Automatic Blood Group Classification Based on SVM

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Abstract- **This paper presents a methodology for classification of blood type using image processing technique which uses support vector machine as classifier. Investigation of blood type is most important before administering a blood transfusion in an emergency situation. Numbers of systems were invented to automate these tests; most of them are unable eventually for emergency situations. At present, Plate test procedure carried out manually in laboratory by technicians for human blood group diagnosis. Recent procedure consumes time in determination of blood type. And as it is carried out manually it also tedious with large amount of blood samples which may cause wrong results. Some of the disadvantages like non standardized accuracy, Slowness are appears in manual testing. The intention of this work is to classify blood groups automatically using support vector machine and provide results in shortest possible period with precision and accuracy.**

Index terms- **Blood type detection, Image processing, GLCM, SVM classifier.**

I. INTRODUCTION

It is mandatory that everyone must know their blood group. The blood group must be determined previous to administering it to any individuals In Blood transfusions. In accordance with current system, these tests are executed manually by laboratory technicians. Large amount of blood samples for testing may leads to erroneous results because of manual testing. To automate the blood typing, number of systems have been developed but are not able to perform in crisis situations. The methodology in this paper categorizes blood group automatically with support vector machine (SVM) as a classifier that classify blood groups without manual errors with a fast response time.SVM is best-known technique in pattern classification and image classification. Work is intended to accomplish results in shortest possible time with correctness.

For that, slide test is processed and captured the images after test and noticed the event of clumping that is agglutination. For slide test one drop of blood and one drop of each reagent, anti-A, anti-B, and anti-D, is used and result interpreted according to the occurrence or not of agglutination after mixing blood with reagents. The agglutination reaction is reaction occurred between the antibody and the antigen, indicating the presence of the antigen appropriate. This agglutination reaction decides the blood type of the person. The Support vector machine (SVM) classifier used in this system. All the information is stored in a database. The aim of system is to provide results with correctness in shortest possible duration without human errors. It is helpful in crisis situations.

II. METHODOLOGY

The main aim of this system is to categorize blood group of human being with precise and accuracy without manual errors within small interval of period. Figure 1 depicts block diagram of system.

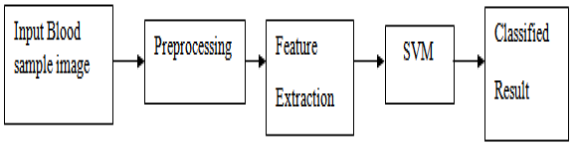

Fig 1: Block Diagram

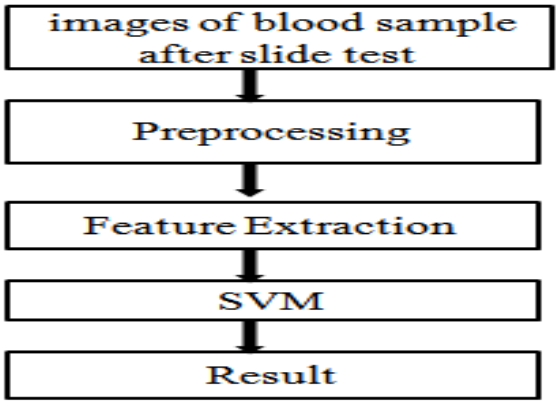

Fig 2: Flow Chart

The following steps are performed in this system as revealed in figure 1.
Step 1]: Collect raw images of blood samples from laboratory and internet.
Step 2]: Conversion of "color image" to "gray scale images.
Step 3]: Execute feature extraction operation.
Step 4]: Categorize data using Support Vector Machine (SVM).

A. Data collection: Collection of all types of blood samples is first step in system. 8 different types of blood groups are present : A +ve, A –ve, B +ve,B -ve,AB +ve,AB -ve,O +ve,O –ve etc. Near about 100 different types of blood samples used to train in this system which is known as trained data set. Figure 3 give a picture of 8 different types of blood groups.

