International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-3, September 2019

RGB Image Cluster Evaluation for Human Blood Group Identification by MLP Classification

Shridevi Soma, Pooja Yashwantaray

Abstract: ***Image processing is helping researchers to reach their goals in many ways, especially in medical fields. Blood organization is very important when it comes to receiving a blood exchange. The most important blood group identification method is ABO blood group system and the RhD blood group system. Blood groups are defined by the occupancy or preoccupied of a specific agglutinate on the get around of a red blood cell. Identifying the blood group is very important for medical treatment in pathological tests, at some point it gives us an inaccurate and also expensive result, therefore, to overcome these problems an efficient and optimal solution is required. The need for accurate detection is high in a disaster situation where there are no laboratory people or experts available to detect the type of it. In the proposed method, we have collected 50 blood sample images for each of 8 blood groups, total 400 blood sample images are considered for experimentation. In preprocessing, the median filter is used to eliminate noise from the blood images. Then these images are converted from RGB to grayscale conversion and also resizing of the images is carried out. Region based segmentation by using two methods Markov Random Field and Region Adjacency Graph are used for segmentation, texture, color, and shape features are extracted from segmented images. Hence this paper proposes a pixel cluster based analysis of the blood type based on the pixel analysis features. The overall accuracy of blood group determination is 93.85%.***

Keywords: ABO blood image, preprocessing, Region based segmentation, Feature Extraction, MLP classifier.

I. INTRODUCTION

The country needs between 8 and 10 million units of blood each year, but also less than 5.5 million units, in addition to 94% of blood donation by men, while women donate only6%. The study of previous literature [1, 3, 5, 6, 8, 12] was based on the detection of blood group using image techniques and the use of SIFT and SVM classifier to determine the blood group. [2] Ana Ferraz.et. al. their paper proposed that, the blood group can be find using image processing using LAB VIEW and IMAQ range of view. To determine the blood type in the classification algorithm. Results of their experiments show that the computerized system has been developed but is not fully mechanized because the slide test is done manually and it takes longer to process the image. [3] NarkisBanu et. al has proposed the blood group search system for multiple patients at a one stretch. Blood samples are collected from several people and blood samples are inserted inside the tube with circular preparation and the engine is placed under the tube. All funnel images are catch with the photographic equipment and motor rotation. Image processing techniques were also used to determine the type of blood, but a long process is needed to determine the type of blood. [9] Gaurav S.Mehare et al. In their paper to determine the human blood in an emergency using the plate method. At present system, the detection procedure is very down. Currently, human blood type are identifying manually by performing a slide test. To collect blood groups by adding reagents and identifying blood aggregation. The results are examined microscopically. The objective of this research is to provide a scheme to identify the blood groups. [10] Gayathri T, Rekha M, et al. It has been proposed to determine the type of non-invasive blood using LED to determine the specific wavelength of the LED that acts as a light source and allows it to fall on the finger. The optical detector is used to obtain the finger signals obtained from the finger. According to the optical properties of the blood group, the detector determines the value of the various voltages. Therefore, differences in blood group voltage are determined. This process is very easy and it is compatible to determine the type of blood in a small amount of time. [11] S.M.Nazia Fathima et. al. In this automatic system, the colored microscopic images are identified. First, you preview the image by matching the graph and the color correction and then converting the color space to RGB to HIS conversion. Then, remove the color and texture of the images using the accumulated graph and the click procedure, severally. Finally, the blood type of the opposite person can be analyzed using a vector support device. The most qualified people are required to drive, which is hard. [14] Prof.R.A.Rathod et al. In, suggested idea is to return manual work in clinical observation to cause the type of blood. Currently, although high technology plays a small role in all medical organization, there is no device obtained to automatically find the blood group. In general, blood type analysis is performed by laboratory technicians.

