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Determination and Classification of Human Blood Types using SIFT Transform and SVM Classifier

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ABSTRACT: 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. This paper based on literature survey of different types of blood group determination method. The developed automated method determines the blood type using image processing techniques. Also we discuss the methodology & advantages of human blood group determination using SIFT, SVM classifier. The developed method is useful in emergency situation to determine the blood group without human error.

KEYWORDS: Blood types, Image Processing, Human Blood,and SIFT, SVM Classifier.

I.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 with the type of receiver. There is 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 of incompatibility. 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 . Thus, the ideal would be to determine the blood type of the patient even in emergency situations and administering compatible blood type from the first unit of blood transfusion. Secondly, the pre-transfusion tests are performed manually by technician's analysts, which sometimes lead to the occurrence of human errors in procedures, reading and interpreting of results. Since these human errors can translate into fatal consequences for the patient, being one of the most significant causes of fatal blood transfusions is extremely important to automate the procedure of these tests, the reading andinterpretation of the results.

Blood group is classification of blood based on the presence or absence of inherited antigenic substances on the surface of red blood cells. These antigens may be proteins, carbohydrates, glycoproteins or glycolipids depending on the blood group system. The ABO system is the most important blood group system in human blood transfusion. The associated anti-A and anti-B antibodies are usually immunoglobin M. Rh blood group system is the second most significant blood group system in a human blood transfusion with currently 50 antigens. The most significant Rh antigen is the D antigen.Blood transfusion is generally the process of receiving blood products into one's circulation intravenously. Transfusions are used for various medical conditions to replace lost components of the blood. Early transfusions used whole blood but modern medical practice commonly uses only components of the blood such as RBCs, WBCs, plasma, clotting factors and platelets. India faces blood deficit of approximately 30-35% annually. The country needs around 8 to 10 million units of blood every year but manages a measly 5.5 million units on top of it 94% of blood donation in the country made by men while women contribute only 6%.

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There is a scope for determining blood types and the software developed using image processing techniques. The slide test consist of the mixture of one drop of blood and one drop of each reagent, anti-A, anti-B, and anti-D, being the result interpreted according to the occurrence or not of agglutination. The agglutination reaction means that occurred reaction between the antibody and the antigen, indicating the presence of the antigen appropriate. The combination of the occurrence of agglutination, or non-occurrence, determines the blood type of the patient [2]. Thus, the software developed based in image processing techniques allows, through an image captured after the procedure of the slide test detect the occurrence of agglutination and consequently the blood type of the patient.

II. LITERATURE REVIEW

T.M.Selvakumari, Blood group detection using fibre optics. In this technique, the transmitter is used to generate pulses of frequency 10KHZ.Then these pulses are fed to the Light Emitting Diode [LED], which converts electrical variations into optical variations. After that the optical signals were launched into the fibre. Then it is fed to the blood sample and it is received by the receiver which converts the optical variations again into electrical variations. The observed electrical variations are different for all blood types. Due to the optical variations ofdifferent blood group, there will be corresponding voltage variation in the output of the photo detector. Thereby the blood groups (ABO) can be determined without using the antigen. But, the Rh (positive and negative) type of the blood group has not discussed.

S.M. NaziaFathima, Classification of blood type by microscopic colour images. In this semi-automated system, the blood group can be identified by microscopic colourimages. Initially it performs image pre-processing by histogram equalization and colour correction and then colour space conversion for converting the RBC to HIS. Then, it extracts the colour and texture feature of the imagesusing cumulative histogram and haralick method respectively. Then finally the corresponding person's blood group can be analysed by using Support Vector Machine (SVM). In this system, the more skilled persons are needed to handle and it is tedious to do.

P.A.Berlitz, Rapid Automated Blood Group Analysis with QCM Biosensors. In this type of analysis, protein, A coating is provided on the gold surface of QCM biosensors for the immobilization of antibodies against blood group antigens A and B which permits the identification of the blood groups with two measurements. But for determining Rh factor one more experiment is needed. Here the computer and software is essential to detect the blood group. It also requires chemicals and reagents for the determination and that is expensive.

