Image Processing based Leukemia Cancer Cell Detection

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Abstract — **Microscopic pictures are reviewed visually by heamatologists and the procedure is tedious and time taking which causes late detection. Therefore automatic image handling framework is required that can overcome related limitations in visual investigation which provide early detection of disease and also type of cancer. The proposed strategy is effectively connected to many numbers of picture, demonstrating accurate results for changing image standard. Distinctive picture handling calculations, for example, Image enhancement, Clustering, Mathematical process and Labeling are executed utilizing MATLAB. Utilizing a portion of the productive image handling instruments we can recognize and section disease cell. The segmentation helps in knowing the precise size and shape of the cancer cell and the area. First we have utilized image enhancement strategies to improve the quality in terms of contrast and standardize the pixel values in the picture. After enhancement, segmentation is done to concentrate on area of interest; in this case it is nucleus. At that point we apply Feature extraction after that we have connected it to classifier to get the desired results as whether the cell is cancerous or not. The algorithm is been utilized on various pictures of the cancerous cell and has constantly given us the correct desired output.**

Keywords—K-mean, GLCM, GLDM.

I. INTRODUCTION

The most vital part of any human body is blood as it keeps one alive. It performs various essential limits, for instance, to trade oxygen, carbon dioxide, and mineral thus on to the whole body. In view of the insights it is been understood that blood cancer is the fifth reason for loss of life in human beings.

Leukemia is a cancer in blood, is reparable when it is identified and cared at right time. Its recognition begins with a complete blood cloud. In the event that there are irregularities in this tally, an investigation was done by pathologists on few of the infected cells to identify whether the cell us cancerous or not and also to find type of leukemia. But there were few drawbacks in this investigation due to many reasons such as time consuming analysis, less accuracy and depending on operators skills. This investigation had an error rate between 30% and 40% in spite of great experience of the pathologists. A channel cytometric test gives an exceptionally precise to arrange leukemia's, yet it is extremely costly and not every one of the healing centers can afford the hardware. The grouping of leukemia sorts encourage the doctors in choosing which analysis suits for a type of cell sort (lymphocytic or myelogenic) infection growth (intense or ceaseless). Paper displays a pre-processing strategy for cancerous cells. Finally the objective of the paper is to generate an element which describes, whether the cell is cancerous or not and also identify the type of leukemia, where mainly leukemia are of four types, they are acute myeloid leukemia, acute lymphocytic leukemia , chronic myeloid leukemia and chronic lymphocytic leukemia.

II. RELATED WORK

Symptomatic radio-graphy assigns the technological parts of medicative pictures and specifically in acquiring therapeutic images. Dr.s.Venkatachalam [1] presents the pre-processing strategies for the leukemia injected cells where the final aim is to generate the elements which describe types of leukemia. The undertaken issues contain: the cell segmentation [1] by using the watershed change, determination of distinct cells, and texture quality, statistical and geometrical examination of the cells.

Image Processing procedure is commonly used as one of the element under imaging research. These strategies are valuable for representation, enhancement, segmentation and numerous more operations which are helpful for processing medicinal image which perhaps MRI, CT or whatever other images acquired through one of the imaging methodology. One of the advantages of utilizing these methods is to identify any abnormality from the norm in the image of medical application. Some of these application in detecting tumor, blocked vessels or here and there broken joints. [2] Vinay Parameshwarappa.al proposed a strategy for recognizing one such variation from the norm saw in brain image. Utilizing a portion of the traditional picture handling devices and Fourier transform.

According to Bhagyashri G.Patil [3] overview, as of late Lung growth cell is gaining the consideration of therapeutic and affected groups under the most recent times in light of its high prevalence unified using hard treatment. Insights from 2008 demonstrate that lung disease, all through world, is the one that assaults the best number of people. Early identification of lung growth is essential for fruitful treatment. There is couple of strategies accessible to identify dangerous cells. Here two techniques for division, for example, thresholding and watershed are utilized to distinguish the disease cell and too discover better approach out of them.

Fundamental mathematical process hypothesis are presented at initially, utilized for identifying the edges and additionally the [4] tumor lung cells MRI and CT images.

Since, salt and pepper noise are more pervasive in medical images the routine techniques are not successful in sifting salt and pepper noise. [4] Numerical morphological processes are utilized to identify the edges and the disease cells. Morphological disintegration is a decent channel of salt and pepper commotion. The trial results demonstrate that the proposed calculation is more proficient for restorative picture de-noising, edge location and recognizable proof than the normally utilized layout based on edge identification calculations and morphological edge recognition algorithm.

III. PROPOSED SYSTEM

Proposed system has two parts training and testing. Both the parts undergo following steps. Image acquisition is the initial step collecting images of the blood from microscope with proper magnification from any of the hospitals. Second step is image preprocessing where following steps are followed initially color conversion takes place, color image is converted to gray scale. Followed by filtering the image, removal of noise from the image and finally histogram equalization is done to increase the quality of image in terms of contrast. Third step is segmentation using k-mean clustering where nucleus is concentrated for the detection process. Segmentation is followed by feature extraction where features of nucleus are extracted using GLCM and GLDM. In the training part features of pure cancer cell is stored in knowledge base. In the testing part, the cell which needs to be tested is taken as input.

