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Recognition of Human Blood Disease on Sample Microscopic Images

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Abstract - *Recognition of blood disease is done by visual examination of blood cell microscopic image. It is possible to classify some types of blood related disease by recognition of blood cell disorders. Leukemia is one type of cancer which leads more death. Here the paper explains the primary analysis of developing recognition of Leukemia type cancers with the help of blood cell images. Early detection of this kind of disease will help the patient to recover earlier and it is very important. So that such diseases can be treated, controlled, monitored and prevented with the early detection. Blood testing is not much expensive and blood cells images are very easy to get available at lab machines. Here the target is on the white cell disorders, such as Leukemia. The features in the blood cells are extracted and study the changes in the texture, color, and geometry and statistics analysis. The classifier input accepts the extracted features and does the analysis.*

Key Words: **Leukaemia, White Blood Cells, Blood Cells, Red Blood Cells, Blood Cancer**

1. INTRODUCTION

For the last several decade medical field became one of the very important field which focus and interprets several methods in the biology and medicine. Many technologies such as medical imaging has improved a lot by using new instruments for early detection, analyzing, storing, transmitting and giving output from the medical images. Hence digital image processing techniques have a wide scope in solving medical problems. There are many challenges to integrate the development of medical imaging with clinical sector. The main challenge is coordination between doctors and engineers for design, development, implementations and validation of different medical devices.

The main aim of the analyzing with images is for collecting data, finding the diseases, diagnose the infection or disease, control and therapy, evaluating and monitoring. With the help of microscopic images of blood cells, it is possible to identify the blood related malfunctions. Cancer is one of the life threatening diseases. In that one of the dangerous diseases is blood cancer called Leukaemia. Any delay in detection leads to death of the patient. Human blood contains white blood cells, red blood cells and platelets. Growth in irregular white blood cells results in Leukaemia. When the situation of abnormality in the white blood cell creates the equilibrium of the blood system can be affected. Blood samples are taken in the labs and examined by hematologists. They are inspects the microscopic images visually which is a hectic, time consuming process. Since it is totally depend on the human manual process so there are chances of errors due to human physical ability which has its own limit. Also there is difficulty in getting consistent result due to the manual visual testing. In this aspect it shows many of the current methods use all data about blood. Such as quantity of red blood cells, haemoglobin level, haematocrit level, mean volume corpuscle and lot more as the parameter for segregating diseases such as cancer, thalassaemia and many more. Much expensive equipment are required and blood testing labs to know the relevant information about blood. Due to the human errors and expensive devices there is a necessity for implementing automatic image processing system at the earliest.

Proposed system will be integrated and developed should be based on the microscopic blood cell images to identify the different categories of blood cancer. Fast, accurate and early detection of the Leukemia will help to start corresponding treatment methods for different types of blood cancers. One of the currently used methods for diagnosing relies on examining immunephenotyping, fluorescence in situ hybridization (FISH), cytogenetic analysis and cytochemistry. Well maintained and costly labs are needed to execute the diagnostic methods and there are high ratio of misidentifications are reported due to manual handling. The labs are depended on technologies, highly trained staff and technicians which are affecting the result.

Then also, there are chances of 50% of patients are diagnosed wrongly in the case of subtypes. In the proposed system, lot of images can be analyzed simultaneously and reduce the analyzing time, without considering the influence of subjective factors and effectively enlarge the precision of detection methods at the same time. The process involved is the inspection and classification of Leukemia. That is on the basis of texture, size of the image, shape, color and statistical analysis of blood white cells. The system can provide a huge benefit to the global human community to increase the efficiency with the help of medical image pattern recognition.