Ferraz, Ana, Automatic system for determining of blood type using image processing technique. In this system, the blood group can be determined using image processing technique with LABVIEW and IMAQ vision. Here the image of that blood sample is captured after the slide test is performed which detect the occurrence of agglutination reaction (clumping). Next the classification of algorithm is used to determine the blood grouping. Finally, all the information is stored in the database. This system is not fully automated because the slide test is conducted manually and it also consumes more time for image processing

Brinkhues O, Giers G, Hanfland, Electronic data processing-assisted serial automation of current methods in blood group serology. The introduction of special centrifugal racks with a transparent bottom into the conventional typing of blood group in glass tubes facilitates the simultaneous work on and reading of a maximum of 32 complete ABO, Rhesus and Kill typing in one series. As a result of the facts that it is unnecessary to label the individual tubes and that the pipetting of serum and erythrocyte suspension is done automatically and through the unmistakable classification of the samples by means of bar-coding, the manual work is reduced to about 50%. Even though it is useful but it is semi-automated system. So the working personnel have some difficulties.

K.Satoh, Y.Itoh, Forensic ABO blood grouping by 4SNPs analyses using an ABI PRISM 3100 genetic analyser. This paper proposed a new method to classify the blood grouping by using PCR-based methods, such as sequence-specific primers with a positive control (PCR-SSPPC) and confronting two pairs of primers (PCR-CTPP) for forensic ABO groupings using fragment analysis by ABI PRISM 3100 genetic analyser. The method allows the well-established base changes at four nucleotide positions 261, 796,802 and 803 to be assayed, so that reliable blood group estimation is established by the presence of three representative alleles such as A,B and O. This process consumes more time to complete the entire task.

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Priyadharshini. R, Ramya. S, Kalaiyarasi,A Novel Approach In Identification of Blood Group Using Laser Technology**.**In this research paper, the proposed idea is to replace the manual work in clinical laboratories for identifying the blood group. Nowadays even though automation plays a vital role in all medical applications but still no device is available to determine the blood group automatically. Usually, the blood group analysis is made by the technicians in the laboratories. They are using the following methods for analysing the blood group 1.ABO forward typing 2.ABO reverse typing 3.Rhesus type testing. Among these three techniques ABO type testing and Rhesus type testing is most widely used in all laboratories. In ABO testing, the antigen is added to the blood sample and based on the reaction between antigen and antibody, diagnosis is made. In Rhesus type of testing, the positive and negative type of the blood group can be determined. Although, it is simple to detect but in handling with large number of samples, it is tedious to do and it may also leads to wrong analysis. To overcome these problems, the proposed LASER technique is used. This is based on the principle, that the LASER intensity changes due to the occurrence of clumping in the blood sample which in turn changes the density of the blood sample. This variation is sensed by the level of the energization of the photocell. The output from the detector is in the form of voltage which is fed to the comparator which decides the blood group using embedded controller.

MehediHasanTalukder1, Md. Mahfuz Reza,Improvement of Accuracyof Human Blood GroupsDetermination using Image processing Techniques,it is very crucial to determine human blood groups in an emergency situation. But according to current system, the detection procedure is very slow. At present, human blood groups are determined manually through plate test procedure. It consists of blood collection and mixing with specific reagents in order to determine the blood agglutination. The results are checked microscopically. In this paper, the main objective is to present a methodology to determine human blood groups using image processing techniques.