And finally SVM classifier with the help of data in the knowledge base is used for classification, where decision is done whether the cell is cancerous or not. If the cell is cancerous then its type is found among acute myeloid leukemia, acute lymphocytic leukemia, chronic myeloid leukemia and chronic lymphocytic leukemia. Fig. 1 describes the architecture of proposed system.
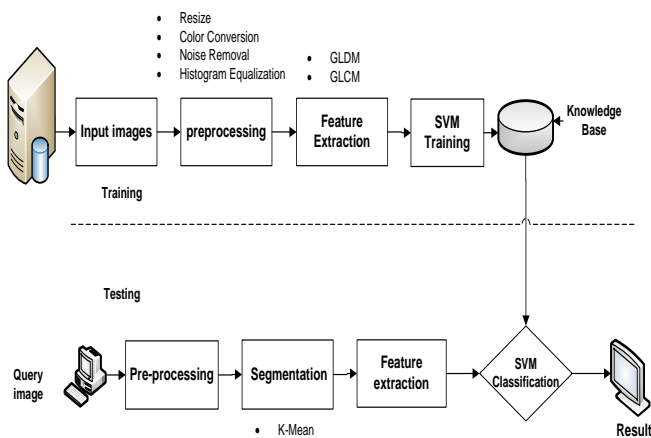

Fig. 1.   Architecture of Proposed System

A. K-mean Segmentation

K-Means is a least squares apportioning strategy that partition an accumulation of articles into K groups. K-Mean method is an unsupervised [5] grouping method that characterizes the information focuses into different classes. The algorithms expect that a vector space shaped by the data features and tries to discover common grouping in them.

Clustering method works as follows considering large number of data sets, take few of the random center points. Grouping the data sets to the nearest center points. Find the new centers for these cluster groups, and again the clustering should be done based on the distance to the nearest center. This procedure should be continued till there are no changes in the arrangement of data sets.

The algorithm iterates over following steps:
1. Determine the intensity distribution of the intensities (also called the histogram).

2. Introduce the centroids with k irregular intensities.

3. Iterate the upcoming steps until the cluster a label of the image does not change any longer.

4. Based on the distance of points from centroid intensity, cluster the points. Equation (1)

$$c\,(i)= \arg\min_j \|y^{(i)} - \mu_j\| \qquad (1)$$

5. For individual clusters, determine the new centroid.

k indicates number of clusters, i is iterations of intensities, and j is iterations of all centroid, and μ_j is intensities of centroids .

B. GLCM

"Gray Level Co-Occurrence Matrix" (GLCM) which is applied in feature extraction technique, has turned out to be a well known factual technique for removing textural highlight from pictures. It is used only for gray-scale image. Basically GLCM calculates number of times pixel i is either vertical, horizontal or diagonal to pixel j, where i and j are gray scale intensity values. As per co-event grid, Haralick characterizes fourteen textural highlights measured from the likelihood network to separate the qualities of surface insights of remote detecting pictures. In our proposed system important features like Angular Second Moment (energy), contrast, auto Correlation, Entropy, variance, dissimilarity, homogeneity, cluster prominence and the Inverse Difference Moment are selected for implementation.

C. GLDM

Gray Level Difference Method (GLDM) depends on the event of two pixels which have a given total gray level difference and which are isolated by a particular displacementδ.

For any displacement δ=(Δp, Δq), Let S(p, q) be image intensity function, let Sδ(p, q) = | S(p, q) − S(p+ Δp, q+Δq) and the estimated probability-density function is defined by

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$$f(i|\delta)=prob(S\delta(p,q)=i) \qquad (2)$$

Use Equation (2) to calculate probability-density function.

D. Classifier

SVM is built up as one of the important instruments for machine learning and information mining. SVM is also used in multi-class classification. A special property of SVM is , SVM minimize error in empirical classification and maximize geometric margin. Hence called as Maximum Margin Classifiers. This study utilizes SVM to arrange pictures, that was a factual order framework suggested by Cortes and Vapnik. [6]

Uses an extensive variety of example acknowledgment issues, picture grouping, money related time arrangement expectation, face recognition, biomedical sign investigation, restorative diagnostics, and information mining utilizes SVM in recent times. SVM Classifier classifies elements between two classes by drawing a hyper-plane. Maximum distance of the nearest element to the hyper-plane is called margin.

In this paper SVM is used as classifier to classify the cell, whether the cell is cancerous or not. Using the information in knowledge base. The SVM also gives option between four kernel types: (i) Polynomial, (ii) Linear, (iii) Sigmoid, and (iv) Radial Basis Function .