Manuscript published on 30 September 2019
* Correspondence Author
Dr. Shridevi Soma*, Professor, Department of Computer Science and Engineering, Pooja Doddappa Appa College of Engineering, Kalaburagi (Karnataka), India.
Pooja Yashwantaray, M.Tech., Department of Computer Science and Engineering, Poojya Doddappa Appa College of Engineering, Kalaburagi, (Karnataka), India

They use the following methods to analyze blood type. If there are three techniques, the ABO and Rhesus type tests are mainly used in all medical experimentation. In the ABO test, The agent is mixed to the blood and, determined on the reaction into the immunizing agent and immunoglobulin, the recognition is made. In the type of Rhesus test, the type of effective and ineffective blood can be find. It is easy to detect, but when conduct with a huge number of samples, it is tedious to do and can also lead to a defective investigation. To control these difficulties, the present LASER mechanism is used. It hang on the rules that the quality of the laser changes due to the appearance of clusters in the blood sample, which in turn changes the density of the blood sample. This difference was detected by the level of photovoltaic activation. The detector must be output in form effort to be provide to the comparison that determines the type of blood using an integrated controller.

Blood transfusion is necessary through the use of certain tests. These tests determine if the donor's blood type is compatible with another user. In some emergency situations, it is a matter of life. A negative blood type is a universal negative donor for any user who consumes this type of blood. ABO: - It is an important system of human blood cells, which are the genetic characteristics of blood cells according to the antigen factor A and B. In response to the fight against the disease. Speed and unambiguous identification of blood types is critical in emergencies. The most important Rh antigen is the D antigen. Usually, the process of collect blood products into the bloodstream through a vein. The various medical institutions will maintain blood transfusions and to replace missing blood components. The liquid from one vessel to another contain whole blood, but currently they only use blood components that contain red and white blood cells, plasma, clotting factors and platelets.

II. PROPOSED METHODOLOGY

In this proposed work, the samples of blood collected from laboratory, it consisting of colored images. On white plate to put the sample and to mix it with serum antigens and to take a picture of sample. After the MATLAB toolbox to help for further processing to images. It will be stored on particular folder to these images. With this system, the chances of human error can be reduced. The system can process the image and it will give the final result. The steps involved in image processing techniques are shown in Figure 1.

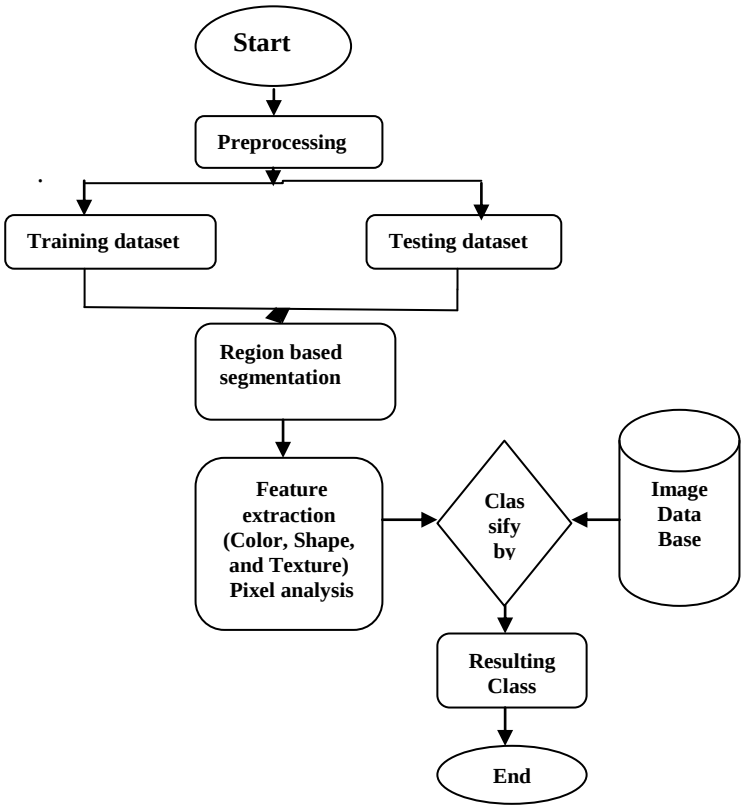

Figure-1: Steps of Determination of Blood Group.

