International Research Journal of Education and Technology
ISSN 2581-7795

A Literature Survey for Detection of Blood Cancer

Sneha. S. M[1], Dr Manasa Ravindra Walmiki[2], Waliza Hasan[3]

[1]Student, Dept. of Bio-Technology, Teresian College, Mysore
[2]Assistant Professor, Dept. of Bio-Technology, Teresian College, Mysore
[3]Student, Dept. of Bio-Technology,Teresian College, Mysore

Abstract-*For the fast and cost effective production of patient diagnosis, various image processing techniques or software has been developed to get desired information from medical images. Acute Lymphoblastic Leukemia (ALL) is a type of leukemia which is more common in children. The term 'Acute'means that leukemia can progress quickly and if not treated may lead to fatal death within few months. Due to its non specific nature of the symptoms and signs of ALL leads wrong diagnosis. Even hematologist finds it difficult to classify the leukemia cells, there manual classification of blood cells is not only time consuming but also inaccurate. Therefore, early identification of leukemia yields in providing the appropriate treatment to the patient. As a solution to this problem the system propose individuates in the blood image the leucocytes from the blood cells, and then it selects the lymphocyte cells. It evaluates morphological index from those cells and finally it classifies the presence of leukemia. In this paper a literature review is been conducted on various techniques used for detecting cancer cells.*

Keywords— Blood Cancer, Image Segmentation, Acute Lymphoblastic Leukemia (ALL), Leukemia, Morphological Analysis.

1. INTRODUCTION

Leukemia is a type of cancer which affects the white blood cells. Blood consists of plasma, and three different types of cells (White Blood Cells, Red Blood Cells and Platelets) and each of these performs particular task. White blood cells help the body to fight against infection and diseases. Red blood cells carry oxygen from the lungs to the body's tissues and vice versa. Platelets help to form blood clots and control bleeding[1]. A body of the person who is suffering from leukemia produces too many blood cells of particular type than another which results in abnormalities in the cells. These abnormal cells look different than normal blood cells and do not function properly (usually white blood cells)[3]. They also interfere with other blood cells, usually red blood cells and platelets.

Two types of abnormal white blood cells can turn into leukemia: lymphoid cells and myeloid cells. When leukemia caused due to lymphoid cells is called lymphocytic or lymphoblastic leukemia and if it is found in the myeloid cells, it is called myelogenous or myeloid leukemia [3]. Leukemia is grouped in 2 ways: Acute or chronic which is grouped on the basis of how fast the cells grow. Lymphoid or myeloid is another type of leukemia which is categorized depending on the type of white blood cell that has turned into leukemia[2],[3].[4]. In acute leukemia, the abnormal blood cells are usually immature blasts (young cells) that do not function properly. These cells grow quickly. Acute leukemia quickly gets worse unless it is treated immediately. In chronic leukemia, young blood cells are present, but mature, functional cells are also produced. In chronic leukemia, blasts grow slowly. It takes longer for the disease to get worse.

The four major forms of leukemia are

1. Acute lymphoblastic leukemia (ALL)

2. Acute myelogenous leukemia (AML)

3. Chronic lymphocytic leukemia (CLL) and

4. Chronic myelogenous leukemia (CML)

The infected cells can be observed in microscopic image, manually by a trained expert where the unique features are visually observed and the classification of type of cancer is done. The variety of features and often unclear images

results in missing of data which can be vital indicator to differentiate the type of cancer, therefore identification task becomes difficult. [2], [3], [4]. In the following section work done by different researchers has been presented.

2. RELATED WORK

Various image processing techniques has been developed by researchers to detect the blood cancer in biomedical images of human blood samples. Some of them are [5], uses thresholding technique in determining the ratio of blood cells for cancer cells detection. In this paper image processing techniques has been used to count the number of blood cells in the biomedical image. With this counted value of blood cell, the ratio of blood cell for leukemia is calculated. The original image which is converted to grayscale image for which a threshold value of intensity is set inorder to differentiate WBC toRBC (thresholding converts a gray scale image to binary image). If results are not satisfied the process is repeated by setting a new threshold value. The results acquired using thresholding technique shows that the ratio of RBC and WBC for normal image to the abnormal image has different range of ratio. For normal images the ratio is 0 to 0.1 whereas for abnormal images its ratio range is 0.2 to 2.5 for ALL and 0 to 14 for AML. The disadvantage of this technique is setting of proper threshold value would be difficult and time consuming.

[6] , uses two methods of image segmentation i.e. thresholding and watershed to detect the cancer infected cells. The segmentation accuracy using thresholding and watershed techniques are 81.24% and 85.27% respectively. From the results watershed segmentation of biomedical image has better accuracy and quality.

