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Blood Group Detection Using Image Processing

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Abstract - *This Determining of blood types is very important during emergency situation before administering a blood transfusion. Presently, these tests are performed manually by technicians, which can lead to human errors. Determination of the blood types in a short period of time and without human errors is very much essential. A method is developed based on processing of images acquired during the slide test. The image processing techniques such as thresholding and morphological operations are used. The images of the slide test are obtained from the pathological laboratory are processed and the occurrence of agglutination are evaluated. Thus, the developed automated method determines the blood type using image processing techniques. The developed method is useful in emergency situation to determine the blood group without human error.*

1. INTRODUCTION

Before the blood transfusion it is necessary to perform certain tests. One of these tests is the determination of blood type and this test is essential for the realization of a safe blood transfusion, so as to administer a blood type that is compatible of type in receiver[1]. There are certain emergency situation which due to the risk of patient life, it is necessary to administer blood immediately. The tests currently available require moving the laboratory, it may not be time enough to determine the blood type and is administered blood type O negative considered universal donor and therefore provides less risk in combability. However, despite the risk of incompatibilities be less sometimes occur transfusion reactions that cause death of the patient and it is essential to avoid them, administering blood based on the principle of universal donor only in emergencies[1].

1.1 Proposed System

In this method developed is proves that it is effective and efficient method to detect the agglutination and determines the blood type of the patient accurately. The use of image processing techniques enables automatic detection of agglutination and determines the blood type of the patient in a short interval of time. The method is suitable and helpful in emergency situations. In future it is intended to improve the system developed by making it smaller so that it can be portable and incorporate GSM technology, to send a message to the mobile of technician of the laboratory in order to avoid unnecessary travel. A method is developed based on processing of images acquired during the slide test. The image processing techniques such as thresholding and morphological operations are used. The images of the slide test are obtained from the pathological laboratory are processed and the occurrence of agglutination are evaluated. Thus, the developed automated method determines the blood type using image processing techniques. The developed method is useful in emergency situation to determine the blood group without human error.

In our proposed system, reagents are mixed with three samples of blood. After sometime, agglutination may or may not occur. After the formation of agglutination, the slide is captured as an image and allowed to process in MATLAB image processing toolbox. By using this system, more chances of human errors can be reduced. Image processing techniques used for blood group identification are

- Pre-processing techniques
- Thresholding
- Morphological operations
- HSL Luminance plane
- Quantification

2. METHODOLOGY

The digital images of blood samples are obtained from the hospital/laboratory consisting of a color image composed of three samples of blood and reagent. These images are processed using image processing techniques namely color plane extraction, thresholding, morphological operations. The steps involved in image processing are shown in the block diagram.

2.1 Data Collection

The images were obtained from laboratory are digital images stored in JPEG format. These images are preprocessed using color plane extraction. The original slide test image obtained from laboratory is as shown in Fig.1.

Fig.1. Original image

2.2 Color Plane Extraction

The color plane contains color information in images. The foreground and background color of each image has different values. The colors in the color plane are not

modified by any color display mapping. In this work only, green color component is extracted because it contains maximum value in the RGB color plane. The green color plane extraction is as shown in Fig.2.

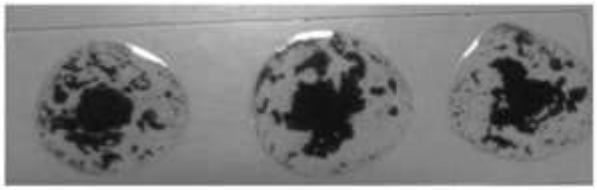

Fig.2Color plane extraction

2.3 Thresholding

It is the simplest method of image segmentation. From a grayscale image thresholding operation is used to create binary images. The gray scale samples are clustered into two parts as background and object [8].

It may be viewed as an operation that involves tests against a function T of the form

$$T=T[x,y,(p(x,y),f(x,)] \quad (1)$$

Where f (x, y) is the gray level at the point (x, y) and p (x, y) denotes some local property of the point. Thus pixels labeled 1 corresponds to objects and pixels labeled 0 corresponds to background. If T depends only on f (x, y) the threshold is global, if T depends on both f (x, y) and p (x, y) the threshold is called local, if T depends on the spatial coordinates x and y the threshold is called dynamic/adaptive.

When T depends only on f (x, y) (in other words, only on gray-level values) and the value of T solely relates to the character of pixels, this thresholding technique is called global thresholding. Clustering is the task of grouping a set of objects in such a way that objects in the same group are more similar to each other than to those in other groups. It can be observed that both background and object are separated as shown in Fig.3.

Fig.3Auto thresholding

2.4 Morphology

It includes pre or post processing operations such as dilation, erosion, morphological filtering and granulometry. The fundamental operations are dilation and erosion. The erosion operation uniformly reduces the size of the objects in relation to their background and dilation expands the size of the objects. By using dilation and erosion secondary operations like opening and closing can be done. Morphological operations are used to eliminate noise spikes and ragged edges [10]. Closing operation is used to fill the holes and gaps. It is the process of dilation which is followed by erosion.

Fig.4Filling holes

Opening operation is used to smoothen the contours of cells and parasites. It is process in which erosion is followed by dilation.

Fig.5 Remove small objects

2.5 HSL Luminance Plane

It stands for hue, saturation and lightness. Most common cylindrical co-ordinate representation of points in an RGB colour model. The result of HSL plane is as shown in Fig.6.

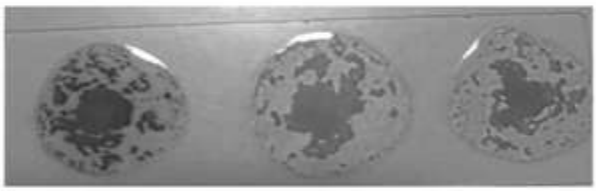

Fig.6HSL luminance plane

2.6 Quantification

Quantify function expressed as a number or measure of quantity. Area, mean, standard deviation, minimum and maximum values of an image come under this. The result of quantification is as shown in Fig.7.

Fig.7 Quantification

The images of slide test were captured by a camera consists of a color image composed of three samples of blood and reagent. The image processing method is experimented on the several images acquired. These images are processed using MATLAB software. The image processing techniques such as color plane extraction, thresholding and morphological operations were performed on the images.

The image obtained after applying auto thresholding clustering function it can be observed that the object and background are separated. In the next step, local threshold operation using Niblack function is applied it calculates a pixel-wise threshold and it can be noticed only the border segmented image.

Image obtained by the application of advanced morphology, it can be observed that the segmented image is filled using closing operation. Advanced morphological operation Opening is performed it can be noticed that it smoothens the contours of cells by removing small objects. Then the images obtained by applying the color plane extraction HSL luminance plane and quantify function. Finally, the blood group can be determined.

3. CONCLUSION

The method developed is proves that it is effective and efficient method to detect the agglutination and determines the blood type of the patient accurately. The use of image processing techniques enables automatic detection of agglutination and determines the blood type of the patient in a short interval of time. The method is suitable and helpful in emergency situations. In future it is intended to improve the system developed by making it smaller so that it can be portable and incorporate GSM technology, to send a message to the mobile of technician of the laboratory in order to avoid unnecessary travel.

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