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# DETECTION OF LEUKEMIA USING IMAGE PROCESSING

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**ABSTRACT**

*Leukemia is a blood cancer, which usually origins in the bone marrow and affects the body's ability to fight against infection. In India fewer than 1 million cases of leukemia are reported every year. Some of the common symptoms are skin rashes, bleeding, feeling tired, fever and increased risk of infections. It is very important to detect leukemia at early stages. Traditional methods (such as microscopic analyses of blood smears) of detecting Leukemia are time consuming, not cost effective and totally dependent on medical personnel. To overcome these drawbacks we propose an automation algorithm using image processing for the detection and classification of Leukemia using processing tool MATLAB. In this process inputs are the microscopic images, and these images are processed using image processing techniques such as Image enhancement, segmentation, feature extraction and classification.*

***Keywords: Leukemia, Segmentation***

## I.INTRODUCTION

Leukemia is a name of a blood disease; it is a cancer of blood cells. Leukemia disease grows very rapidly hence it has to be detected as early as possible. It originates in bone marrow when bone marrow produces large number of white blood cells or abnormal White Blood Cells. Leukemia has four major types: Acute Lymphocytic Leukemia (ALL), Acute Myelogenous Leukemia (AML), Chronic Lymphocytic Leukemia (CLL) and Chronic Myelogenous Leukemia (CML)(3).

Leukemia is detected manually by experts under microscope. This manual examination method is costly, time consuming and totally depends on operator's knowledge and skills. Detection through Digital image processing overcomes the above problems. Digital image processing requires images as the primary input, and do not require expensive lab equipments.

To automate the process of detection of leukemia many image processing algorithms have been developed. This system takes microscopic blood smear images as their input. Depending on type and quality of the image various image processing techniques are used to get desired output. Various techniques such as image enhancement, segmentation, feature extraction and classification are used to detect and identify the leukemia types. All this study shows that the segmentation of the image is the most important step in leukemia image

processing. The accuracy of results of next steps (feature extraction and classification) is based on segmentation output.

Sos Agaian, Monica Madhukar, and Anthony T. Chronopoulos, in[1] proposed a technique to automatically detect and segments AML in blood smears using k-means segmentation algorithm. Romel Bhattacharjee and Lalit Mohan Saini in[2], proposed a method to detect Acute lymphoblastic leukemia. For classification a set of features which include Area, Perimeter, Circularity, and Form Factor of a cell is constructed. Mashiat Fatma, Jaya Sharma in[3], suggests neural network for classification.

## II. PROCESS OVERVIEW

Fig. 1, shows the steps involved in the proposed system.

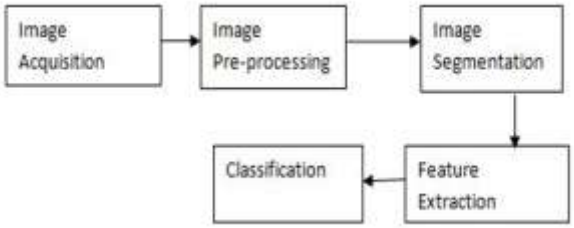


Fig. 1. Basic block diagram of proposed system.

### 2.1 Image Acquisition

The input to the proposed system is the microscopic images of blood smear. The system is trained using a set of different types of leukemia images. These images are the RGB images. In MATLAB RGB images are stored as 3 dimensional arrays. So working with this matrix data in MATLAB is easier. Database of different types of leukemia images is taken from online database.

### 2.2 Image Pre-processing

Pre-processing is the step of image processing which makes the given image most suitable for the further processing steps. In this images are enhanced. Depending upon the results needed many pre-processing techniques can be used for removing the noise, for improving the quality of image for adjusting the contrast etc. In this case it is the color conversion. The RGB image model is represented in the HSI model to enhance the diff erent colors in the image, in order to diff erentiate those colors.

### 2.3 Segmentation

Segmentation is the process of diff erentiating objects, colors, patterns or textures within an image itself. The main purpose of segmentation step in image processing is to obtain a particular part or objects from the entire image. Accuracy of feature extraction and classification depends on the segmented output. There are various segmentation algorithms but the k- means clustering algorithm is most widely used. In this proposed system k-means algorithm is used. The number of clusters (k) in this case is taken 4.

