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Predicting a Superlative Classifier for the Identification of Blood Cancer in Human

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Abstract: Microscopic imaging techniques are employed by scientists to improve their ability to view the microscopic world .The process of visual inspection is time consuming and tiring. Detection and curing a diseases on time is very much needed in case of high severity and the result of any test takes 2-8 days. This paper presents an automatic scheme to detect the accurate presence of cancer in blood cells. Firstly, the microscopic images is pre- processed. Secondly, the Canny edge segmentation is used to segment the image. Finally the features are extracted and classified using the proposed classifier, CNN. The procedure is repeated for KNN, RF classifiers .The CNN is compared with the other algorithms. The experimental results shows the superiority of the proposed classifier when compared with the other existing classifiers. The classification accuracy for CNN is 3-4% an improvement over earlier existing classifier. The automatic image processing steps such as pre-processing, segmentation, feature extraction, classification are executed using MATLAb.

Keywords: Digital Image Processing, Microscopic images, Cancer blood cells, Convolutional Neural Network, MATLAB.

I. INTRODUCTION

Cancer is a disease that involves abnormal cell growth. They form a subset of neoplasms. A neoplasm or tumour is a group of cells that have undergone unregulated growth and will often form a mass or lump. Cancers are classified by the cells that the tumour cells resemble and is therefore presumed to be origin of the tumour. Leukemia is a type of blood cancer and if it is detected late, it leads to death Leukemia is the cancer of blood and bone marrow. There are four types leukemia such as Acute myeloid leukemia, Acute lymphocytic leukemia, Chronic Myeloid leukemia, Chronic lymphocytic leukemia shown in Fig.1. .Typically cancer diagnosis is made by pathologists using visual inspection of morphological and chromatic nuclear features in a stained tissue sample and this task is not trivial. In this paper, we proposed an automated method which can reliably segment and classify the blood cancer nuclei in microscopic images of blood cell samples. For initial pre-processing, the microscopic images are gray converted .The images are converted from RGB to gray scale image .The noise that included in the image is filtered using image processing filters. . The second part of our approach is devoted to the segmentation of the image .Segmentation plays an important role in image processing since separation of a large image into several parts makes further processing simpler .Then, the separation problem is solved by using canny edge detection. The third approach describes the proposed classification method in details .The classifiers used are KNN,RF and the CNN-Convolutional Neural Network .The remaining part of the system includes the feature extraction .It is the process of converting the image into the data so that we can check the resulted values with the standard values. Then, we compare the proposed method to other existing classification methods. Finally, the conclusions are provided. Experimental results are provided to demonstrate the effectiveness of CNN based classifier as well as comparisons to KNN and RF classifiers. Finally the concluding remarks are given in the conclusion.

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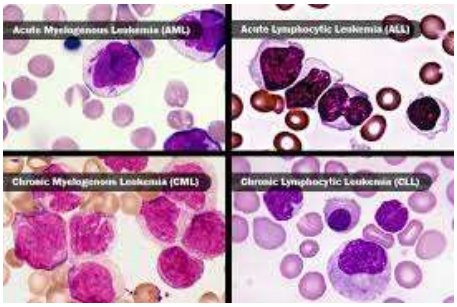


Fig.1 Types of leukemia

II. EXISTING SYSTEM

1]In this method,microscopic image is taken which goes through an enhancement process further the image is segmented into parts to get the proper result using k-mean algorithm. The parameters such as area, perimeter, eccentricity are account and classification are done. The *k*-means clustering based segmentation algorithms are used because of the preservation of the desired information. Supervised machine learning techniques are used for the classification of microscopic images.

1.Microscopic images: Cancer infected blood cell images is collected from the authorized websites and government hospital in order to carry out the further processing.

2.Enhancement: The main purpose of the pre-processing is to remove an image degradation such as noise and contrast enhancement of region of interests.

