ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 7, Issue 3, March 2018

RED BLOOD CELL DETECTION USING HAUGH TRANSFORM AND SURF TECHNIQUE

Bhavya Anand[1](Aries.bhavya@gmail.com)

Yukta Goel[2](yuktagoel@gmail.com)

Dr.Amita Goel[3](Amitagoel@rediff.com)

(Maharaja Agrasen Institute of Technology)

Abstract

Counting of red blood cells (RBC) in blood cell images is critical to recognize and also to take after the procedure of treatment of numerous infections like anemia, leukemia and so on. To precisely distinguish fetal RBCs from maternal RBCs, multiple features including cell measure, roundness, slope, and saturation contrast amongst cell and entire slide are utilized as a part of administered learning togenerate feature vectors, to tackle cell color, shape, and contrast variations. A large number of medical images in digital format are generated by hospitals and medical institutions every day. Consequently, how to make use of this huge amount of images effectively becomes a challenging problem. Numerous digital images are being caught and put away, for example, therapeutic images, engineering, publicizing, plan and design images, and so forth. In this work, the focal point of our investigation is on medical images However, locating, identifying and counting of red blood cells physically are repetitive and tedious that could be simplified by means of automatic analysis, in which segmentation is a crucial step. In this paper, we show a way to deal with automatic segmentation and counting of red blood cells in microscopic blood cell images using Hough Transform and SURF.

Keywords: - Image Processing, Detection, Red Blood Cell, Counting, Hough Transform SURF etc.

I. Introduction

The human blood generally consists of red blood cells(RBCs), white blood cells (WBCs), platelets, and plasma.The liquid part in blood is plasma that contains softened saltsand proteins. RBCs constitute approximately 40% of bloodvolume. WBCs are smaller in volume, but larger than RBCs.The comparative particles, which are smaller than WBCs andRBCs, are called platelet cells [6, 16]. Anaemia is a kind of RBC twisting, as a rule realized by a nonappearance of mineral iron in the blood. Iron is very importantto the human body for the creation of an iron-rich proteincalled haemoglobin, which helps the RBCs to carry oxygenfrom the lungs to the rest of the body [2, 4, 5]. This ailmentoccurs when the blood contains a low number of RBCs or theyhave insufficient haemoglobin. RBCs are continually beingproduced inside the spongy marrow in the huge bones of thebody. The renewing of the RBCs is the main job of the marrowas it continually replaces the old cells. After approximatelyseven days of maturation, the new RBCs are released into thebloodstream. The normal lifespan of RBCs is about 120d.

The main function of the RBCs is to carry oxygen and remove carbon dioxide (a waste product) from the body. The shape of the RBCs is like a disk, which can move easily through the blood vessels.

II. Literature survey

In [9] an iterative thresholding algorithm is utilized for segmentation purpose particularly from noisy images. This algorithm conquers the issue of cell extraction and segmentation from heavy noisy images. This algorithm works over the adjusted threshold of images iteratively providing robustness to image.

In **[10]** discusses about the malarial image processing system. This system detects and classifies malaria parasites in Giemsa stained blood slides images. Then after parasitaemia evaluation is done. Morphological approach to cell image segmentation is more precise than the classical watershed-based algorithm is shown in this paper. Grey scale granulometries are connected in view of opening with circle molded components, level and non-level. Non level circle molded structuring component improves the roundness and the red cells minimization.

In **[11]** a system classifies and identify malaria parasite by using microscopic images of blood cells. Morphological approach and the significant necessities in developing this framework are the best systems for blood cell images segmentation.

In **[12]** research work on an Automated Cell Count method is described. A precise method of segmentation for counting white blood cells automatically is presented here. Initial a straightforward thresholding approach is connected and the calculation is determined about blood spread images from priori information. The marks are balanced at that point with a specific end goal to deliver meaningful outcomes. This method is more influential as compared to traditional methods which use information of local context. It can perform accurate segmentation of white blood cells though they have un-sharp limits.