III. PROPOSED 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 Fig.1.

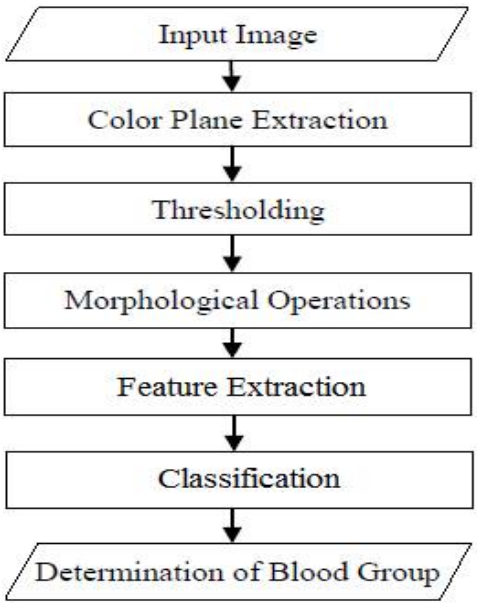

Fig.1.Steps of Determination of Blood types using Image Processing

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A. DATA COLLECTION

The images were obtained from laboratory are digital images stored in JPEG format. These images are pre-processed using color plane extraction. The original slide test image obtained from laboratory is as shown in Fig.2.

Fig.2. Original Image

B. 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.3.

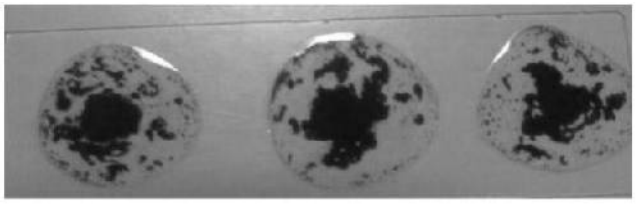

Fig.3 Color Plane Extraction

C. 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 beviewed as an operation that involves tests against a function T of the form

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

Where f(x, y) is the gray level at the point (x, y) and p(x, y) denotes some local property of the point. A threshold image is defined as

$$g(x,y)=\{1 \text{ if } f(x,y)>T$$

$$\{0 \text{ if } f(x, y)\leqslant T \quad (2)$$

Thus pixels labeled 1 corresponds to objects and pixels labeled '0' correspond 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 co-ordinates 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.4.

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Fig.4 Auto thresholding

D. NIBLACK FUNCTION

Niblack's algorithm calculates a pixel-wise threshold by sliding a rectangular window over the gray level image. The computation of threshold is based on the local mean m and the standard deviation s of all the pixels in the window and is given by the equation,

$$T_{niblack} = m + k * s \qquad (3)$$

Where m is the average value of the pixel, and k is fixed to -0.2 and s is the standard deviation.

If threshold T depends on f (x, y) and p(x, y), this thresholding is called local thresholding. This method divides an original image into several sub regions, and chooses various thresholds T for each sub region reasonably. It can be observed only the segmented part of an image as shown in Fig. 5.

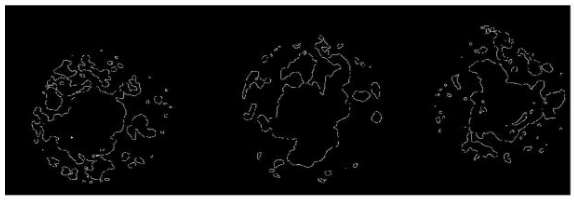

Fig.5 Local Thresholding

E. 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.

Closing operation is used to fill the holes and gaps. It is the process of dilation which is followed by erosion. The closing of a set A by structuring element B is defined and it is given by the equation,

$$A \bullet B = (A \oplus B) \ominus B \qquad (4)$$

It can be observed that the segmented image is filled using closing operation is shown in Fig. 6.

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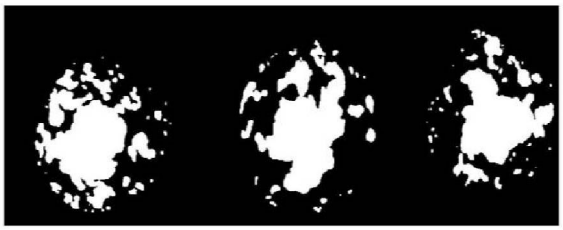

Fig.6 Filling Holes

Opening operation is used to smoothens the contours of cells and parasites. It is process in which erosion is followed by dilation. The opening of a set A by structuring element B is defined and it is given by the equation,

$$A \circ B = (A \ominus B) \oplus B \qquad (5)$$

Therefore, the opening of A by B is the dilation of A by B, followed by the erosion of the result by B .It can be noticed that it smoothens the contours of cells by removing small objects is shown in Fig 7.

