

AUTOMATED BLOOD GROUP RECOGNITION SYSTEM USING IMAGE PROCESSING

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ABSTRACT- Determination of blood type is important before administer a blood transfusion in an emergency situation. Blood grouping is the first and foremost essentiality for many of the major medical procedures. Traditional ways of detecting blood group have remained analogue in this era of digitization and are therefore vulnerable to human fallibility. So it would be very efficient and arguably a lifesaving approach if the process of detecting blood can be completed successfully in a cost-effective way with the technologies at hand and without the plausibility of man-made error. The proposed system aims to develop an embedded system which uses Image processing algorithm to perform blood tests based on ABO and Rh blood typing systems. The proposed system helps in reducing human intervention and perform complete test autonomously from adding antigens to final generation of the result. The proposed system aims at developing results in shortest possible duration with precision and accuracy along with storage of result for further references. Thus, the system allows us to determine the blood type of a person eliminating traditional transfusions based on the principle of the universal donor, reducing transfusion reactions risks and storage of result without human errors.

KEY WORDS: Antigen, Blood Samples, GPU, Histogram, LBP (local binary pattern), Nearest

Neighbor Classifier, Image Processing, Pattern Matching.

1.INTRODUCTION

The blood Typing system is basically used to determine the blood group that the person possesses. Blood Detection is most important and essential activity. The differences in the blood group of individuals are due to presence or absence of certain protein molecule named as antigens or antibodies. The antigen is any foreign substance that causes an immune response either alone or it forms a complex with a large protein molecule. Antibodies are the proteins produced by the immune system to defend against the foreign substances that may cause harm to our body, therefore, they are the guards of our body.

Motivation According to a study conducted by the Accident Research Centre (ARC) of BUET, road accidents claim on average 12,000 lives annually and lead to about 35,000 injuries. In these accidents it is often necessary to perform urgent blood transfusion where it is essential to determine blood group of the victim rapidly. Besides, there are some other use cases where blood typing may be needed at the point-of-care such as public health centers, battle field, schools, veterinary care centers and forensic sites.

Perhaps, the most telling need is in rural areas of developing countries where access to labs and trained technicians is simply not present.

Unfortunately, Detection of blood group in disaster or remote areas where expertise is unavailable is challenge. As a result, Transfusions between blood groups can be catastrophic. Therefore, knowing the blood type of donors and recipients is of the utmost importance. The conventional system of blood typing may prove life taking due to lack of trained technicians .In real time, the health technicians, in these situations, must decide quickly what procedures they must apply, in order to guarantee the best treatment for the patient.

In the mentioned emergency situations, where there is no time for human blood typing, the universal donor blood is administrated. As a result, some reactions may occur, risking the patient's life and stock levels of blood from universal donor blood type decreases.

This paper presents an automatic system which is able to perform this most basic and fundamental pre-transfusion test quickly, easily, in safe conditions, and with high reliability, even in remote locations. To this end, the data acquisition is based on image processing techniques to obtain results from an image of the glass slide and concluding with numeric values to maintain precision in conducting result.

2.LITERATURE REVIEW

Blood is one of the most important element of the human body which works as a major connective tissue and keeps the circulation of many essential ingredient like oxygen and various nutrients. It is extremely necessary forvarious medical procedures to be well known about blood type and other features of blood such as the RBC count and CBC . The traditional method of detecting the blood group is usually the plate test and the tube test.

Both of which are done by under complete analog procedures with human observation. In the era of digitization, it is not an efficient way to handle such a basic yet essential medical

procedure in a full analog environment. There are also a few techniques such as micro plate testing andgel centrifugation .

These procedures are costly and those need to be done by people with strong skill set with some particular equipment. In a situation of emergency which might be a difficulty to afford with. Basically, the process of blood group analysis depends on the agglutination of a sample blood. The blood of a patient is mixed with three types of antigens, which are antigen A, antigen B and antigen D.

The agglutination in any particular blood sample ensures the positivity of that blood belonging in that correspondent group. The detection of the composite organisms from a sample blood slide has been done via image processing techniques like threshold morphological operations . Errors can be occurred in these procedures if the detection of agglutinations is solemnly done with human eyes.

Wrongly calculated blood group results in extreme situations in case of further diagnostics upon that decision. For determining the correct blood group we need an impeccable operation justified with logical and mathematical calculations and flawless image processing to detect residual errors that evade corrective procedures. Image segmentation is one of the most fundamental techniques of image processing. In segmentation, a bigger image is divided into a number of sub images.

