood cell sample with the probability of useful information.

Accuracy also reduced, Nguyen et al [3] proposed a distance transform for solving the issue of co-occurrence cells problem. Their method is on the clumped cells. Chiu at al [4] proposed a method to detect the circles using Hough transform. Compared to other methods, this method is less efficient and very difficult to find the cells in complex images. Because, it is based on probability-based usage problem. Circular Hough transform is used for finding the circularity features of RBC cells and find the count values. This method achieved 96% accuracy than existing other methods.

Naitra [5] proposed a method that extract RBC from microscopic images. Spatial smoothing and filtering are used for image enhancement. Edge detection is performed for separating the RBC cell from the WBCs and platelets. histogram and edge detection. This method is based

on basic circular Hough transform. The main drawbacks of this methods are high memory usage and not able to find co-occurrence cells.

Yazan et al [6] proposed the method that perform the segmentation by using iterative structured algorithm counting of WBC and RBC count. Performance evaluation is based on accuracy, precision, recall and F-measurements. Counting is based on circle detection method. Enhanced algorithm was used to detect the irregular circles and selection of optimal circle.
Venkata Lakshmi et al [7] proposed method which is cost effective and provide better accuracy result. Watershed algorithm can be used for handling of overlapping of cells. Erosion is performed by using morphological operators. It proved the better utilization than other methods.

Sharif et al [8] proposed the method for red blood cell segmentation which perform automated counting of RBC. Morphological operators are used for binary erosion and hemanth kumar t al [9] proposed the efficient data processing method for smart environment.

Brumancia et al [10] proposed the method for information fusion using Dempster shafer system and predict the emotion using emotional mining of medical information [11]. In this paper [12], achieving evidence-based drugs analysis is done using big data. This procedure is possible by gathering of medical evidences, grouping of data, Mapping of disease data set and Medicines, and report generation. In [13] and [14] they used machine learning and IoT based system monitoring all the activities.

3. PROPOSED WORK

The proposed method is used to investigate the microscopic image of blood cell and performed the segmentation. The analysis is done by using thresholding method and morphing methodologies, and the counting is done by using the features extracted from the blood cells. It can be done with the help of iterative structured circle detection method. Prep processing involves removal of noise using sobel filter. It is based on convolving the image with an integer valued filter and it uses only the integer values for coefficients. Therefore, the initial picture is separated into two separate images; the primary pictures, and that we establish the most effective thresholding. Pre-processing is performed on the blood cells. The original image is converted into gray scal image for eliminating the hue and saturation information. The image was converted into binary for visualizing all the red and white blood cells in the image. Morphological operators can be used for filling the holes. After cells separation, every picture is pre-processed victimisation morphology operators to get the string picture victimisation Cagy operator. Then, a well-structured detection algorithm will be used for the counting of blood cells in each picture.

3.1. Image Acquisition

Image acquisition is done by acquiring the digital images of digital images of a blood sample in either .jpeg format or any other suitable image formats. These pictures are in the form of an RGB colour plane. The images are microscopic images which are obtained from hospitals or from laboratories using digital magnifiers or employing a photographic camera which will be placed at the viewing point of the microscope. Blood cells of the stained blood could be taken with the thin glass slide and digital microscope. Geismar stainer is used for blood film image that can be used to differentiate platelets, red and white blood cells in the blood.

3.2. Image Pre-Processing

It is the process of removing the unwanted noise from the image and improve the quality and give satisfactory of the image. The Image pre-processing includes various tasks of removing the noise from the images, improving the contrast, isolating the regions and the color models for grayscale and HSV picture and binarization. Grayscale shows the intensity of an image

Sobel filtering is normally used to remove the noise present in the picture. Detecting edges is the one of the important process in image processing. It helped us to reduce the amount of data to process and maintains the structural aspects of the image. It calculated the derivatives of the image separately for the x axis and y axis. By researching and studying various sample pictures it had been taken that the central filter would be the simplest and the suitable filter for noise removal. The following fig 1 shows the system architecture of proposed work.

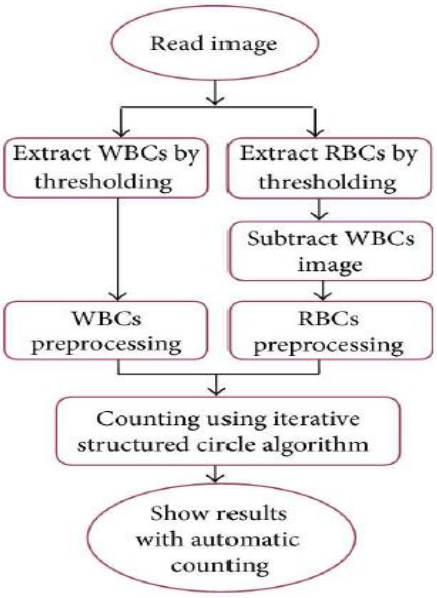

Figure 1 System Architecture

3.3. Image Enhancement

Improvement methods can increase the standard, distinction and brightness value of the of a picture, also improve its details. Picture is enhanced by using hue saturation and identify the nucleus of the leukocyte of the cells within the image. To get improved quality picture, preprocessing is used to get intensify picture. Perception of the objects can be improved by using contrast enhancement. Enhancement is performed in brightness between the objects and their background. Gray level histogram is calculated for finding the total number of pixels in the image and distribution of percentage of gray level value in the image.