2.4 Feature extraction

In this step different types of features of the segmented image are extracted. Features that contain important information are selected to get desired output. In this proposed system it requires multiple features for better classification. Features that are extracted in this project are Energy, Correlation, Sum Entropy, Difference entropy, entropy, information measure of Correlation, Contrast, and Correlation etc.

2.5 Classification

Based on the features that are extracted for different types of leukemia the classifier is trained. A classifier assigns an identity to the inputted image based on the trained known classes. Classification in this proposed system is done using Neural Network.

## III.EXPERIMENTAL RESULTS

Leukemia images obtained from online database and from Goa Medical College are used as input images. And pre-processing and segmentation steps are performed on these images. GUI is created to execute the steps of code step wise and to make it user friendly. First the RGB image is converted into HSI model. Then k-means algorithm is used to segment the image into different parts. Following fig.2 shows flow chart of the performed steps.

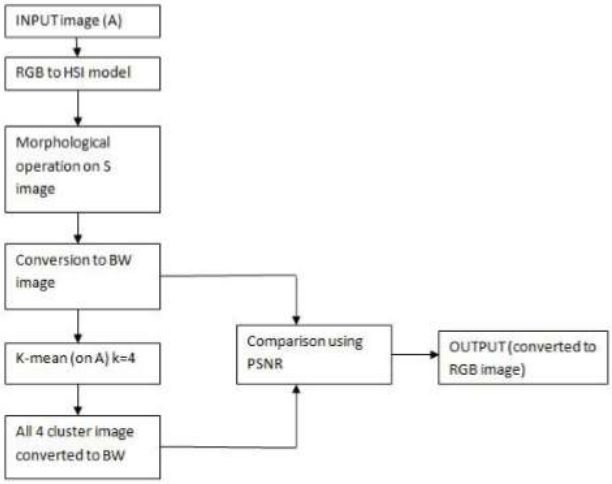


Fig. 2. Flow chart of the proposed system.

Graphical User interface has been created in order to make it user friendly. Fig 3 shows the pop up that comes after running the code.

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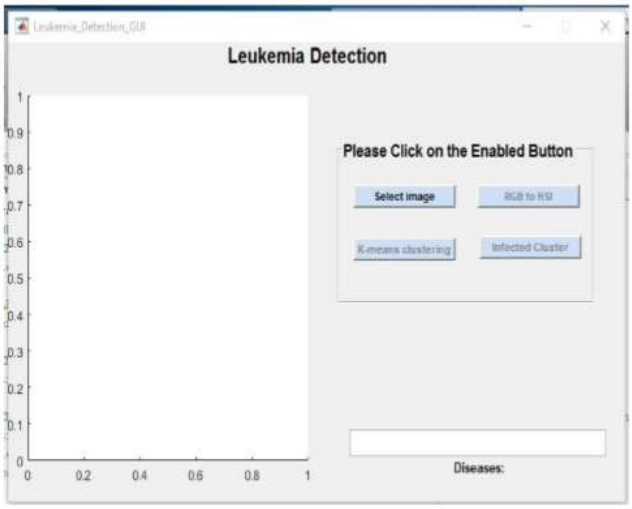


Fig. 3. GUI created for detecting Leukemia.

It shows four buttons that are select image, RGB to HSI, k-means clustering and infected cluster. At first only "select image" is enabled. It allows browsing and selecting the desired image. After selecting the image "RGB to HSI" gets enabled.

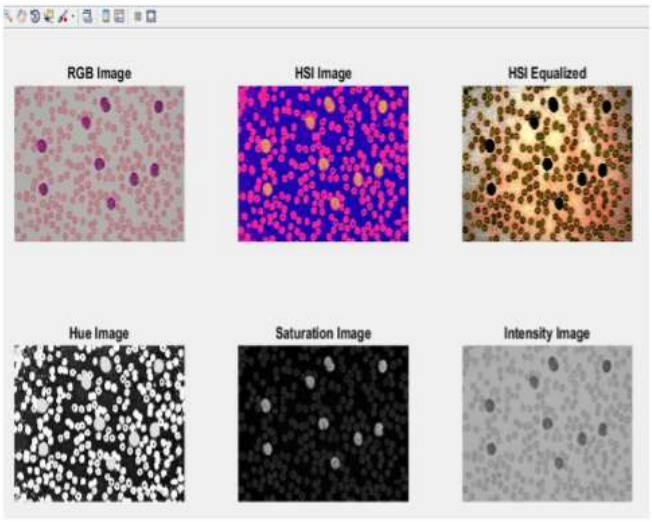


Fig.4. RGB to HSI conversion of selected image.

