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Comparative Analysis of Various Techniques Based on Leukemia Detection

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Abstract: Leukemia can be cured if it is detected and treated at the early stage. The need for automation of leukemia detection arises since current methods involve manual examination of the blood smear as the first step toward diagnosis. This consumes more time and also its accuracy is greatly dependent on operator's ability. So this paper has reviewed commonly used techniques in the prevention of leukemia detection with good accuracy rate. In addition to this various metrics has also been presented to measure the working model capability for leukemia detection.

Keywords: Leukemia, Medical Imaging, Classification, Image Processing, Metrics, Survival Rate.

I. INTRODUCTION

Medical imaging has become one of the most important visualization and interpretation methods in biology and medicine over the past decade. This time has witnessed a tremendous development of new, powerful instruments for detecting, storing, transmitting, analyzing, and displaying medical images. This has led to a huge growth in the application of digital image processing techniques [1] for solving medical problems.

One of the most feared by the human disease is cancer. Leukemia is a type of blood cancer, and if it is detected late, it will result in death. Leukemia is a malignant disease with an age-adjusted incidence of 3.7 per 100,000 men and women per year in the United States [1]. The disease affects both children and adults. Although about 80% of adult patients achieve complete remission after intensive chemotherapy, only 30% to 40% of patients survive 5 years after diagnosis [2]. Many patients experience a relapse, which is caused by the presence of minimal residual disease (MRD) and in most cases is incurable.

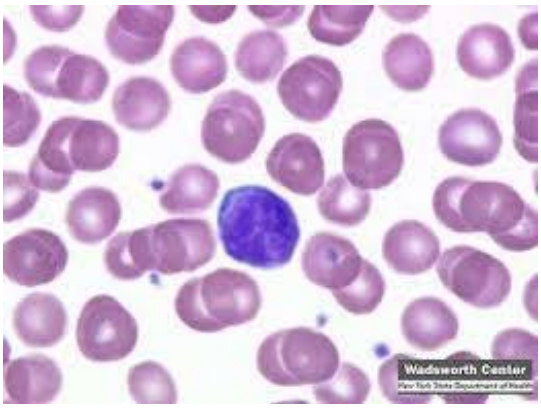

Fig.1: Blood Sample suffering from Leukimia [Through the Microscope: Blood Cells – Life's Blood.http://www.wadsworth.org/chemheme/heme [3 October 2011].]

The diagnosis of leukemia frequently follows a routine blood test that results in an abnormal blood cell count. Once leukemia is suspected, the doctor may take samples of bone marrow and blood to examine cell shape. Samples are also sent to the pathology lab to identify proteins located on the surface and chromosomal and changes [3]. This information is important for diagnosis of individual patients.

Leukemia can be cured if it is detected in the early stage and treated. The need for automation of leukemia detection arises since current methods involve manual examination of the blood smear as the first step toward diagnosis [4]. This consumes more time and also its accuracy is greatly dependent on operator's ability. ALL can be treated using chemotherapy, immunotherapy, and biological therapy but before treating ALL must be detected. ALL can be detected automatically and this avoids use of manual operations. The main advantages of using automated techniques are [5]:

1. It reduces the computational time.
2. No need for skilled operators.
3. The overall accuracy and efficiency can be improved

So, this paper makes a comparative study of various recognition and prevention methodologies to reduce the rate of leukemia effect in world using mainly DIP technologies i.e.

Hossein Ghayoumi Zadeh, et al.[6] In this work, an image analysis approach for automated detection, preprocessing-smoothing, enhancement, segmentation, feature extraction- morphological and calorimetric and then detection and classification of particular cells, especially the cancer cells from normal cells is done. Minai D. Joshi, et al.[7] This paper has proposed automatic Otsu's Thresholding for blood cell segmentation method along with image enhancement and arithmetic for WBC segmentation. K-NN classifier has been utilized to classify