While the algorithms run individually on the sub-divided images, the calculations occur more specifically and the result becomes more precise. There are several ways of image segmentation. Otsu method is one of them. Otsu is an automatic threshold selection region based segmentation method. Another Significant and important image processing technique is thresholding. Thresholding does

binarization on any image. Some special thresholding techniques also does denoising. In some cases, some segmented image becomes cloudy and the important information which is needed to be extracted become complicated to retrieve. In such situations thresholding is very helpful .

So, basically, thresholding techniques makes an image in black and white and it makes the image much clearer. One automated design was brought up where the researcher suggested the whole test was done based on slide test for determining blood types and a software developed using image processing techniques. The image was processed by image processing techniques developed with the IMAQ Vision software from National Instruments .

This particular research introduced us with the very concept of developing numerical calculation over the processed image since this paper discussed standard deviation with respective mean value to detect the occurrence of agglutination which was concluded with the value 16. In this research every samples with standard deviation value below 16 were found as samples where no agglutination occurred and samples with standard deviation values greater than or equal to 16 are samples classified as agglutination occurred. While developing our method we intended to keep the calculation area simpler to ensure bits intelligibility. Although Ferrazhas pursued with his research with blood grouping and image processing this paper led us to one of the crucial computation of our algorithm.

3.ANALYSIS

There are two parts of detecting a blood group. One part is detecting which group it belongs to like A, B or O and another part is detection of positive or negative type. Both test are done in single slide. From our proposed method we detect the agglutination of the blood sample

when they are mixed with antigens. When agglutination occurs that means, that type of blood group is detected for the current sample. If the part A of the slide has agglutination and part B does not agglutinate then we decide the detected group for the sample blood is group A.

Similarly, if part A do not have any agglutination and part B has agglutination then we decide that blood sample as group B. However, if there is no agglutination in any of parts then the detected blood group type is group O and if the agglutination has occurred in both part A and B then the detected group is AB.To check if blood is positive or not, we focus on the Rh-factor part. If any agglutination occurs in Rh factor part then blood group is positive and if the agglutination does not occur then the blood group is negative

O positive is the most common blood type; **O negative** is the universal donor type, meaning those with this blood type can donate red blood cells to anybody.

B+ is the third most common occurring blood type. Your regular and frequent blood donations are especially valued, and many in our area will be given a fighting chance at life because of your generous gift.

Annually, more than 120,000 units of blood, platelets and plasma are required to meet the needs of the hospitals we serve, and your blood type is crucial to maintaining an adequate supply. We are grateful to you for so willingly giving the “gift of life”, and through your continued commitment, we are able to maintain our heritage of service to those in need. 1 in 12 people have B+ blood.

4.COMPATIBLE BLOOD TYPES

There are two parts of detecting a blood group. One part is detecting which group it belongs to

like A, B or O and another part is detection of positive or negative type. Both test are done in single slide. From our proposed method we detect the agglutination of the blood sample when they are mixed with antigens. When agglutination occurs that means, that type of blood group is detected for the current sample. If the part A of the slide has agglutination and part B does not agglutinate then we decidethe detected group for the sample blood is group A. Similarly, if part A do not have any agglutination and part B has agglutination then we decide that blood sample as group B. However, if there is no agglutination in any of parts then the detected bloodgroup type is group O and if the agglutination has occurred in both part A and B then the detected group is AB.

