DETECTION OF LEUKEMIA USING MATLAB

[1] Shailesh J. Mishra , [2] Mrs.A.P.Deshmukh

Abstract- **Leukemia disease is one of the leading causes of death among human. Its cure rate and prognosis depends mainly on the early detection and diagnosis of the disease. At the moment, identification of blood disorders is through visual inspection of microscopic images by examining changes like texture, geometry, colour and statistical analysis of images. This paper describes a preliminary study of developing a detection of leukemia types using microscopic blood sample images. Image analyzing is very important role play in the diseases of leukemia can be detected and diagnosed at earlier stage. Images are used as they are cheap and do not require expensive testing and lab equipment. In this paper used detection of leukemia cells in the normal blood cells using MATLAB.**

Keywords: Blood cells images, MATLAB.

INTRODUCTION

Leukemia is a type of cancer that affects the white blood cells. This affected white blood cells capture the bone marrow and the bone marrow is the soft material inside the of most bone. The abnormal white blood cells stay in bone marrow and reproducing in an uncontrolled way. In this way the normal healthy white blood cells in converted to abnormal uncontrolled cells the effect of this thing is human body is less able to fight off infections. The abnormal white blood cells also affect red blood cells and platelets. This affected red blood cells leads to less oxygen being delivered to the organs and tissues of your body it cause anaemia, and it can make to feel tired and breathless to the patient.. And affected platelets due to abnormal cells can lead to problems with the blood-clotting system, and results in bleeding and bruising much more easily than usual.
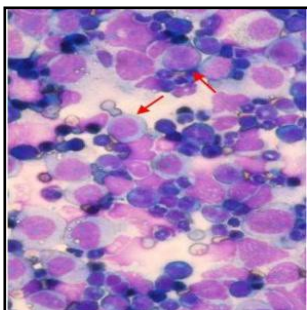

Figure-1: Leukemic Image

In initial stage identification of the leukemia type, greatly aids in providing the appropriate treatment for the particular type. Its detection of leukemia starts with a complete blood count. If the count blood cells are abnormal, the patient is suggested to consult the doctors. Therefore, to confirm the presence of leukemic cells, a study of morphological bone marrow and peripheral blood slide analysis is done. In order to classify the abnormal cells in their particular types and subtype of leukemia, a haematologist will observe some cells under a light microscopy looking for the abnormalities presented in the nucleus or cytoplasm of the cells. The clinical behaviour of the disease can be predicted using this classification and accordingly treatment should be given to the patient. In leukemia disease, large numbers of abnormal white blood cells are produced by bone marrow due to unknown cause. In pathology manual detection of leukemia is done which is time consuming as well as costly due to high cost pathology instruments. Hence automatic technique is adopted for fast and accurate results. In this technique image of blood sample is processed and nucleus part is segmented and finally cells are classified whether they are blast or normal one.

BACKGROUND

Leukemia is one of the types of cancer and it is tissue obtaining in the blood cells.. For leukemia study first knowledge about normal blood cells. Normal Blood Cells can develop in the bone marrow called Stem cells and the stem cells produce different kinds of blood cells.

Figure-2: a) White blood cell   b)Red blood cell   c)Platelets

The working of white blood cells help fight infection in the human body. There are several types of white blood cells available in human body shown in figure-2(a).
The working of red blood cells carries oxygen to tissues throughout the human body shown in figure-2(b)
The working platelets help form blood clots that control bleeding in the human body shown in figure-2(c).
In human blood cells white blood cells, red blood cells, and platelets are made from stem cells as the human body needs them. When cells are used for long time or damaged, they die, and new cells take their place.
 Figure-3 shows stem cells can produce into two different types of blood cells. First, a stem cell is myeloid stem cell and second is lymphoid stem cell:
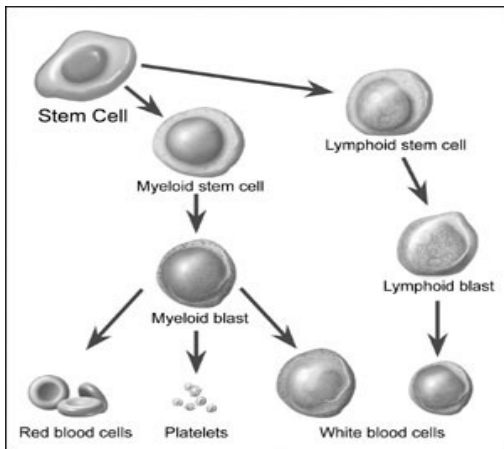
Figure-3: Stem cell type