[7] , thispaper proposes the use of morphological analysis of leukemic infected image thereafter segmentation has been done which provides 2 enhanced images of cytoplasm and nuclei regions. Here bimodal thresholding has been used,where two threshold values of intensities was given to get the images of cytoplasm and nuclei and boundary of infected cell is traced and unwanted objects in the surrounding is filtered.From the results 98.33% of overall sufficient segmentation ratio of was obtained.

[9] ,has proposed segmentation framework that consists of an integration of several digital image processing algorithmswhich is called Zack Algorithm. A sample of twenty microscopic blood images were tested and obtained 92% accuracy for nucleus segmentation and 78% for cytoplasm segmentation with this results it is possible to extract the nucleus and cytoplasm region in a WBC image sample.

[10] , for enhancement and segmentation of image, automatic Otsu's threshold has been proposed in this paper.kNN classifier has been utilized to classify blast cells from normal lymphocyte cells. The system can be applied to 108 images which are available in public image dataset for the study of leukemia. This method has given 93% accuracy. The k- Nearest-Neighbours (kNN) is method of classifying non-parametric variables. This method is simple but very effective which can also be used to differentiate blast cells from normal white blood cells.

[11] , used adaptive thresholding technique using kernel fuzzy clustering method (KFCM). Instead of having single threshold value, a threshold value which changes dynamically with the image needs is used called adaptive thresholding. The output of adaptive threshold algorithm were given to KFCM clustering and the fuzzy image with fuzzy boundaries are obtained. Adaptive and KFCM both can be together used for the medical images and low intensity images and resultant image has better accuracy and quality. The results of adaptive thresholding are better than global thresholding.

[13] , in this paper image segmentation is done using wavelet transform and its results are compared with the conventional segmentation technique and the results obtained using wavelet transforms are better than conventional methods.

[14] , has segmented the image using K Means clustering and neural networks. The results are analyzed by comparing various error metrics and time complexity of the both the algorithms. Image segmentation done using feed forward neural networks has less noise and a very slow convergence rate. In this research K-means clustering and artificial neural networks (ANN) are studied to obtain a set of algorithms which can be combined in order to achieve a better performance in image segmentation. A comparison has been done to find out the best algorithm for image segmentation.

[15] , has propose k-means and improved watershed segmentation algorithm for medical image segmentation. The conventional watershed algorithm has an advantage of complete division of image but the disadvantage is over- segmentation and sensitivity. The improved watershed segmentation algorithm makes use of an automated thresholding. This segmentation reduces the over-segmentation and also false edges. In this paper proposed method produces segmentation maps which have 92% fewer partitions than the segmentation maps produced by the conventional watershed algorithm.

3. RESEARCH METHODLOGY

From the literature review the following are steps to be followed for the automation of medical image recognition, shown in the figure 1.

Fig- 1: Sequence of steps for automatic blood sample imagerecognition

Research methodology follows:

3.1. Microscopic Image Acquisition

Microscopic image of blood cells has to be obtained from nearby hospital with sufficient magnification.

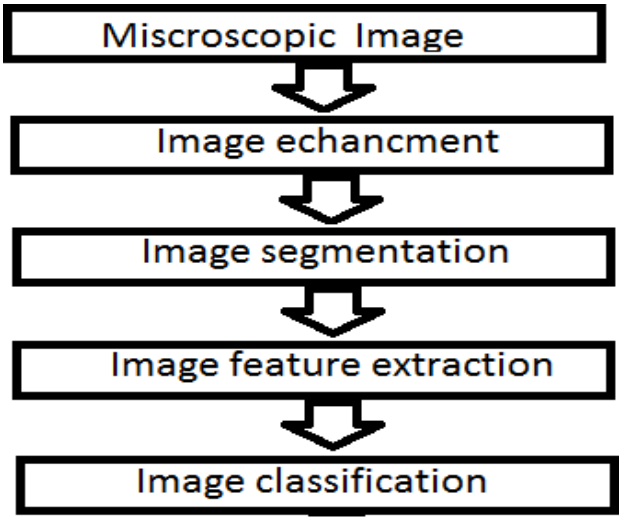
3.2. Image Enhancement (Preprocessing)

The medical image obtained may contain noise due to excessive staining. The image has to be denoised using any of the image denoising technique which improves the quality of the image but the image may appear as slightly blurred. The background of the blood sample image has to be excluded because the Region of Interest is white blood cells. This preprocessing of image, like noise reduction and enhancement will make the edges of the white blood cells sharper in the image [22].

3.3. Image Segmentation

The aim of the image segmentation is partition of an image into multiple segments. In this particular case the image segmentation partitions the white blood cell (WBC) from RBCs and plasma in the blood sample image. Image segmentation technique is a very hot area of research in the field of Image Processing. A lot of research work as been done on image segmentation and there are different segmentation algorithms but no single algorithm will be suitable for different types of images. Therefore as a result an algorithm designed for one particular image cannot be applied for other type of image [22]. Therefore developing a single segmentation technique for different images still remains a changing job. An automatic image Segmentation technique which gives the accurate results and which consumes less time especially for medical images can help in saving life by early detection of disease and early treatment.

