DETECTING AND COUNTING THE NO. OF WHITE BLOOD CELLS IN BLOOD SAMPLE IMAGES BY COLOR BASED K-MEANS CLUSTERING

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Abstract- Nowadays, many diseases which were incurable to human become the main topic in every country. Solemn illness that becomes killer to mankind was the kind that cannot be detect early, no early symptoms, and can spread throughout the body without notice. Sometimes, it can only be realized after critical conditions. This kind of disease was incurable and cause death to the infected person. One of the challenges in medical science is to detect and identify diseases for early detection by medical imaging technology. Medical imaging modalities such as X- Ray, Computed Tomography (CT) Scan, Magnetic Resonance Imaging (MRI), and Ultrasound produce medical image captured from human body arrangement for analysis and diagnosis. In addition, analysis in medical field for diagnosis was done by counting cells from microscopic images. Moreover, blood related diseases such as anemia or leukemia due to lack or extreme production of blood cells also become serious illness which causes death. Early discovery of these diseases needs to be done to reduce death rate. One of the technologies used to solve the problem is by image processing. However, this method required knowledge and ability to apply many different methods in an analysis. Therefore, a simple and easy method needs to be identified to help clinician.

Index Terms- Blood cancer detection, Color based clustering, WBC Count, K-means clustering.

I. INTRODUCTION

The main objective of this project was to determine the easier and simple method for white blood cell (WBC) extraction, and count the number of WBCs detected in blood sample images. The scope of this project was to analyze on fifty images of Blood cell having cancerous infection and perform extraction and counting the number of WBC. It will use clustering of each color part in the images and extracting the affected area. To count the number of cell, we will use grayscale intensity approach. This project will used MATLAB image processing toolbox from Math Work. While analysis, it was found that the affected area i.e. the WBCs in any blood cell image has color as Dark blue, red, violet and which can be extracted by using color based clustering and extracting them from the rest of the image and then counting the affected area. The foremost criteria of this paper is counting the no. of WBC cells which helps people in laboratory to declare if someone has blood cancer. In the study of the blood cell images, it was found that the images showing blood cells have WBCs as dark blue color. The k-means clustering takes out clusters of three different colors in the image. It makes sure that the resolution of the image is not taken up for counting process.

A. BLOOD CELL DESCRIPTION

Blood circulatory system is one of the most important systems in human‘s body. The function of this system is to transport blood throughout the body. This system consists of blood vessels which are arteries, veins, and capillaries, heart that act as pumping system, and blood that act as the medium for the system. Blood transportation is very important in order to supply oxygen to our body, carries carbon dioxide for gaseous exchange, minerals, nutrients, and ensure healthiness. Blood cell composed of White Blood Cells (WBCs), Red Blood Cells (RBCs), platelets, and plasma. There are five types of WBC which are Monocyte, Lymphocyte, Neutrophil, Basophil, and Eusinophil. Each component in the blood cells plays their own role in maintaining living activities and health. The number of each element plays important role to ensure healthiness. Lack or extreme amount of blood cells, and the shape of RBC‘s in the body can cause disease such as leukemia or anemia, and other medical problem. WBCs number is important to conclude human‘s health state. This is due to the number or quantity of this cell determined the individual health condition and indicates diseases which might occur. WBCs involve directly in human body defend system. Knowledge on typical range of WBC counts in Afro-Caribbean adults will be immediate clinical value to physician and the WBC counts in Jamaicans are comparable to those African origin. There are several ecological factors that affect the result obtained which are widespread infections, migrant populations living in the developed countries, and social factor. Therefore, orientation value of WBC must be obtained from their native habitat population for accurate analysis in cell counting. Blood cells sample

images taking from microscopic can be analyzed to count the number of target cells by manual counting and automatic counting. Manual counting can be very detail but might not accurate due to human error. Meanwhile, computerized technique using software was developed to improve the quality of analysis. However, some problem might occur when system failed to count WBC number precisely due to cell overlapping with other cells. This is due to the technique used was based on the cell size and shape. Incomplete shape of cell in image also will cause problem to count the cell accurately. Research need to be done to overcome the problem by using other technique, or improving existing technique.

B. PREVIOUS FINDINGS FOR BLOOD RELATED DISEASES

From the clarification on pathology of blood cells, especially on WBC, it can be said that normal quantity of WBC is important to ensure person healthiness. Normal number of WBC in average human adult was about 7000/micro liter, about 1% of total blood cell in the body. Increase in the number of WBC in the body was called leukocytosis, while decrease in the number of WBC was called leucopenia. Leukocytosis was most likely to occur compared to leucopenia. The example of leukocytosis was shown in fig(1), when excessive amount of WBC is recognized in a sample of microscopic blood image. The dark blue cells indicate WBC‘s, while light blue indicates RBC‘s. From the image, it shows that WBC‘s number was high or most likely same as the number of RBC‘s. Meanwhile, the comparison between normal WBC quantity and abnormal WBC numbers can be seen through fig (2).