A) IMAGE ACQUISITION

Getting images is the most important prerequisite in image processing. We collected 50 blood samples for each group of 400 samples. The blood samples are kept on the white paper and the images are taken under the light spot setting by the digital camera. Digital images of blood samples are obtained from the hospital/laboratory consisting of a color image consisting of blood samples as shown in Figure2.

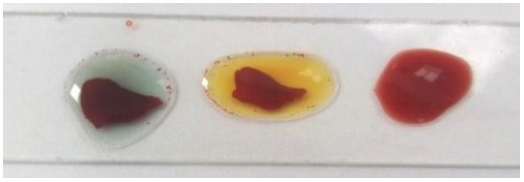

Figure-2: Original Image

The image is in JPEG format. The main reason for JPEG format is, it compresses the image while storing and it converts image into bitmap image. Bitmap image is just an uncompressed image, it means that while processing the bitmap image is considered and all the processing is performed in this bitmap image.

B) PRELIMINARY-PROCESSING OF IMAGE

It is a common procedure for images composed of a kind of impurities or noise. The goal of processing image is to improve data that prevents unwanted noise or increases some image quality. It also eliminates noise from the image which is a contrast in brightness or color information. Pre-processing retains edge information for further processing. In the proposed method, medium filter techniques are used.

i) Median Filter

The mid filter is used to eliminate noise and it is nonlinear digital filtering technique. It is filter out which blocks the high frequency content of the image (mainly boundaries) and allow the low frequency content two pass through it. Median filtering is very widely used as it conserves edges while eliminating noise mainly salt and pepper type noise.

ii) Gray Scale Conversion

The color image can be viewed as three images (red green, blue) .The combined of three color images convert to gray scale images. Gray scale is a range of monochromatic shades from black means zero intensity and white means full intensity to be measured, it have gray color or no color. Figure-3 shows conversion of RGB to Gray scale Image.

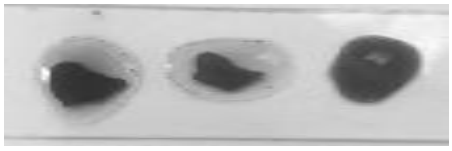

Figure-3: Conversion of RGB to Gray Scale Image.

iii) Resizing of Image

Image resizing is an important role in image processing technology, to expand the size of the selected image and pixel format. When you need to resize the image to increase or decrease the total number of pixels, while you can reallocate or rotate an image. When you zoom in to increase the amount of pixels.

C) REGION BASED SEGMENTATION

Image fragmentation is a commonly used technique for processing and analyzing digital images to divide the image into multiple parts or Regions, often based on pixel properties in the image. Image fragmentation may include chapter foreground background, or group pixel areas based on similarities in color or shape as shown in Figure- 4.

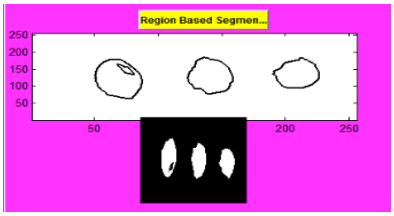

Figure-4: Region based segmentation.

i) Region Growing: Area growth is a procedure that assembles sub-regions into larger regions, with the starting point. These regions to increase by join each seed point to nearest pixels with their properties (gray scale, texture, shade, and structure).

ii) Markov Random Field

The random markov field is that the information in the local physical shape of the images is sufficiently defined to define a good description of the image. The image density of a specific position depends on a region of pixels only.

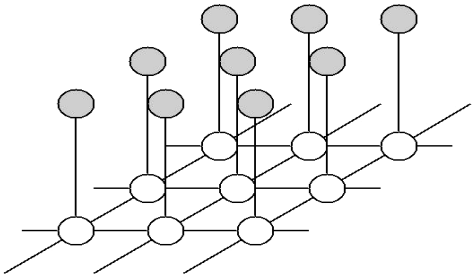

Figure- 5: MRF for image restoration

In Figure 5, the structure of an markov field that could be used for the establishment of the image. Variables exactly to recognized data can be include into the model. The values of white nodes represent real pixels that will unknown and the noisy pixels represent the gray nodes. Note that the latent variables are connected to their neighboring pixels, but the data points are connected to only one latent variable. This models our belief that the estimated pixel values should depend on both the noisy data and the estimated neighboring pixel values.

iii) Region Adjacency Graph

RAG represents a non-routed weighted graph inherited from the network graph. When a new node is formed by combining two nodes, the edge weight of all the incident edges in the resulting node can be updated by a user-defined function.