A myeloid stem cell further divided to form a red blood cell, platelets, and one of the white blood cells.

A lymphoid stem cell also produces one of several types of white blood cells, such as B cells or T cells.

Leukemia Cells:

A person whose suffer with leukemia, the abnormal white cells blood cells produce in the bone marrow. The abnormal and unshaped white cells are leukemia cells.

Unlike and abnormal blood cells is leukemia. Leukemia cells don't die when they should. Abnormal white blood cells attack to the normal white blood cells, normal red blood cells, and normal platelets. This makes it difficult for normal blood cells to do their work..

Types of Leukemia

Leukemia type based on the speed of disease develops in the human body and spreading quickly captures the human body. In generally there are two types of leukemia chronic leukemia and acute leukemia.

Chronic leukemia: Chronic leukemia capture human body very slowly, initially chronic leukemia inflected in human body patient not occurred any symptoms. Meaning of this thing is normal white blood cells works normally and abnormal or leukemia cells not affect the working of normal cells. In this way very slowly chronic leukemia capture maximum area of human body and patient start to getting the symptoms. And in this case patient visit the doctor, leukemia is in its final stage.

There are two common types of chronic leukemia:

I. Chronic Lymphocytic Leukemia – Chronic Lymphocytic Leukemia – Chronic Lymphocytic Leukemia generally catch the older patients that mean that person who suffer last twenty to twenty-five the patient of blood pressure, diabetes this types of disease, meaning of this thing is the person whose age is more than fifty year occurs this types of leukemia. In initial stage this leukemia is not any symptoms so patient not find the leukemia in initial stage. If patient create problems like as weakness, fatigue, and weight loss patient immediately visit the doctors. Chronic Lymphocytic Leukemia cells shown in figure-4.
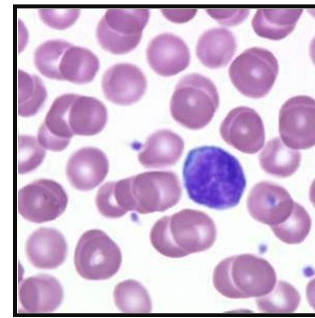

Figure-4: Chronic Lymphocytic Leukemia (CLL)

Chronic lymphocytic leukemia symptoms

Chronic lymphocytic leukemia is a slow-growing disease and many signs of Chronic lymphocytic leukemia are not getting clear symptoms in the initial stage, symptoms are accrued countable at the last stage of Chronic lymphocytic leukemia that mean in this stage patient suffered to the leukemia but medical science or doctors does not get any helps the patient. Some of the conditions that may arise as Chronic lymphocytic leukemia slowly develops and spreads may include:

1) Anemia: Working of red blood cells transports oxygen provided the human body. If the abnormal white blood cells affect the working of red blood cells, the symptoms of anemia occurred to the patient like as weakness, fatigue, lack of energy and shortness of breath.

2) Leukopenia: Working of white blood cells producing antibodies and warding off disease. If the abnormal white blood cells affect the working of normal white blood cells, the symptoms of leukopenia reduced immunity, more frequent infections and fevers.

3) Thrombocytopenia: Working of blood platelets are the particles in the blood that aid with clotting. If the abnormal white blood cells affect the working of normal blood plates, the symptoms including easy bruising, bleeding or nose bleeds, and bleeding gums.