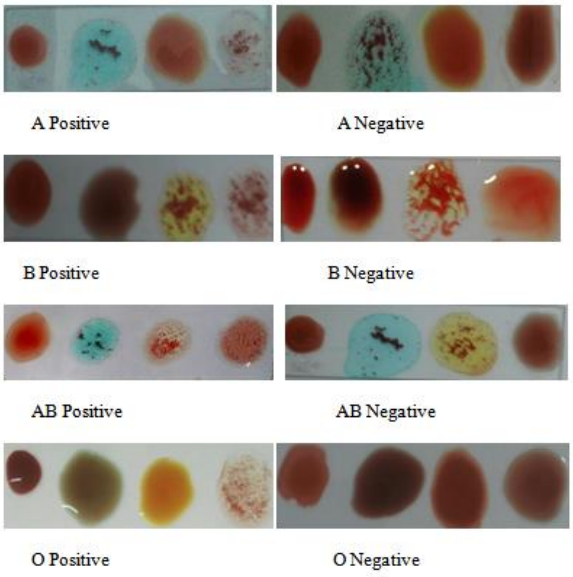

Fig 3: Blood samples

B. Preprocessing: The next step is preprocessing. It contains conversion of color image to gray scale image and it uses local binary pattern and calculate histogram as shown in figure 4 and 5.

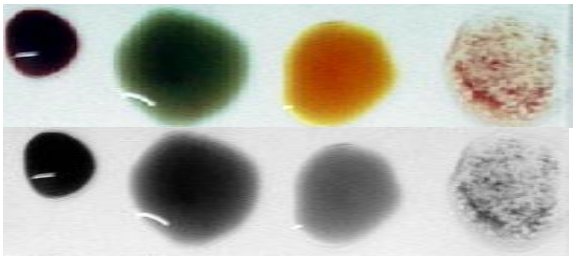

Fig 4: Gray scale conversion

C. Feature Extraction: different features like contrast , correlation , energy, homogeneity, mean, standard deviation, entropy, RMS, variance, smoothness, kurtosis, skewness are extracted in this system. Gray level co occurrence matrix is used for feature extraction.
I) GLCM:
The GLCM functions exemplify the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship take place in an image, creating a GLCM, and then extracting statistical measures from this matrix. The graycomatrix function creates a gray-level co-occurrence matrix (GLCM) The number of gray levels in the image determines the size of the GLCM. By default, graycomatrix uses scaling to decrease the number of intensity values in an image to eight, but you can use the NumLevels and the GrayLimits parameters to manage this scaling of gray levels. Graycoprops used to extract feature information (e.g., contrast, correlation, energy, and homogeneity) from the GLCM.
Different features can be extracted using GLCM as follows:

1) Contrast: measures local variations in GLCM.

$$Contrast = \sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} |i-j|^2 p(i,j)$$

where i, j are the spatial coordinates of the function p (i, j), Ng is gray tone.

2) Correlation: measures the joint probability occurrence of specified pixel pairs.

$$Correlation = \frac{\sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} (i,j) p(i,j) - \mu_x \mu_y}{\sigma_x \sigma_y}$$

3) Energy: Energy is also called as Uniformity or Angular Second Moment. It is the sum of squares of entries in the GLCM Angular Second Moment measures the image homogeneity.

$$Energy = \sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} {p_{ij}}^2$$

4) Homogeneity: dealing with the closeness of the distribution of elements in the GLCM to the GLCM diagonal.

$$Homogeneity = \frac{\sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} p_{ij}}{1 + (i-j)^2}$$

5) Mean: Calculates average intensity available in image.

$$Mean = \sum_{i,j=0}^{Ng-1} (i,j) * p_{ij}$$

6) Standard Deviation: S.D. gives desperation of pixel intensity from mean value

$$S.D. = \sqrt{\sum_{i,j=0}^{Ng-1} ((i,j) - M)^2 * p_{ij}}$$

Where M is Msean.

