

International Journal of Computer Science and Mobile Computing



A Monthly Journal of Computer Science and Information Technology

ISSN 2320-088X

IMPACT FACTOR: 5.258

IJCSMC, Vol. 5, Issue. 3, March 2016, pg.492 – 498

Analysis of WBC for Cancer Identification

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Abstract—*Analysis of WBC allows the evaluation and diagnosis of a vast number of diseases. The analysis of white blood cells (WBCs) is a topic of great interest to haematologists. Nowadays the morphological analysis of blood cells is performed manually by skilled operators. This contain numerous drawbacks, such as slowness of the analysis and a nonstandard accuracy, dependent on the operator skills. This paper presents a complete and fully automatic method for identification of CANCER by using microscopic images blood sample.*

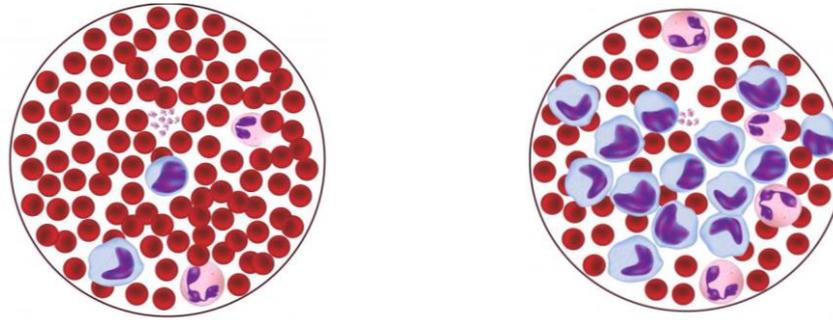
The proposed method firstly individuates white blood cells from which, subsequently, features of WBC are extracted. The whole work has been developed using MATLAB environment, in particular the Image Processing Toolbox. This is important because segmentation of nucleus is much easier than the segmentation of the entire cell.

Keywords— “MATLAB”, “Microscopic blood image”, “Cancer”, “Segmentation”, “White blood cell analysis”.

I. INTRODUCTION

Previously the diagnosis of blood sample is done by manual method, which require more human involvement and it is time consuming process and its accuracy depend upon process performed by expert. The human visual inspection is tedious, lengthy and repetitive. [2] The automated analysis by computer requires only image and not an actual blood sample; for this, it turns to be less expensive but at the same time more accurate in providing precise standards result.

The main goal of this work is to identify the diseases on the basis of some factor related to WBC, like shape and size of WBC. In recent years, the use of image processing techniques has widely increases. These techniques helps to identify the cancer cells in the human blood and provide information on the cells morphology. The microscopic images processing techniques depending on various the type of blood cells to be analysed. Our work focuses on the analysis of white blood cells. A typical blood image usually contain four components: plasma, red blood cells, white blood cells and platelets. [2]The most represented cells in the blood are RBCs and WBCs. WBCs can be easily identify, as their nucleus appears darker than the other content of cells (Fig. 1 shows an example).



1. A) Normal blood cell

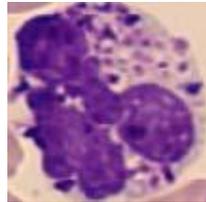
1. B) Infected blood sample

Fig. 1 Normal and Infected Blood Sample

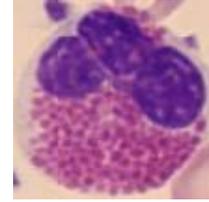
However, the analysis and the processing of the image related to the WBCs can present some difficulty due to wide variations in cell shape, dimensions and edges. There are five types of WBC (as shown in Fig. 2)



