IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 5, June 2022
Impact Factor: 6.252

Determination of Blood group using Image Based Canny Edge Detection Technique

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Abstract: *Blood group determination is done before a blood transfusion in emergency situations or while checking blood group of a person for donation. It is a fast and easy way to ensure that you receive the right kind of blood during surgery or after an injury. If you are given incompatible blood, it can be fatal resulting in agglutination. Hence, before the blood transfusion it becomes necessary to perform certain tests. Determining blood group is one of the tests before transfusing the blood during emergency situations. Microscopy has intermittently proved inefficient since it is time consuming and also the results are difficult to reproduce. Also, experts are needed. Due to these reasons, automation of evaluation process is of high importance. Based on the processing of digital images acquired during the slide test, a software is developed in image processing to determine the blood group during emergency situations without any error. The images obtained are then processed, occurrence of blood clumping is checked and accordingly the blood group is determined. Thus, using image processing techniques, this developed automated method will be useful in determining the blood group..*

Keywords: ABO system, agglutination, Blood samples, Threshold, Segmentation, Binary image, Serum, Matlab

I. INTRODUCTION

Blood types were discoverd by Austrian Karl in 1901. ABO blood group system and the Rh D blood group system are the most important blood group system used for determining blood group of a person and the test used for determining the blood group is blood typing. The blood groups are defined by the presence or absence of a specific antigen on the surface of a red blood cell. There are four ABO blood groups: A, B, AB and O. They refer to the presence of different antigens on the red blood cells and antibodies in the blood. Blood group O means you have neither antigen present on the surface of RBC and antibodies A and B in the blood, but blood group AB means you have both the A and B antigens present and no antibodies in the blood. Blood group A has antigen A present on the surface and antibody B in the blood, while blood group B has antigen B present on the surface and antibody A in the blood. Referring to Rh D blood group system, one more antigen called Rh D is involved while determining the blood group. If D antigen is present on the red blood cells of a person then he/she is Rh D positive, while one who does not have D antigen on the red blood cells is Rh negative.

While having a blood transfusion, blood grouping is very important. If there is any incompatibility while transfusing blood, it can be fatal causing intravenous clumping in the patient's blood. Antigens on the red blood cells in the blood of the person receiving blood can be attacked by the antibodies produced in the blood due to incompatibility. Naturally occurring anti-bodies are not present in the blood of a person having blood group O, hence person with blood group O can safely donate blood to a person with any other blood group[. Similarly, a person with blood group AB can receive blood from a person having any other blood group safely due to absence of antibodies in the blood. A person with positive blood group can be given either Rh D positive or Rh D negative blood, but a person with negative blood group can only receive blood from a person with Rh D negative blood. Hence, a person with O -ve blood group is an universal donor whereas one with AB +ve blood group is a universal receiver.

Developed is by using image processing techniques. Three samples of blood are taken on a slide, each mixed with reagent anti-A, anti-B and anti-D respectively. After sometime, agglutination occurs and the result is interpreted according to the occurrence of agglutination. The agglutination reaction is the occurred reaction between the antibody and the antigen,

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indicating the presence of a particular antigen. The condition of the occurrence of agglutination determines the blood group of the hus, the software developed based on image processing techniques allows detection of agglutination on the slide through an image captured after mixing specific reagents and consequently the

II. PROPOSED SYSTEM

Firstly, three samples of blood are mixed with three different reagents namely anti-A, anti-B and anti-D are taken on a slide. After sometime, agglutination may or may not occur. After the occurence of agglutination, the slide containing three samples of blood mixed with three different reagents is captured as an image and allowed to process in MATLAB image processing toolbox. This system reduces the chances of false detection of a blood group. Image processing techniques used for blood group detection are:

1. Gray scale conversion
2. Binary conversion
3. Image segmentation
4. Canny edge detection
5. Result.

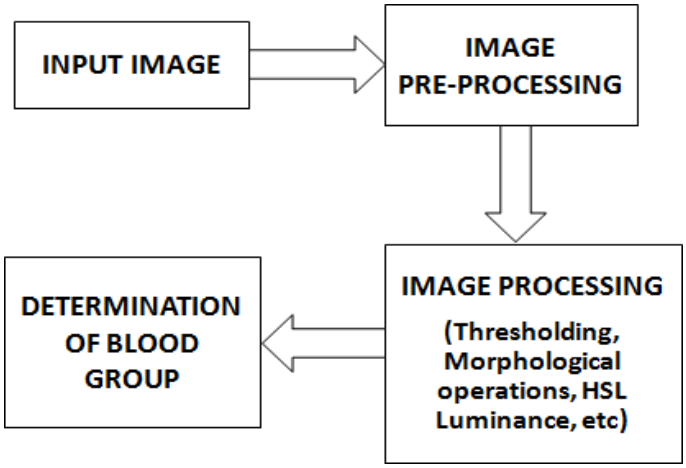

Figure: Basic block diagram

III. METHODOLOGY

Figure 1 clearly depicts the flowchart of the system.

