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AUTOMATIC BLOOD PARAMETER DETECTION USING MATLAB

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Abstract:-Blood and its components are main indicator tool in determining many pathological conditions. The deficiency of red blood cells, which constitutes 99% of blood cells and specialized as an oxygen carrier, causes various blood disorders. The diagnosis of blood cells manually is tedious and time consuming that could be simplified utilizing automatic analysis. We aim to automate the process by means of making a system that will detect RBC and WBC count along with detecting the level of hemoglobin and cancer cell detection.

We aim to use processing along with machine learning to create this system that will provide RBC as well as WBC count of the user and will provide an accurate hemoglobin level for the sample provided by the user. We will use multiple image processing techniques and machine learning technique to achieve this desired result. With the advent of image processing, neural network microscopic photographs can be processed for the parameters required. The input of the system will be an image of the blood sample that will be acquired using microscopic camera and will be stored in database. Various algorithm are being applied on the image to count different parameters from it and accordingly the output will be displayed on the screen. In simple words, this system will prove to be cost effective and will not be time consuming as it will be using the best algorithms to automate the system.

Keywords: Machine learning, Artificial Intelligence, Hemoglobin Detection.

I. INTRODUCTION

Blood is the most crucial part of all medical research and diagnosis of diseases. Its an important indicator of a health of a human being and essential life giving entity for our survival. In Pathological laboratories producing precise result for every test mainly in the area of RED BLOOD CELL (RBC) count are a major issue. The RBC and WBC count is very useful for diagnosis of various diseases such as anemia, leukemia, tissue damage, etc. .Methods generally used in the hospital laboratories counts the blood cells manually- time consuming and inaccurate results.

Image processing is a powerful method to identify each single cell in blood samples. For this method, some pre-processing and some post –processing techniques have been implemented on the image of blood sample in order to provide a much cleaner and clearer image [1]. We aim to use image processing along with machine learning to create a system that will provide RBC as well as WBC count of the user as well as give an accurate hemoglobin level and platelet detections for the sample provided by the user.

We have used advanced image processing technique with a new set of contour detection algorithm to achieve this desired result and here we have also used the advent of image processing.

Following are the objectives of the given research:

i. To propose a method for segmenting RBC region automatically.
ii. To differentiate the normal RBC and abnormal RBC from blood images.
iii. To assess the developed system qualitatively and quantitatively.
iv. Segmentation and classification method is used to develop an automated RBCs counting system
v. To test segmentation and performance of the system accurately and reliability towards the RBCs count process.
vi. To classify WBC using control detection.
vii. To detect the hemoglobin level using hemoglobin estimation method.

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II. PROPOSED SYSTEM

In MATLAB, Image processing tool are used for detection and calculation of blood parameters. For this method, few pre-processing and post –processing techniques are included. In Pre-Processing technique it consists of image acquisition, image segmentation, etc.

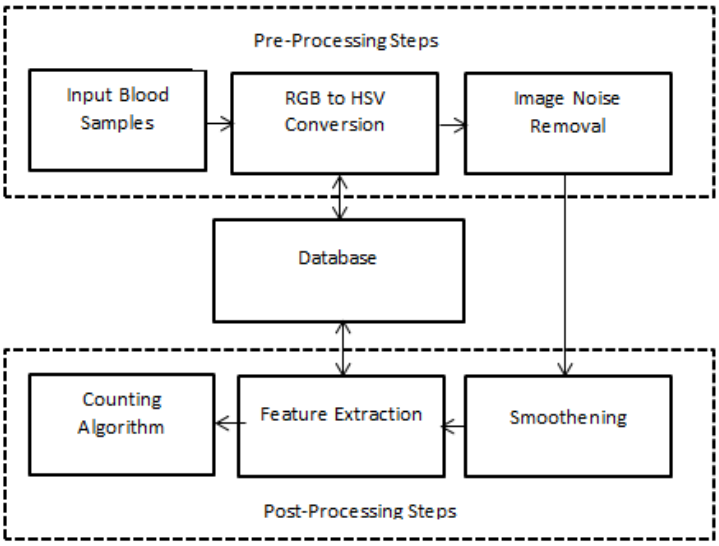

Fig. 1 Block Diagram

The post-processing steps include different mathematical operation for detection and counting algorithms as follows:

The steps used for RBC and WBC Detection is as follows:

Step1- Input Image Blood samples: -

In this step we have captured the blood sample image from database. This blood samples contained lots of irrelevant noise so we cannot apply algorithm directly, so some preprocessing steps need to apply.

Step2-Image Enhancement:-

Image taken from the database in RGB color format .So we need to convert it RGB (Red, Green, Blue) to HSV (hue, saturation, value) image. – HSV model describes color similarly in a way how human eye prefer the image also describing image in terms of RGB make object discrimination complicated.

Step3- Masking

In this step, we have to apply 3x3 mask on the HSV image. Masking is a process in which extraction of blood parts from the background .The mask can be moved from left to right and top to bottom on image and perform the convolution operation. So required object extracted from the background [3].

Step-4 Image Noise Removal-Gaussian Blur

In this step we take input from step 3 which will be a masked image which contains some noise in it. Hence we will be using Gaussian smoothing to remove noise present in it. Gaussian smoothing is the process of blurring the image by using a Gaussian function or kernels [2]. Here we are using 5*5 kernels. A kernel is an array (square) of pixels(a small image).Hence to blur the image we convolve the image with a low pass filter. It actually removes the noise or high frequency component from the image and gives blurred image when this filter is used.