Work done in medical image segmentation by various researchers and various techniques has been discussed in chapter II. Abnormal immature white blood cells are called blasts. The Proposed method should be able to differentiate the blast cell from the normal cells. For determining whether a cell is a blast or no, lymphocytes and myelocytes of blood only has to be considered and others like neutrophils, basophils and eosinophils can be barred from the image. When the blast cells are identified it can proceeded for the next step and sub images which contains nucleus only has to be focused which reduces the errors because there can be similar color scales in WBCs with other blood particles [23].



3.4. Image Feature Extraction

Feature extraction is the technique which extracts the desires features from the pre-processed images which contains of different abnormalities. The different features of the image can be size, shape, composition, location etc. Feature extraction is essential for the classification of desired objects. [23]. Feature Extraction is an essential important pace in the construction of any pattern classification which

intends to extract the relevant information that differentiates each [8]

• Geometrical Features consists of geometrical parameters like area, radius, perimeter, symmetry, boarder, concavity, compactness, solidity, eccentricity, elongation, form factor.

• Texture Features consists of homogeneity, energy, correlation, entropy contrast, angular second momentum.

• Color Features consists of the RGB color spaces will be transformed into HSV color spaces. Their mean color values will be obtained.

• Statistical Features consists of the mean value, variance, skew ness, kurtosis of the histograms of the image matrix and the gradient matrix for RGB or HSV color space.

Based on [19], ALL is small, blast cells are uniform, cytoplasm is scanty, round and usually contains single nucleoli inside nucleus. While in AML, the blasts are larger and irregular form and usually multiple nucleoli with the presence of Auer rode. [24] said that, the WBC appears rather darker than the background while red blood cell (RBC) appears in an intermediate intensity level. [25] indicates that white cells are the darker elements in images with RBC appear to be pale. Platelets are much smaller than white and red cells.

3.5. Image Classification

Depending on the features extracted from the above step the classifier classifies a cell as normal cell or cancer affected cell i.e. blast cell. This is done by comparing some of the features like geometric, statistical, texture and size ratio from regions obtained in the segmentation process with standard feature. Then the results are analyzed to identify the types and subtypes of acute leukemia[25][24].

Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads- the template will do that for you.

4. DISCUSSION

Some of the issues which have to be resolved about blood cells are blood sample itself. Due to environmental pressures cells get deformed to arbitrary shapes, [16] Because of diseases overlapped cells may get joined. This problem of overlapping can be overcome by watershed method.[6],[17]. Another issue regarding blood cells is collection of data because the collecting more samples is a not an easy task. Filtering and elimination of unwanted objects from the cell region. All the above mentioned issues have to be considered while designing a system. Therefore an automated image analysis system has to be developed to measure morphologic parameters and evaluation of cervical cells.

5. CONCLUSION

This research contains detection of blood cancer cells and classification of the types of leukemia from microscopic image samples using image processing. The proposed method extracts the features in microscopic images by examining changes on various parameters like texture, geometry, colors and statistical analysis input. The system should have high reliability, accuracy and efficacy, less processing time, smaller error, less cost and must be robust. Early identification of leukemia yields in providing the appropriate treatment to the patient.

REFERENCES

[1] C.R., Valencio, M.N., Tronco, A.C.B.,Domingos, C.R.B., “Knowledge ExtractionUsing Visualization of Hemoglobin Parameters to Identify Thalassemia”,Proceedings of the 17th IEE Symposium on Computer Based Medical Systems, 2004, pp.1-6.

[2] R., Adollah, M.Y., Mashor, N.F.M, Nasir, H., Rosline, H., Mahsin, H., Adilah, “Blood Cell Image Segmentation: A Review”, Biomed2008,Proceedings 21, 2008, pp. 141-144.

[3] N., Ritter, J., Cooper, “Segmentation and Border Identification of Cells in Images of Peripheral Blood Smear Slides”, 30thAustralasian Computer Science Conference, Conference in Research and Practice in Information Technology, Vol. 62, 2007, pp. 161-169.

[4] 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.

[5] Abdul Nasir, Mustafa N, Mohd Nasir, " Application of Thresholding in Determing Ratio of Blood Cells for Leukemia Detection" in the Proceedings of International Conference on Man-Machine system (ICoMMS) oct 2009 ,Batu Ferringhi, Penang, Malaysia.

[6] Bhagyashri G Patil, Prof. Sanjeev N.Jain , "Cancer Cells Detection Using Digital Image Processing Methods" in International Journal of Latest Trends in Engineering and Technology".