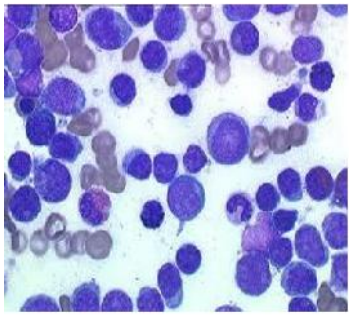


Fig (1): Example of Leukocytosis

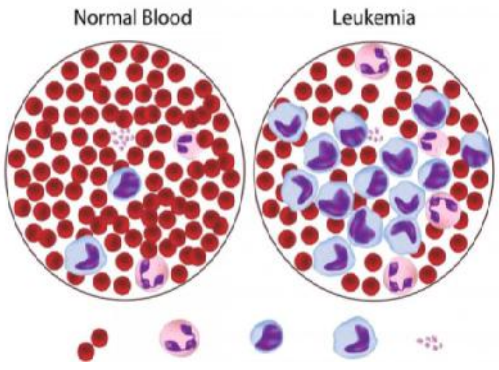
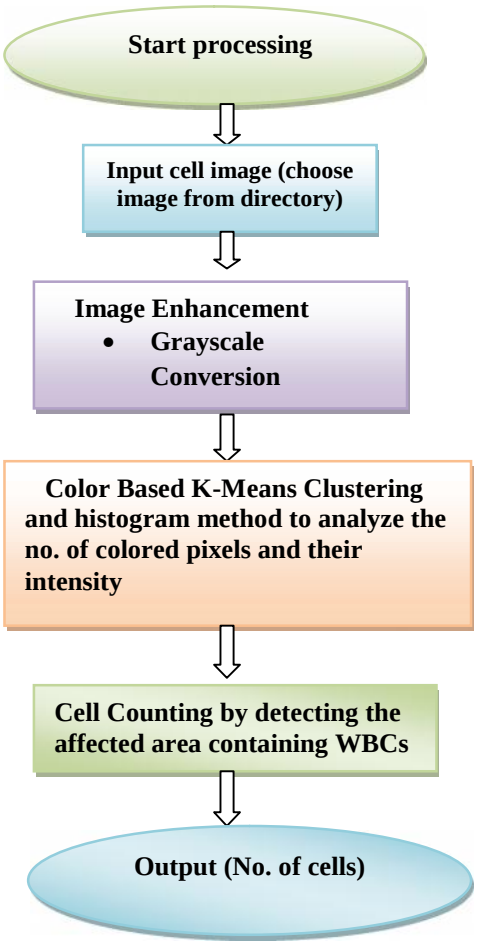


Fig (2): Comparison between Normal Blood and Leukemia

C. PROPOSED METHOD

The method mentioned in this paper for WBC extraction and counting is Color based clustering method by focusing on image intensity level. There are several steps needed to be done in this method to get the desired result. fig (3) shows the block diagram of flow processes involved in this research. It shows that this research and study is started by importing the input image into MATLAB workspace (m-file). Then, the image will be transformed into grayscale image by using specific function called grayscale conversion.

Then, the grayscale image undergoes next process by using different techniques and functions for further analysis. Meanwhile, for WBC extraction and counting, it only needs contrast adjustment and function for counting the number of WBC by referring to the number of boundaries detected. Below figure shows the flow of the process:



The steps involved in the processing of images are as below:

Steps for clustering

1.Read the image.
2.Convert image from rgb to lab color space.
3.Combine a&b color space i.e both the color axis while leaving the l i.e intensity axis.
4.Convert data type to double.
5.Arrange the above data into column vector.
6.Define variable which contains total number of clusters.
7.Apply k-means clustering on the above data.

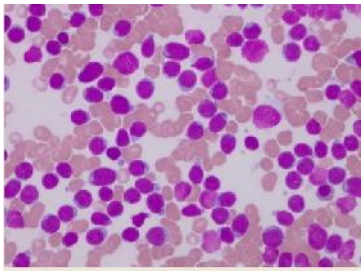
8.Calculate percentage area of the infected part.