After clicking on "RGB to HSI" we get the output as shown in fig 4. It gives HSI equalized, hue, saturation and intensity images of the selected leukemia image. Out of all these images Saturation image enhances and represents the required cells from entire image. This saturation image is used for finding the correct cluster.

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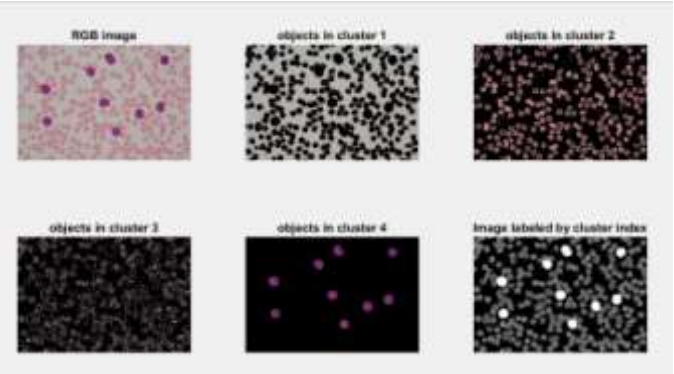


Fig. 5. k-means clustering segmentation output, for k=4.

After selecting "k-mean" we get the output as shown in fig 5. Fig 5 shows segmented output of the selected image. The image is represented in four(k=4) clusters. The value 4 is selected by experimenting and checking for all the images of dataset.

After this step the "infected cluster" button enables. After selecting "infected cluster" it gives the correct cluster which we required for further classification. Fig. 6 shows the output.

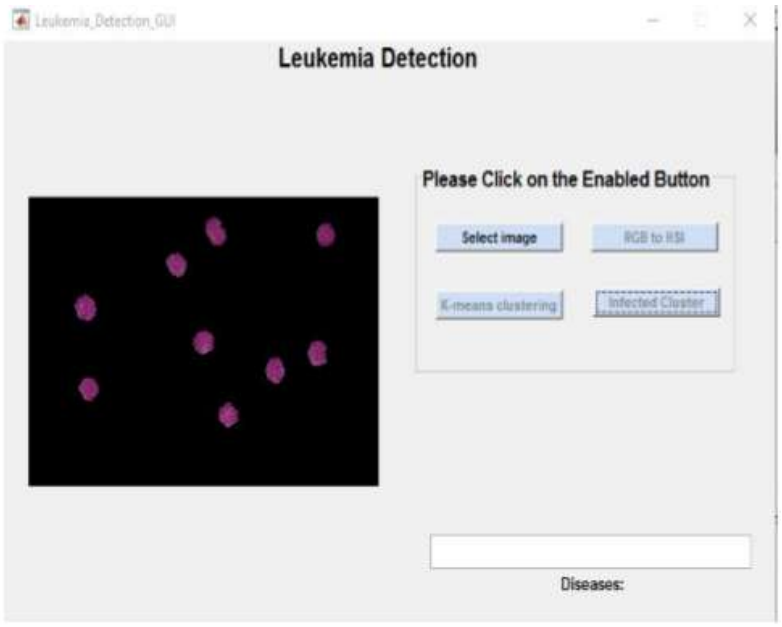


Fig. 6. Detected cluster of Acute Myelogenous Leukemia (AML) cells.

