Finding Cells Number in Medical Images

Shahla Hazim Ahmed Kharofa

Department of Dental Basic Sciences, College Of Dentistry, University of Mosul, IRAQ

ABSTRACT

The process of dealing with medical images is of great importance because it relates to human health. Therefore, the application of modern technological is a very important aspect, and on this basis has been Image J system, which represents an application for images processing, and this application can view, edit, analyze and process the various images and can execute operation quickly and more accurately. In this research, ImageJ system was used to find the number of cells in colored medical images. Color Base Thresholding method was used to determine the sample color (cell). Two methods were used to find the number of cells, first method is Analyze Particles and the second method is ITCN. Both methods gave similar results if the number of cells computed is small. While giving different results if the number of cells is computed very large.

Keywords: Medical Image Processing, Cells Number, ImageJ System.

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INTRODUCTION

Images are the common and convenient means to transmitting information. A image is worth a hundred words. Imagesare transmitting information about positions, sizes and relationships between objects. They portray spatial information that we can recognize as objects. Human beings are good at deriving information from such images, because of our innate visual and mental abilities. About 75% of the information received by human is in pictorial form.[1]

Image processing techniques are widely used in medical fields, especially at the stages of detection of a specific disease or tumor. [2]Medical images were an important tool in clinical medicine for diagnostic purposes and the data acquired could be transferred to the computer to be processed. The use of computer in the treatment of medical images is a powerful tool to help the doctor in the analysis and understanding of images. And enable him to diagnose the disease. [3][4]In medicine, the process of finding the number of cells is considered a basic measure of the success of treatment. It is a faster method to start the image analysis process. So the process of object (cells) is accompanied by a reduction in input information. [5,6]

Medical image processing has many benefits as many algorithms have been applied on a larger scale. In many cases doctors have been able to perform the examination and diagnosis without the need to open the patient's body and conduct operations. [7]

Color:

Colors play a large role in image processing as it is possible to make large changes in how to interpret images by highlighting details in the picture such as the detection and simplification of a particular object. [8][9]Color has been used as a descriptor in a variety of applications. The color images will be clearer and more accurate in the details of the gray level images. Color study is an important factor in the development of color vision systems. [10] There are many color models, the main purpose of which is to facilitate color specifications in some acceptable standard methods. Each model has properties suitable for certain applications. The most famous color models that have been successful is the RGB (red, green, blue).[11-13]

ImageJ System:

Imagej is one of the most common systems used in the medical field, and used to determine the number of blood cells as it helps doctors to diagnose diseases. It is a public domain Java image processing program inspired by NIH Image for the Macintosh. [14,15]

The system supports standard image processing functions, as it can perform various complex mathematical operations to measure the areas and angles of the image as a whole or the specific area and it can create density histograms and line profile plots and enables it to conduct various statistical processes and it is possible to carry out geometric transformations [16]

Imagej system is designed in an open architecture to help solve any image processing problem. It provides accurate results for the number of cells in a sample tissue image. It is a major research tool that has helped to advance in many different fields of science as well as other fields of research. The greater number of functions available to count cells in the system results in more things to be included in counting, while things can be separated theoretically in Image J, this is process, which makes all objects is increased. [17-19]

METHODS

In this research, I used color base threshold method to determine the sample color (cell) that can be count, then I used Analyze Particles method or ITCN method to count the number of cells in the medical color image.

Color Base Thresholding
This method depends on color as a basic rule. It gives an idea of how to help understand things in the best way,by way of selecting one of the objects (cells) that have the same color values of the cells. As a result, the objects (cells) that have the same color will be obtained. [14][19]
In sample color, we will found the cells in the image or part of the image that were of the same specified color.[20][21]

Procedure to determine the steps of execution:
Input (Image name), Make a duplicate of the image so you can compare, Plugins – Segmentation – Color based thresholding, Select RGB, Draw a circle on one of the areas in the image that I needed and Click sample (Obtain the image that contain sample).