In **[13]** using a filter bank of a' trous wavelet filters, curvelet transform implements curvelet sub-bands and uses a ridgelet transform as a component step, and idea throughout is that transforms ought to be over entire, more willingly than basically examined. In this computerized transforms are connected for de-noising of some standard images established in repetitive noise. A combination of geometric distance and an enhanced distance transform combining intensity gradients is used for the watershed step

In **[14]** An explicit mathematical model for characteristics of cell nuclei like size and shape measures is included. For each detected nucleus, a confidence score is computed by measuring suitability of nucleus in the model.

Paper [15] demonstrates the helpfulness of an automatic morphological strategy to perceive the Acute Lymphocytic Leukemia (ALL)with the help of images of peripheral blood microscope. The demonstrated system individuates the leucocytes from the others platelets, after that it picks the lymphocyte cells (the cells causes exceptional leukemia), morphological indexes from those cells areevaluated then after and at last classification is performed whether the presence of the leukemia is there or not.

III. Problem statement

The main key purpose of the issue is probably the absence of all around acknowledged standard criteria that nearly mirror the sensational atomic changes that happen amid delayed capacity of red blood cells and which, simply put, would enable 'good' blood to be distinguished from 'no longer sufficiently good' blood. The conventional device used to count blood cell is the haemocytometer. It consists of a thick glass microscope slide with a rectangular space making an assembly of specific measurements. This space is scratched with a network of opposite lines. It is possible to count the chamber of cells in a specific volume of fluid and calculate the concentration of cells in the fluid.

To count blood cell, doctor must view haemocytometer through a microscope and count blood cells utilizing hand count counter.

IV. Proposed System

The motive for the work is to count the quantity of red blood cells in a given blood test. For this we have applied various pre-processing techniques like edge detection, spatial smoothing filtering and adaptive histogram equalization to detect and extract the red blood cells from the images. Feature extraction has been done through the Hough Transform technique which has been utilized to discover the red blood cells in light of their sizes and their shapes. This isolates the red blood cells from whatever is left of the picture of the blood test so further procedures like counting can be connected only on them.

The outline is isolated into three critical stages: Blood amass location, RBC is counting, WBC counting. Figure 1 demonstrates general piece graph of digital ımage processing. From control panel of system we have to select an option to perform required test i.e. Blood group detection, RBC counting, WBC counting. After this one window will appear from which we have to select an input image. All the images are stored by the name of patients. Then image undergoes some image processing techniques as mentioned below and we get the result in given below image. Figure 1 shows general block diagram of Digital Image Processing.

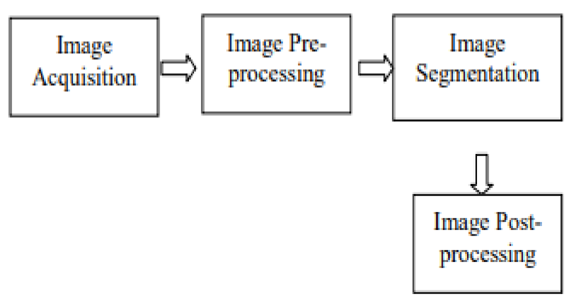

Figure 1: General block diagram of Digital Image processing

Phase-I: Blood Group Detection

This is the first phase of proposed system i.e. Blood Group detection. Figure 2 shows flow of blood group detection.

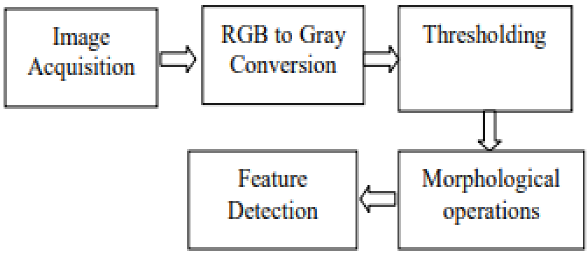

Figure 2: Block diagram for Blood Group Detection

In image acquisition of blood amass discovery images of blood tests are gotten from the research facility comprising of a shading picture made out of three examples of blood and reagent.Simply a glass slide with blood sample is placed on a white paper and photo is taken by using a phone camera of 12MP. The image is read from phone storage at the time of system evaluation. In preprocessing rgb to gray conversion is performed. Next step is to detect SURF features that work on gray images. In computer vision, speeded up robust features (SURF) is a local feature detector and descriptor. It can be used for object recognition, image registration, classification or 3D reconstruction [6]. Here we have used SURF to detect the coaugulation formed in an image. In light of this position of coaugulation we are detecting blood assemblies.