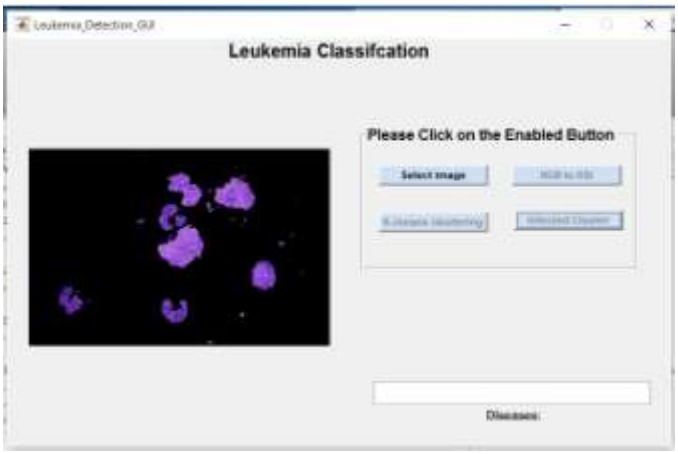


Fig. 7. Detected cluster of Chronic Myelogenous Leukemia (CML)

Fig. 7 shows the detected cluster of CML image.

## IV.CONCLUSION

As presented in this paper an automation system has been designed for the detection and classification of leukemia cells. Proposed system has four major steps that are pre-processing, segmentation, feature extraction and classification. It is performed on 12 leukemia images obtained from Goa Medical College (GMC) and on some leukemia images taken from online dataset. Images are converted in HSI color model for better segmentation. K-means algorithm used for segmentation process gives accurate results for the used databases. It segments all four types of cells correctly. To obtain better results more experiments with different algorithms can be done. More research can be done to choose the number of clusters automatically.

## REFERENCES

[1] Sos Agaian, Senior Member, IEEE, Monica Madhukar, and Anthony T. Chronopoulos, Senior Member, IEEE, Automated Screening System for Acute Myelogenous Leukemia Detection in Blood Microscopic Image, Ieee Systems Journal, 2014 Ieee.

[2] Romel Bhattacharjee, Lalit Mohan Saini, Robust Technique for the Detection of Acute Lymphoblastic Leukemia, 2015 IEEE Power, Communication and Information Technology Conference (PCITC) Siksha O Anusandhan University, Bhubaneswar, India.

[3] Mashiat Fatma, Jaya Sharma, Identification and Classification of Acute Leukemia Using Neural Network, 2014 International Conference on Medical Imaging, m-Health and Emerging Communication Systems (MedCom).

[4] Shubhangi Khobragade1, Dheeraj D Mor2,Dr. C.Y.Patil 3, Detection of Leukemia in Microscopic White Blood Cell Images, 2015 International Conference on Information Processing (ICIP) Vishwakarma Institute of Technology. Dec 16-19, 2015.

[5] Jakkrich Laosai and Kosin Chamnongthai, Acute Leukemia Classification by Using SVM and K-Means Clustering, Proceedings of the International Electrical Engineering Congress 2014

[6] Ashwini Rejintal, Aswini N, Image Processing Based Leukemia Cancer Cell Detection, IEEE International Conference On Recent Trends In Electronics Information Communication Technology, May 20-21, 2016, India.

[7] Ansha Beevi S.1, Remya R.S.2, An Overview on Acute Lymphocytic Leukemia Detection using Cell Image Segmentation, IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661,p-ISSN: 2278-8727, PP 22-29.

[8] Mausumi Maitra, Rahul Kumar Gupta, Manali Mukherjee, Detection and Counting of Red Blood Cells in Blood Cell Images using Hough Transform, international Journal of Computer Applications (0975 8887) Volume 53 No.16, September 2012.

[9] A.S.Abdul Nasir, M.Y.Mashor, H.Rosline, Unsupervised Colour Segmentation of White Blood Cell for Acute Leukaemia Images, 2011 IEEE Conference.

[10] Rupinder Kaur Sandhu, Dr. Raman Maini, Automated Detection of Leukaemia, Volume 8, No. 5, May-June 2017 International Journal of Advanced Research in Computer Science.

[11] Malwinder singh1,Meenakshi bansal 2, A Survey on Various K-Means algorithms for Clustering, IJCSNS International Journal of Computer Science and Network Security, VOL.15 No.6, June 2015.

[12] Biplab kanti das, Krishna kumar jha, Himadri sekhar dutta, A New approach for Segmentation and Identification of Disease Aff ected Blood Cells, 2014 International Conference on Intelligent Computing Applications.