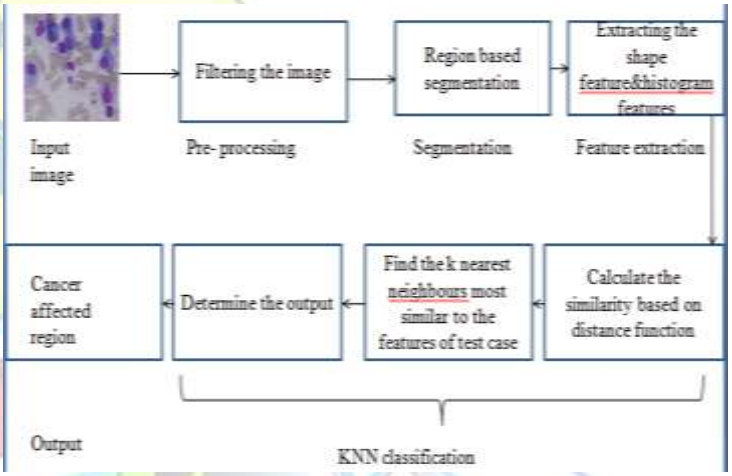
3.Segmentation: Segmentation is the process of portioning an image into sub parts, so that properly each and every area is scanned during processing.

4.Feature Selection: In this phase we try to extract some of the features from the processed image.Feature extraction is the process of converting the image into data so that we can check these values with the standard values and finally we can differentiate with cancerous and non- cancerous data.

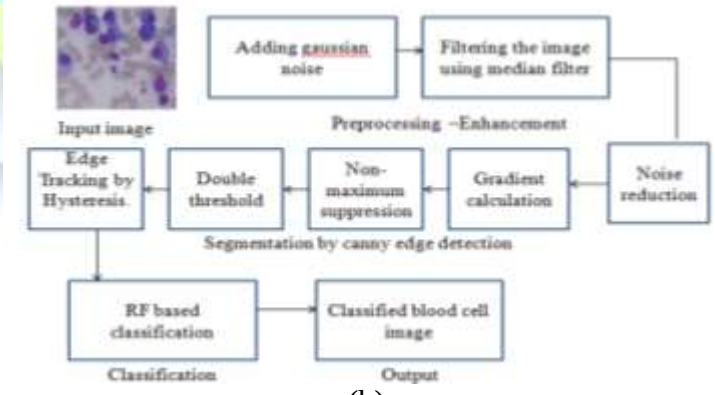
5.Classification: In this final phase, the extracted features are used to provide the final answer. All feature extracted are listed into the different columns with their values. When we give any image as an input to the proposed system then we first calculate the feature values. The values of the test image features are checked with the previously calculated values Based on the values of the input image the classifier classifies that test image into either infected or not infected class.

III. PROPOSED SYSTEM

The image from the dataset is first converted into gray scale representation. Edges in the image are detected using canny edge detection method and segmented by watershed segmentation .Image is then subjected to four class random forest classification3(b). Image is then processed using Knn classifier in which the region based segmentation is involved3(a). Then the blood vessel are masked and classified by k nearest neighbor algorithm. 2D fully connected convolution is applied to the input. Features such as threshold of the image and frequency features are extracted and compared. Finally the output image is obtained and the accuracy is detected using the features3(c).



(a)



(b)

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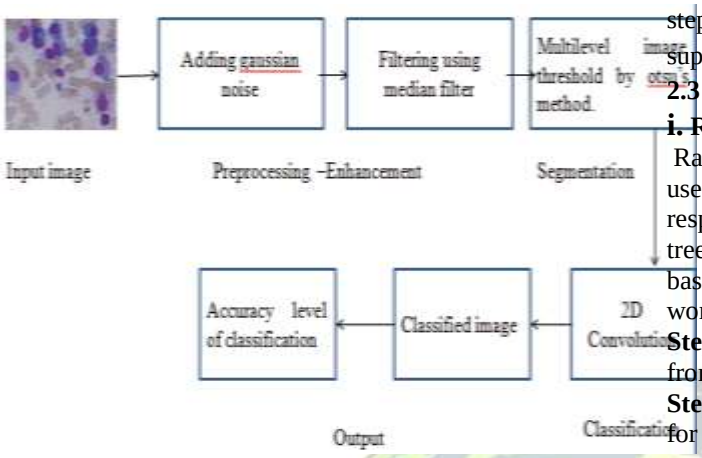

(c)

Fig.3.(a) Architecture of proposed system by KNN classification (b)by RF classification(c) CNN classification

2.1.PREPROCESSING:

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. The image is pre processed using imfilter and sobel filter are used for multidimensional filtering. B = imfilter (A,H)Imfilter filters the multidimensional array `A` with the multidimensional filter `H`. The array, `A`, can be a non sparse numeric array of any class and dimension. The result, `B`, has the same size and class as `A`. Each element of the output, `B`, is computed using double-precision floating point. If `A` is an integer array, then output elements that exceed the range of the integer type are truncated, and fractional values are rounded.

