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Blood Cell Segmentation of Micro scopic Images using K-means Clustering Algorithm with SIFT

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Abstract:

In the field of medicine, the most hazardous cancer is Leukemia. It affects bone Marrow, blood, and lymph system. Leukemia is either acute or chronic. Microscopic images are used to detect the blood cancer. Moreover, haematologists are examined all these images which takes more time and causes late detection. Therefore, for early detection of disease an automatic imaging system is setup which includes pre-processing and post processing that conquers the limitations in visual examination. In pre-processing firstly the noise is removed by CLAHE. In post processing the image is segmented by K-means clustering algorithm and features of white blood cell nucleus extracted by Scale invariant feature extraction classifier (SIFT). In this work also the results of proposed method are compared with existing method which includes Otsu segmentation with KNN classifier.

Keywords — **Leukema, Median filter, segmentation, K-means clustering, Scale Invariant Feature Transform.**

I. INTRODUCTION

Now-a-days for effective treatment option the accurate medical diagnosis is necessary [1]. Medical diagnosis is a process where it identifies a disease by critical investigation of its symptoms and a sequence of laboratory tests. The most and commonest effected blood cancer in both adults and offspring's is Leukemia. It is one type of blood cancer which affects especially the white blood cells. Generally human blood consists of three cells such as White Blood Cells, Red Blood Cells and Platelets. Each of these cells functions a specific task. White blood cells fights against infections in human body where as Red blood cells transports oxygen from lungs to body tissues and vice versa. Platelets assist for control bleeding by blood clots [2].

In leukaemia affected person too many white blood cells are produced over the normal count which results abnormalities in the cells. These abnormal cells cultivate more and interfere with other blood cells[3]. Due to abnormal growth of cells they are not function properly [4]. In diagnosis of leukaemia the imaging system plays an important role which includes machine learning techniques [5].

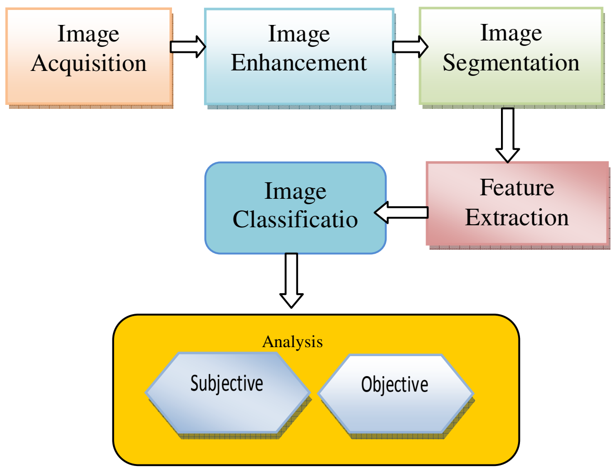
In this paper a novel method is proposed where K-means Clustering is used for segmentation and SIFT for feature extraction for the detection of blood cancer (Leukaemia).

II. PROBLEM DEFINITION

Segmentation of Cytoplasm and nucleus is difficult in overpopulated blood smear. In existing method otsu method is used for image segmentation and for feature extraction K-nearest Neighbours Classification algorithm (KNN). The existing method has less accuracy and more processing time.

II. PROPOSED METHOD

The proposed implemented method in this research work is shown in Figure.1



is meant to extract the cancer effected cells from microscopic images.

A. *Microscopic Image Acquisition*

Microscopic images have to be obtained from nearby hospitals or from public database with sufficient magnification.

B. *Image Enhancement (Pre-Processing)*

The acquired Microscopic image may contain noise which will reduce the contrast. So, to improve the quality of image in terms of contrast it has to be processed through de-noising technique where it removes blureness. In this work a median filter is used to remove the noise. It works only on region of interest (white blood cells) which makes regions of white blood cells sharper by exclude background. [6].

C. *Image segmentation*

The segmentation is the process of partitioning an image into multiple regions. In the field of image processing especially in medical area segmentation plays a prominent role. So much of research is going on to develop a unique algorithm for segmentation which works on all types of imaging modalities because existing algorithms works on one particular image and cannot work on other type of image [7]. However, development of single segmentation algorithm is a changeling task which works on all types of images. Contour recognition is still an exigent problem in segmentation process.

So, automatic image segmentation is required for contour detection with high accuracy and less processing time [8]. In this paper K-means clustering method is proposed for segmentation to isolate white blood cells from plasma and red blood cells.

The proposed segmentation algorithm is a simple unsupervised algorithm which is suitable to solve all clustered problems efficiently. It assigns K number of cluster for a given image. The assignment of centroid is a difficult job to produce accurate results in different locations. So, the centroids must be placed at maximum distance [9].

K-Means clustering method forms cluster by taking each pixel whose centroid is small.

