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ROI Based Pixel Segmentation for Human Blood Type Classification by Neural Network

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Abstract— In the modern times digital image processing technology used by the end users has been in the interest as it provides the easy solution to the complicated issues. Like face recognition, image classification etc. We have proposed the concept of blood group type detection using image processing techniques based on the input images. It will be very difficult to detect the type of the blood to any end user. The need of the accurate detection is high in disaster situation where no lab or expert persons are available to detect the type of it. Hence we have proposed a pixel cluster based analysis of the blood type based on the Region Adjacency Graphs (RAG) and Super Resolution Mapping (SRM) with pixel analysis and Region of interest (ROI) based image segmentation. Later the use of neural network will help to classify the image based on the pixel analysis features. The proposed system results were obtained by using MATLAB. Successful results were obtained and accuracy of the proposed system is most desirable.

Keywords— Blood type detection, Image segmentation, Pixel analysis, Neural Network

I. INTRODUCTION

The blood transmission is necessary has to performed by using the some of the tests. These tests will determine the donor blood type is compatible to the other user or not. In some of the certain emergency situation when it's a question of life, it is necessary to supply the blood immediately. The O-negative type of the blood is considered to be the universal donor will allow any user to consume this type of the blood. The compatibility of the blood type is different which can be tabled as follows. The humans who will be in need of the blood in the situation where the labs are not available than the works like blood type detection based on the image only will help a lot.

Table 1. Blood Type Detection Standard

Anti-A	Anti-B	Anti-C	Blood Type
0	0	1	O – Positive
0	0	0	O – Negative
1	0	1	A – Positive
1	0	0	A – Negative
0	1	1	B – Positive
0	1	0	B – Negative
1	1	1	AB – positive
1	1	0	AB – negative
1	1	1	Not Valid

Blood type is classified based on presence or the absence of inherited antigenic substances which will be on the surface of red blood cells (RBC). These may be the glycoproteins, proteins, carbohydrates or glycol lipids based on blood group system. In India blood deficit is around 30-35% yearly. The country needs 8 to 10 million units of blood yearly but the supply is only 5.5 million units. The 94% of blood donation is by the men while women percentage is just 6 [1].

Figure 1. Blood sample

In recent times the detection of the blood group in the area of medical science is in the lab manual only. The blood samples as above figure 1. is collected and performed some operation by the chemicals which will give the result. But in emergency situations like accidents the supply of the blood is very urgent, hence there is a demand for the blood type detection methods by using the images will help the needy human beings.

The objective of the proposed work is to provide a solution to recognize the blood type based on the images taken as input. The system should be able to detect the type of the blood based on the image sample given.

Rest of the paper is organized as follows, Section I contains the introduction of blood type detection using different image processing techniques, Section II contain the related work of blood type detection and its corresponding methods, Section IV contain the methodology with flow chart and implementation steps, Section V describes optimal results and analysis of result accuracy, Section VI concludes research work with future directions.

II. RELATED WORK

Osareh, Alireza [2] stated that the blood group identification is very important criteria in the real world. Images of the human blood samples collected by using the digital cameras and in the condition of the laboratory which consist of a color image which is composed of generally 3 samples of the blood. Use of the ada boost classifier will help in accurate detection.

Veropoulos, K and Campbell [3] proposed the Automatic system which will be capable of tests in a short time, adapting for any 6 type of the emergency based accidental situations. IMAQ Vision from National Instruments has been adopted to extract the features of the slide test similar values.

Yun, Lim Cho and Ng [4] specifically discussed the Diabetic Retinopathy by using Retinal Images for the patients who starts to deteriorating in the vision day by day which is a symptom of diabetic retinopathy where the blood vascular are segmented by utilizing difference in between the blood vessels contrast and the surrounding background. Around an efficiency of 88.46% has been achieved.