Image Segmentation by Circular Hough Transform

The circular Hough transform is then connected to green color image. This transform searches for the blood cells in the image and then detects them. The function "draw circle" draws circles around the detected cells. Even the overlapped circles are detected. Equation (1) is a standard equation of circle.

$$r^2 = (x - a)^2 + (y - b)^2 \quad (1)$$

Here "a" and "b" are the coordinates for the center, and r is the radius of the circle.

$$x = a + r\cos(\theta)$$

$$y = b + r\sin(\theta) \quad (2)$$

It is a feature extraction technique used in image analysis, computer vision and digital image processing. It was at first recommended as a strategy for line discovery in edge maps of images, at that point stretched out to distinguish general low-parametric protests, for example, circles [17, 18].To recognize a straight line in an nxn image, the simplest method is to compute all possible lines defined by every pair of points in the image and then find all subsets of points that are closed to particular line.

$$yi = axi + b \quad (3)$$

Rewriting the equation

$$b = -axi + yi \quad (4)$$

The computation involved will be enormous because the maximal possible line is $n(n-1)/2 \sim n^2$ and then (n) $[n(n-1)]/2 \sim n^3$. Comparisons need to be performed for each and every point in the image. The problem is solved using Hough Transform that uses the parametric description of the shape to reduce the computation involved. Considering two points (x_1, y_1) and (x_2, y_2) in the x-y plane, the line equation is:

Two points are represented in the x-y as well as a-b plane. The first point (x_1, y_1) and the second point (x_2, y_2) each yield a line in the a-b plane and both the lines intersect at a point and this is also true for all the points contained in the line. Using this unique feature a parameter space called as the accumulator cell or Hough space is created with a-axis and b-axis having a min and max of the expected range. The same method used for the detection of straight lines can also be extended for the detection of circle and the equation is:

$$(x-a)^2 + (y-b)^2 = r^2 \quad (5)$$

The equation for circle detection contains three unknowns (a,b,r) parameters and therefore the accumulator cell should be of three dimensional for three unknown variables.

The reason for the strategy is to find defective instances of items within a certain class of shapes by a voting technique.This voting methodology is completed in a parameter space, from which protest applicants are gotten as nearby maxima in a supposed gatherer space that is unequivocally developed by the algorithm for computing the Hough Transform. Any Hough Transform based technique basically works by splitting the input picture into an arrangement of voting components. Each such component votes in favor of the theories that may have produced this

ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 7, Issue 3, March 2018

component.The votes from various voting component pixels are included into a Hough picture, with the stature of the pinnacle providing the certainty of the recognition.

The procedure involves two significant phases:-

1. The digital microscope is interfaced to a computer and the microscopic images are obtained as digital images.

2. Image Enhancement //For better segmentation of the blood cells, the obtained image has to be enhanced.

3.Green Plane Extraction// the green plane is extracted from the imported blood cell image. The other planes such as red and blue are not considered because they contain less information about the image.

4. Contrast Adjustment // To enhance the image, its contrast is adjusted by altering its histogram. The image's histogram is equalized.

5. Image Segmentation // This involves selecting only the region of interest in the image. Here only the blood cells are selected, because they are the areas of interest. When Hough transform is applied, not much of the image segmentation is needed because the applied transform looks only for the circular objects in the image.

6. Detection of Blood Cells // The circular Hough transform is then applied to the contrast adjusted image. This transform searches for the blood cells in the image and then detects them. The function "draw circle" draws circles around the detected cells. Even the overlapped circles are detected.

