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Cancer cell Detection using FMM Compressed Images

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Abstract: ***Counting a lymphocytes is bit a time consuming and tedious task and also not that interesting but we should not neglect the task because doctor should get an accurate report about a patient so that it will help to understand a doctor more about a patient and sometimes the manual counting of lymphocytes may also lead to improper / incorrect count of a lymphocyte which affect in analyzing a patient so we should not neglect the task. Because of these disadvantages we are developing an automated tool to count the number of lymphocytes using image processing. Initially image is converted into gray scale to get the maximum accuracy in the result, and then the image is compressed so that it can be stored in a minimal storage space, then edge detection of a cell is done through canny detection process to extract the counter boundary of the blood cell, then dilation and erode is applied to enlarge the interested cell and contract the non-interested cells by using a morphological characteristics ,then watershed algorithm is applied to segment the cytoplasm and nucleus from the blood cell. Finally counting of lymphocytes is performed.***

Keywords:Fmm Compression, Lymphocytes, Cancer Cell, Erythrocytes, Leukocytes, Thrombocytes.

I. INTRODUCTION

In recent years the image processing mechanisms are used widely in several medical areas for improving earlier detection and treatment stages, in which the time factor is very important to discover the disease in the patient as fast as possible, especially in various cancer tumors such as lung cancer, blood cancer, breast cancer etc.

Globally blood is categorized into three different groups, erythrocytes (RBC), leukocytes (WBC) and thrombocytes (Platelets). WBC are classified based on its nucleus and cytoplasm characteristics. They are granulocytes and agranulocytes, again the granulocytes are containing the three kinds, those are Neutrophil, Basophil and Eosinophil and agranulocytes contains LYMPHOCYTES and Monocytes.

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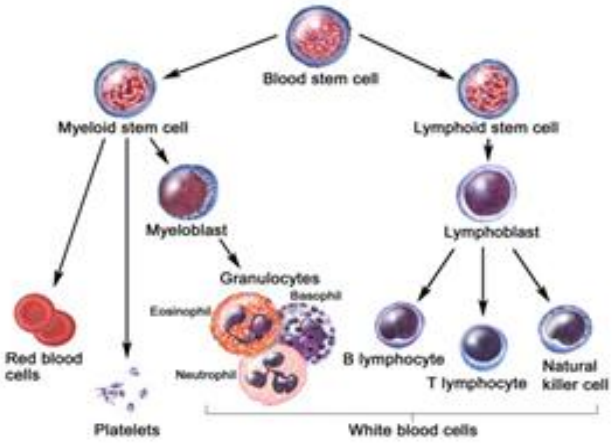


Figure 1: Types of blood cells

Source: https://goo.gl/images/jnEips

Here we are more concentrating on Lymphocytes.Lymphocytes are spread in the blood to lymphoid tissue everywhere in the body. The lymphocytes are having large nuclei and cytoplasm. There are two functionally distinct types: T-Lymphocytes and B-Lymphocytes. These are present great in numbers in the lymphatic tissue. Out of hundred WBC cell a normal human should have around 30-35 lymphocytes if it is increased then it causes lymphocytosis, if it is decreased than normal it may cause lymphocytopenia,analyzations of normal and affected lymphocytes are done here. The cancer lymphocyte cells are combining to form tissue called LYMPH NODES.

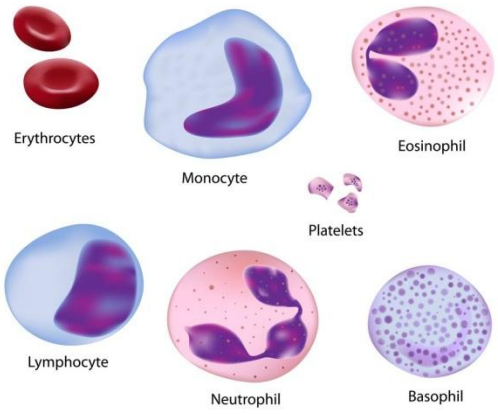


Figure 1: Types of lymphocytes

Source: https://goo.gl/images/u14VEv

Calculating the number of lymphocyte cells is an important task conventionally lymphocytes are counted by pathologist. Pathologistsmake use of DC and NCC for manual counting of blood cells. Both manual counting techniques have their own drawbacks. Each technique will consume more time and require a greater number of pathologists as it can't be performed by a single person and which also lead to lots of confusionand sometimes these methods may not give accurate result. In some situations, cells may be in confusion state. Because of this, ambiguity arises about the classification among WBC and counting of WBC. To overcome all these limitations, we are proposing an algorithm for conversion of image to gray scale, compression, edge detection, dilate, erode and segmentation of lymphocytes in the image.