Step-5 Segmentation

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In this step we have used different segmentation technique based on similarity and dissimilarity. It is a technique in which grey scale image converted into binary image, using multi thresholding separate background from foreground.[3]

Step-6 Counter Detection

In counter detection technique is useful for analyzing the shape and detecting the object from image. Hear 3 X 3 masks are used to detect the points which are then connected to form the boundary of the image.

Algorithm to detect hemoglobin level:

For hemoglobin estimation, we first generate pixel intensity distribution histogram for the blood spot sample image. The highest peak in the histogram has corresponding hemoglobin value that is calculated and presented on UI [4]. Here pixel of image are analyzed considering red color intensity and histogram is plotted

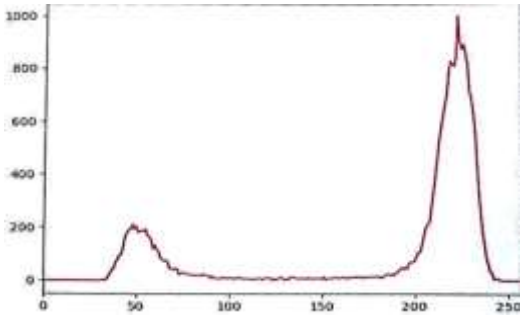

Fig. 2 Histogram of Hemoglobin

Steps for Platelet Detection:

Platelet detection is done using Blob Algorithm [5]. Blob detection detects specific geometry shape such as area, shape, color, etc. Filtering process applied to the shape detected by Blob detection. The basic idea is given as

1) Take an image and do some pre-processing steps and remove the noise from it.
2) Non recursive-
i) If pixel's value is zero
ii) If pixel is out of boundary then also its value is zero.
3) Recursive-If pixel is on
i) Turn of current pixel
ii) Return 1 plus the sum of its entire surrounding pixel

RESULT ANALYSIS

Result of RBC and WBC detection can seen below where input microscopic image is converted to an output image where the detected RBC and WBC in black and violet color.

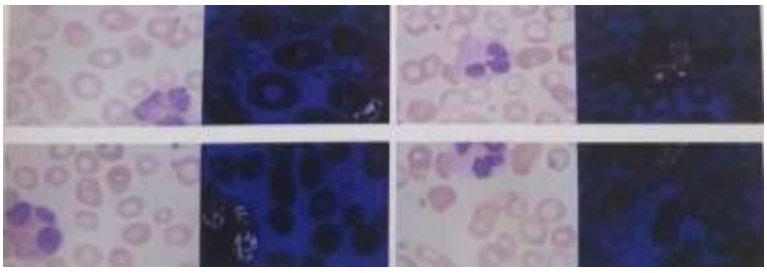

Fig.3 Output of RBC/WBC detection

Two Outputs of platelet detection can be seen below where blue circle is shown over the platelet detected. The platelets are small cell compared to RBC and WBC.

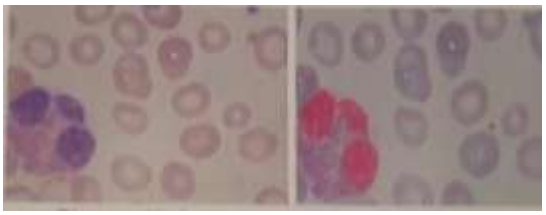

Fig.4 a) Output of Platelet detection

Fig.4 b) Output of Platelet detection

The output of Hemoglobin detection shown as below where a red pixel intensity by which hemoglobin levels are calculated using Hb color scale.

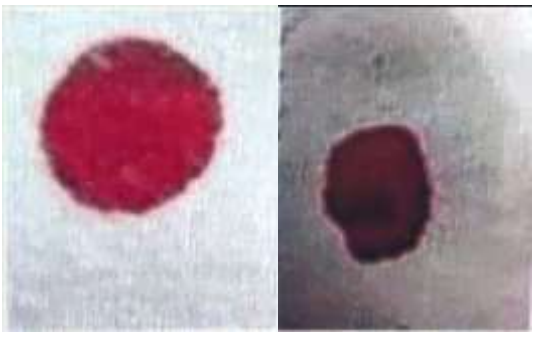

Fig. 5 a) Output of Hemoglobin Detection

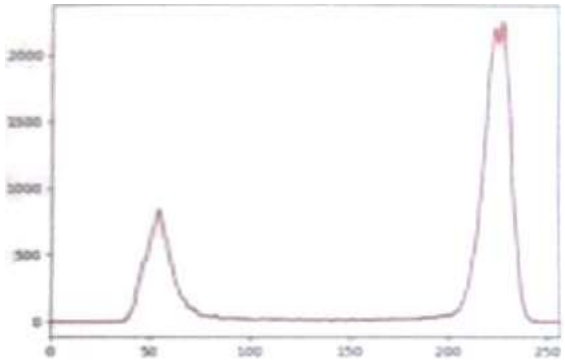

Fig.5 b) Histogram for Hemoglobin

CONCLUSION

Our proposed system consists of GUI. Use of the system will also remove the human errors occurring during manual testing of blood .Hence it is helpful for better diagnosis of diseases.

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