E. A. Henneman, G. S. Avrunin [5] discussed the detection of blood types without any involvement of the human and the human errors which is much more essential and the proposed methods such as the threshold of image and morphological based operations has been used

F. Ana, C. Vitor [6] proposed the automated system which will be used to detect the blood type based on the image processing techniques in the RGB color scale valise. The system will be efficient to detection and classify by using the methods like histogram equalization at an accuracy of 95.

Ferraz, Ana [7] proposed based on the color images the detection of the blood type has been proposed by the author in this work. When there is no availability of the expert persons the use of digital image processing based blood type detection will be an important factor. A min of 10 image of the dataset has been used by the author from every possible blood group type the results are compared by the user in the manual way which was much accurate and efficient and error free.

III. METHODOLOGY

The proposed method for the detection of blood group from collected blood samples consists of four consecutive methods (Figure 2).

1) Image acquisition
2) Image pre-processing
3) Image feature extracting
4) Image classification decision making

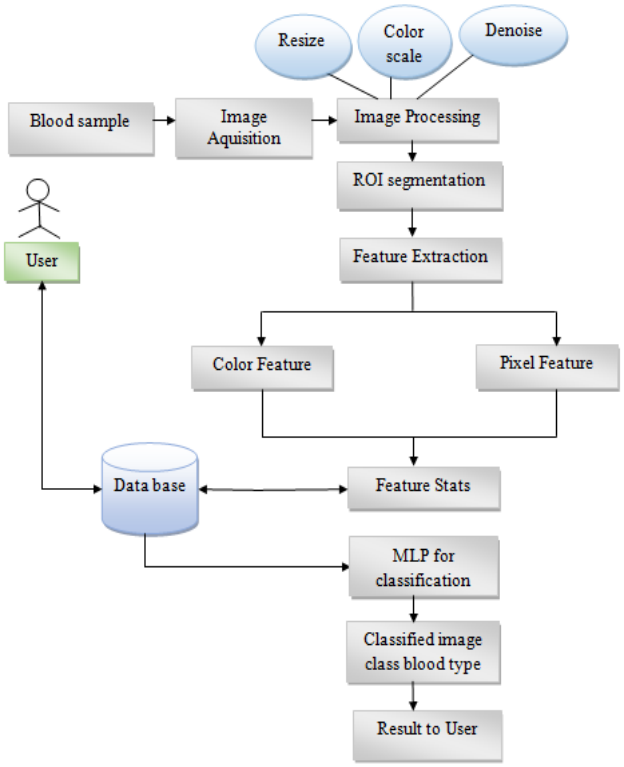

Figure 2. Flow Diagram for detection of blood type

The methods are explained in brief in the following main sections,

A. *Image Acquisition*

It is a process of acquiring the images from the resources figure 3 stored in the remote or the nar by location. The matlab provides the specific function for the image reading as imread() , which is a in built function. It is done by the following modes.

- Image recognition
- Capture
- Store

Figure 3. Image collected at lab by digital media

B. Image Pre-processing

Images pre-processing method consist of two steps:

1) *Image –processing:* In this step the image is read and reconstructed for further process.
2) *De-noise image by DWT (Discrete Wavelet Transform):* In this step image is resized and gray scale conversion is made (Figure 4).

Figure 4. RGB to HSV space image

Discrete Wavelet Transform is accordance to a sub band coding; it was set up for the speedy computation of Wavelet Transform. The major advantage of Discrete Wavelet Transform is that it is effortless to implement and reduce the instant management for the resources [8]. The Discrete wavelet transform is as shown in figure 5.

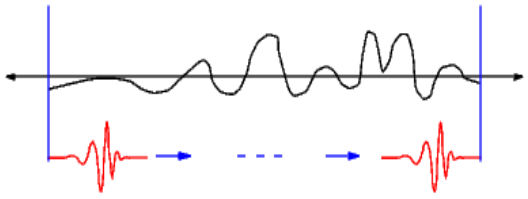

Figure 5. Non-linear De noise by DWT

C. ROI based image segmentation

We use a hierarchical structure based, region based approach for image segmentation by combining of the detection and image segmentation.