II. Chronic Myelogenous Leukemia (CML) – In above discussion Chronic Lymphocytic Leukemia generally detected in the old patients meaning of that it obtain at the senior citizen. In chronic Myelogenous Leukemia can detected at any age patient but in many case this leukemia detected in the age between ages 35 to 45 years.

In chronic Myelogenous Leukemia initial symptoms are weight loss and fatigue and which may cause left upper abdominal pain. Chronic Myelogenous Leukemia cells shown in figure-5. Initial symptom chronic myeloid leukemia obtains in bone marrow white blood cells and after spread in the whole body of patient.
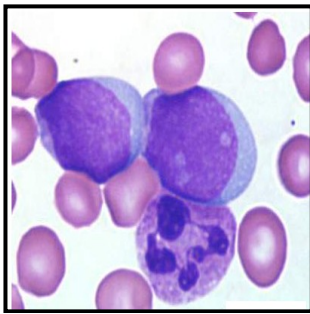
Figure-5: Chronic Myelogenous Leukemia (CML)

2. Acute leukemia: The acute leukemia cells cannot do any kind of the work to normal white blood cells. In acute leukemia the number of leukemia cells increases rapidly and very quickly rich the last stage of patient that mean medical science and doctors not help the patient to fight the leukemia.

There are two common types of acute leukemia:

I. Acute Lymphocytic Leukemia (ALL) – Acute lymphocytic leukemia usually obtain in the kids age that is 1 to 12 years children and at the oldest age. Initial symptoms of patients are fatigue, fever and bleeding. Acute lymphocytic leukemia cells shown in figure-6.
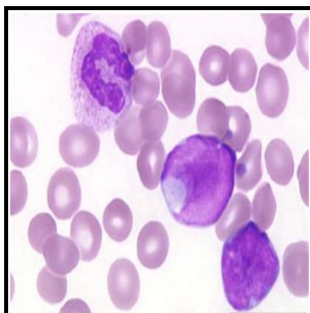

Figure-6: Acute Lymphocytic Leukemia (ALL)

Acute lymphocytic leukemia symptoms like as weakness, Fatigue, Fever, Headaches, Pale skin, Vomiting, Body aches and Loss of appetite

II. Acute Myelogenous Leukemia (AML) – Acute myelocytic leukemia is mostly obtain in kids less than 1 year of age and rarely obtain in older children but also seen in the older age patients. In acute myelocytic leukemia the first symptoms 25% patients are bone pain and joint pain. And 50% patients seen enlarged spleen, but lymph node enlargement is rare. Acute myelocytic leukemia cells shown in figure-7.
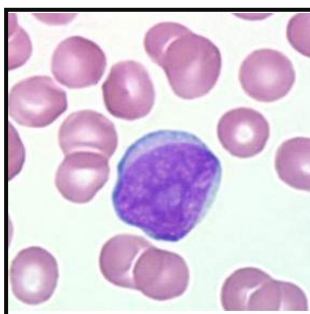

Figure-7: Acute Myelogenous Leukemia (AML)

Acute myelogenous leukemia symptoms
1) Frequent infections and fever: The important role of white blood cells is to ward off infections and protect our bodies from foreign germs and bacteria. Acute myelogenous leukemia reduces the number of healthy white blood cells therefore the body is not as capable of defending against foreign germs and bacteria. For this region patients of acute myelogenous leukemia may have an increased rate of infections and fevers.
2) Anemia: The important role of red blood cells carries oxygen throughout the body. The abnormal blood cells caused by acute myelogenous leukemia may lead to feeling tired and/or weak and having shortness of breath.
3) Easy bleeding or bruising: In human body the role of platelets control bleeding. If the abnormal blood cells affected the normal plates working and in case of patients have any minor cuts or bruises blood flow slow healing.
4) Joint and bone pain: The increased number of leukemia cells can cause pain in bones, joints or both.

