

Review of Blood Group Detection Using Image Processing Technique

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Abstract- For Blood transfusion process blood group detection and its compatibility with receiver person is very much essential. In emergency situation to find appropriate donor large number samples needed to be observed in short period of time. If not possible we need to use universal donor type of blood group and some time it is not compatible with receiver person which may lead to death of person. Hence manual testing method may fails in emergency situation. Therefore it is necessary to develop approach which gives faster results in critical time and find appropriate donor. Thus we can develop automated approach for blood group detection using image processing techniques which results better over manual method. This approach is not affected by human errors also accurate and cheap.

Keywords- Blood Transfusion, Antigen, Agglutination[1], SVM

I. INTRODUCTION

Basic principle behind blood transfusion is blood donation must be harmless to the donor. To find compatible blood, Blood group detection is necessary. Blood group is classification of blood based on presence or absence of antigen substances on the surface of red blood cells. Antigen may be proteins, carbohydrates depending upon blood group system. Basically there are two main blood group systems ABO and Rh system. ABO system contains Anti A and Anti B (antigen) substances used to find A,B,AB,O blood group and Rh system consists of Anti D which decides whether blood group obtained from ABO system is positive or negative.

In manual testing method three blood samples are taken and then Anti A, Anti B and Anti D is added to blood sample respectively as shown in fig(1)&fig(2) The reaction occurred between antigen and antibody called as agglutination. Agglutination [1] means clotting in sample. Depending on presence or absence of agglutination blood group is determine. This is quite time consuming process and unable to apply it in emergency situation.



Fig.1 'O' Positive Blood Sample [1]



Fig.2 'A' Positive Blood Sample[1]

On other hand in software based image processing approach we can observe agglutination using image processing techniques and detect accurate blood group. In these automatic process images of blood samples with adding reagent is captured. After this image processing operations like thresholding and morphology are performed. Due to this we able to see agglutination and detect blood group. This process happens in few seconds hence this approach very much advantageous over manual one.

II. LITERATURE REVIEW

a. Blood Types

A blood type is a classification of blood based on presence or absence of antigen substances [2]. Before blood group detection we need to know about different blood types. There are mainly two blood typing systems ABO and Rh[1],[2].ABO system determines whether person belongs to blood A or B or AB or O and Rh determines whether blood type is positive or negative. By refereeing [2] blood groups are as follows:

1. O Positive Group

Adding Antigen A, Antigen B, Antigen D in blood sample, where agglutination is seen in Antigen D added blood samples which is shown in fig.3



Fig.3 'O' Positive blood sample [1]

2. O Negative Group

Adding Antigen A, Antigen B, Antigen D in blood sample, where agglutination is not seen in all three samples which is shown in fig.4



Fig. 4 'O' Negative blood sample [1]

3. B Positive Group

Adding Antigen A, Antigen B, Antigen D in blood sample, where agglutination is seen in Antigen B and Antigen D added blood samples which is shown in fig.5



Fig.5 'B' Positive Blood sample [1]

4. B Negative Group

Adding Antigen A, Antigen B, Antigen D in blood sample, where agglutination is seen in Antigen B added blood samples which is shown in fig.6



Fig.6 'B' Negative Blood sample [1]

5. A Positive Group

Adding Antigen A, Antigen B, Antigen D in blood sample, where agglutination is seen in Antigen A and Antigen D added blood samples which is shown in fig.7



Fig.7 'A' Positive Blood sample [1]

6. A Negative Group

Adding Antigen A, Antigen B, Antigen D in blood sample, where agglutination is seen in Antigen A added blood samples which is shown in fig.8



Fig .8 'A' Negative Blood sample [1]

7. AB Positive Group

Adding Antigen A, Antigen B, Antigen D in blood sample, where agglutination is seen in all three added blood samples which is shown in fig.9.