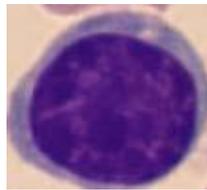
2. A) Neutrophil



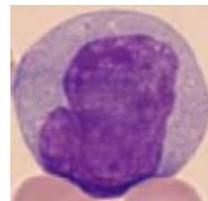
2. B) Basophil



2. C) Eosinophil



2. D) lymphocyte



2. E) Monocyte

Fig. 2 Types of WBC

II. LITERATURE REVIEW

By Analysis of previous research paper, there are various paper based on WBC such as [1]Color based segmentation of WBC in Blood photo micrographics using image quantization” bakht azam, rashid jalal 2014 which include CAD Technology (Computer Aided Diagnosis) for separation WBC and RBC by using color based segmentation. [2]White Blood Cells Identification and Counting from Microscopic Blood Image” Lorenzo Putzu, and Cecilia Di Ruberto , 2013 which include ZACK Algorithm and Boundary fill algorithm for identification and count of WBC .[3] A New White Blood Cell Segmentation”, J.Cheewatanon, T. Leauhatong, S. Airpaiboon, and M. Sangwarasilp,” 2011.which include Mean Shift Filter Region Growing Algorithm for Effective and segmented image. The Drawback of the above mention paper are-it can separate and identify type of WBC and RBC and cannot identify specific diseases .We have overcome this drawback in proposed method by identifying CANCER.

III. PROPOSED METHOD

The proposed method, we introduce is differ from other method, the method we introduce in this paper can identify different types of cancer. The entire process of project can be perform in four phases. The first process is INPUT AND PRE-PROCESS. The methods of per-processing inserted between the various-stages of the segmentation, in order to make the latter simpler and more robust.

A. INPUT AND PRE-PROCES

This module take the microscopic blood sample image, this blood sample image is in JPEG format. In the sample image, the background is brighter in the center than at the bottom of the image. The pre-processing step before analysis, it identify the background uniform and then convert the image into a specific image format. To make the background illumination more accurate, there is a need to create an almost similar to the background as a separate image and then subtract this almost similar part from the original image.

B. SEGMENTATION

Image segmentation technique is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify as well change the representation of an image into something that is more meaningful and easier to analyses. Segmentation of image is used to find objects and boundaries in images. More precisely, [1] segmentation of image is the process of giving a label to every pixel in an image such that pixels with the same label share certain characteristics.

