Blood Group Detection using Image Processing

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Abstract— Domain of image processing is progressing a lot and has achieved tremendous milestones. Image processing is helping in many ways for the researchers to achieve their goals especially in security and medical fields. Detection of blood group in disaster or remote areas where expert is unavailable is challenge. In this paper we have proposed a system which will detect blood group using image processing techniques. Steps to detect the type of blood group using image processing techniques are discussed.

Keywords— Blood Group detection ; blood group type identifier ; Image processing; Histogram; Segmentation;

I. Introduction

The field of image processing has achieved a lot in the last few years and has helped the people in research, security and medical fields to achieve milestones and their major goals. It has also been through many great changes in the last years. Medical imaging is one of the fields which is being integrated into various components of medical applications providing great relief to the people in the reduction of the time and efforts.

Image processing has also helped in the blood group detection by making it available at areas where experts are not available. Being it a challenge, there is a system that is proposed in the following project which will be able to detect the blood groups using image processing techniques. We have also provided the steps to detect the blood groups using these image processing techniques.

II. PROPOSED SYSTEM

Our techniques for the blood group detection using image processing can be accessed by either a lab technician or a new user as well who knows nothing about the blood group detection techniques.

The process requires the blood sample to be put on the white plate and mix the sample with the antiserum and then take an image of the mixed potion. Then, the system will process the image and will give the blood group in a very short period of time.

The steps that the system follows are given below -
1. Image Acquisition
2. Image Pre-Processing and Segmentation
3. Detection of Blood Group Type

The following steps are discussed in details as

i) Image Acquisition

At first we obtain the images of the slides where the blood and antiserum are mixed using a camera. The images are then annotated using matlab for the further processing.

ii) Pre-Processing

This step involves the resizing, color change and the binary production of the image.
The resizing step involves bringing the image into a correct size and format. It is at first converted from rgb to hsv format and then from HSV to grayscale.
Then the image is converted into binary format.
Then the image has to go through the advanced morphological operations and finally the segmentation process.

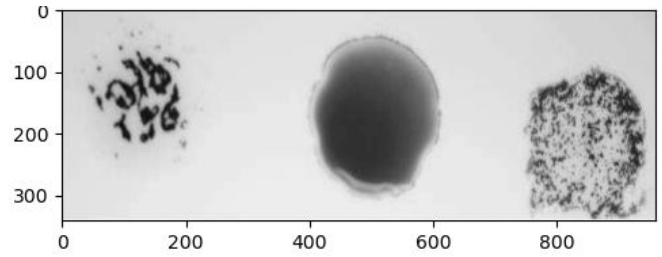
The following steps are defined below -

a) HSV conversion

This step includes the change of color characteristics like saturation, family, shade, tint and intensity.

- The color coordinates are involved in a cylindrical system and all the colors are defined inside a hex cone.
- The hue value lies between 0 to 360 degrees
- Saturation(S) range is from 0 to 1 that ensures the purity or strength of the color as the value approaches towards 1 as there is no white color present.
- Brightness(V) also ranges in between 0 to 1, where 0 represents black image and as the value approaches 1 it becomes brighter.

The conversion through V step provides us with a more precise picture for further segmentation.



b) Binary Conversion

When we get the converted precise image in the HSV format, then it is converted to a binary image. The image is converted to the binary form using a global threshold level.

c) Morphological opening operation

This step involves some operations on the binary image to make it free of any imperfections and an image reformation happens to make it better for the further processing. The details of the process are :

- Removal of small components like spurs, noise and outliers from the processed image
- This is an erosion technique followed by dilation using the same structuring technique for both the operations.

defines by as follows -

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

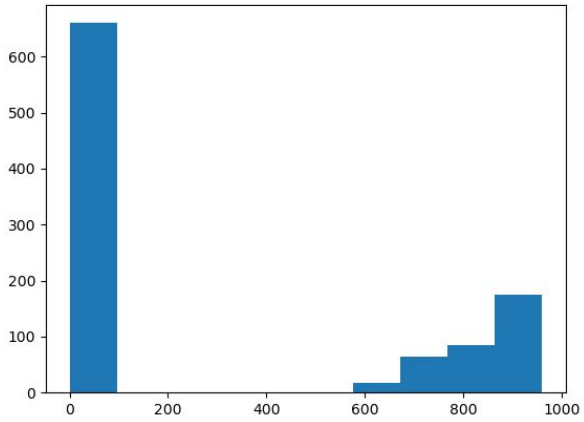
Where $\ominus$ and $\oplus$ denote erosion and dilation respectively and A represent the image and B is the structuring element.