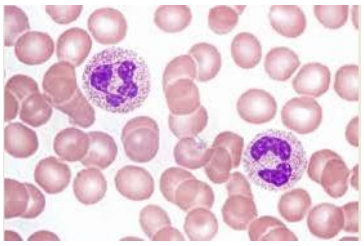
Steps for object counting

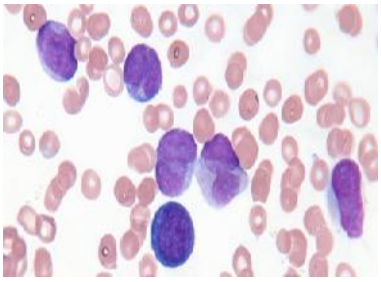
1. Read the image.
2. Extract the blue plane from the image and store it into a variable.
3. Convert image from rgb to gray.
4. Subtract the gray scale image from extracted blue plane image.
5. Calculate the threshold of subtracted image.
6. Convert the subtracted image into black and white image.
7. Calculate all the connected objects.

D. EVALUATION OF PROPOSED METHOD

The experiment was performed on 50 random images of cancerous blood cells. Some of the examples of the images are below:







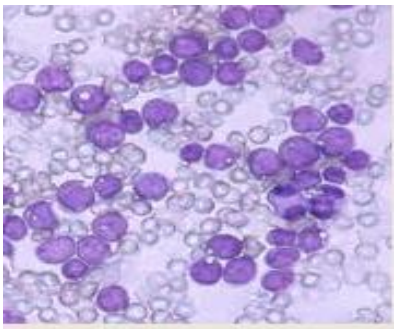


Table 1: Comparison between Manual and Automatic Counting of WBC's

No.	Sample	Manual Counting	Automatic Counting
1	Blood Sample Image1	2	3
2	Blood Sample Image2	6	8
3	Blood Sample Image3	2	2
4	Blood Sample Image4	12	14
5	Blood Sample Image5	16	21
6	Blood Sample Image6	71	85
7	Blood Sample Image7	2	3
8	Blood Sample Image8	17	18
9	Blood Sample Image9	6	8
10	Blood Sample Image10	6	9
11	Blood Sample Image11	3	323
12	Blood Sample Image12	6	6
13	Blood Sample Image13	8	129
14	Blood Sample Image14	3	42
15	Blood Sample Image15	Can't be determined	66
16	Blood Sample Image16	6	6
17	Blood Sample Image17	6	6
18	Blood Sample Image18	6	6
19	Blood Sample Image19	3	3
20	Blood Sample Image20	2	60
21	Blood Sample Image21	3	72
22	Blood Sample Image22	9	9
23	Blood Sample Image23	3	3
24	Blood Sample Image24	17	17
25	Blood Sample Image25	Can't be determined	99
26	Blood Sample Image26	11	11
27	Blood Sample Image27	3	3
28	Blood Sample Image28	8	8
29	Blood Sample Image29	5	5
30	Blood Sample Image30	20	20
31	Blood Sample Image31	12	12
32	Blood Sample Image32	4	4
33	Blood Sample Image33	16	16
34	Blood Sample Image34	11	11
35	Blood Sample Image35	8	8
36	Blood Sample Image36	3	3
37	Blood Sample Image37	20	20
38	Blood Sample Image38	4	4
39	Blood Sample Image40	5	6
40	Blood Sample Imag40	Can't be determined	100
41	Blood Sample Image41	3	3
42	Blood Sample Image42	2	2
43	Blood Sample Image43	20	20
44	Blood Sample Image44	8	8
45	Blood Sample Image45	4	11
46	Blood Sample Image46	2	3
47	Blood Sample Image47	3	3
48	Blood Sample Image48	Can't be determined	110
49	Blood Sample Image49	2	2

50	Blood Sample Image 50	3	3

E. RESULTS & CONCLUSIONS

With the implementation of proposed method, we get the results which calculates the minimum number of pixels detected because there can be huge no. of RBCs, fluid and WBCs and the percentage of RBCs & fluid in the complete cell would be more than the WBCs in the image. So, when calculating the cancerous area, it would be the minimum of the overall area covered by colored pixels. The proposed method can be very helpful in diagnosing the blood cancer at early stage. This method is generalized to detect cancer at initial stage wherein cancerous cells would be lesser. So, here we conclude the results achieved:

1. Number of cells counted manually are same in some of the case because the images are clear and the cells are prominent in size to be captured by human eyes.

2. Number of cells are not same in some of the case where the images do not have WBCs defined in prominent size. They cannot be detected and extracted through naked eyes. Hence, the one detected by color based clustering are actual count of WBC Cells.

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