AB can receive AB

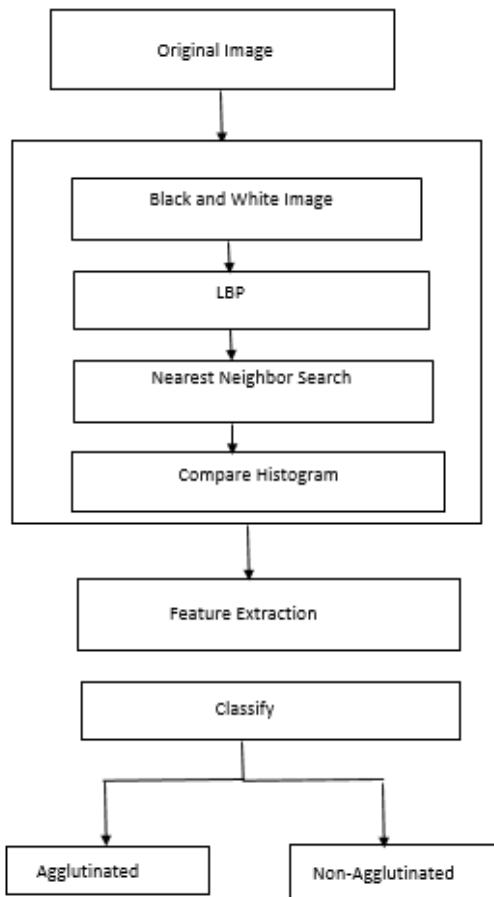


O- can receive O-
O+ can receive O+, O-
A- can receive A-, O-
A+ can receive A+, A-, O+, O-
B- can receive B-, O-
B+ can receive B+, B-, O+, O-
AB- can receive AB-, B-, A-, O-
AB+ can receive AB+, AB-, B+, B-, A+, A-, O+, O-
Compatible Plasma Types
O can receive O, A, B, AB
A can receive A, AB
B can receive B, AB

4. METHODOLOGY

The results of slide test are captured by a camera consisting of a color image composed of the blood sample and reagent. This image goes under various transformations as below:

1. The Raw Image of Blood Samples is stored in computer buffer.
2. These images are converted into gray scale images.
3. A local Binary Pattern i.e (LBP) is applied to this images.



LBP is The local binary pattern (LBP) operator was developed as a gray-scale invariant pattern measure adding more information to the “amount” of texture in image Local Binary Pattern-Local binary patterns (LBP) is a type of visual descriptor used for classification in computer vision. LBP is the particular case of the Texture Spectrum model proposed in 1990. LBP was first described in 1994. It has since been found to be a powerful feature for texture classification.

4.2 MORPHOLOGICAL OPERATIONS:

Morphology is a tool of extracting image components that are useful in the representation and description of region shape,

such as boundaries, skeletons, and the convex hull. 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 a structuring element. This is a fundamental step in extracting objects from an image for subsequent analysis.

4.2.1 DILATION

Dilation is the process that grows or thickens the objects in an image and is known as structuring element. Graphically, structuring elements can be represented either by a matrix of 0s and 1s or as a set of foreground pixels. The dilation of A by B is set considering all the structuring element origin locations where the reflected and translated B overlaps at least one element. It is a convention in image processing that the first operand of AB be the image and the second operand is the structuring element, which usually is much smaller than the image.

4.2.2 EROSION

Erosion shrinks or thins objects in binary image. The erosion of A by B is the set of all points z. Here, erosion of A by B is the set of all structuring element origin locations where no part of B overlaps the background of A. In image processing applications, dilation and erosion are used most often in various combinations. An image will undergo a series of dilations and erosions using the same, or sometimes different, structuring elements. The most important combinations of dilation and erosion are opening and closing

4.3 HSL LUMINANCE

HSL luminance stands for Hue, Saturation and Luminance. Hue is expressed in a degree around a colour wheel, while saturation and brightness are set as a percentage. Shade uses a

standard window colour picker with a scale of 0 to 239(which can be regarded as 1 to 240) for each quality, which makes calculations easy. HSV stands for Hue, Saturation and Value. A third model, common in computer vision applications, is HIS. In each cylinder, the angle around the central vertical axis corresponds to hue and saturation. Hue in HSL and HSV refers to Saturation and differs dramatically.

A new and efficient process of digitally blood group detection model is proposed which is applied for the image sets that we can collect from hospitals. Image sets are captured by a mobile device and then processed through the image processing methods and algorithms. We counted the edges for each images and by analyzing the data we computed blood type from our sample captured real life image. Both, experimental result with of our collected dataset and comparison with the real time diagnostic result indicate promising process of effective performance.

This paper presents a new and efficient model of blood group detection with image processing techniques. We worked on a real time dataset that consists of 100 blood samples. The blood sample was segmented in three parts and then we applied Canny edge detection method. After that, we counted the detected edges to determine the blood group of the sample. The experimental result with of our collected dataset and comparison with the real time diagnostic result indicate promising process of effective performance. We will try to detect blood group from microscopic images by using shape and pattern detection method of the specific antibody in the blood cell that reacts with the antigen which will not require any pathology tests for blood group detection. Our method for blood group detection is feasible for common people. Diagnostic centers can capture the images for collecting data and gives accurate results.

5. CONCLUSION

The proposed system aims to develop an embedded system which uses Image processing algorithm to perform blood tests based on ABO and Rh blood typing systems. The input taken to this system is a blood sample whose images are captured and forwarded to the image processing algorithm. It uses SVM for classification of images and pattern matching algorithms for matching of images. It makes use of GPU for faster computation of the process of blood detection.

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