Comparative Analysis of Extraction and Detection of RBCs and WBCs Using Hough Transform and k-Means Clustering Algorithm

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Abstract: Blood cell analysis is very much important for all human beings, because there are WBCs, RBCs, and Platelets in our blood, White blood cell count gives the vital information about our blood and diseases related to blood that help diagnosis many of the patient's sickness. This research work presents an adaptive approach for extracting, detecting and counting the WBCs in microscopic blood sample images. In the research work i used two different approaches to perform my task one is k-means clustering technique and second is Hough transform. I also used to study the different parameters like number of cells, number of WBCs and also calculate the time for our code to be executed.

Keywords— WBCs, RBCs, Hough transform, k-means clustering, time calculation, thresh-holding, image processing.

Introduction

One of major challenges in computer vision is to determining the location, shape, or quantity of instances of a particular object. An example is to find and count the circular objects from any image. There are a number of feature extraction techniques available for circle detection and extraction, one of the most commonly used methods is the Circular Hough Transform. The goal of this research note is to provide the user with an understanding of the operations behind these algorithms. An overview of the Hough Transform and k-means clustering is also given.

Hough Transform

Generalized Hough Transform

The Generalized Hough Transform is a modified version of the Hough Transform that not only seARCHES FOR ANALYTICALLY DEFINED shapes, but also arbitrary shapes. This method uses the principle of template matching, which relies on detecting smaller elements matching a template image.

Circular Hough Transform

The Circular Hough Transform set the radius to a constant value or provides the user with the option of setting prior to running the application. For each edge point, a circle is drawn with that point as origin and radius. The CHT depends on a pre-define value of the circles radius.

k- Means Clustering

One of the clustering algorithms is K-mean clustering; K-means clustering algorithm is used to cluster observations into groups of related observations without any prior knowledge of those relationships. The k-means algorithm is one of the simplest clustering techniques and it is commonly used in medical imaging, biometrics and related fields.

Related Work

Venkatalakshmi.B [1] et al has analyzed that the major issue in clinical laboratory is to produce a precise result for every test especially in the area of Red Blood Cell count. The number of red blood cell is very important to detect as well as to follow the treatment of many diseases like anemia, leukemia etc. Red blood cell count gives the vital information that help diagnosis many of the patient's sickness. S.Kareem [2] et al described a novel idea to identify the total number of red blood cells (RBCs) as well as their location in a Giemsa stained thin blood film image.The method utilizes basic knowledge on cell structure and brightness of the components due to Giemsa staining of the sample and detects and locates the RBCs in the image. Jameela Ali [3] et al has stated predominantly emphases on two algorithms Hough Transform and the Sub-Pixel Edge Detection and their application on 1-Dimensional barcode scanning. The system is meant to verify Barcode on-line. It primarily focuses on two aspects of barcode verification. One is two detect the angle if barcode is skewed in the image and correct the same. The other is to detect the edges of a barcode in real time blurred image using sub-pixel edge detection. Ms. Minal [4] et al has stated that the Hough transform has been a frequently used method for detecting lines in images. However, when applying Hough transform and derived algorithms using the standard Hough voting scheme on realworld images, the methods often suffer considerable degeneration in performance, especially in detection rate, because of the large amount of edges given by complex background or texture.Naveed Abbas [5] et al has modified the Hough transform,it was proposed that improves the detection of low-contrast circular objects.The original circular Hough transform and its numerous modifications were discussed and compared in order to improve both the efficiency and computational complexity of the algorithm. Gaganjit Singh [6] et al presented Blood cell counting by laboratory task utilizes hemocytometer and microscope. The conventional task depends on physician skill. It is laborious. A.Shanmugam [7] et al concluded that HoughT ransform is recognized as a powerful tool for graphic element extraction from images due to its global vision and robustness in noisy or degraded environment. However, the application of HT has been limited to small-size images for a long time. Besides the well-known heavy computation in the accumulation, the peak detection and the line verification become much more time-consuming for large-size images.J. C. Allayous [8] et al introduced a new Randomized Hough Transform aimed at improving curve detection accuracy and robustness, as well as computational efficiency. Robustness and accuracy improvement is achieved by analytically propagating the errors with image pixels to the estimated curve parameters. The errors with the curve parameters are then used to determine the contribution of pixels to the accumulator array. The computational efficiency is achieved by mapping a set of points near certain selected seed points to the parameter space at a time. Clark F. Olson [9] et al stated the techniques to perform fast and accurate curve detection using constrained Hough transforms, in which localization error can be propagated efficiently into the parameter space. We first review a formal definition of Hough transform and modify it to allow the formal treatment localization error. We then analyze current Hough transform techniques with respect to this definition.

Research Methodology

To implement the objective listed above following methodology is adopted.