1. Analyze Particles Method
This method is used to find the number of objects (cells) in binary image. Analysis is performed by selection all image or part of the image. [20] convert the image to binary image. Go to **Analyze → Analyze Particles** on the Analyze Particles select show outlines and select display results. click ok. As a result,each counted particle will be outlined and numbered in a new widow. The data window contains measurements for each particle. [22]

2. ITCN Method
ITCN method (Image-based Tool for Counting Nuclei) Is the second method used to find the number of cells in medical images. It is harder than the first method, as it depends on measuring the following points:

Measure the diameter of big cell, Measure the minimum distance between cells and either a region of interest (ROI) selected with ImageJ selection tools or a black and white mask image that is white in regions that are to be counted. In this research, the white and black mask image was used and the mask image was determined based on where the cells were to be counted. [23]

Suggested algorithm:

The following algorithm was proposed to calculate the number of cells in medical images. This algorithm is:

1. input color image
2. Execute color base threshold by select the sample that the same color of cells that can be count
3. Find edge of color image, Process – find edge
4. Convert color image to gray image, (Image – Type – 8 bit)
5. Convert gray image to binary image, (process – Binary – threshold). (if you want to execute ITCN method go to step 7)
6. Execute analyze particles method: go to step 11
7. Find the diameter of large cell in the image
8. Find the minimum distance between the cells
9. Input the mask image (the same size of binary image)
10. Execute ITCN method between binary image and mask image) by enter the diameter and minimum distance)
11. Show the image (that contain the count cells)
12. if the original color image contain more than one cells color go to step 1, else go to step 13
13. end

RESULTS AND DISCUSSION

In this research, the suggested algorithm has been applied on a number of medical images (two color images (image1, image2)), to find count of cells in the image. The flow chart of suggested algorithm are shown in (Figure 1). and the results of execution suggested algorithm are shown in (Figure 2,3) and (Table 1).