FUNDAMENTAL STEPS IN IMAGE PROCESSING

Image Acquisition: Generally image involves pre-processing such as scaling and acquiring an image in digital form.

Image Enhancement: Enhancement is to process an image so that the result is more suitable than the original image.

Image Restoration: The principal goal of restoration techniques is to improve an image in some predefined sense. It deals with improving the appearance of an image.

Image Compression: Compression refers to the process of reducing the amount of data required to represent a given quantity of information.

Image Segmentation: Segmentation subdivides an image into its constituent regions or objects. Segmentation is the procedure partition an image into its constituent parts or objects. The level to which the subdivision is carried depends on the problem being solved.

Colour Image Processing: Adding colour to gray scale image so as to improve description of the image and better human perception.

DESIGN
The design of this project cost is very less due to the use of basic methods like clustering segmentation, for edge detection and morphological methods such as erosion and dilation for smoothing. All these methods are low cost and simple and give us the desired output if applied in the correct sequence and in the correct way with appropriate parameters. Initially we discuss the fundamental steps for making the image more suitable for human perception and comprehension. Once we get a more detailed and descriptive image, we perform a set of operations on the image so as to predict the presence of Lymph oblasts in the collection of cells in our given sample and we try to extract that cell using morphological methods. We perform

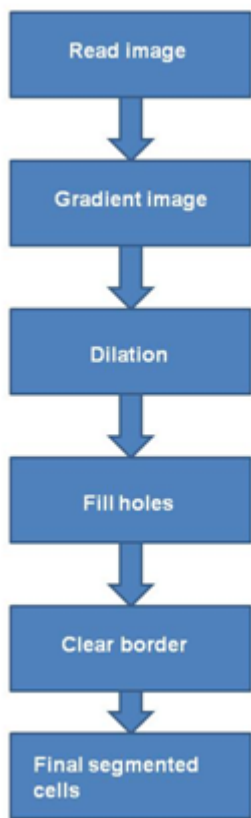processes such as scaling, noise correction, threshold, edge detection, geometric feature extraction etc.

Figure-8: Implementation design

The operations are focussed on processing the selected call and determining whether it is actually malignant or not. This is done by observing the cell boundary closely to observe its shape. If the shape coincides with any geometric feature (circular, oval, etc) we deduce that the cell is not infectious. On the other hand, if the cell boundary doesn't coincide with any geometric figure, it may be inferred that the cell is malignant and the patient requires immediate treatment.

METHODOLOGY

1. Read Cell Image: read the images which may have leukaemia cells. This image is provided to the program.

2. Gradient: The received images change in intensity or colour is done in the process of gradient. The gradient image can be occurred using filter and the simplest filter for this operation is sobel filter.

3. Dilate the Image: The binary gradient mask is dilated using the vertical structuring element followed by the horizontal structuring element. In dilation simply replicates positive intensities on the border to form softened image.

4. Fill holes: After dilation gradient mask shows the outline to cell, but there are still holes in the interior of the cell. To fill these holes we use the infill function and get the image.

5. Clear Border: The leukaemia cell of interest has been successfully segmented, but it is not only object has been found, to that object connected border are also found. To remove the border of the image by using the imclear border function.

6. Final Segmented Cells: A method for displaying the segmented object would be to place in red marks on the segmented cell.