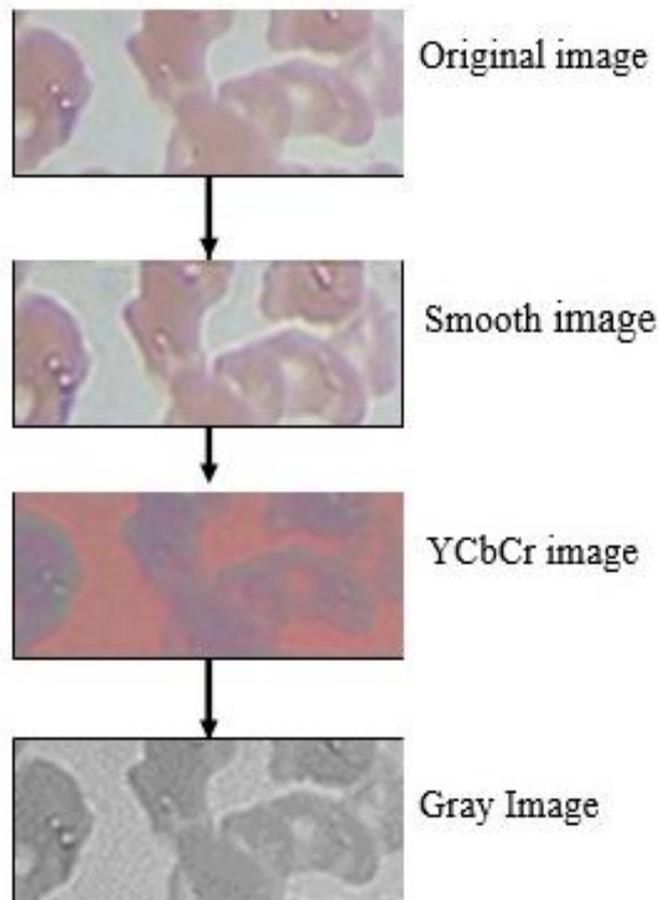


Fig: Flow Chart

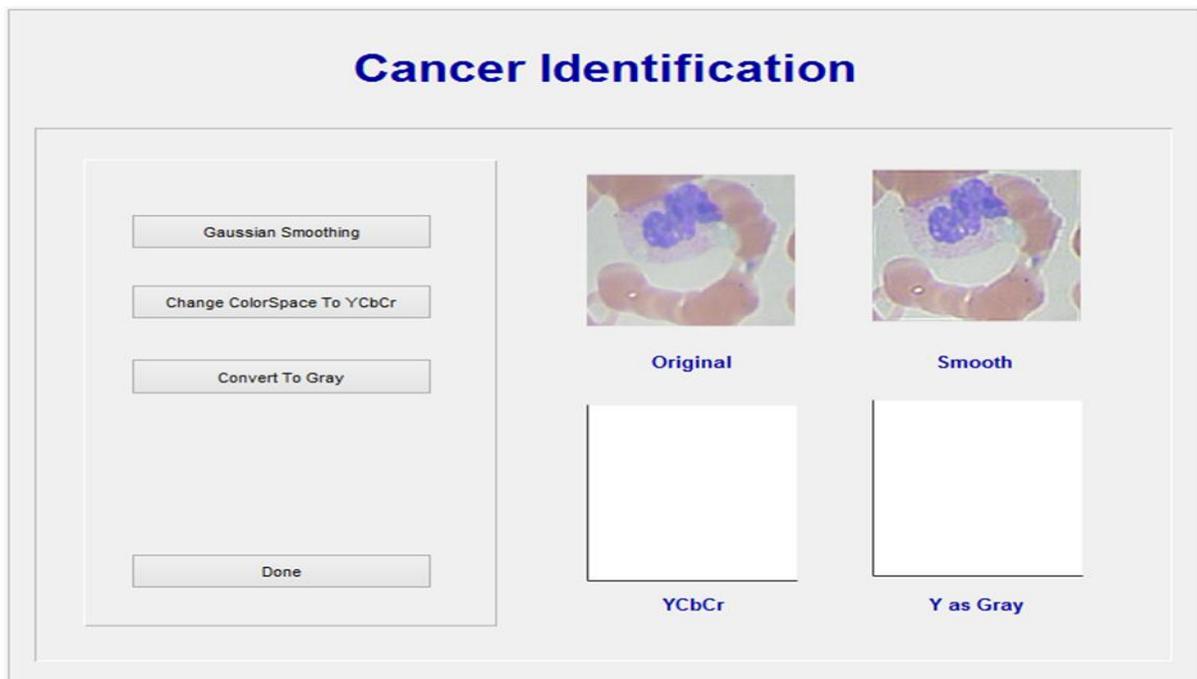
a) **Smoothing:**

In image processing technique, a Gaussian smoothing is the result of blurring an image by a Gaussian function. It's widely used effect in graphics software, typically to reduce image noise and reduce detail. Gaussian smoothing is also used as a per-processing stage in computer vision algorithms in order to enhance image structures at different scales such as space representation and scale space implementation. Gaussian blur is a

low-pass filter, attenuating high frequency signals. The Gaussian blur is a type of image-blurring filter that uses a Gaussian function for calculating the transformation to apply to each pixel in the image. The equation of one dimension Gaussian function is in two dimensions:

$$G(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}}$$

Where x is the distance from the origin in the horizontal axis, y is the distance from the origin in the vertical axis, and σ is the standard deviation of the Gaussian distribution. When applied in two dimensions, this formula produces a surface whose contours are concentric circles with a Gaussian distribution from the centre point. Values from this distribution are used to build a convolution matrix which is applied to the original image. Each pixels new value is set to a weighted average of that pixel's neighbourhood. The original pixel's value receives the heaviest weight and neighbouring pixels receive smaller weights as their distance to the original pixel increases. This results in a blur that preserves boundaries as well as edges better than other, more uniform blurring filters. A Gaussian blur effect is typically generated by convolving an image with a kernel of Gaussian values. In practice, it is best advantages of the Gaussian blur's separable property by dividing the process into two passes. In the first pass, a one-dimensional kernel is used to blur the image either in the horizontal or vertical direction. In the second pass, another one-dimensional kernel is used to blur in the remaining direction.



b) YCbCr conversion:

In scientific Research, Human eye has different sensitivity toward colour and brightness. For cancer analysis we require specific format, so there is need of converting the input image into YCbCr, where Y' is the luma component, CB and CR stand for blue-difference and red-difference Chroma components. Y' (with prime) is distinguished from Y , which is luminance, means that light intensity is nonlinearly encoded based on gamma corrected RGB primaries.