7. Counting of Blood Cells // Counting the number of cells drawn gives the total number of blood cells in the image.

8. Image Acquisition // It is a process of acquiring a digital image.

9. RGB to Gray conversion // Image obtained by digital camera is in RGB format. But for post processing, this image need to be converted into gray scale format. This makes processing much simpler.

10. Image Segmentation by gray thresholding // The thresholding function uses Gray method, which chooses threshold valve to minimize intra-class variance of the black and white pixels.

11. Convert to binary image // Segmented image need to be converted to binary image in order to make further processing easier.

12. Feature matching // In this work, the contribution of our work is the introduction of a new algorithm for image classification that is called the Speed-Up Robust Feature detector (SURF) for the classification problem of Red blood cells. This algorithm is effective for scale invariant feature transform. Our approach does not need to extract nucleus and cytoplasm. We utilize image matching in this method. We make use of image matching as the classification purpose.

13.Area Calculation // Area: Sum of pixels enclosed by cell boundary has to be calculated. Based on area and perimeter of each object white blood cells are counted.

V. RESULT

It is meaning the RBC images are not separated from the foundation. That is the reason channel Red isn't selected. After thresholding process, the next step is to edit or 'make up' the image by using several morphological operations. Morphological functions can enhance the data in a binary image by expelling undesirable data, for example, noise particles, and particles touching the outskirt of images, molecule touching each other or particle with uneven borders. Morphological tasks depend just on the relative ordering of pixels esteems not the numerical esteems. Subsequently it particularly suited to the processing on binary images and furthermore dark scale images. That is why the conversion of the RGB image into binary is essential in the image processing. For the experimental result we have taken size of 200*200 images.

In MATLAB, the algorithm of morphological operation is quite similar. Since the emphasis is on the RBC as the items, the incomplete molded RBC or, for example, joined to the fringe will be ignored. "Remove border" means eliminating the particles that touch to the image border.

ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 7, Issue 3, March 2018

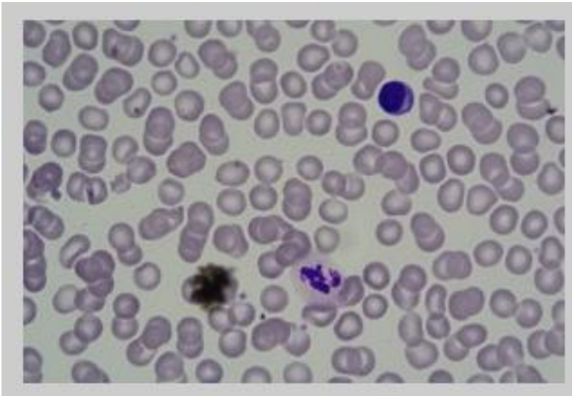

Figure 3: Image of Blood Smear

The red blood cells here are normal, happy RBC's. They have anarea of pivotal whiteness around 1/3 the point of the RBC. The RBC's display minimal variability in estimate (anisocytosis) and shape (poikilocytosis). A of small fuzzy blue platelets are seen. In the focal point of the field are a band neutrophil on the left and a segmented neutrophil on the right.