7) Entropy: Entropy demonstrates the amount of information the image that is needed for the image compression. Measures the loss of information or message in a transmitted signal and also measures the image information.

$$Entropy = \sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} -p_{ij} * \log p_{ij}$$

8) RMS: computes root mean square value of image.

$$X_{RMS} = \sqrt{\frac{1}{N} \sum_{n=1}^{N} |X_n|^2}$$

9) Variance: Square of standard deviation is variance; which is also recognized as the normalized second order moment of the image.

$Variance = \sum_{i,j=0}^{Ng-1} ((i,j) - M)^2 * p_{ij}$

10) Smoothness:

$1 - \frac{1}{(1+a)}$ Where a is sum(double(image))

11) Kurtosis: Kurtosis is a determination of how outlier-prone a distribution is. The kurtosis of the normal distribution is 3. Distributions that are extra outlier-sprone than the normal distribution have kurtosis greater than 3; distributions that are less outlier-prone have kurtosis less than 3.

$Kurtosis = \frac{1}{\sigma^4} \sum_{i,j=0}^{Ng-1} (i,j) - M)^4 * p_{ij} - 3$

12) Skewness: Skewness is a calculation of the asymmetry of the data around the sample mean. If skewness is negative, the data are spread out more to the left of the mean than to the right. If skewness is positive, the data are spread out more to the right. The skewness of the normal distribution (or any perfectly symmetric distribution) is zero.

$Skewness = \frac{1}{\sigma^3} \sum_{i,j=0}^{Ng-1} (i,j) - M)^3 * p_{ij}$

Where M is mean, σ is standard deviation

D] SVM: Support vector machine is one of the classifier used in this system to classify different blood groups. SVM maps the Feature vector into higher dimensional feature space, and afterward create an isolating hyperplane with highest margin to collect the GLCM fratures. highlighted pixels held by SVs used to create margins. Whereas higher dimensional space defined by kernel function.SVM model symbolize examples as a point in space. The examples of contradictory classes are divided by clear gap. As shown in figure New examples mapped in similar space and forecast belongs to type. When Training/ testing data set modeled and categorized into more than 2 types or classes with svm then it referred as MultiSVM. Thus it classifies the test blood sample and predict category of blood sample among the eight different types of blood groups.

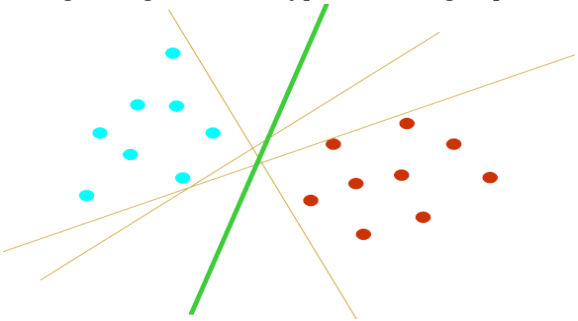

Figure 5: SVM separating hyperplane

Most noticeable advantages of SVM are:

- Vigorous with noisy data
- Less intensive
- Executes well in higher dimensional spaces.
- Lack of training data is frequently not a strict Trouble

III. RESULT

To determine the class of unknown blood sample, first of all the unknown test image is loaded and features were extracted. After comparing extracted features of unknown blood sample test images with trained data set; system predicted result that the test image of which group. Near about 20 test images are tested in this system. That classified correct blood group within time. Accuracy of blood group prediction may affect due to blurred images or low quality images. So that images should be clear.