[13] Rege M.V.1, Dr.B.W. Gawli2, Detection of Leukemia in Human blood sample through Image Processing, A Review IJMTER-2015

[14] J.Hari,A.Sai Prasad,S.Koteswara Rao, Separation and Counting of Blood cells using Geometrical Features and Distance Transformed Watershed, 2014 2nd International Conference on Devices, Circuits and Systems (ICDCS).

[15] S. Pavithra, J. Bagyamani, White Blood Cell Analysis Using Watershed and Circular Hough Transform Technique, International Journal of Computational Intelligence and Informatics, Vol. 5: No. 2, September 2015.

[16] Tapas Kanungo, Senior Member, IEEE, David M. Mount, Member, IEEE, Nathan S. Netanyahu, Member, IEEE, Christine D. Piatko, Ruth Silverman, and Angela Y. Wu, Senior Member, IEEE, An Efficient k-Means Clustering Algorithm; Analysis and Implementation, Ieee Transactions On Pattern Analysis And Machine Intelligence, Vol. 24, No. 7, July 2002.

[17] S.Kareem, R.C.S Morling and I.Kale, A Novel Method to Count the Red Blood Cells in Thin Blood Films, 2011 IEEE.

[18] Yogesh Karunakar, Dr. Alhad Kuwadekar, An unparagoned application for Red Blood Cell Counting using Marker Controlled Watershed Algorithm for Android mobile., 2011 Fifth International Conference on Next Generation Mobile Applications and Services.

[19] Mr. Dixit Kolhatkar, Ms. Nisha Wankhade, Detection and Counting of Blood Cells using Image Segmentation: A Review,, 2016 World Conference on Futuristic Trends in Research and Innovation for Social Welfare (WCFTR16).

[20] Subrajeet Mohapatra, Dipti Patra, Automated Leukemia Detection using Hausdorff Dimension in Blood Microscopic Images, 2010 IEEE.

[21] Subrajeet Mohapatra, Dipti Patra, Automated Cell Nucleus Segmentation and Acute Leukemia Detection in Blood Microscopic Images, Proceedings of 2010 International Conference on Systems in Medicine and Biology 16-18 December 2010, IIT Kharagpur, India.

[22] Subrajeet Mohapatra, Sushanta Shekhar Samanta, Dipti Patra and Sanghamitra Satpathi, Fuzzy based Blood Image Segmentation for Automated Leukemia Detection, 2011 IEEE.

[23] Jianpeng Qi, Yanwei Yu*, Lihong Wang,and Jinglei Liu, K*-Means: An Effective and Efcient K-means Clustering Algorithm, 2016 IEEE International Conferences on Big Data and Cloud Computing (BDCloud), Social Computing and Networking (SocialCom), Sustainable Computing and Communications (SustainCom).

[24] Chaitali Raje, Jyoti Rangole, Detection of Leukemia in Microscopic Images Using Image Processing, International Conference on Communication and Signal Processing, April 3-5, 2014, India.

[25] M.Saritha, Prakash.B.B, Sukesh.K, Shrinivas. B., Detection of Blood Cancer in Microscopic Images of Human Blood Samples: A Review, International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT) 2016.

[26] Fabio Scotti, Robust Segmentation and Measurements Techniques of White Cells in Blood Microscope Images, MTC 2006 - Instrumentation and Measurement Technology Conference Sorrento, Italy 2427 April 2006.

[27] Vasuki Shankar,Murli Mohan Deshpande, N Chaitra, S Aditi , Automatic detection of Acute Lymphoblasitc Leukemia using Image Processing, 2016 IEEE International Conference on Advances in Computer Applications (ICACA).

[28] Gurpreet Singh, GauravBathla, SharanPreetKaur, A Review to Detect Leukemia Cancer in Medical Images, International Conference on Computing, Communication and Automation (ICCCA2016).

[29] Luis H. S. Vogado1, Rodrigo de M. S. Veras1, Alan R. Andrade1, Flavio H. D. de Araujo2, Romuere R.V.eSilva2, FatimaN.S.deMedeiros2, Unsupervised Leukaemia Cells Segmentation Based on Multispace Color channels, 2016 IEEE International Symposium on Multimedia.

**[30]** Thorsten Zerfa, Erik Halmeyer, Timo Schlarb, and Matthias Elter, Segmentation of leukocyte cells in bone marrow smears, 2010 IEEE.