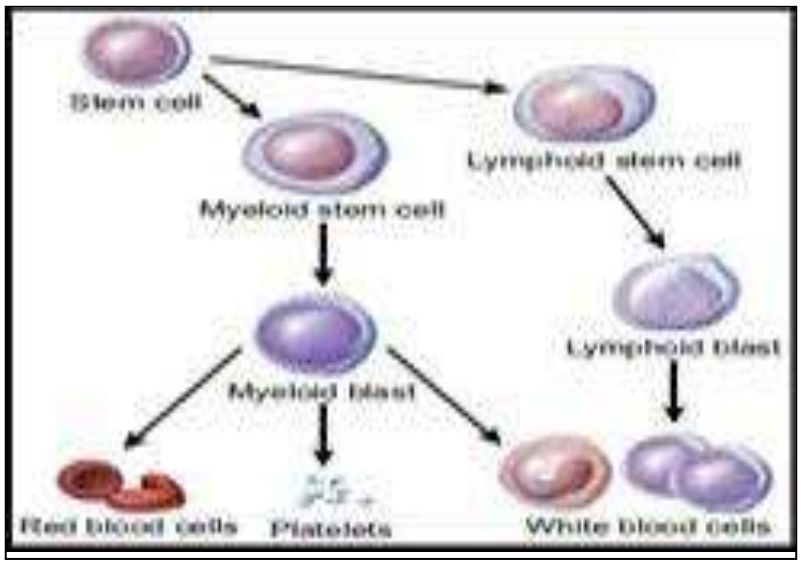

Fig -1: Blood Cell

The pattern recognition is based on many algorithms; hence the purpose is to increase the algorithm that can differentiate figures from human blood cell image, since it is the ultimate source to find disorders at the very first stage which can prevent the disease easily. The sample collection protocols may be different hence the system should adopt all the methods and time and different parameters related to this. The expectation from the system is that, it will give lab results very fast, easily and effectively. This paper reviews the work done in classification of blood cell recognition and the methods to be used in the research areas. There are many types of learning methods like supervised learning, unsupervised learning and reinforcement learning. Here it adopted the method of reinforcement learning (RL) in detecting the types of Leukemia. It is a very effective learning method which can solve many of the problems in the medical image detection problems.

The medical images have very related grey stage and texture between the concerned objects. During the process there may be errors of segmentation which can increase. In the case of supervised learning method, lack of enough number of training samples lead to error. In the case of reinforced learning method a minimum of training dataset is noticed.

2. BACKGROUND

Body blood is circulating entire body which can give much information about the changes in health and starting of new diseases. When considering an individual the number or look of the blood cells formed will give the health condition.

Leukemia– Bone marrow produces the blood cells called stem cells. The bone marrow situated in the middle of every bone which is a very soft material. Once the stem cells get matured it forms the other type of blood cell. The functions of each blood type are different. The following are the blood components:

a) Red Blood Cell - ERYTHROCYTES – It takes oxygen to tissues and circulating through lungs which purifies carbon dioxide.

b) White Blood Cell - LEUKOCYTES – It defends the organism from infection. We can see different types of leukocytes in blood.

c) Platelets – When there is a wound or bleeding the platelets helps to clot the blood to control bleeding.

d) Plasma – It is one of the fluid form in blood, that contains not solved ions required for cell purpose and contains chloride, sodium, hydrogen, magnesium, potassium and iron.

Blood circulation is a cyclic process when the blood cells are old or got damaged such cells will pass away and fresh cells will come up in that place.

Figure- 1 shows the process of stem cell maturation and evolution interested in several component of blood. It splits into myeloid stem cell or lymphoid stem cell. Myeloid stem cells ultimately grown-up and become myeloid blast. The red blood cells, platelet and several types of white blood cells are formed from this blast. Similarly, lymphoid stem cells also grow up and figure out lymphoid blast. Several types of white blood cells are formed from this process. White blood cells from lymphoid blast are differing from myeloid blast. Leukemia is a life threatening disease and is very dangerous; hence the study is focused on this

disease. Patients having leukemia, their bone marrow generates irregular white blood cell. General White cells will die after some time, but irregular white blood cell will not pass on when it time ends. Due to the increase in the abnormal white blood cells that interfere normal white cells duty. This leads to the imbalance of blood system in the body of the human. Blood cancer – Leukemia is categorized based on how fast this problem develops and became problematic.

Leukemia can be acute or chronic.