As per first approach - k-MEANS CLUSTERING

1) Call input image
2) Clustering image
3) Histogram equalization
4) Image segmentation
5) Blood cell extraction
6) Counting cells

As per second approach - HOUGH TRANSFORM

1) Call Input image
2) Hough transforms edge linking
3) Image segmentation
4) Snake body detection
5) Output image
6) Counting cells

Results

The input image is taken as shown in figure 1, it is a blood sample microscopic image. We use two approaches to reach our aim, one is k-Means clustering and other is Hough Transform. In the first input image there are several cells like WBC, RBC and PLATELETS. We have used k-Means clustering Algorithm to extract WBCs from the image, the WBC's are shown in the figure 3 , and it extracts the cells in some different color. The white blood cells showed in purple color and background in black. By using filter, the noise are removed from this image, then it act as the input image for Clustering technique. This technique is the final step of counting white Blood cells in the image. In the second image where the cells are extracted, the morphological operations, logical operations and clustering techniques are used in this stage to extract the white blood cells from other cells and background. Morphological and XOR operation are applied on two binary images, the result is shown in the figure 2 After that clustering algorithm is applied to this image to extract the white blood cell. As a result obtained from the in figure 2 , the white blood cells showed in purple color and background in black. By using filter, the noise are removed from this image, then it act as the input image for k-means clustering. This technique is the final step of counting white Blood cells in the image Figure 4. For this process the centre point of white blood cells are needed and they are chosen by their own, the k-means clustering algorithm has a property to select its center point as 'k' by its own internal commands.