Figure for obtain images using MATLAB:
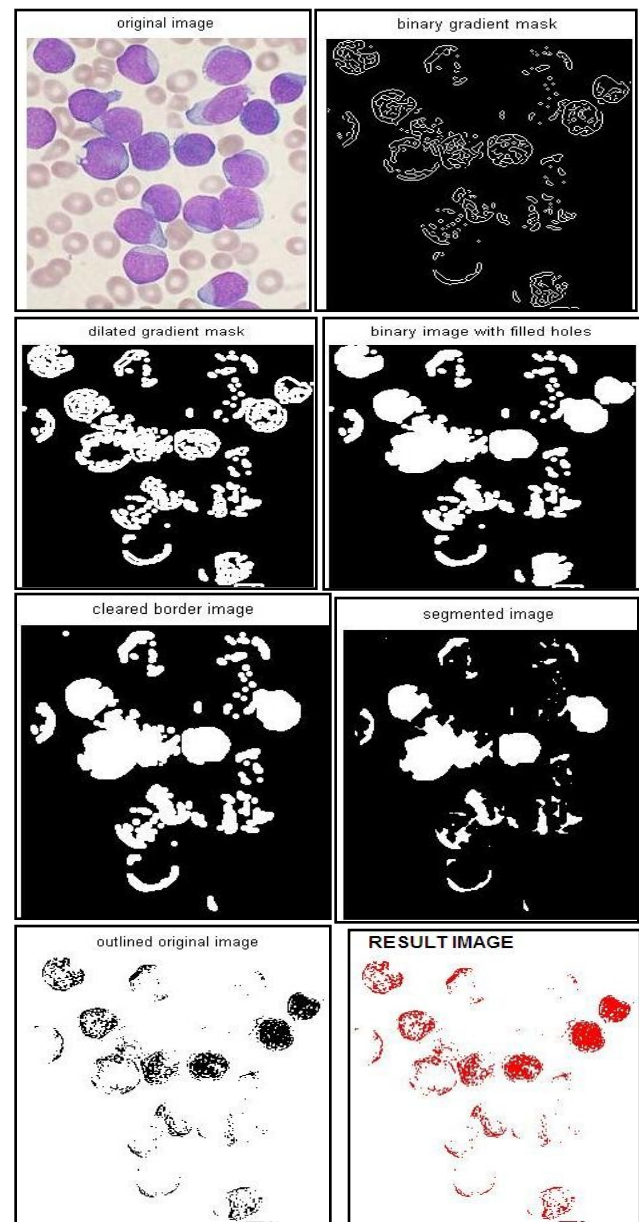
CONCLUSION: Above explain method use only detection of leukemia in human blood cells. In this method blood cell image processing segmentation, deletion, fill hole and clear border operations are used to obtain the edge of the cancerous blood cell. Pathological tests are costly and timely, so this process is not use for every month or short duration. Using this method process of testing is easy chip,

if suspected cells are obtain then go to laboratory and check all test under the doctors observation.

REFERENCES:

[1] Fauziah Kasmin, Anton Satria Prabuwono, Azizi Abdullah, "Detection Of Leukemia in Human Blood Sample Based on Microscopis Images: A Study," Journal Of Theoretical and Applied Information Technology, vol. 46 no 2, 2012.

[2] Ruggero Donida Labati, Vincenzo Piuri, Fabio Scotti, "The Acute Lymphoblastic Leukemia Image Database for Image Processing," Universita Degli Studi Di Milano, 10.1109/ICIP.2011.6115881, 2011.

[3] S.Jagadeesh, Dr. E.Nagabhooshanam, Dr. S.Venkatachalam, "Image Processing Based Approach to Cancer Cell Prediction in Blood Samples, "International Journal of Technology and Engineering Sciences, vol.1, ISSN: 2320-8007, 2013

[4] Behrooz Ghandeharian, Hadi Sadoghi Yazdi and Faranak Homayouni, "Modified Adaptive Centre Eighted Median Filter for Uppressing Impulsive Noise in Images", IJRRAS, Vol,1, Issue.3,
December 2009.