3.4. Image Segmentation

The analysis s taken to divide objects from the backdrop. The different analysis methods by using bar chart,Otsu adaptable and Global thresholding. The Circular Hough transform methodology finds some extrinsic circles thanks to co-occurrence, so removing one in every of the co-occurrence circles then taking mean of the count of each tactic gives very approximate results. Circular Hough transform is a general methodology for finding circles in a picture, it usually suffers from some problems in a basement in performance, specifically in terms of speed, because of the more amount of edges given by complex backdrop or texture, usually researches use analysis to arrange abnormalities in the blood cells. Also, a Fuzzy approach is employed for sub picture element. The same procedure can be applied in the sub picture part of feature space clustering to classify leukocyte and also used to find the difference between the maximum and minimum axis length, perimeter, circularity and exact proportion of the space between the nucleus and cytoplasm.

3.5. Image Post-Processing

Image post procedure covers features removal and morphing methods. Morphology covers enlargement, wear and tear, closing method is used to close the holes and gaps and gap method will in smoothening a picture. Morphological method usually erasers platelets. We used morphological area nearing to the lower value component of the picture and area nearer to the higher component value of the image. Feature extraction can be used to get the quantitative focusing of data object. Shape features like area, border of nucleus and circularity factor are used as important features in classification. Texture represents the entropy, homogeneity and contrast feature are used in classification. Color options includes color components are removed. Cells containing borders shows less information.

4. PERFORMANCE ANALYSIS

Adding formula is applied to add the number of separated blood cells. Connected component labeling is used for calculation. Numbering of separated blood cells is finished by finding variety of connected segment in meta picture. Proposed method is additionally a good method for numeration RBCs in a picture. Proposed method counts the number of circular shaped objects i.e. Red Blood Cells present in the given picture.

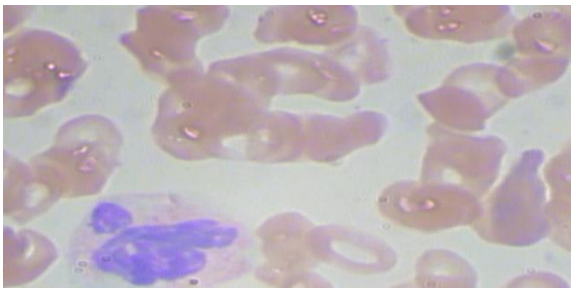

Figure 2 Image of blood before processing

Fig 3 shows the blood cells after processing. Sensitivity is the possibility of a positive detection test among individuals that have the ill health and it is defined as:

$$\text{Sensitivity} = \frac{T_P}{T_P + F_N}. \tag{1}$$

Specificity is the possibility of a negative detection test among individuals that do not have the ill health and it is defined as:

$$\text{Specificity} = \frac{T_N}{T_N + F_P}. \tag{2}$$

Accuracy represents the closeness of the output of the classifier and genuine value and it is defined as:

$$\text{Accuracy} = \frac{T_P + T_N}{T_P + T_N + F_P + F_N}. \tag{3}$$

Table 1 Summary Result

Sets	Manual counts	Proposed counts	TP	FN	FP	PR	RC
1	110	118	110	1	2	98.3	98
2	85	92	87	2	6	88	89
3	51	58	50	3	8	89.2	97
4	20	31	25	1	4	89.4	96.2
5	81	89	82	1	3	91.2	97.6
6	73	84	75	1	4	93.4	95.2
7	23	34	28	0	4	93.6	95.4
8	43	49	41	2	3	94.5	98
9	34	41	38	3	6	98	99.4
10	54	59	50	4	7	87	96.7

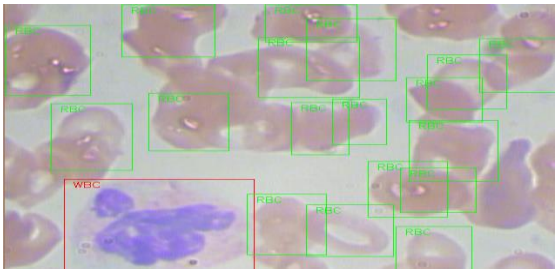

Figure 3 Image of blood cells after processing

5. CONCLUSION

This paper proposed automated cell count using circular hough transform. A comparison is done between the proposed method with existing works. Results of the work showed that proposed method is accurate in counting the number of WBCs RBCS in blood and can be easily used in any medical facility with low investment cost for infrastructure. Proposed method is evaluated with the existing method by using true positive, true negative, false positive and false negative parameters. This technique can acknowledge the co-occurrence of blood cells and can add them one by one.

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