Fig.9 'AB' Positive Group [1]

8. AB Negative Group

Adding Antigen A, Antigen B, Antigen D in blood sample, where agglutination is seen in Antigen A and Antigen B added blood samples which is shown in fig.10



Fig.10 'AB' Negative Blood Sample [1]

b. Generalized Block Diagram



Fig.11 Generalized Block Diagram

By referring [2], [3] and [4] one can get idea about over all system that is "Blood Group Detection Using Image Processing". The typical block diagram related to this system is as show in fig 11, include following stages:

1. Image Acquisition

Image acquisition means acquiring color images. For blood group detection using image processing color images of reagent added blood samples are captured using

camera(resolution upto 12MP) otherwise hardware which interfaces embedded board and camera module can be implemented using DC motor as controlling unit [1],[4].Database of such captured image are stored and used for blood group detection.[3]

2. Image Pre-processing

Images those were acquired are may be blurred or influenced by noise. Image Pre-processing removes noise by color plane extraction, gray scale conversion and filtering techniques which described in [2], [3]

3. Image Processing

For blood group detection image processing stage is very much important. Image processing involves many operations due to which object and background details are separated out and agglutination can be seen clearly. Image thresholding and morphology are primary operation in image processing.

Thresholding is simple approach of image segmentation. Object and background are separated using global thresholding technique and pixels in object separated out using local thresholding technique described in [2], [4].

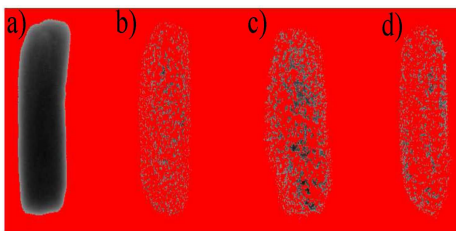


Fig. 12 Image obtained by global thresholding [4]

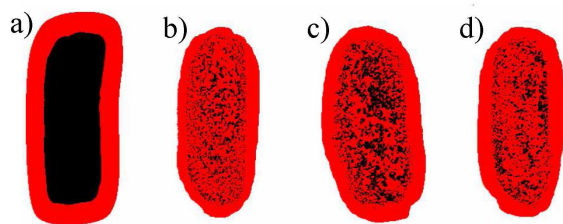


Fig.13 Image obtained by local thresholding [4]

Image Morphology is the process of extracting image components like shapes, boundaries. It includes operations such as dilation, erosion, opening, closing.Opening separates objects which are just touching each other and closing fused the narrow gaps and holes [5].

4. Classification

There are an increasing number of researches done on classification of blood groups. Referring [6], [7] and [8], blood samples can be classified using standard deviation method, SVM classifiers and artificial neural method. Standard deviation using matlab can calculated as,

$$SD = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$$

Where, N=total no. of values

x_i =ith position value

μ =mean value

By observing multiple samples of individual blood group, standard deviation value is set for each group. Any random sample having SD value below the threshold value then that sample belongs to corresponding blood group, described in [6].

SVM (Support vector machine) involves separating data into training and testing test. The goal of SVM is to find hyper plane that separates clusters of vector in such a way that cases with one category of target variables are on one side of plane and cases with other category are on other side of plane [7].

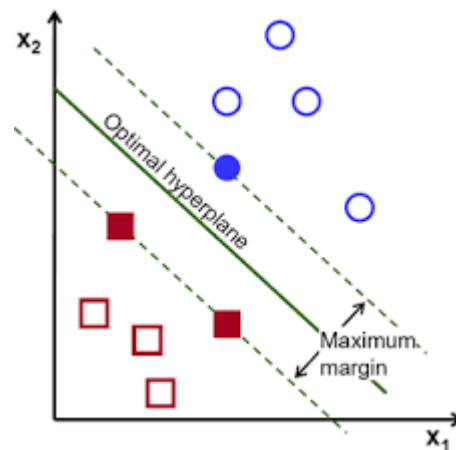


Fig.14 SVM Classifiers [7]

In summary, SVM gives good accuracy but it is complex technique of classification whereas Standard deviation method is less complex. By increasing number of samples, accuracy of standard deviation method can be improved.

III. CONCLUSION

Blood group is classified on basis of ABO and Rh. system. In this we can observe agglutination which determine appropriate Antigen present and in turn detect blood group. To see agglutination we will perform image processing operation. There are multiple ways to do this. But basic operations are thresholding and morphology. In thresholding color images are converted to grayscale first and in turn binary image. On that binary image morphological operation like dilation, erosion, closing, opening operations are performed [2]. In which we remove small objects from image. Also sometimes Standard deviation method is used to detect presence or absence of agglutination. Now to classify blood group there are different methods and algorithms. Mainly SVM and decision tree, artificial neural network algorithms are used. Along with this LBP, standard deviation, pattern matching techniques also used to classify blood group samples after applying image processing techniques. After this appropriate blood group and its agglutinated images are displayed on GUI interface.

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