Chronic Leukemia– In the initial stages, leukemic blood cells will do function like normal white blood cells. Slowly but surely they became problematic chronic Leukemia.

Acute Leukemia– In this case the blood cells cannot generate functions like normal white blood cells. But the quantity of Leukemia cells will increase quickly and become severe in a little time.

Generally, Leukemia is categorized into four types:

Acute Lymphocytic Leukemia- ALL – Generally affects on the children aged 2-10 years. It is a common type of Leukemia. It can also affect on adults

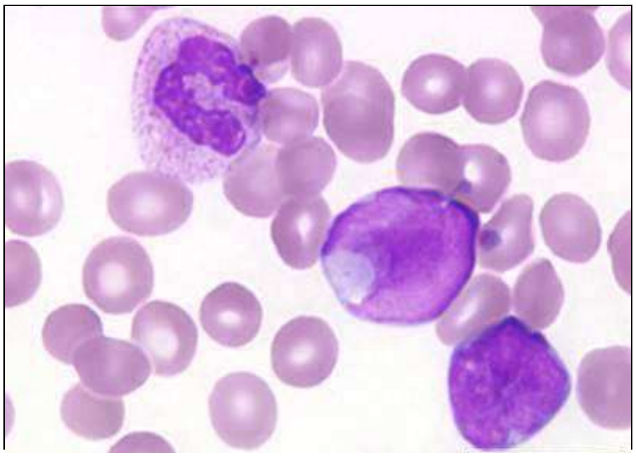

Figure -2: Acute Lymphocytic Leukaemia

Acute Myeloid Leukemia(AML) – Generally found in children below age 1 year. This type of Leukemia is enormously unusual in young people. But this is mainly in adults with age 40 years.

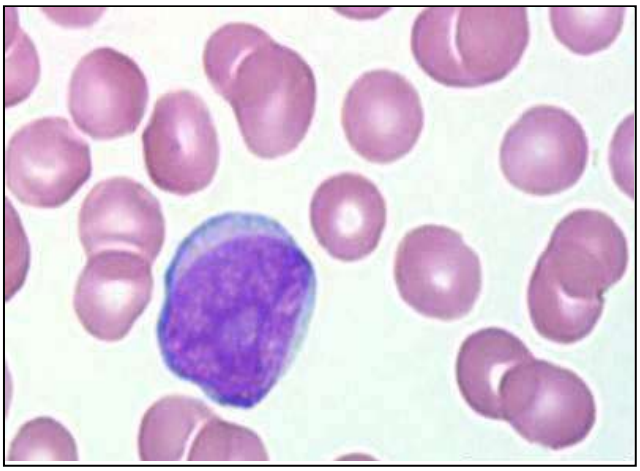

Figure -3: Acute Myeloid Leukaemia

Chronic Lymphocytic Leukemia(CLL) – CLL generally affects to older peoples. But it is very rare to found in the peoples below age 40.

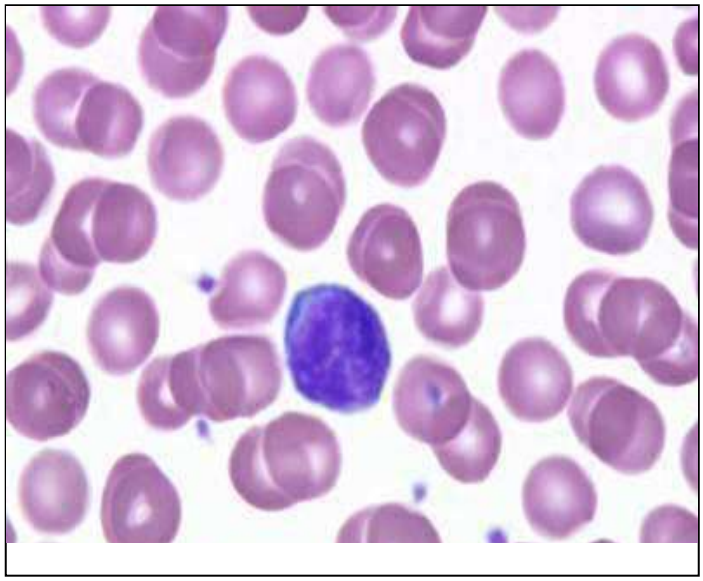

Figure -4: Chronic Lymphocytic Leukaemia

Chronic Myeloid Leukemia- CML – In this category of Leukemia will affect all people , then also commonly risk is for the people age over 45 years.