2.2.SEGMENTATION:

Image segmentation is the division of an image into regions or categories, which correspond to different objects or parts of objects. Every pixel in an image is allocated to one of a number of these categories.

CANNY EDGE DETECTION

The canny edge detector is so popular because it is the most optimal method of finding edges with good detection, good localization and single response to an edge. Canny determined edges by an optimization process and proposed an approximation to the optimal detector as the maxima of gradient magnitude of a Gaussian smoothed image.Process of Canny edge detection algorithm can be broken down to 5 different steps: Noise reduction, Gradient calculation,Non-maximum suppression,Double threshold,Edge tracking by hysteresis.

2.3 CLASSIFICATION

i. Random Forest Classifier

Random forests is an ensemble model which means that it uses the results from many different models to calculate a response. In the case of random forests, several decision trees are created (grown) and the response is calculated based on the outcome of all of the decision trees.The working of random forest include four steps as follows:

Step 1 − First, start with the selection of random samples from a given dataset.

Step 2 − Next, this algorithm will construct a decision tree for every sample. Then it will get the prediction result from every decision tree.

Step 3 − In this step, voting will be performed for every predicted result.

Step 4 − At last, select the most voted prediction result as the final prediction result.

ii. KNN Classification

The normal lymphocyte cells and the blast cells are classified with the help of these extracted features using kNN classifier. kNN(k-Nearest Neighbor classifier) is a simple supervised classification method. It stores the normal values of normal lymphocyte cell's features. Then, it compares the values with that of the blast cells. Feature vector of input images is compared with the database. The class with which minimum distance is obtained is identified class. The classifier used in this is Euclidian distance classifier.

iii.2-D CNN Classification

The dataset for training and validation processes consists of two parts; the training features set which are used to train the CNN model; while a testing features sets are used to verify the accuracy of the trained using the feed- forward back propagation network. Neural networks are used in the automatic detection of cancer in blood samples. The final output of our project is to detect the cancer accurately with the help of iterations obtained and accuracy graph and the confusion matrix.

2D CNN is applied to classify the image.A 2-D convolutional layer applies sliding convolutional filters to the input. The layer convolves the input by moving the filters along the input vertically and horizontally .Computes the dot product of the weights and the input, and then adding a bias term.

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2.4.FEATURES EXTRACTION

Transforming the input data into the set of features is called feature extraction. In the present work, after the analysis, Features such as Entropy,threshold of the image and frequency features are extracted to get accuracy in the method of classification for disease identification.

IV. RESULTS AND DISCUSSION

The proposed system is tested on the blood cell images as shown below. Microscopic images were captured from bone marrow aspirate slides of patients diagnosed with multiple myeloma as per the standard guidelines. Slides were stained using Jenner-Giemsa stain. Images were captured at 1000x magnification using Nikon Eclipse-200 microscope equipped with a digital camera. The proposed technique has been applied on microscopic blood slide image.Fig.5 shows the microscopic input image.In the algorithm of segmentation using matlab the image is enhanced using background subtraction Fig.6 and detecting the edges of the cell using canny edge detection fig.7.The final classified image using KNN and CNN is shown in Fig.8and Fig.9.