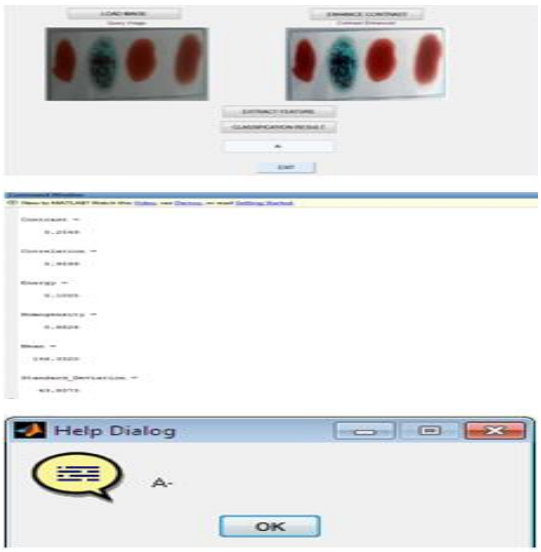

Fig. 6 : Test image1

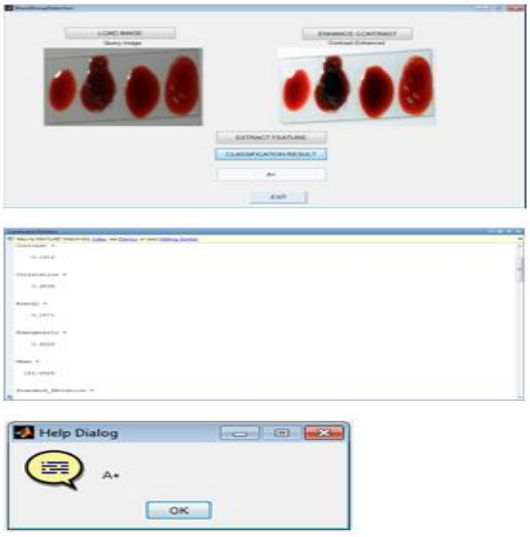

Fig7: Test image 2

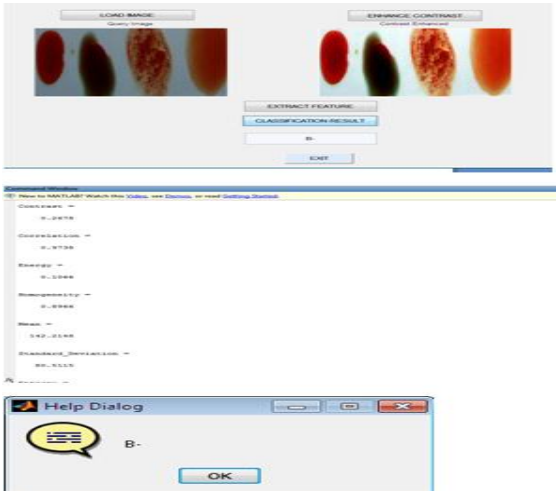

Fig8: Test image 3

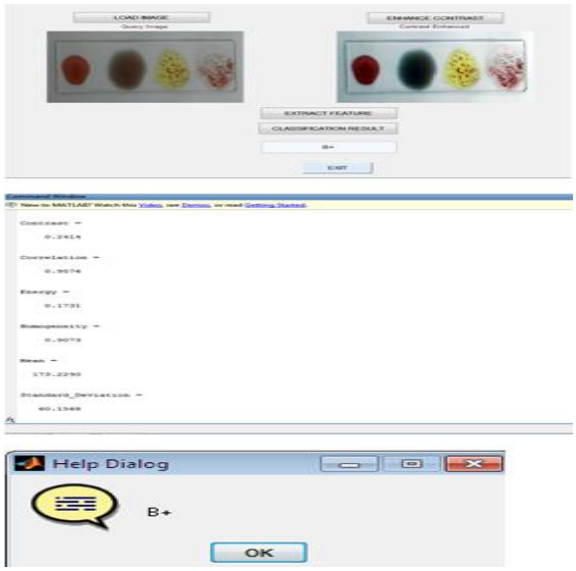

Fig9: Test image 4

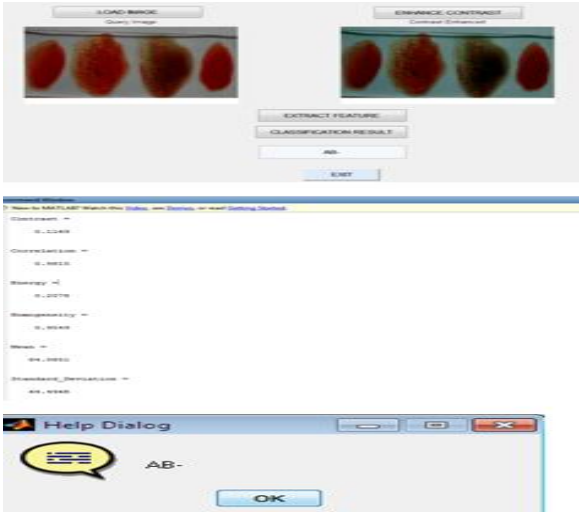

Fig.10: Test image 5

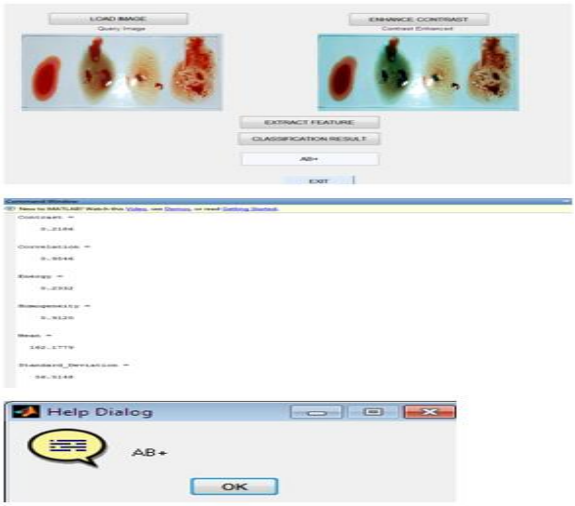

Fig. 11: Test image6

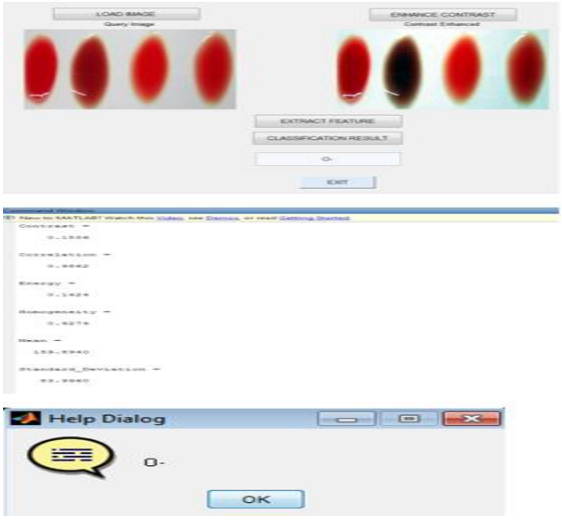

Fig. 12: Test image7

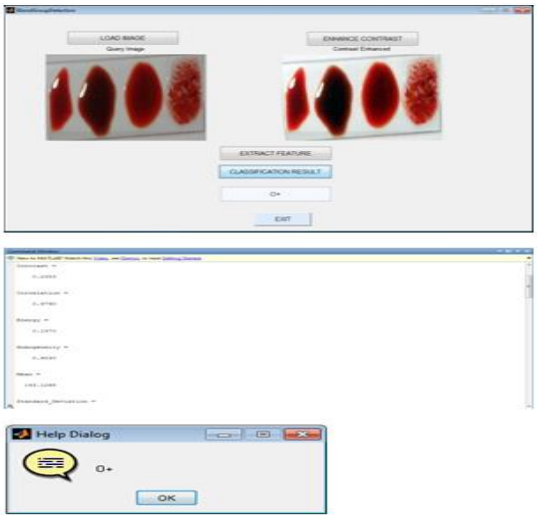

Fig. 13 Test image8

IV. CONCLUSION

The system classifies blood group of test image among eight different classes within small interval without manual errors. Near about 20 test images are tested and predicted exact blood group with the help of about 100 trained samples set. Poor quality images may produce wrong result so that images for train and test should be clear. Accuracy of system can increased with high quality images.

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