Each image contains two colors. The first color is selected and the algorithm is applied in both ways to find the number of cells within the first color. Then the second color is selected and the algorithm is applied in two ways to find the number of cells within the second color. We can apply the algorithm to other images containing more than two colors (three or four colors).
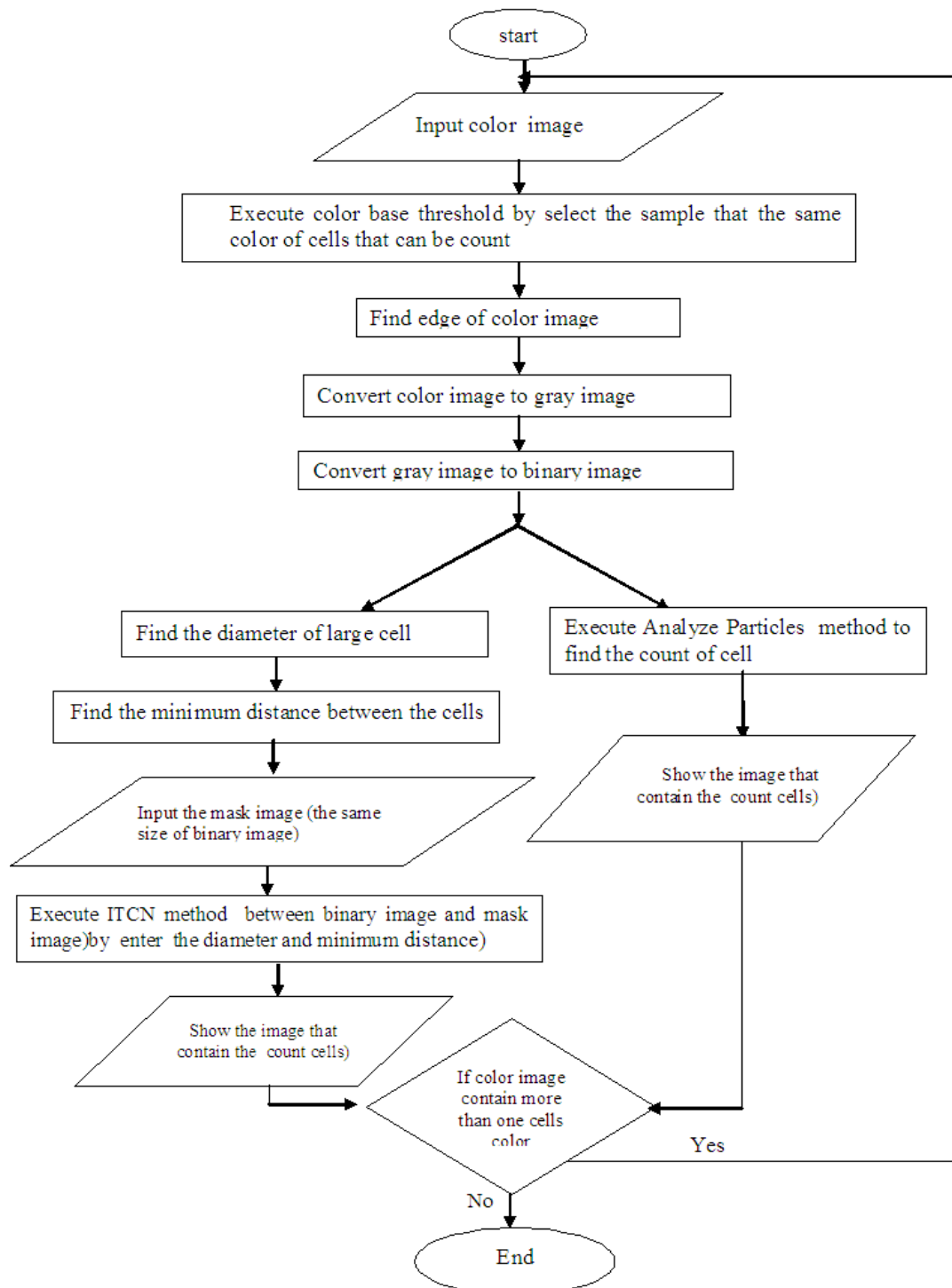