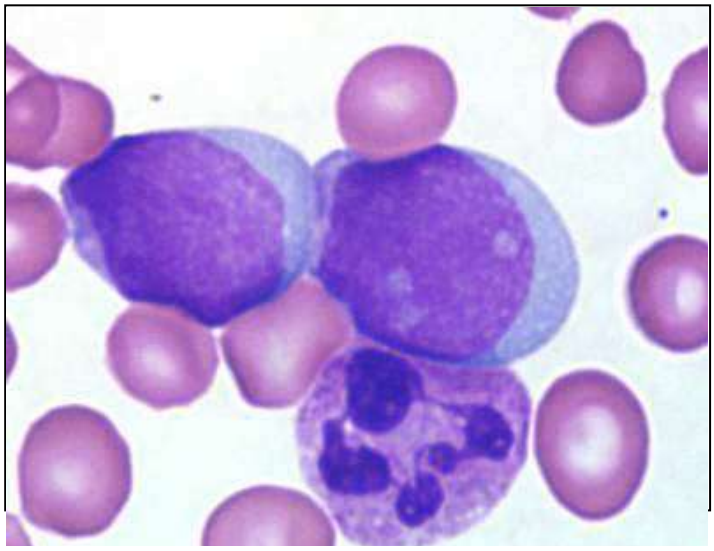

Figure -5: Chronic Myeloid Leukaemia

Research Methodology

In research methodology the aim in the segmentation is for separating the image into uniform regions. Below figure - 5 shows the proposed architecture of the system.

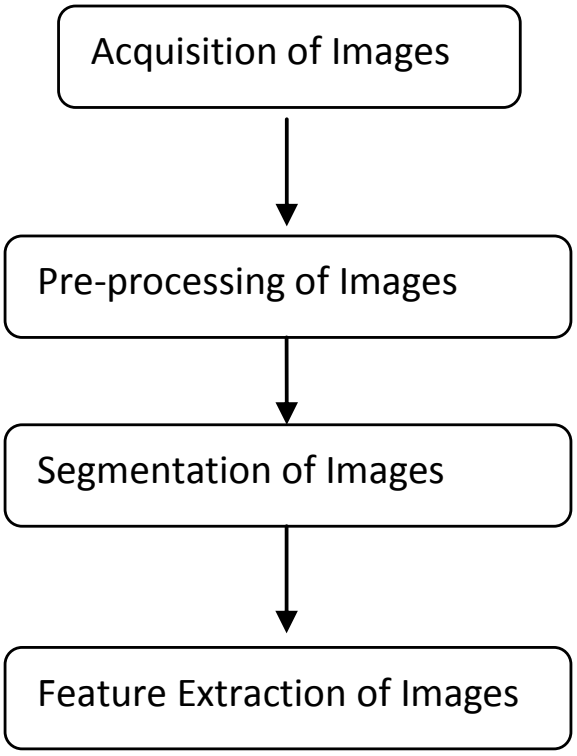

Figure -6: Flow Diagram of proposed architecture of Leukaemia Detection System

Image Acquisition

The blood cells are stored in the labs as slides. This slides will be converted to digital images from slides with effective magnification.

Pre processing

There may be different noises may be affected on the images during the image acquisition process. The reason may be due to shadows or high brightness that make ROI (region of interest) display as blurred region. Unwanted background needs to be removed since in the proposed system region of interest will be WBC. At the stage of pre-process, enhancement of image can be completed as the contrast improvement method, which can progress the medical image excellence.