Dilation adds pixels to the boundaries of objects in an image, while erosion removes pixels on object boundaries.

d) Histogram

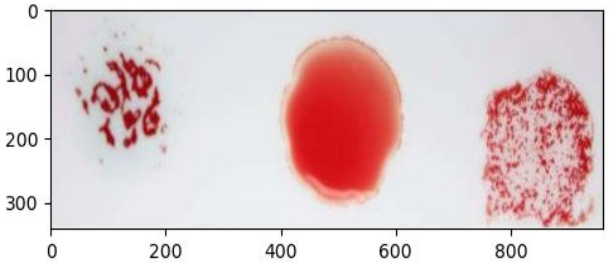
This step involves the use of the vertical histogram of the image being processed to provide certain information corresponding to the regions of the blood sample in the refined image.
The method of calculating the vertical histogram and its equation are -

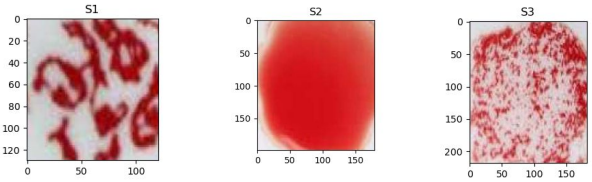
$$h(img) = \sum_{i=1}^{c} \sum_{j=1}^{r} whitepixel_j$$



iii) Segmentation

Segmentation is done on the processed image using the contours. Some examples of the segmented images are as follows -



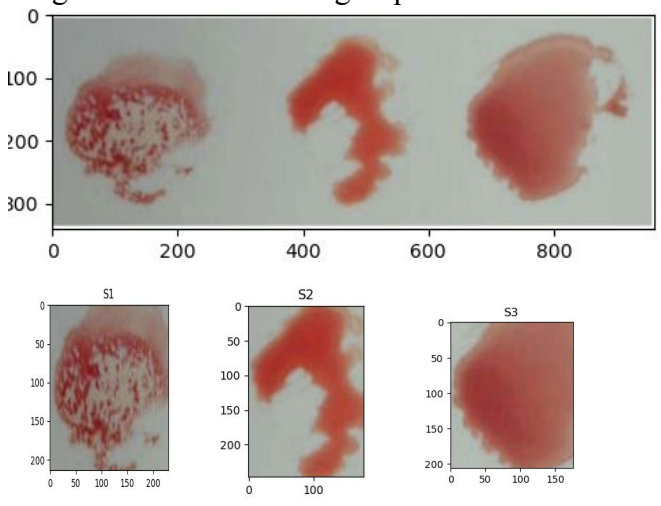


d) Blood Group Detection

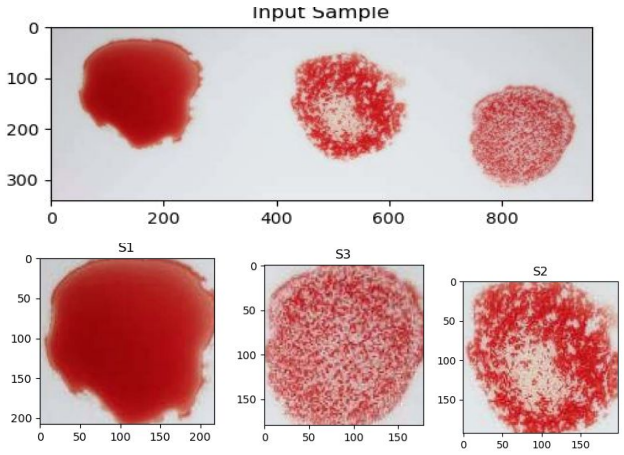
Now, the segmented image has to be carried out from certain stages using certain properties for the blood group detection as -

- The densities of the white pixels for each segmented region are calculated at first to get an estimate of the area that consists of white pixels in the image. If the white count is less than 14000 then 1 is return otherwise 0.
- Calculation of the elements or the total number of elements in the segmented image. For this simple blob detector was created and if the no of elements are more than 6 then 1 is returned otherwise 0.

These two stages clearly specify that the distorted region in the image should contain less number of white pixels and should contain more number of elements in the segmented image. This helps in the detection of the distorted part in the segmented image for different blood groups.



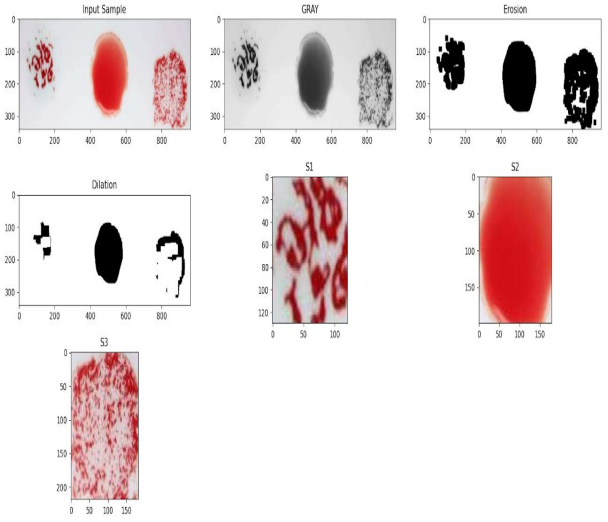
Original and Segmented Image of A Negative Blood Group type



Original and Segmented Image of B Positive Blood Group type

III. Conclusion

The whole system developed is capable of detecting the type of blood group using python algorithms. Colored images from the camera are integrated into the python algorithm and then converted into the HSV format using the V channel for the conversion. Then, we use the application of a global threshold technique for the binary conversion of the image and then the image is rendered for the development of the histogram.The processed image is then segmented using the contours. At last, the blood group of the image is classified for this processed image.



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