II. LITERATURE SURVEY:

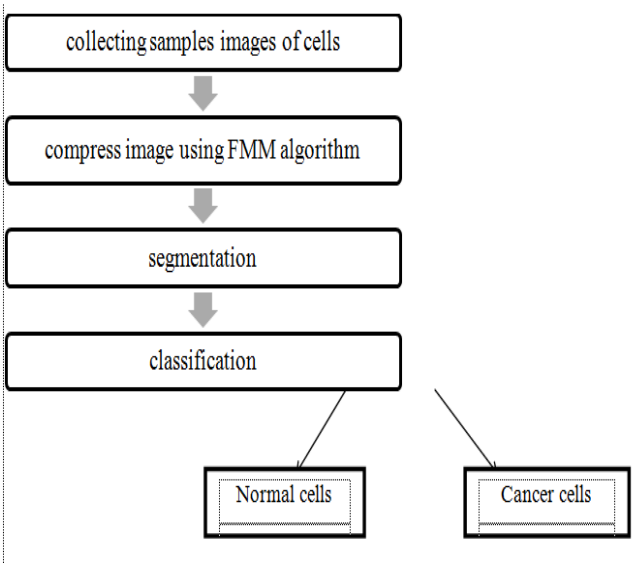
Neelam et al [1] suggests EM (Expectation Maximization) segmentation algorithm to identify cell and locate WBC nucleus and cytoplasm, then RGB images are being converted to H (Hue), S (Saturation), V (Value) equivalent image. EM algorithm followed two stages; first stage includes blood smear input, converting RGB image into HSV image, k-Means clustering, cropping WBC nuclei which is part of sub image. Second stage includes, considering stage one output sub image by converting to HSV, EM algorithm followed by k-Means clustering, finally ending up with locating segmented cytoplasm. S Manjunath et al [2] gave brief knowledge about NCC (Newbaur counting chamber), DC (Differential Counting) methods to count lymphocytes. Then they have implemented an algorithm to detect the lymphocytes in lymph nodes where initially color image is a input then it is converted into gray, then in the next step threshholding is applied for red, blue, green separately, then edges are detected by canny method, then dilation or erode is applied on an image, then erode is applied on dilated image finally detected lymphocytes from lymph nodes. Domenico et al [3] proposed a new method that how to reduce the number of rejected images by pre-processing procedure pointed out to the correct detection of the micro nucleus into human lymphocyte images which is acquired from the image flow cytometer due to bad exposure, Gaussian out of focus and Gaussian noise by applying awierner'sdeconvolution technique. Leysa et al [4] projected WBC segmentation using 2 steps, first segmentation of nucleus by threshold algorithm where certain value will be given to each pixel in the image based on color and morphological operations then cytoplasm is segmented by watershed algorithm which is tedious and onerous, the procedure of segmentation carried out like firstly region finding then contour detection algorithms are used then conversion of image into gray scale then erode then watershed transformation is appliedfor segmentation of non-overlapping cells . T.Geraud et al [5] proposed a method to segment an image based on the morphological characteristics by using a method where a different pixel value is given to a different color images according to the values the image will be segmented. if we use more values the accuracy of a result will be less. Joostvromen et al [6] proposed a method to segment the red blood cells from the blood smear using the SEM images. They more concentrate to segment the overlapped red blood cells, means only the upper most cells. Simple Contour technique is used for the segmentation where the atoms in the blood smear image react with the photons of the SEM then segmented image is appeared on monitor. James et al [7] proposed a method for segmentation of image by color, the system is capable of tracking several regions of up to 32 colors at 30Hz. The software system is composed of 4 main parts threshold classifier, form regions to connect components, separation and sorting. Souer robot at robocup-99 is used as a software which reduces the time consumption and reduces the work of pathologists. Akshay et al [8] mentioned that how speaker is recognised using 2 techniques one is identification and the other one is verification by using k-means clustering for segmenting and vector quantization. Bernard et al [9] as we know that white blood cells are the indicator of some diseases, there are 2 types of lymphocytes T and B-lymphocytes in this paper they have concentrated on T-lymphocytes that how retroviruses are involved in the cause of some leukemia's, lymphomas and sarcomas in various animal species. Vijay Lakshmi et al[10] This paper suggest us that how RF radiation are harmful to human body which is emitted due to broadcasting, medicine and industry which harms DNA of human cell it may lead to cancer sometimes so detection of DNA is also important using snake algorithm for segmentation purpose. Duangatte et al [11]propose a new method called pap test which is mainly concentrated to check cervix cancer this test includes many algorithm like CHT compact though transfer where it will detect all circle shape cells so that if in case of any abnormalities we can find easily but it fails to detect in overlapping cells then k-means is used to segment the normal and abnormal cells then snake algorithm is used for segmentation which consumes more time then genetic algorithm is applied to segment overlapping cells even it gives a more accuracy of segmented cells but it is slow process. Nipontheera-umpon [12] proposed a new method to segment single cell of white blood cells in bone marrow into two regions, one is nucleus and another one is non-nucleus. The method is based on fuzzy c-means clustering and mathematical morphology. WBC present in bone marrow is classified according their maturation, as maturation is continuous process, WBC are classified into distinct classes. The fuzzy clustering of pixels provides the over segmentation in which several patches are generated patches are the group of the similar pixels connected to reduce the time consumption. These patches are then combined to form two segments of nucleus and non-nucleus regions depending upon their similarities. Firas et al [13] new method for compression in which the quality of the image remains the same and measured using PSNR (peak signal to noise ratio) if the value is high then considered as a good compression which consists of converting each pixel value in an 8*8 matrix into multiple of 5. After that, the new value could be divided by 5 to get new values which are of6-bits length for each pixel and it is less in storage space than the original values which is 8 bits.