- We use a energy function in our model to decompose the given seen image into semantically consistent region 'K'. Each of the image pixels 'P' in the image 'I' belongs to the unique region in the image this is identified by region corresponding variable (RP)(1).
- The Rth region is nothing but a set of pixels PR (2) whose regions corresponds variables is equal to R. We use P and R to denote the pixels and R and S to denote the regions.

Hence, the facts can be stated as follows:

$$Rp \in \{1.....K\} \quad --------(1)$$

$$Pr = \{P : Rp = r\} \quad ---------(2)$$

Hence, we allow the object to be decompose in to number of regions 'n'. Some of the regions which may not belong to be regions denoted by 'Or'(3). The group of pixels which have liking regions Oth object which denoted by 'Po' (4)(5).Hence, mathematically these can be expressed as follows.

$$O r \in \{\emptyset ,1.....N\}----------(3)$$

$$O r = phi \quad ----------(4)$$

$$Po = Vr : Or = o Pr \quad --------(5)$$

D. Feature extraction

In this process of Feature Extraction the blood type images are processed by using the method of feature extraction in two types as by texture and pattern by using the regionprop() function form the image processing tool box which is used for the image classification.

The image features are extracted from the image part of segmented. The functions used are **regionprops (), bwconncomp ()** methods. The connected components form the input image is extracted based on the 8 cc values. These connected co-ordinate values are passed for the **regionprops ()** for the feature extraction. With the help of GLCM (gray level co-occurrence matrix), pixels of pairs information is collected, occurrence of the pixel brightness in an image exhibits by the GLCM. The valued matrix is created at distance d=1 and angles which are represented in the degree ranges of (0, 45, 90,135) [9]. It provides the stats like the entropy, energy, contrast and correlation. For texture character profile such as smooth, silky, and rough GLCM is used. GLCM is prepared from the gray scale values and picks up the relationship between two neighbouring pixel at a time.

E. Pixel analysis

The use of the region starting and the region ending coordinates it will be easy to detect and extract the blood type of the core by using the simple loop operation and also we can segment the processed image in case of processing. Detection of the region of the blood pixel is mainly the two methods (Figure 6)

- Density of the pixels
- Scattering of the pixels

These two will give the pixel values accurately in the real time environment.

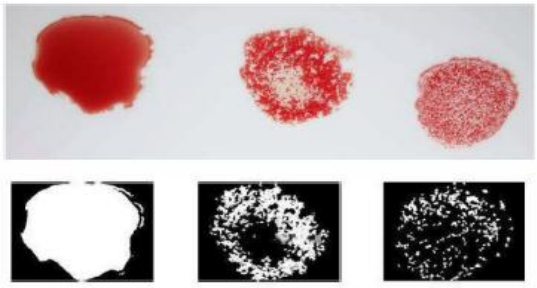

Figure 6. B Positive Blood sample original and segmented

F. *Neural Network (NN) Image classification*

In the proposed system of blood type recognition the classification method has been performed by using field forward artificial neural network model like a neural network.

This model maps the set of input data on to the proper set of output. The NN consist number of multiple layer nodes in a directed graphs among them each of these layers are connected with each other accept the input layer each are these known layers are as neurons are the processing units.
NN uses a supervised learning process of the classification known as Back Propagation NN 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.
Diagrammatical representation of the NN can be as follows (Figure 7).

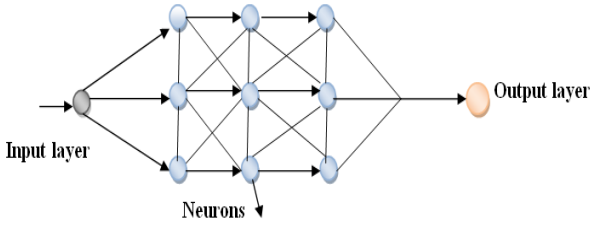

Figure 7. Diagrammatical representation of the Neural Network

The neurons which act as the functional unit, takes input from input layer process them and give the output to the system. Each of these functional modules performs Back Propagation Module based on the supervised learning process.