IV. RESULT AND DISCUSS

Fig. 2 shows the microscopic input image. In the proposed method microscopic image is enhanced using pre-processing steps, they are color conversion, filtering and histogram equalization. Followed by segmentation using k-mean algorithm. Fig. 3 shows enhanced image using histogram equalization, here enhancement is done in terms of contrast.
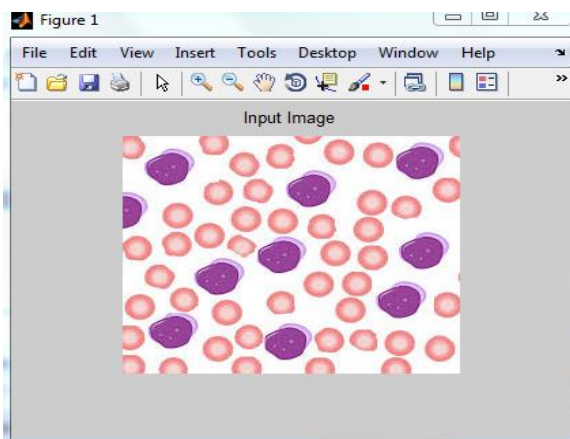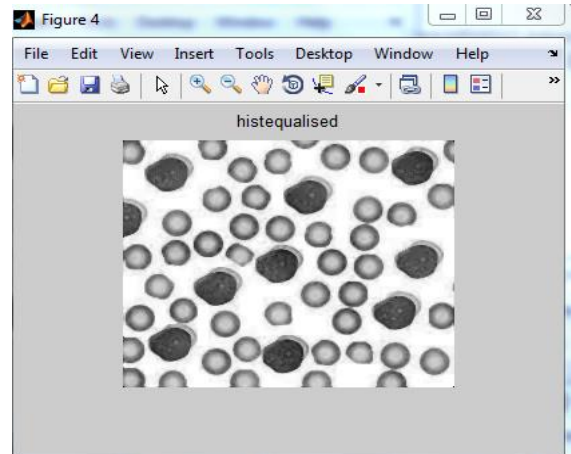

Fig. 2.   Input Image

Fig. 3.   Enhanced image

For K-mean segmentation we have selected 3 classes. The Fig. 4, Fig. 5 and Fig. 6 shows k-mean segmentation outputs. Here K is taken as 3 because to get the proper region of interest, in this case it is nulecus.
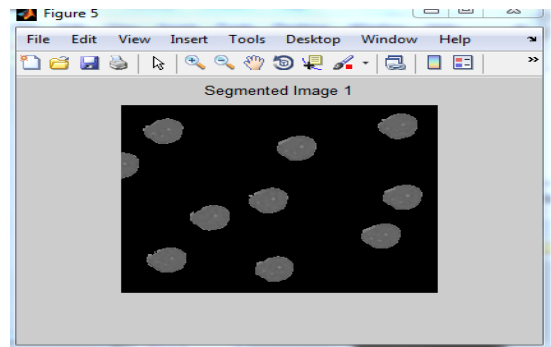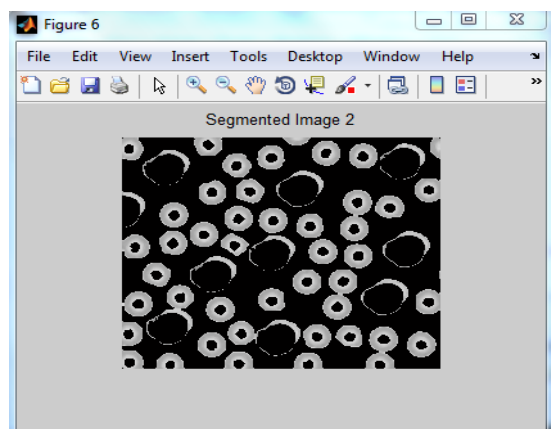

Fig. 4.   Segmented Output of K-mean

Fig. 5.   Segmented Output of K-mean
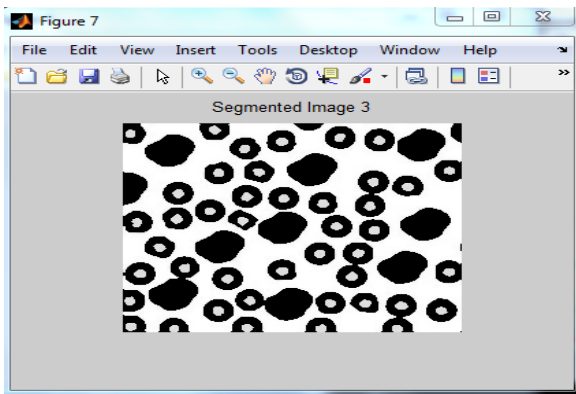
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Fig. 6.   Segmentation Output of K-mean

After obtaining segmentation, Fig. 4 is taken for feature extraction as it has complete nucleus which is the region of interest. Feature extraction is done through GLDM and GLCM. Finally SVM classifier is used to classify input microscopic image as cancerous or not.

V. CONCLUSION

The main aim of this paper is cell segmentation followed by feature extraction to detect cancer cells. Features such as Angular Second Moment (energy), contrast, auto Correlation, Entropy, variance, dissimilarity, homogeneity, cluster prominence and the Inverse Difference Moment etc. are considered for accurate precision of identification. The results show that the k mean method is applied for best segmentation performance. Likewise, the completely divided core can be better accomplished by utilizing Matlab based calculation since it is less sensitive to variations in the input image.

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