[7] ADNAN KHASHMAN, ESAM AL-ZGOUL, "Image Segmentation of Blood Cells in Leukemia Patients" in RECENT ADVANCES in COMPUTER ENGINEERING and APPLICATIONSISBN: 978-960- 474-151-9

[8] FAUZIAH KASMIN, ANTON SATRIA PRABUWONO, AZIZI ABDULLAH "DETECTION OF LEUKEMIA IN HUMAN BLOOD SAMPLE BASED ON MICROSCOPIC IMAGES: A STUDY" , Journal of Theoretical and Applied Information Technology 31st December 2012. Vol. 46 No.2.

[9] Farnoosh Sadeghian, Zainina Seman, Abdul Rahman Ramli, Badrul Hisham Abdul Kahar, and M-Iqbal Saripan, "A Framework for White Blood Cell Segmentationin Microscopic Blood Images Using Digital Image Processing" in Shulin Li (ed.), Biological Procedures Online,Volume 11, Number 1 to the author(s) 2009

[10] Ms. Minal D. Joshi, Prof. Atul H. Karode, Prof. S.R.Suralkar, "White Blood Cells Segmentation andClassification to Detect Acute Leukemia" in International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 2, Issue 3, May – June 2013

[11] Tara.Saikumar, B.K.Anoop, P.S.Murthy in "Robust Adaptive Threshold Algorithm based on Kernel Fuzzy Clustering on Image segmentation" in Natarajan Meghanathan, et al. (Eds): ITCS, SIP, JSE-2012, CS & IT 04, pp. 99–103, 2012. © CS & IT-CSCP 2012

[12] Michael Barnathan,"Mammographic Segmentation Using WaveCluster", open access algorithms ISSN 1999-4893, Algorithms 2012.

[13] Xu Gongwen, Zhang Zhijun, Yuan Weihua, XuLi Na, "On Medical Image Segmentation Based on Wavelet Transform" in IEEE , ISBN 978-1-4799-4262-6, June 2014

[14] Chinki Chandhok "A Novel Approach to Image Segmentation using Artificial Neural Networks and K-Means Clustering" in Chinki Chandhok / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 ,Vol. 2, Issue 3, May-Jun 2012, pp. 274-279

[15] Ng, HP ong,S.H; Fooong, K.W.C in "Medical Image Segmentation Using K-Means Clustering and Improved Watershed Algorithm" IEEE , ISBN 1-4244-0069-4,2006

[16] N., Ritter, J., Cooper, "Segmentation and Border 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

[17] I., Cseke, "A Fast Segmentation Scheme for white Blood Cell Images", IEEE, 1992, pp. 530-533.

[18] A., Khashman, E., Esam Al-Zgoul, "Image Segmentation of Blood Cells in Leukemia Patients", Recent Advances in Computer Engineering and Applications, ISBN: 978-60-474-151-9, 2009, pp. 104-109.

[19] N.I., Birndorf, J.O., Pentecost, J.R., Coakley, K.A., Spackman, "An Expert System to Diagnose Anemia and Report Results Directly on Hematology Forms", Computers and Biomedical Research, Vol. 29, 1996, pp. 16-26.

[20] S., Mohapatra, D., Patra, S., Satpathi, "Image Analysis of Blood Microscopic Images for Leukemia Detection", International Conference on Industrial Electronics, Control and Robotics, IEEE, 2010, pp. 215-219.

[21] T. Markiewicz, S. Osowski, B., Marianska, L., Moszczynski,"Automatic Recognition of the Blood Cells of Myelogenous Leukemia Using SVM", Proceedings of International Joint Conference on Neural Networks, Montreal , Canada, July 31 – August 4, 2005, pp. 2496-2501

[22] N., H., A., Halim, M., Y., Mashor, R., Hassan, "Automatic Blasts Counting for Acute Leukemia Based on Blood Samples", International Journal of Research and Reviews in Computer Science, Vol. 2, No. 4, August 2011, pp. 971-976.

[23] Athira Krishnan, Sreekumar K, " A Survey on Image Segmentation and Feature Extraction Methods for Acute Myelogenous Leukemia Detection in Blood Microscopic Images" , (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (6) , 2014, 7877- 7879

[24] A.Sindhu1, S.Meera2 " A Survey on Detecting Brain Tumorinmri Images Using Image Processing Techniques" , International Journal of Innovative Research in Computer and Communication Engineering. Vol. 3, Issue 1, January 2015

[25] Niranjan Chatap, Sini Shibu "Analysis of blood samples for counting leukemia cells using Support vector machine and nearest neighbor", e- ISSN: 2278-0661,p-ISSN: 2278-8727, Volume 16, Issue 5, Ver. III (Sep – Oct. 2014), PP 79-87 www.iosrjournals.org.