The area's adjacent graphs, as its name indicates, represent the boundaries of the regions in a graph. The node in graph that will be region of each image. There is a surface between each pair of adjacent areas.

D) FEATURE EXTRACTION

In the proposed work total of 12 features are used to describe the image in the feature space. Feature extraction techniques are applied to obtain the feature that will be useful for image classification and recognition.

The method of extracting high-level neural network (NN) is used to extract the property in several layers.

1. For Texture

a) Correlation: Perfectly +ve image correlation value = 1, perfectly negative image correlation value = -1. This calculation of the pixel will be passes over the whole image$A = \pi r^2$ to get the linear.

$$\text{Correlation}=\sum_{i,j=0}^{n-1} Pi,j\left[\frac{(i-\mu i)(j-\mu j)}{\sqrt{(\sigma i^2)(\sigma j^2)}}\right] \quad (1)$$

(b) Energy: The energy makes use of texture which will result in the sum of square elements in GLCM. Square root of angular 2nd moment based on the texture termed as the energy.

$$\text{Energy}= \sum_{i=1}^{Ng}\sum_{j=1} P^2 d(i,j) \quad (2)$$

2. For Shape

(a) Area: Number of white picture elements in the image.

Area= Length× Width (3)

(b) Perimeter: It is defined as the length around the partition of the region.

Perimeter=2×Length+2×width (4)

(c) Form factor: Scattering of white pixels within the bounding box.

$$\frac{4\pi \times Area}{Perimeter^2} \quad (5)$$

(d) MajorAxisLength: The length of the main axis of the ellipse that is the same as the second central moments of the region.

(e) MinorAxisLength: The minimum axis length of the ellipse that has the same usual second central moments as the region

(f) Rotundity $= \frac{4 \times Area}{pi \times MajorAxis^2}$ (6)

(g) Density: Density is defined as the area of the white pixel inside the bounding box. The ratio between the area of the white pixel inside the bounding box and the area around the square:

Density= $\frac{Area\ of\ white\ pixels\ within\ bounding\ box}{Area\ of\ bounding\ box}$ (7)

(h) Convex hull: It returns the set of convex hull points in 2D or 3D space.

E) PIXEL ANALYSIS

Using this information on the coordinates of the beginning and end of the area, we can easily crop the area of interest (blood mixture of area). Using a simple loop process and we can divide our treated image for further processing. We detect blood type using two properties of the segmented image mentioned. Calculating the white pixel length for each fragmented area (the area of the white pixels) in the first place.

Then calculate the total number of objects (elements) in each segmented image that clearly identifies the two areas that the distorted blood area must contain less white pixels (mean less red components) and must contain more elements in the image. Using these two features, we can easily detect the deformed part of the split image. The figures depict the original captured images and the divided images of all types of blood groups.

.

F) MULTLAYER PERCEPTION FOR IMAGE CLASSIFICATION

In the proposed system of traffic sign recognition the classification method has been performed by using field forward artificial neural network model like a multilayer perceptron.

This model assigns the input data set to the appropriate output set. The multilayer to be composed of the number of multilayer nodes in a graph manage between them, each of these layers are connected to each other, accept the input layer, each of these known layers are the neurons that are the processing units.

MLP uses a supervised learning process of the classification known as Back Propagation Model. Each of the layers takes the input from the system and forwards the data to the output which will indeed the process the system based on the recent data.

1. TRAINING

Database training folder consist 400 blood samples. The features are trained in the similar way as mentioned above. The feature values will be stored on STATS folder. Based on pixel analysis it will classify ‘C’ & ‘F’ to identify the blood group.

2. TESTING

To test all the images using median filter, segmented using (MRF, RAG), feature extracted (color, shape) and for classification using MLP.