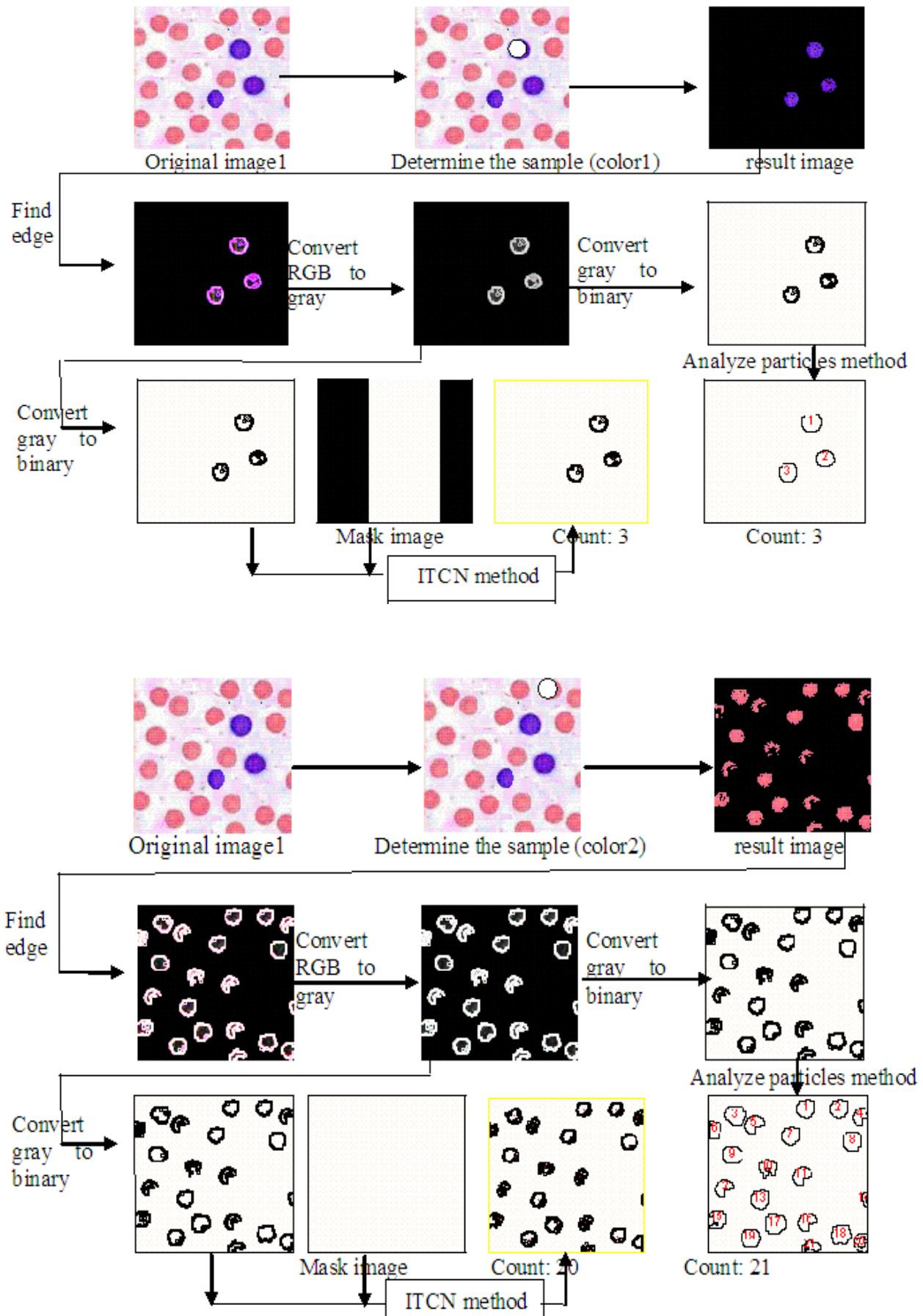**Figure (1) the flow chart of suggestion algorithm**