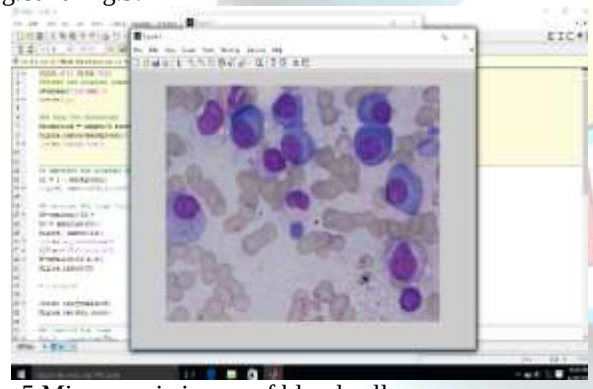

Fig.5 Microscopic image of blood cell

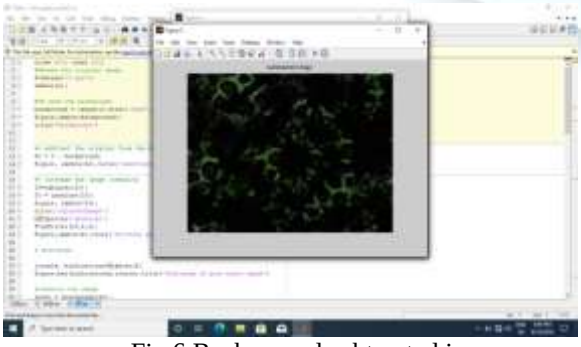

Fig.6 Background subtracted image

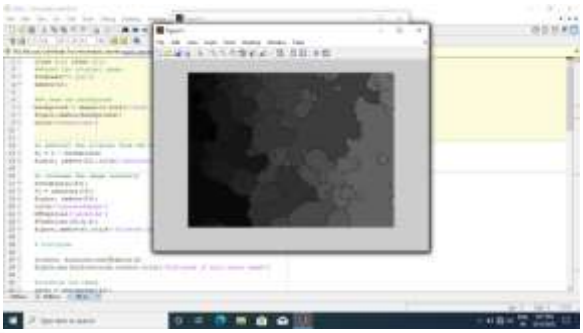

Fig.7 Edge detected image

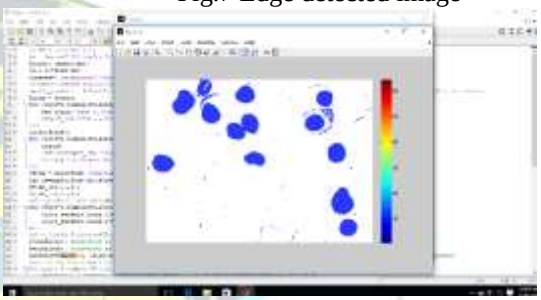

Fig.8 Leukemia affected region is classified using KNN

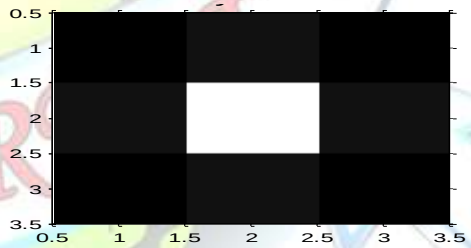

Fig .9 Affected region is classified using CNN

The Fig.10 shown below compares the accuracy level of the existing classifier with the proposed classifier and shows that the CNN method is applied for good classification performance.

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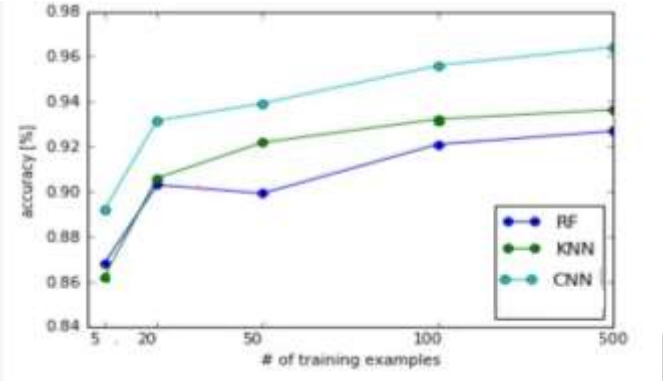

Fig.10 Accuracy comparison for three algorithms

V. Conclusion And Future Work

The main aim of this paper is cell classification followed by feature selection to detect cancer cells. The result shows that the Convolutional neural network method applied for classification is better classifier for good classification performance.On the complete image database,the classification accuracy for CNN reaching an improvement of 3-4% over earlier methods. The future work may include the mobile application that works on cancer detection can be developed.

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