III. RESULT AND DISCUSSION

The techniques are implemented using MATLAB. Total of 400 images are collected to create database. Total 8 blood groups per each 50 images are collected total 400 images to get the all the results. The result of each stage of image is as shown below,

A) PRE-PROCESSING

Pre–processing is an improvement of the image data that suppresses unwanted distortions or enhance the image. Figure-6(a, b) shows the original and denoised image respectively.

Figure-6: a) original image b) Denoising image

B) SEGMENTATION (MRF & RAG)

To divide an image alive regions. When a region based technique beginning in the inside of an object and then “growing” outward until it encounter the object boundaries. Region based segmentation is determining the region directly as shown in Figure 7.

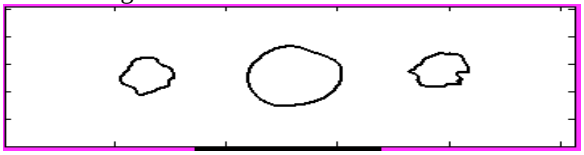

Figure-7: Region based segmentation

C) FEATURE EXTRACTION (color, shape)

It is very important technique is applied to get features that will be useful in classifying and recognition of images. Figure-8 shows the result of feature extraction of image.

Figure-8: Feature Extraction of image

D) PIXEL ANALYSIS (C&F)

Beginning and end coordinates of the region; we can easily remove the area of interest (the blood mixture area) using a simple loop process and we can divide our treated image for further processing. We detect the blood type using two characteristics of the fragmentary image: Clumping and Filling. As shown in Figure 10**.**

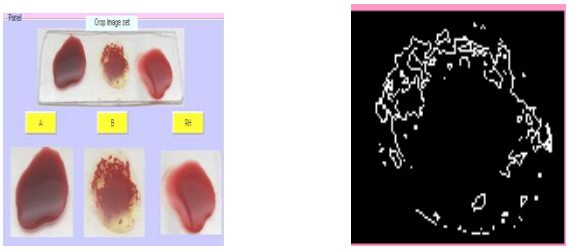

Figure-6: a) original image b) Denoising image

i) Clumping: we take the blood samples and to add the reagents, to live two seconds after the reaction of that, it is process of the antigen is mixed with corresponding antibody. The resulting image is as shown in Figure 11(a).

ii) Filling: To add the reagents with blood, but it's not reacted means the antigen is not mixed with corresponding antibody. Figure 11(b) shown the process of Clumping and Filling.

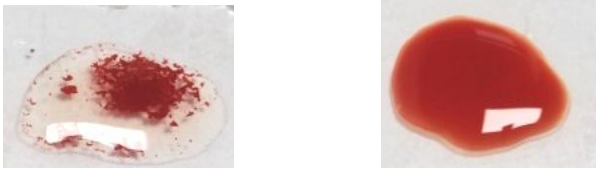

Figure-11 : (a) Clumping (b) Filling

We are detecting the blood group by using two properties from the segmented image which are Clumping and Filling. Table-1 gives the details of train and test images the accuracy of every class of blood image is also shown in Table-1.

TABLE 1. DETAILS ABOUT THE BLOOD GROUP WITH THEIR ACCURACY

Classes	Training	Testing	Correctly Classified	Incorrectly Classified	Accuracy(%)
Class-1	200	200	194	6	97
Class-2	150	100	92	8	92
Class-3	50	100	93	7	93
Class-4	50	90	82	8	91
Class-5	200	150	144	6	96
Class-6	100	150	145	5	96
Class-7	50	150	138	12	92
Overall Accuracy					93.85%

E) ACCURACY CALCULATION

We have calculated accuracy by considering 400 blood samples per each group 50.

$$\text{Accuracy (\%)} = \frac{\text{Correctly Recognized bloodsamples}}{\text{Total number of blood samples}} * 100$$

a) The graph of overall accuracy with training and testing blood samples is as shown in Figure-12.