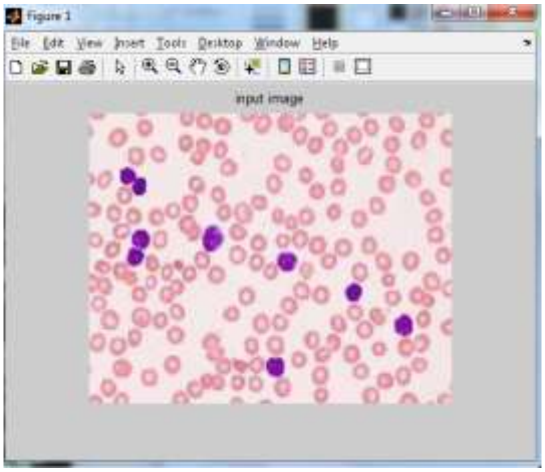

Figure 1

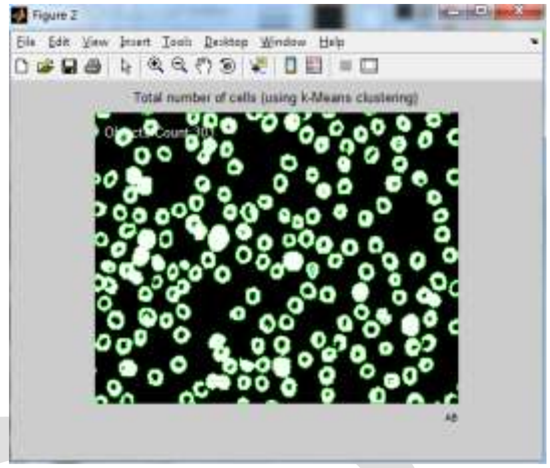

Figure 2

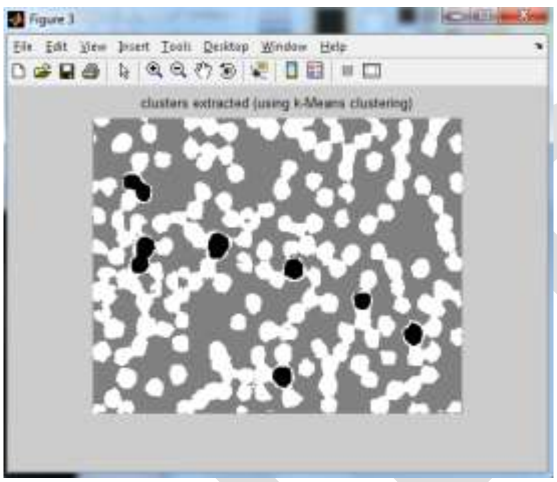

Figure 3

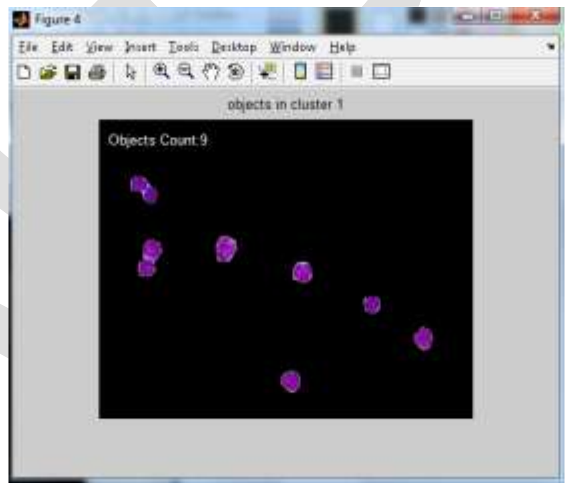

Figure 4

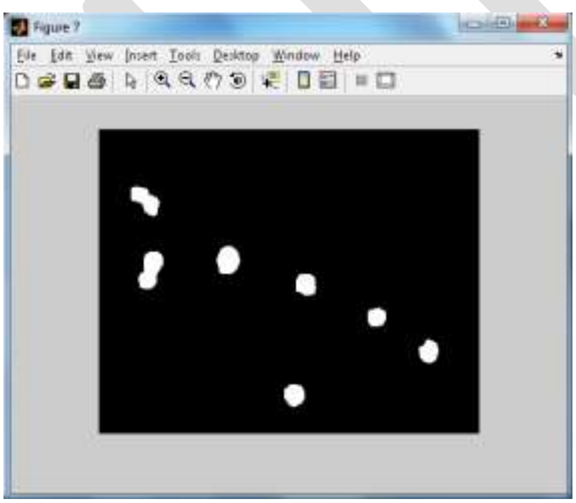

Figure 5

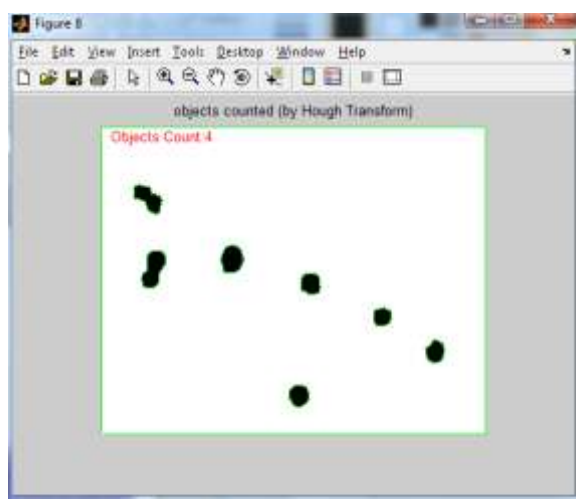

Figure 6

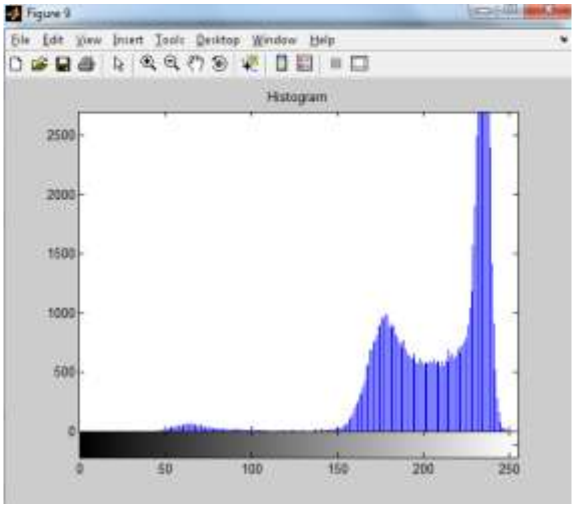

Figure 7 **Figure 8**

Hough Transform is used to detection objects in the image with any shape, but WBC's are with round shape, so we used Circular Hough Transform. In Figure 5 shows Hough Transform circular cells. By using filter, the noise are removed from this image, then it act as the input image for Hough Transform technique. This technique is the final step of counting white Blood cells in the image. For this process the centre point of white blood cells are needed. The counting of cells is done using Hough transform; first we used this algorithm to draw circles on around all cells, than cells are counted using same counting method as per our first algorithm. In the Figure 7 image we have created histogram for the blood sample image; it is actually a graphical representation of image based on their color. In the figure 8 we have calculated the total time to execute the complete code, for this purpose we have used an inbuilt clock function from MATLAB library. We use clock command to calculate the time.

Conclusion

This research work is based on counting blood cells from different blood sample images, it is important for every human being to know about their blood cells. Our implemented algorithms are k-means clustering algorithm and Hough transform. These two methods include extraction of cells, count of cells and time calculation for getting output. This paper develops an approach used to count white blood cells in blood image without the use of microscope, because using the microscope is very much costlier process.

Future Scope

To develop a technique for users that will become efficient for counting blood cells in different images, someone could develop a graphical user interface system for counting different parameters on a single window, it would be a good approach to improve our design. In our research work I took single image at a time, but someone can add more graphic options to work on different images at one time. One can use some other technique to implement same design with reduced time. Someone can also calculate some other parameters also.

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