Duy-dinh le et al [14] proposed a method of detection using visual information of the image where vector of each frame is formed by concentrating on histograms of local binary patterns extracted from overlapped images and fixed-size rectangles within the frame.

Then SVM classifier is used to classify the image based on the vector pixel this will overcome the disadvantages of noisy image detection and moving objects in the video. K Pradeep et al[15] suggested a method for detecting an RBC among blood smear which contain RBC,WBC and platelets firstly check the quality of the image then image is converted into G component because it contain more information than red and blue have then plotted histogram graph between gray level and number of pixels to enhance the image improving the quality of the image so that it should recognize the details of image through human eye by intensity resolution then thresholding the image but here all 0's becomes 1's which means black becomes white vice versa then filling of holes, filling background from the edge of the image then clearing borders, erosion and interior pixel removal and finally image segmentation is done. Akshay et al[16] in this paper they proposed a new method to detect whether the image of the eye is normal or abnormal though eye is the very sensitive part of our body it takes time to detect abnormalities in this paper they are compressing an retinal image using FMM algorithm the image must be taken in high resolution so that the quality will be good then image in converted into green component and then watershed algorithm is applied then compare with the thresholding then canny edge detection methods for counter tracing then segmentation and compare the image with original image and find the probability of normal and abnormal eye images.

III. PROPOSED METHOD

Detection of lymphocytes from lymphnodes contain a steps including converting image into gray scale, then using FMM algorithm image has compressed because nowadays people concentrates more on storage ,there are two types of compression loss and lossless compression now here we are using lossless compression where there is no loss of the information or data, then detection method where edges has been traced and founded the correct edge or the shape of the image it is also used to detect whether the cells are normal or any abnormalities are present, then erode or dilate can be applied we have used erode operation where the unwanted cells are neglected it means they will be contracted then the cancered cell will be identified then k-means clustering is used to classify normal and cancer cells where we will choose two particular colors one represents normal cells and another represents cancered cells so that we can visualize the data that how many cancered cells are present in an image.



IV. COMPRESSION:

Compression of an image is performed to reduce the size of the image which is an advantageous method in our paper, in this we have used FMM compression method so that no information has lost during compression.

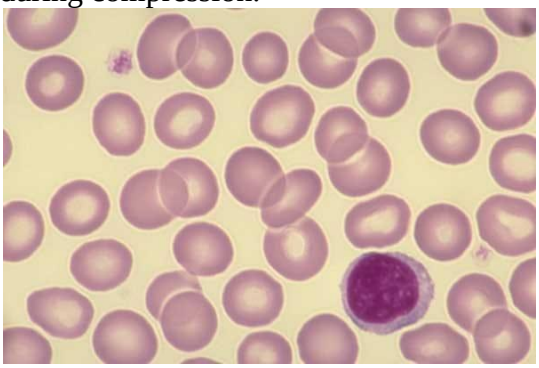


Figure 3: Original image

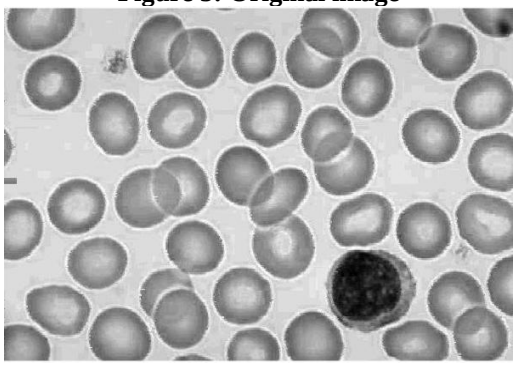


Figure 4: Compressed image

Feature extraction:
Blood smear image has been converted into G(green) component instead of R(red) and B(blue) because this G component contains more information than other two.