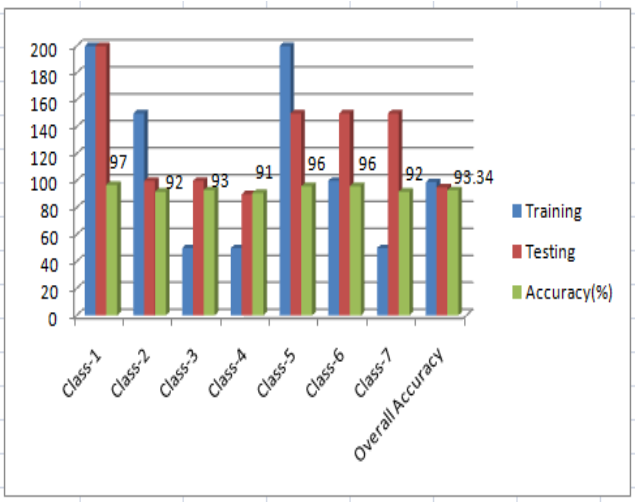

Figure-12: Overall Accuracy of Training & Testing blood samples

IV. CONCLUSION AND FUTURE SCOPE

In this paper blood group identification and classification method is developed by considering seven blood classes. The blood sample images are preprocessed and region based segmentation is used to enhance the images and extract the region of interest that is background. Texture, shape and color features are extracted. These features are trained. The images are classified using multilayer feed forward network. From the experiment it is observed that MLP classifier performs better with an overall accuracy of 93.85%.The future work will be able to use the sensor devices to recognize the type of blood in live scenario.

REFERENCES

1. Amol Dhande,"Identifying the blood group using Image Processing" on 2018 International Research Journal of Engineering and Technology.vol 5, pp 2639-2642.
2. Ana Ferraz, "Automatic System For Determination of Blood Types Using Image Processing Techniques" on 2013 IEEE 3rd Portuguese Meeting in Bioengineering.
3. Narkis Banu,"An Automatic System To Detect Human Blood Group Of Many Individuals In A Parallel Manner Using Image Processing" on 2018 International Journal of pure and Applied Mathematics.vol 118,no.20, pp 3119-3127.
4. Mr.Sudhir G. panpatte, "Application of Image Processing for Blood Group Detection" On 2017 International Journal of Electronics, Communications and Soft computing Science and Engineering. pp 61-65
5. Abu-Bakr Y amin, "Image Processing Based Detection and Classification of Blood Group Using Color Images" on 2017 International Conference on Communication, Computing and Digital Systems.
6. Malhar Bhatt, Shashi Prabha, "Detection Of Abnormal Blood Cells Using Image Processing Technique" On 2015 International Journal of Electrical and Electronics Engi`neers.vol 7, pp 89-94.
7. Ana Ferraz, Filomena Soares, " A Prototype For Blood Typing Based On Image Processing" On 2013 Fourth International Conference On Sensor Device Technologies and Applications.vol 3,pp 139-144.
8. Enes Ayan, ErdemKamilYildirun, "Real Time Blood Type Determination by Gel Test Method on an Embedded System" On 2016 International Journal of Applied Mathematics, Electronics and Computers.vol 5,pp 412-415.
9. Gaurav S.Mehare, Chetan G.Pinjarkar, "A Non Invasive Blood Group Detection Based on Light Emitting Diode" On 2018 International Research Journal of Engineering and Technology.vol 5,pp 2040-2043.
10. S.M.NaziaFathima,"Classification of Blood Types by Microscope Color Images" On 2013 International Journal of Machine Learning and Computing.

AUTHORS PROFILE

Dr. Shridevi Soma M.Tech, Ph.D., Author working presently as professor in Department of Computer Science and Engineering, Pooja Doddappa Appa College of Engineering Kalaburagi, Karnataka, India. She has 18 years of Teaching and 10 years of Research Experience, and completed her B.E, M.Tech. and Ph.D. in Computer Science and Engineering. Her Research Area includes Digital Image Processing and Pattern Recognition, Cloud Computing, Internet of Things, Big Data Analytics. She published more than 30 Research papers in above mentioned areas, also Guiding Research Students.

Pooja Yashwantaray is currently pursuing M.Tech. in Computer Science and Engineering from the Department of Computer Science and Engineering at Poojya Doddappa Appa College of Engineering, Kalaburagi, Karnataka, India.