This objective of the algorithm is to minimize an objective function as squared error function [10].

$$J=\sum_{j=1}^{k}\sum_{i=1}^{n} \left\| x_i^{(j)} - c_j \right\|^2$$

D. Feature Extraction

It is the process of extracting the desired features from the pre-processed image which contains of different abnormalities [11]. The features such as geometry, texture size and statistics from the region of interest popped up from image segmentation. In this paper Scale invariant feature extraction (SIFT) used to extract the desired features from the microscopic image.

III. RESULTS AND DISCUSSION

In the proposed method input image denoised using median filter and then image enhanced is applied to the denoised image. CLAHE method is used for enhancement followed by segmentation using K-means algorithm.

Fig. 1 Input Microscopic image

Fig.1.shows input microscopic image of blood cancer. Generally microscopic images are in RGB format. It does not support for image processing techniques. So colour transformation is required to represents the colour data in to best to perform the segmentation process. Fig 2 shows the gray scale Image

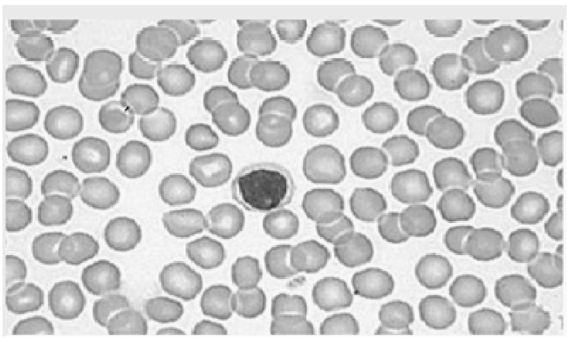


Fig. 2 Gray scale image

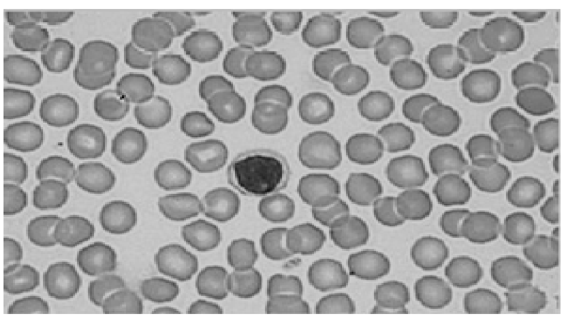


Fig. 3. Enhanced image by CLAHE

Normally the microscopic images contain low frequency noise. Due to this the images have low contrast and appear as blurred image. So to remove the noise the image must be processed through enhancement technique like CLAHE where it removes the noise. The enhanced image obtained by CLAHE is as shown in Fig.3.

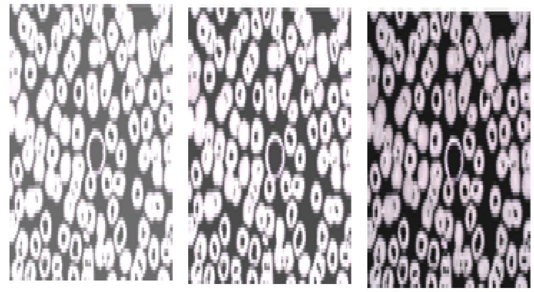


Fig. 4. K-means Clustering Output

To detect the cancer nuclei in Microscopic Images, it must be segmented with K-Means Clustering. The clustering output is as shown in Fig.4.

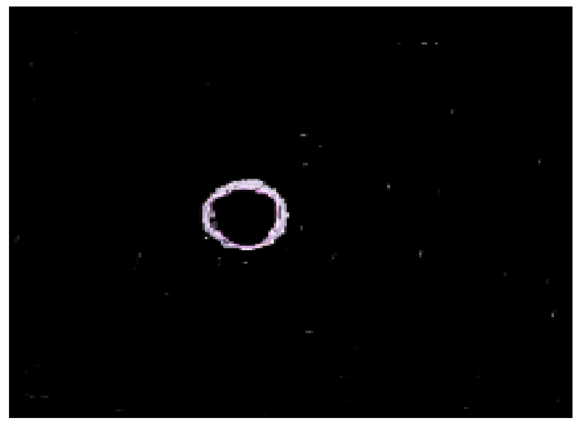


Fig. 5. Detected image

Fig.5. shows the segmented part of malignant cell in microscopic image. The segmented image (White blood cells) consists of sharp edges and fine details of a blast cell. After segmentation the input image (segmented image) undergoes through feature extraction where it calculates the features such as PSNR, Accuracy, Sensitivity etc. of an image by scale invariant feature transform.

TABLE I: Performance Measures

S.No	**Parameter**	**Otsu**	K-Means
1	PSNR	24.30	29.61
2	Accuracy	81.30	92.70
3	Sensitivity	74.24	80.32
4	CPU time(Sec)	14.73	11.2

From table I it is concluded that the proposed method gives the best results over existing methods.

IV. CONCLUSIONS

The proposed method detects the malignant cells in the blood from microscopic imagery using K-means clustering and SIFTS. In this paper an attempt is made to detect the cancer. This method would help and assist the pathologist to analyse the cancer cells accurately within less span of time.

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