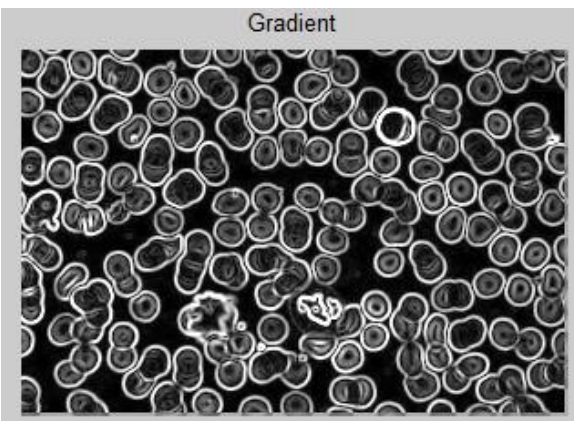

Figure 4: Gradient Image of Blood Smear

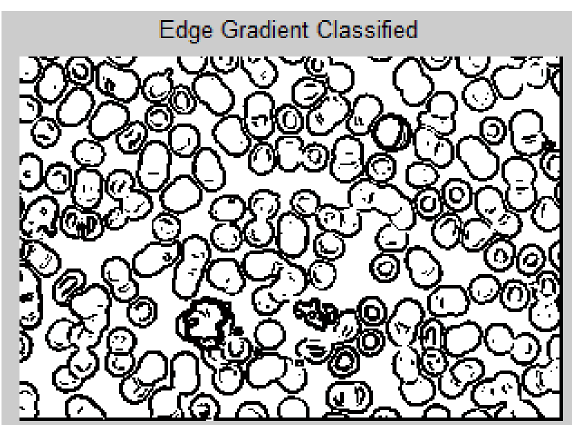

Figure 5: Edge Gradient classified of Blood cell

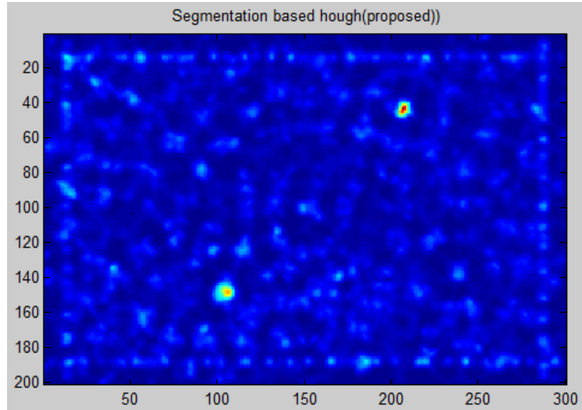

Figure 6: Segmentation based Hough of Blood cell

Figure 6 shows the output images of segmentation based Hough.

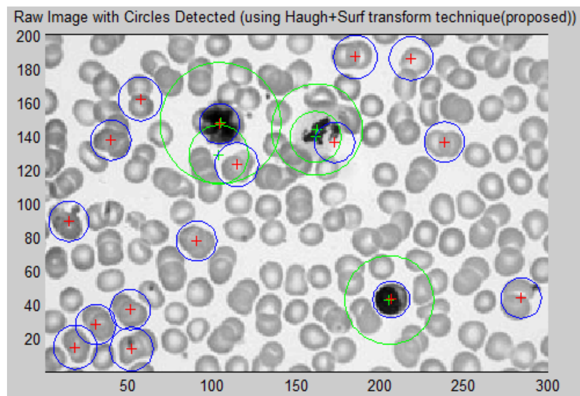

Figure 7: Image with circles detected (using Hough + surf transform technique)

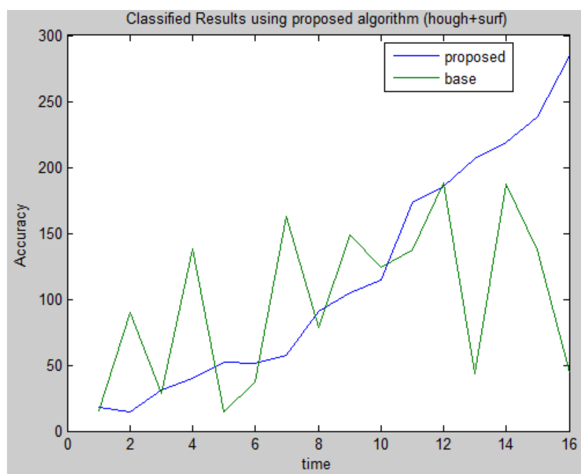

Figure 8: Classified results using proposed algorithm (Hough + surf)

VI. Conclusion

This paper proposed a method to automate the segmentation, feature extraction and classification of red blood cells using Hough transform and SURF algorithm. Also, the proposed show features an upgraded precision of selecting the right hover from three competitor circles, the ability to identify unpredictable cells, the utilization of dynamic number of iterations, and improved detection of overlapping cells. The proposed method performed the segmentation and classification of RBCs well when results were compared with the ground truth, which was determined by experts. The following segmentation and counting exactness's were accomplished using the proposed strategy.Hence, segmentation of blood cells and identification of blood type is very important. The human blood consists of the RBCs, WBCs, Platelets and Plasma.The research currently works efficiently for count of blood cells, in future researchers can work upon the detection of various disorders (Leukemia, anemia and similarly) related to the abnormal blood cell count.