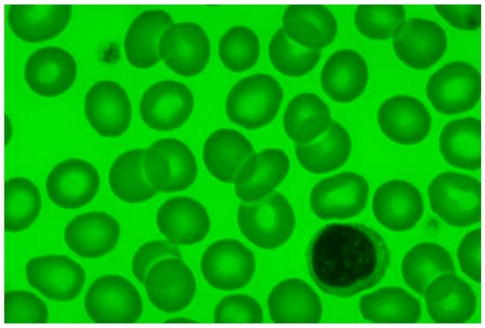


Figure 5: Image converted into G c

Edge detection:
Canny edge detection method is used to detect the edges where we can recognize the normal and abnormal cells in the blood smear through counter tracing.

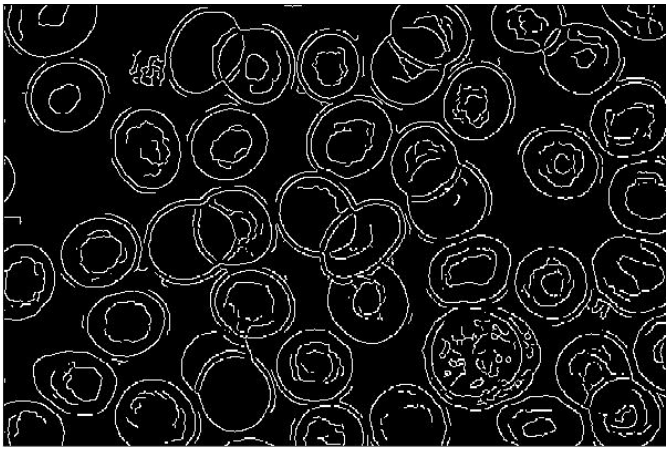


Figure 6: Canny edge detected image.

Segmentation:

Watershed algorithm is used to segment nucleus from the cytoplasm so that we can identify the shape of nucleus that it is normal or not so that cancer cell detection becomes easy in the blood smear image.

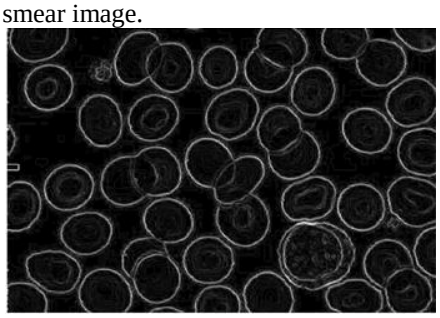


Figure 7: Watershed algorithm

Erode:

Erode function is applied on the edge detected image so that the only the interested cells remain in the same size rest gets contracted so that we can easily recognize that how many cancered cells are present in an image.

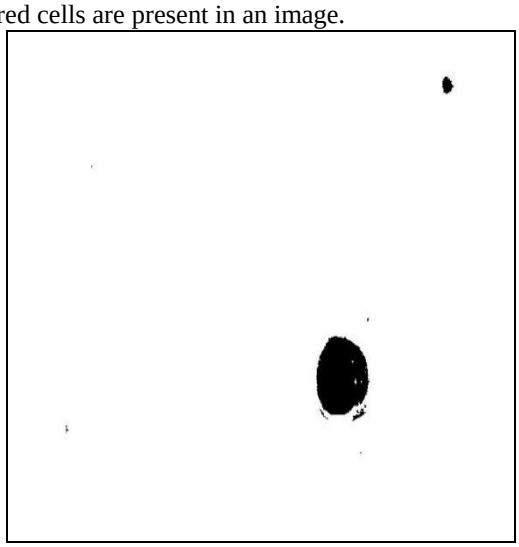


Figure 8: Eroded image

Classification:

SVM is used as classifier where it will classify the cancer cell in the blood smear.