Segmentation of Images

Segmentation is done on the white blood cells and determines the region of interest that is nucleus in the white blood cells. Cytoplasm is very little in Leukemia cell images. Hence the evaluation will be only on the nucleus of white blood cells. That is possible to determine the types of white blood cells around the nucleus. Lymphocytes and myelocytes are to be well thought-out and want to be determined them, are they blast cells or not-blast cells. Excluded cells are neutrophils, basophils and eosinophils. In the processing of next step is started once the blast cells are determined. Secondary images containing nucleus only will be considered.

Feature Extraction of Images

Significantly most difficulty in making of features of blood cells that distinguish them in a way enabling the detection of different blast types with the maximum accuracy. Nucleus of lymphocytes and myelocytes are to be used the features.

Geometrical Features – This refers the regions, radius, perimeter, solidity, regularity, compactness, concavity, eccentricity, elongation, form factor that needs to be gained.

Texture Features – This refers homogeneity, energy, contrast, entropy, correlation, angular second momentum that needs to be gained.

Color Features – The Red Green Blue color spaces will be altered into Hue Saturation Value or L*a*b color spaces. For the calculation its mean color standards are gained.

Statistical Features – The mean value, skewness, variance, kurtosis of the histograms of the matrix of image and the gradient matrix for Red Green Blue or Hue Saturation Value or L*a*b color space that is most suitable needs to be gained.

Classification

Classification is the task of assigning to the unidentified test vector to a recognized class. A reinforcement learning algorithm is suggested in this method.. The reinforced learning approach can categorize the types of Leukemia into ALL, CLL, AML and CML. Fig - 6 shows the basic model of RL.

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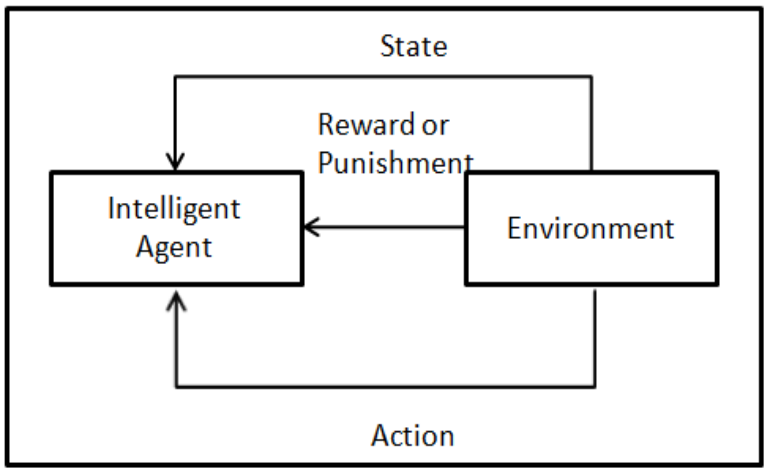