The learning process in perception will be performing by after every single data is processed and each of these processed data has been given with the learning data to the next layer. By this process perform iteratively each of the neurons in the next layer will get the knowledge from the previous layer and this process is continued till the end of the processing method. At the end with classified and processed result will be given to the user as resulting output [11].

IV. Results and Discussion

Results or output of the proposed system or the entire involves input image de noise, feature extraction, pixel analysis and detection of blood type using neural network is describe brief as follows:

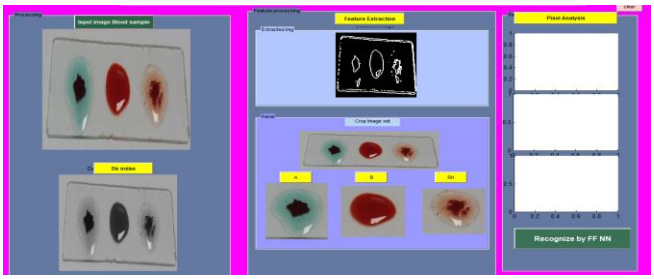

Figure 8. Output of feature extraction

Figure 8. is the output of input image feature extraction based on texture and pattern.

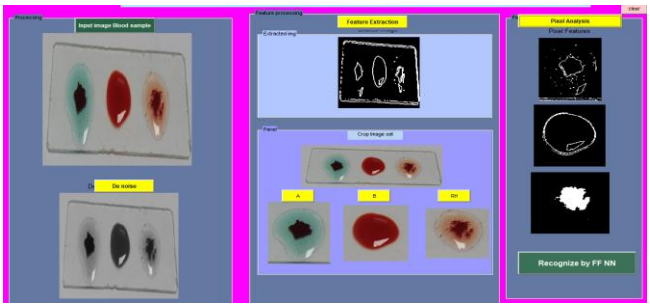

Figure 9. Output of pixel analysis

Figure 9. is the output of the pixel analysis based on the detection of region of the blood pixel, analysing by density and scattering of pixel.

Accuracy of the proposed system is plotted in the graph below figure 10. Each blood type is compared with trainig values and tested values as in the table 2., the proposed system outputs the more desireable result.

Table 2. Accuracy of training values and tested values

Blood Type	Training Accuracy	Testing Accuracy
A+	98	93
A-	97	91
B+	92	86
B-	89	88
AB+	91	84
AB-	89	85
O+	98	98
O-	99	97

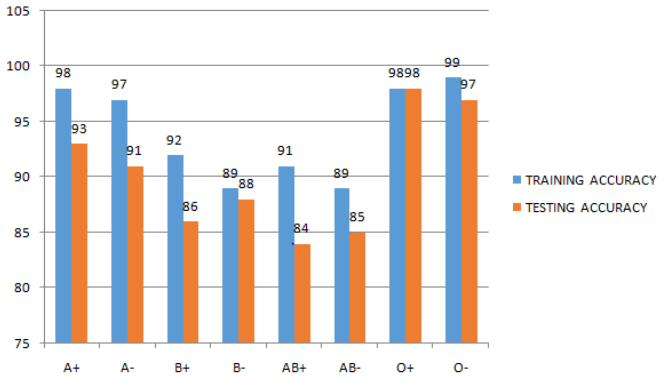

Figure 10. Accuracy of training and testing output values

V. CONCLUSION AND FUTURE SCOPE

In this paper we have proposed the blood group detection based on the image passed do it at simple level dataset. The proposed work will be able to process the image by using the DIP technologies by using the ROI based image segmentation. Later the segmented image is passed to feature extraction. These features STATS will be used with the image CF processing of individual image segment. The MLP used for the final feature classification and later result will be displayed.

The future work will be able to use the sensor devices to recognize the type of blood in live scenario.

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