[5] Raymond H.chan,chung-wa Ho and Mila nikolova, "Salt and pepper noise reduction by mediantype noise detections and detail-preserving Regulation", IEEE Transaction on image processing,
Vol.14,No.10,October 2005

[6] MedlinePlus, The U.S. National Library of Medicine [Online]. :
http://www.nlm.nih.gov/medlineplus/ency/article/003643.htm

[7] High White Blood Cell Count [Online]. :
http://www.buzzle.com/articles/high-white-blood-cell-count.html

[8] MedHelp, The World's Largest Health Community [Online]. :
http://www.medhelp.org/medical-information/show/5066/Complete-blood-count---series?page=2

[9] The Encyclopedia of Surgery [Online]. :
http://www.surgeryencyclopedia.com/Ce-Fi/Complete-Blood-Count.html

[10] C.R., Valencio, M.N., Tronco, A.C.B.,Domingos, C.R.B., "Knowledge Extraction Using Visualization of Hemoglobin
Parameters to Identify Thalassemia",Proceedings of the 17th IEE Symposium onComputer Based Medical Systems, 2004, pp.1-6.

[11] R., Adollah, M.Y., Mashor, N.F.M, Nasir, H.,Rosline, H., Mahsin, H., Adilah, "Blood CellImage Segmentation: A Review", Biomed
2008, Proceedings 21, 2008, pp. 141-144.

[12] N., Ritter, J., Cooper, "Segmentation andBorder Identification of Cells in Images of Peripheral Blood Smear Slides", 30th
Australasian Computer Science Conference,Conference in Research and Practice in Information Technology, Vol. 62, 2007, pp. 161-169.

[13] D.M.U., Sabino, L.D.F., Costa, L.D.F., E.G., Rizzatti, M.A., Zago, "A Texture Approach to Leukocyte Recognition", Real Time Imaging,
Vol. 10, 2004, pp. 205-206.

[14] M.C., Colunga, O.S., Siordia, S.J., Maybank, "Leukocyte Recognition Using EMAlgorithm", MICAI 2009, LNAI 5845,
Springer Verlag Berlin Heidelberg, 2009, pp. 545-555.

[15] K.S., Srinivisan, D., Lakshmi, H., Ranganathan, N., Gunasekaran, "Non Invasive Estimation of Hemoglobin in Blood Using Color Analysis",
1st International Conference on Industrial and Information
System, ICIIS 2006, Sri Lanka, 8 – 11 August 2006, pp 547-549.

[16] W., Shitong, W., Min, "A new Detection Algorithm (NDA) Based on Fuzzy Cellular Neural Networks for White Blood Cell Detection", IEEE Transactions on Information Technology in Biomedicine, Vol. 10, No. 1, January 2006, pp. 5-10.

[17] H., Shin, M.K., Markey, "A Machine Learning Perspective on the Development of Clinical Decision Support System Utilizing Mass Spectra

of Blood Samples", Journal of Biomedical Informatics 39. 2006, pp. 227-248.

[18] M., Chitsaz, C., S., Woo, "Software Agent with Reinforcement Learning Approach for Medical Image Segmentation", Journal of Computer Science and Technology, Vol. 26, No. 2, 2011, pp. 247-255.

[19] National Cancer Institute,
http://www.cancer.gov/cancertopics/wyntk/leukemia [3October 2011].

[20] Through the Microscope: Blood Cells – Life's Blood.
http://www.wadsworth.org/chemheme/heme[3 October 2011].

[21] T., Bergen, D., Steckhan, T., Wittenberg, T.Zerfab, "Segmentation of leukocytes and erythrocytes in Blood Smear Images", *30th Annual International IEEE EMBS Conference, Vancouver, Canada, August 20 - 24*, 2008, pp.3075-3078.

First Author –

Name:	Prof. Shailesh J. Mishra
Designation	Assistant Professor,
	Sanmati Engineering College,
	Washim , Maharashtra, India,
Education Qualification:	M.Sc (App.Elect), M.E(appear)
Area of Specialization:	DIC & Design, Instrumentation

Second Author –

Name:	Prof. Mrs. Anupama P. Deshmukh
Designation	Assistant Professor,
	P.R.M.I.T.& R. Badnera ,
	Maharashtra, India,
Education Qualification:	B. E., M. E.
Area of Specialization:	DIC & Design, Instrumentation
Home page	**apd.html**