Fig.7 Remove Small Objects

F. FEATURE EXTRACTION

The SIFT (Scale Invariant Feature Transform) algorithm takes an image and transforms it into a collection of local feature vectors.Each of these feature vectors is supposed to be distinctive and invariant to any scaling, rotation or translation of the image. In the original implementation, these features can be used to find distinctive objects in different images and the transform can be extended to match location in images.it consist of four phases: extremadetection, keypoint localisation, orientation assignment and descriptor computation.

G. SVM CLASSIFIER

The Support Vector Machine (SVM) is a popular classification technique. A classification task usually involves separating data into training and testing sets. Each instance in the training set contains one target value and several attributes. The goal of SVM is to produce a model (based on the training data) which predicts the target values of the test data given only the test data attributes. In the parlance of SVM literature, a predictor variable is called an attribute, and a transformed attribute that is used to define the hyper plane is called a feature. The task of choosing the most suitable representation is known as feature selection. A set of features that describes one case is called a vector. So the goal of SVM modelling is to find the optimal hyper plane that separates clusters of vector in such a way that cases with one category of the target variable are on one side of the plane and cases with the other category are on the other size of the plane. The vectors near the hyper plane are the support vectors.

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IV. ADVANTAGES

1) People can have option for online blood type determination.
2) While bringing the patients to the hospital, in case of emergency, blood sample images can be taken & sent to the hospital for type determination via Wi-Fi or GSM to save patients life.
3) Using this system we can also count RBC, WBC.
4) Without any error human blood group can be determined using SIFT transform and SVM classifier.
5) Authentic proof permanent due to software.
6) It's not necessary to determine blood group many times.

V. CONCLUSION

The method developed 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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REFERENCES

[1]. Selvakumari, T.M. (2011). Blood Group Detection Using Fiber optics, American Journal of Physics, vol.4, issue 3, pp.165-168
[2]. NaziaFathima.S.M. (2013).Classification of blood types by microscopic colour images, International journal of machine learning and computing.vol 3, no. 4, pp.376-379.
[3]. Berlitz,P.A., claussen, J., Doring, J.S., Drechsel, H., North off, H., and Gehring,F.K.(2012).Rapid Automated blood group analysis with QCM Biosensors, 5th European Conference of International Federation for Medical and Biological Engineering IFMBE proceedings, volume 37,pp 1039-1042
[4]. Ferraz, Ana, Member, IEEE (2013), Automatic system for determining of blood type using image processing technique. Bioengineering (ENBENG), IEEE Feb 20-23
[5]. Satoh K, Itoh Y (2006), Forensic ABO blood grouping by 4 SNPs analyses using an ABIPRISM 3100 genetic analyzer, International Congress Series 1288 (2006) 49-51.
[6]. Ryszard S, Romaniu and Jerzy Gajda (2013). LASER Technology and Application 2012, International Journal of Electronics and telecommunications, vol.59, pp.195-202.
[7]. Priyadharshini.R, Ramya.S, Kalaiyarasi.S, Kalpana Devi. S "A Novel approach in Identification of Blood group using Laser Technology" IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163.
[8]. Mehdi HasanTalukder, Md. Mahfuz Reza, Mahbuba Begum, Md. Rabiul Islam, Md. MahmudulHasan, "Improvement of Accuracy of Human Blood Groups Determination using Image processing Techniques", (MBSTU) Santosh, Tangail, Bangladesh IJARCCE *Vol. 4*, Issue 10, October 2015.