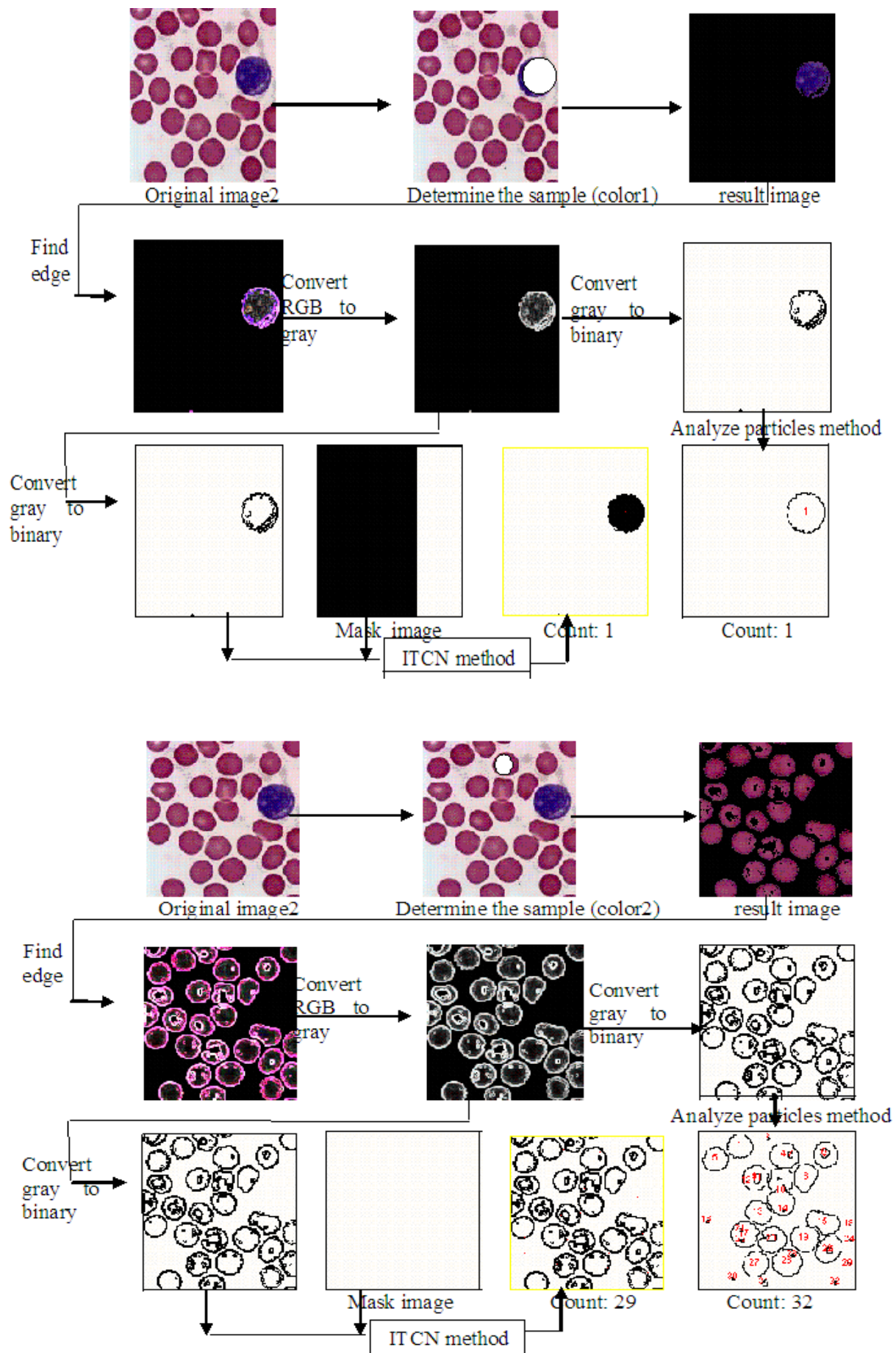**Figure (2) Execution suggestion algorithm to image1**

Figure (3) Execution suggestion algorithm to image2

Table (1): Represent the results of execution Suggestion Algorithm to images1 and image2

Images	Samples	Analyze particles method	ITCN method
Image1	color1	3	3
	color2	21	20
Image2	color1	1	1
	color2	32	29

CONCLUSION

The medical images processing is one of the most important fields in scientific research, because it is help the doctor in the analysis and diagnosis of the patient's condition. The ImageJ system was used. It is an independent program which is a versatile database for a wide range of image processing applications. It is used extensively in the treatment of medical images and images related to different sciences.

In this research, used imagej system to obtain more accurate results, I used color base threshold method to determine the sample color (cells) that can be count, Then divided this work into two methods: The first method is the Analyze Particles method and the second method is the ITCN method to find the number of cells in the medical images, Both methods gave similar results if the number of cells computed is small.but give different results specially if the number of cells that can be counted is large.

The research concluded with a set of conclusions that can be summarized as follows:

- The Analyze Particles method is easy to execute, need less time to implement, do not need a mask image and less accurate than the ITCN method especially when the number of cells that can be calculated is much.
- The ITCN method is it has complex calculationsby found the diameter of the large cell and measure the minimum distance between the cells, execution time is longer than Analyze Particles method, you need the mask image and be the same size of the original image and more accurate than the Analyze Particles method especially when the number of calculated cells is many.

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