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blast cells from normal lymphocyte cells. N.Z. Supardi, et al. [8] This paper presents the study on blasts classifying in acute leukemia into two major forms which are ALL and AML by using K-NN. 12 main features that represent size, color-based and shape were extracted from blood images. The k values and distance metric of k-NN were tested inorder to find suitable parameters to be applied in the method of classifying the blasts. Fauziah Kasmin, et al.[9] This paper describes a preliminary study of developing a detection of leukemia types using microscopic blood sample images. It will use features in microscopic images and examine changes in texture, geometry, color and statistical 256 analysis. Changes in these features will be used as a classifier input. Lim Huey Nee, etal.[10]. In this paper, the gradient magnitude, Thresholding, morphological operations and watershed transform to perform cell segmentation is done. 50 images were used to test the proposed method and the result showed that the method managed to obtain qualitatively good segmentation results. N.H. Abed Halim, et al. [11] In this paper, a global contrast stretching and segmentation based on HIS color space is used to improve the image quality. Image enhancement procedure is used to extract the nucleus region in the WBC image sample by using same threshold value, for both ALL and AML images. Ruggero Donida Labati, et al.[12] In this paper, they proposed a new public dataset of blood samples, specifically designed for the evaluation and the comparison of algorithms for segmentation and classification. For each image in the dataset, the classification of the cells is given, as well as a specific set of figures of merits to fairly compare the performances of different algorithms. The number of counting blood cells will then be used to calculate the ratio of blood cells for leukemia detection.

II. SCOPE OF COMPARATIVE STUDY

We have divided this section into seven separate categories: -Precision rate, Recall rate, accuracy, False Negatives, False Positives, Sensitivity and Specificity. Below these parameters has been discussed to check the comparison between them.

1. **False Negatives (FN)**: are the true characters that are not evaluated by the method.

2. **False Positives (FP):** are the false characters that are evaluated by the method.

3. **Recall rate (r):** are the true characters detected by the algorithm.

4. **Precision rate (p):** are the false characters detected by the algorithm.

5. **Sensitivity:** It is the ratio of the true characters that are evaluated by the method.

Sensitivity = (1)

6. **Specificity:** It is ratio of the true characters that are evaluated by the method by neglecting the background.

Specificity = (2)

7. **Accuracy**: It is measured by the ratio of the true characters that are evaluated by the method to the false characters that are evaluated by the method.

Accuracy = (3)

III. COMPARATIVE REVIEW

Name	Title	Technique	Parameters
Ahmed Abd El-Nasser and et.al [13]	Enhanced leukemia cancer classifier algorithm	gene appearance monitoring	Accuracy = good
Xavier Thomas [14]	First contributors in the history of leukemia	Review	Nil
Manisha pokharel [15]	Leukemia : A Review Article	Review	Nil
SarveshNikumbh [16]	Biogeography-based informative gene selection and cancer classification using SVM and random forests	BFO-SVM	Accuracy = good
IZheng, Geoffrey I. Webb [17]	Subsumption resolution: an efficient and effective technique for semi-naive Bayesian learning	naive Bayes classifier	Class value = good
N.H. Abed Halim, et al. [18]	Nucleus Segmentation Technique for Acute Leukemia	HIS color space	Accuracy = good
RuggeroDonidaLabati, et al. [19]	Nucleus Segmentation Technique for Acute Leukemia	segmentation and categorization	Blood cell ratio = good
SubrajeetMohapatra and et.al[20]	Fuzzy based blood image segmentation for automated leukemia detection.	Review	Nil
Bryan L. Betz [21]	Acute myeloid leukemia diagnosis in the 21st century.	Review	Nil
Min Pei [22]	Genetic Algorithms For Classification and Feature Extraction	GA and K Nearest Neighbor	Test data = appropriate.

IV. CONCLUSION AND FUTURE SCOPE

Recently need of leukemia detection in medical field is enhancing due to high death rate in the world. In this paper various main techniques has been presented like techniques based on image processing, MATLAB. In addition to this various performance parameters has also been presented to show the evaluation of working model. Future scope of the work lies in the utilization of various feature extraction as well as classifiers in proposed work.

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