Figure -7: Basic Model of RL

Resulting Output Dilated Gradient Mask- Original Experimental Image

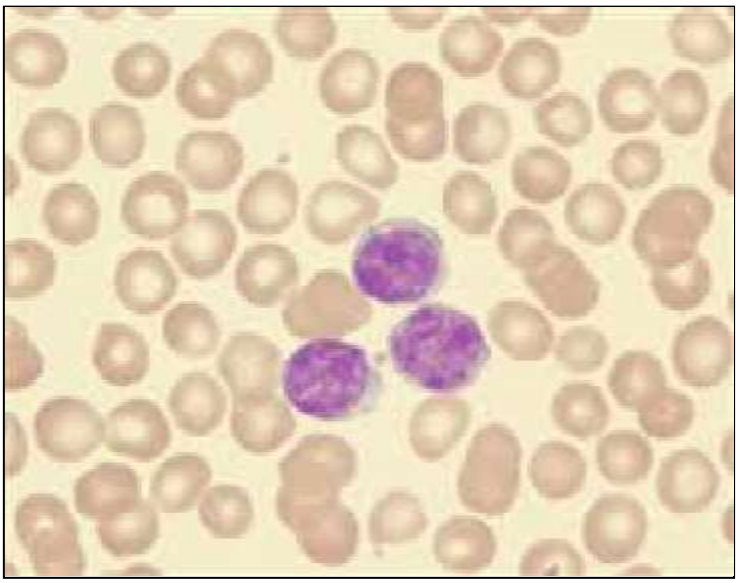

Figure -8: Original Experimental Image

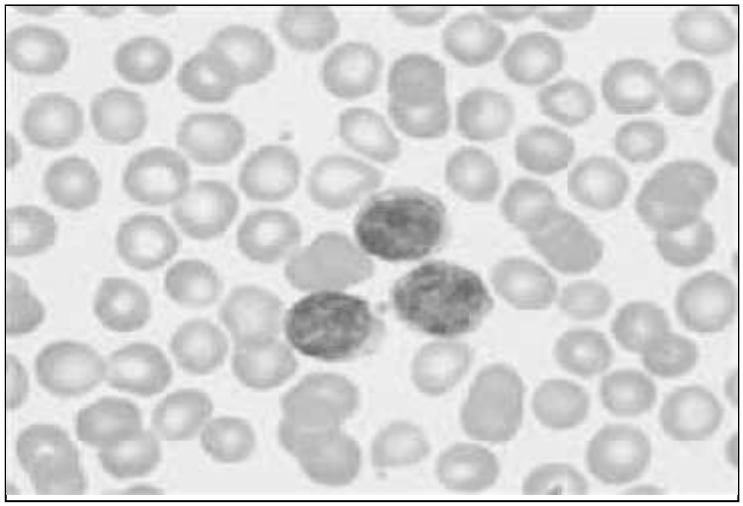

Figure -9: Gray Image

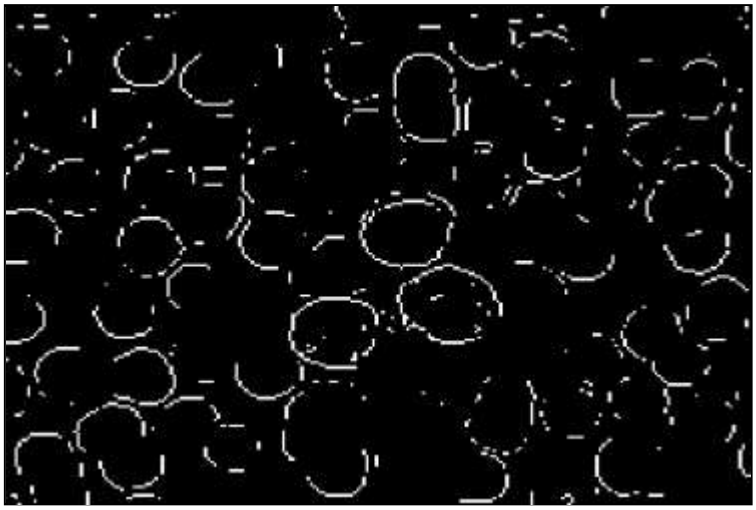

Figure -10: Binary Gradient

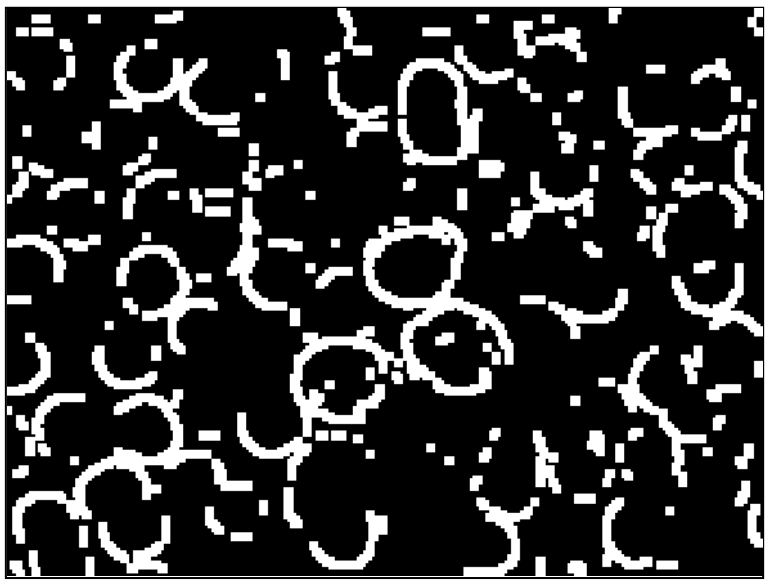

Figure -11: Dilated Gradient Mask

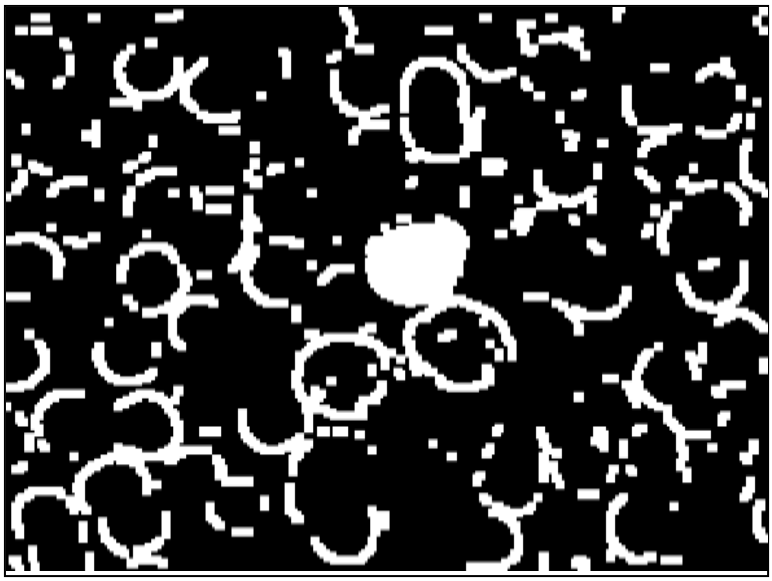

Figure -12: Binary Image with Filled Holes

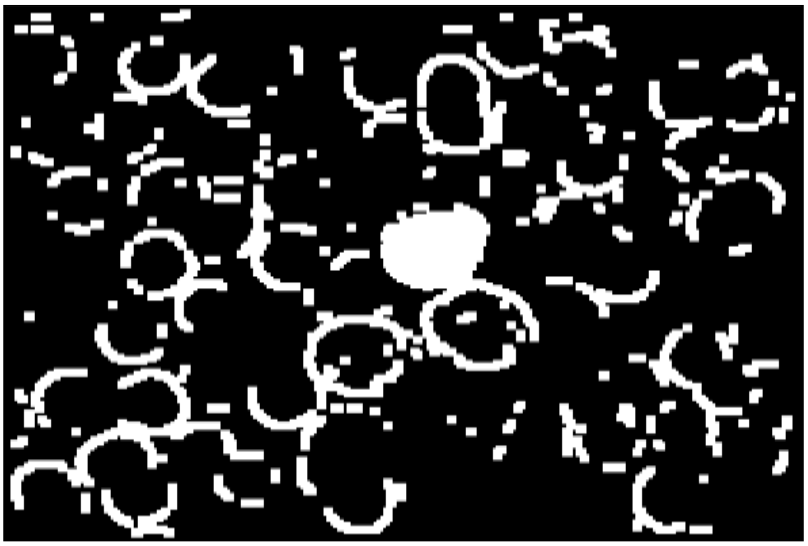

Figure -13: Cleared Bordered Image

Figure -14: Segmented Image

Figure -15: Original outline Image

3. CONCLUSIONS

Microscopic blood sample images are used to detect the life threatening disease Leukemia which is handled in this research paper. The proposed system can be made by means of features extracted from the microscopic images by investigating corrections on geometry, texture, colors and statistical analysis as a input of a classifier. The system should capable of doing targeted functions with efficient, consistent, fast, lesser error, elevated accuracy, and lower cost and must be robust towards varieties that exist in individual, time, sample collection protocols, and so on. The information collected and extracted from the blood cell microscopic image samples will be benefited to the patients by analyzing, predicting, evaluating and starting the treatment without delay.