REFERENCES

[1] J.M. Sharif, M.F. Miswan, M.A. Ngadi, M.S.H. Salam, M.M. bin Abdul Jamil, Red blood cell segmentation using masking and watershed algorithm: a preliminary study. In: Proceedings of the IEEE 2012 International Conference on Biomedical Engineering (ICoBE), 2012, pp. 258–262.

[2] Urrechaga E, Hoffmann J J, Izquierdo S and Escanero J F 2015 Differential diagnosis of microcytic anemia: the role of microcytic and hypochromic erythrocytes Int. J. Lab. Hematol. 37 334–40.

[3] Abbas N., Mohamad D., Abdullah A.H. Semi-automatic red blood cells counting in microscopic digital images. J. Tecnol. 2015:73.

[4] Elsalamony H A 2014 Sickle anemia and distorted blood cells detection using Hough transform based on neural network and decision tree *Proc. of the Int. Conf. on ImageProcessing, Computer Vision, and Pattern Recognition(IPCV)* p1.

[5] Das D K, Chakraborty C, Mitra B, Maiti A K and Ray A K 2013 Quantitative microscopy approach for shape based erythrocytes characterization in anaemiaJ. Microsc249136–49.

[6] Deligiannidis L and Arabnia H 2014 Emerging Trends in Image Processing, Computer Vision and Pattern Recognition vol 1 (San Mateo, CA: Morgan Kaufmann).

[7] Pooja R. Patil, G. S. Sable and GauriAnandgaonkar, "Counting of WBCs and RBCs from Blood Images Using Gray Thresholding", International Journal of Research in Engineering and Technology, Vol. 03, 2014

[8] Just Kjeldgaard Pedersen, Simon, "Circular Hough Transform", Vision, Graphics and Interactive Systems, 2007.

[9] H. S. Wu, J. Barba, and J. Gil, "Iterative thresholding for segmentation of cells from noisy images" Journal of Microscopy, vol. 197, no. 3, pp. 296–304, 2000

[10]C. Di Rubeto, A. Dempster, S. Khan, and B. Jarra, "Segmentation of blood images using morphological operators," in Proceedings of the 15th International Conference on Pattern Recognition, vol. 3, pp. 397–400, 2000.

[11]C.D., Ruberto, A., Dempster, S., Khan, B.Jarra, "Analysis of Infected Blood Cell Images Using Morphological Operators", Image and Vision Computing, Vol. 20, 2002,pp. 133-146

[12]Q. Liao and Y. Deng, "An accurate segmentation method for white blood cell images," in Proceedings of the IEEE International Symposium on Biomedical Imaging, pp. 245–258, 2002

[13] J.L. Starck, E.J. Candes, D.L. Donoho, "The curvelet transform for image denoising", IEEE Transaction on Image Processing 11 (6) (2002) 670–684.

[14] G. Lin, U. Adiga, K. Olson, J. F. Guzowski, C. A. Barnes, and B. Roysam, "A hybrid 3Dwatershed algorithm incorporating gradient cues and object models for automatic segmentation of nuclei in confocal image stacks," Cytometry Part A, vol. 56, no. 1, pp. 23–36, 2003.

[15]Fabio Scotti University of Milan, Department of Information Technologies, via Bramante 65, 26013 "Automatic Morphological Analysis for Acute Leukemia Identification in Peripheral Microscope Images" IEEE International Conferenceon Computational Intelligence For Measurement Systems and Giardini Naxos, Italy, 20-22 July 2005.

[16] Lam P 2015 Anemia: Causes, Symptoms and Treatments (UK: Medical News Today) http://www.medicalnewstoday.com/articles/158800.php.