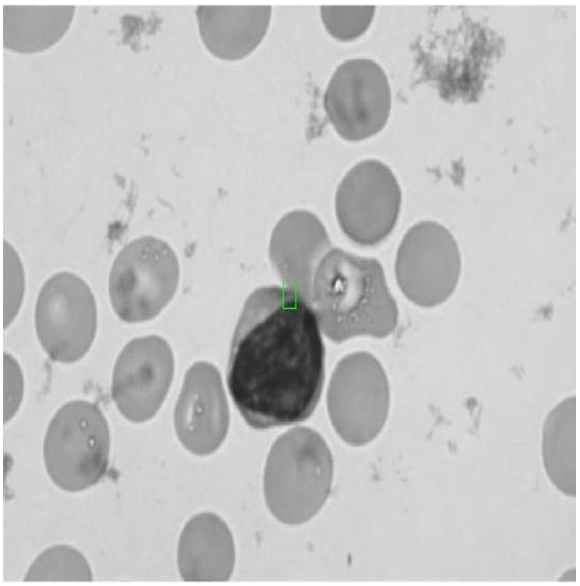


Figure 9: SVM classifier

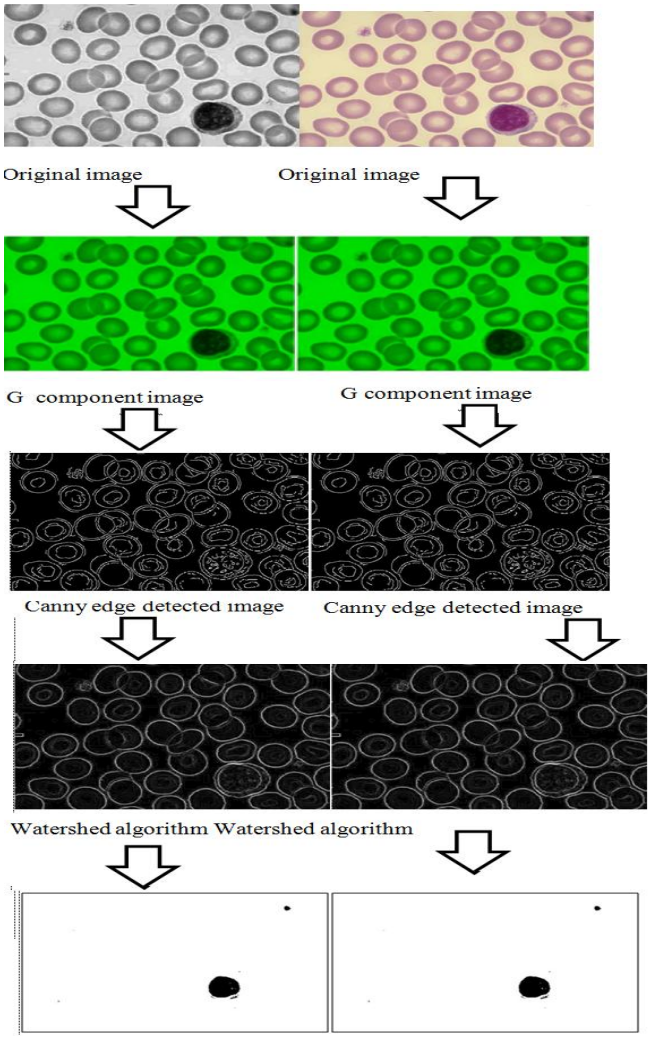
Algorithm:

Step 1: input a blood smear image.
Step 2: compress an image.
Step 3: convert it into G component.
Step 4: canny edge method is performed for the detection of edges.
Step 5: watershed algorithm is applied to segment
Step 6: erode is applied on the image.
Step 7: SVM method is used for classification.

V. RESULT AND DISCUSSION:

As per presented paper we observe that very less work is done on compressed blood smear images in the proposed method we have experimented with 80 blood smears images and after compression and segmentation classification gives a better accuracy when we use SVM classifier to classify cancer cells, the results are depicted above and we concluded that comparison doesn't affect the accuracy of the system.

We compare the segmentation and classification of original blood smear images with the segmentation and classification of the compress blood smear images and there is no significant difference in the classification results the procedure is depicted below in the figure.



Eroded Image Eroded image

VI. CONCLUSION:

Image type	Data set	F-measure
Original image	40	86.37
Compressed image	40	84.68

We have developed an automatic system which will detect the cancer cells in the blood smear the techniques which are used are images is converted into compressed image which is most advantageous in our paper then converted into G component, then contour tracing by canny detection method then erode is performed based on the morphological characteristics of the cells then SVM for classification, from these experiments we have achieved a good classification among cancer and normal cells.

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