REFERENCES

[1] "A Phenomenal Progression to Predict and Extort the Features of Anomalous Cell Growth to Detect the Leukemia in Bone Marrow Using Mathematical Standards and Traditional Conversion Process" by D.Napolean and K.Ragul.

[2] "Unsupervised Blood Microscopic Image Segmentation and Leukemia Detection using Color based Clustering" by Subrajeet Mohaptra and Sangamithra Sathapthy and Dipti Patra.R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[3] W., Qiang, Zhongli, Z., 2011. "Reinforcement Learning, Algorithms and Its Application", International Conference on Mechatronic Science, Electric Engineering and Computer.

[4] The Web Site www.mathworks.in.

[5] The Web Site http://www.wadsworth.org/chemheme/heme

[6] The Web Site www.hematologyatlas.com

[7] T. Arumuga Maria Devi, 2018, "Deep Learning on Lung Cancer Detection", ICRTSMA 2018 International Conference on Recent Trends in Stochastic Modeling and its applications, Department of Statistics, Manonmaniam Sundaranar University.

[8] TS Sakthi, K Parasuraman, T. Arumuga Maria Devi, 2016, "Implementation of Lung Cancer Nodule Feature Extraction using Threshold Technique", International Advanced Research Journal in Science, Engineering and Technology.

[9] T. Arumuga Maria Devi, 2012, "A Novel Technique in Fingerprint Identification using Relaxation labeling and Gabor Filtering".

[10] Kumar Parasuraman, G Sam Jeba Thurai, T Arumuga Maria Devi, 2015, "Blood Vessels Segmentation by Radial Gradient Symmetry Method Via Different Threshold Values", ICTACT JOURNAL on Image and Video Processing

[11] T. Arumuga Maria Devi Aruna Jeyalakshmi, Kumar Parasuraman, 2015, "Graph Cut Based Method for Automatic Lung Segmentation for Tuberculosis by using Screening Method in Chest", CiiT International Journal of Digital Image Processing.

[12] T.Arumuga Maria Devi S.Benisha, 2016, "Recent Analysis of Parasite Infection on Hyperspectral Camera through Marker Controlled Watershed Segmentation Process", International Journal of Engineering Science and Computing

[13] Kumar Parasuraman and T. Arumuga Maria Devi Kayathri K, 2016, "Acute Mylogenous Leukemia Detection.

[14] T. Arumuga Maria Devi S. Mohamed Vijithan, Kumar Parasuraman,2016,"A Novel Approach for MRI Brain Image Segmentation using Local Independent Projection Model", CiiT International Journal of Digital Image Processing.

[15] Dr.T.Arumuga Maria Devi Sorna Percy , 2016, "An Efficiently Identify The Diabetic Foot Ulcer Based On Foot Anthropometry Using Hyper Spectral Imaging", International Journal of Information Technology & Management Information System (IJITMIS).

[16] Mariammal Dr.T.Arumuga Maria Devi ,2016, "SVM Based Performance Of Iris Detection, Segmentation, Normalization, Classification And Authentication Using Histogram Morphological Techniques", International Journal of Computer Engineering & Technology (IJCET).

[17] Dr.T.Arumuga Maria Devi, 2014, "Automatic Liver Segmentation using Mean Shift Techniques", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET).

[18] Dr.T.Arumuga Maria Devi , 2017, "A Non Invasive Computer Aided Diagnosis System For Early Detection Of Lung Carcinoma In Ct Medical Images" , International Journal of Latest Trends in Engineering and Technology (IJLTET).

[19] D.Muthukumar Dr.T.Arumuga Maria Devi ,2018,"A Systematic Review on PC Based Digital Signal and Image Processing of Bio Electrical Signals using Hyperspectral Analysis", International Conference on Recent Trends in Engineering and Sciences.

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