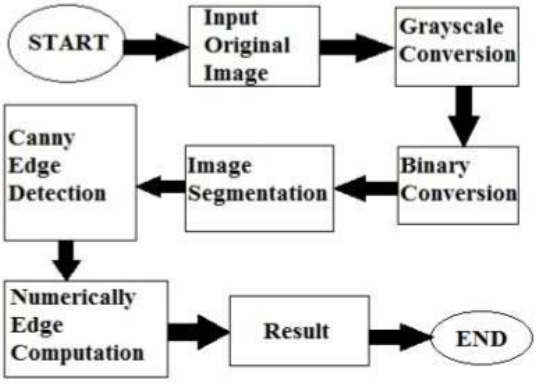

Fig 3.2 Detailed Block Diagram of Proposed Processing Method using Canny Edge Detection.

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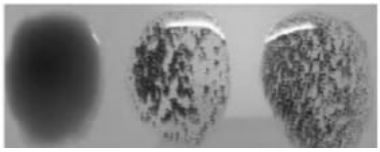
3.1 Input Original Images

Three samples of blood are taken on a slide, each mixed with reagent anti-A, anti-B, anti-D respectively and images of slide are taken. These images are digital images stored in JPEG format and they are pre-processed using colour plane extraction. The original slide test image used as input is as shown in figure.

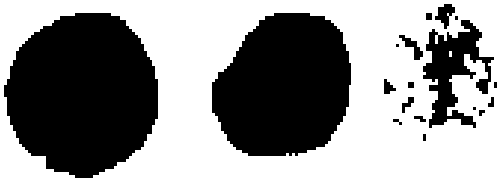
3.2 Gray Scale Conversion

RGB image is based on RGB Color Model where Red, Green and Blue lights are combined together in numerous ways to reproduce a broad array of colors. The name of the model comes from these additive primary colors. The main approach of this color model is representing and displaying the images in electronic system. It is a device dependent color model where different devices can detect a given RGB value through the color elements and properties and their response to the individual R, G, and B levels.

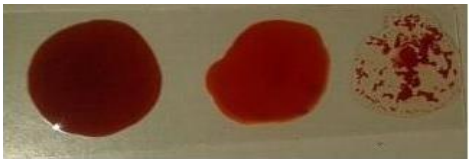


3.3 Binary Conversion (Thresholding)

Thresholding operation in image processing is used to create binary images. The gray scale samples are clustered into two parts as background and object. In this case, multilevel thresholding is performed using Otsu's method. More than one threshold are determined for a given image and segmentation is done creating certain regions. One background with many objects is the result of this multilevel thresholding. It is a clustering-based image thresholding. Figure 5 shows the result of multilevel thresholding using Otsu's method.



Morphology is a tool of extracting image components that are useful in the representation. In morphological operation, there are two fundamental operations such as dilation and erosion, in terms of the union of an image with translated shape called



3.4 Image Segmentation

Segmentation is the process of dividing a digital image into multiple segments within the sets of pixel

3.5 Canny Edge Detection

Canny approach is a way of edge detection in image processing which works by detecting discontinuities in brightness. Canny edge detection is a multistep detection algorithm which can detect edges from the pixel image.

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IV. RESULTS

GROUP A	GROUP B	GROUP D	RESULT
NOT AGGLUTINATED	NOT AGGLUTINATED	NOT AGGLUTINATED	O-
NOT AGGLUTINATED	NOT AGGLUTINATED	AGGLUTINATED	O+
NOT AGGLUTINATED	AGGLUTINATED	NOT AGGLUTINATED	B-
NOT AGGLUTINATED	AGGLUTINATED	AGGLUTINATED	B+
AGGLUTINATED	NOT AGGLUTINATED	NOT AGGLUTINATED	A-
AGGLUTINATED	NOT AGGLUTINATED	AGGLUTINATED	A+
AGGLUTINATED	AGGLUTINATED	NOT AGGLUTINATED	AB-
AGGLUTINATED	AGGLUTINATED	AGGLUTINATED	AB+

V. CONCLUSION

A fast, accurate and robust blood group judgment method is proposed for the rapid and accurate identification of blood types in the case of emergency transfusion. A large number of experiments show that this method can quickly and accurately identify whether the serum and antibody agglutination reaction, and then get blood type determination, to meet the needs of automated rapid blood type analyzer.

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