YCbCr isn't an absolute colour space; rather, it is a way of encoding RGB information. [3]The actual colour displayed depends on actual RGB primaries used to display the signal. Therefore a value expressed as YCbCr is predictable only if the standard RGB primary chromaticities are used. YCbCr and YCbCr are a practical approximation to colour processing and perceptual uniformity, where primary colours corresponding roughly to red, green and blue are processed into perceptually meaningful information. By doing this, subsequent image processing, transmission and storage can do operations and it introduce errors in perceptually meaningful ways. YCbCr is used to separate out a luma signal (Y') that can be stored with high resolution or it can be transmitted at high bandwidth, and two Chroma components (CB and CR) that can be bandwidth-reduced or sub-sampled, compressed, or otherwise treated separately for improved system efficiency. (As shown in fig 4)

C) Gray-Scale Conversion:-

A Gray-scale digital image is an image in which value of each pixel is a single sample, that is, it carries only intensity information. Images of this sort is also known as black-and-white, are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest..(As shown in fig 4)

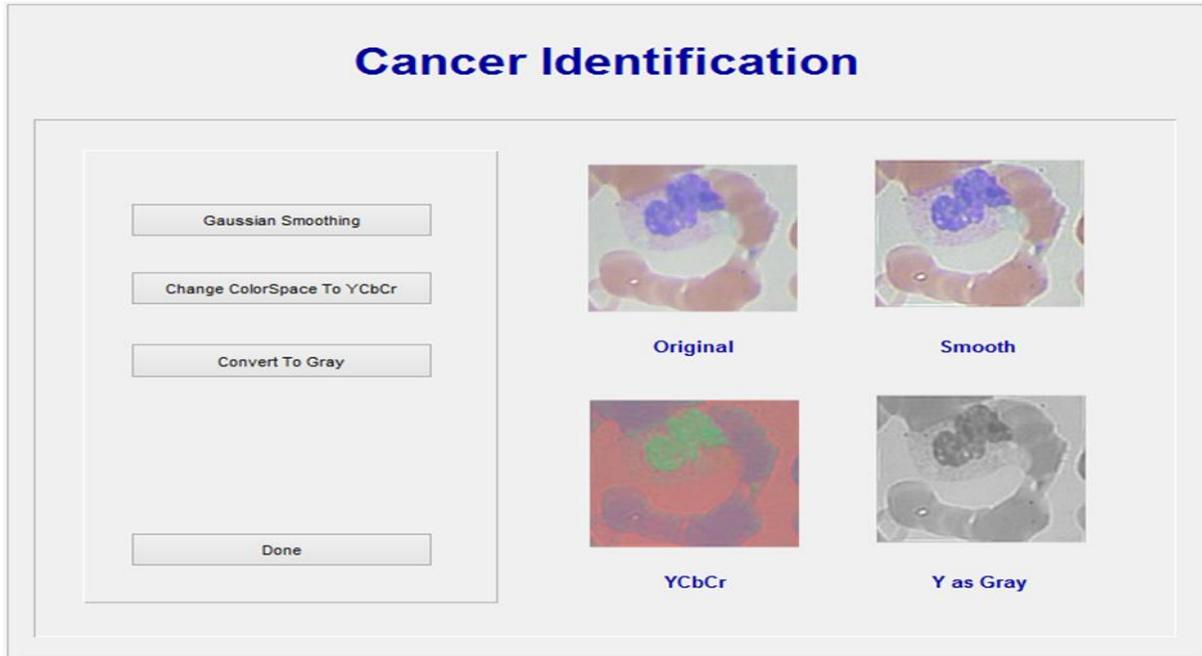


Fig. 4 Conversion of RGB to YCbCr and Gray-scale

The intensity of a pixel is represented with in a given range between a minimum and a maximum, inclusive. This range is represented in an abstract way from 0 (total absence, black) and 1 (total presence, white), with any fractional values in between.

C. Feature extraction: -

After convert the image in grey scale we need the extract the feature of image by using Gabor filter. Gabor filters are band pass filters which are used in image processing for feature extraction in image processing, feature extraction is a special form of dimensionality reduction. The main goal of feature extraction is to obtain the most relevant information from the original data and represent that information in a lower dimensionality space. A set of Gabor filters with different frequencies and orientations may be helpful for extracting useful features from an image.

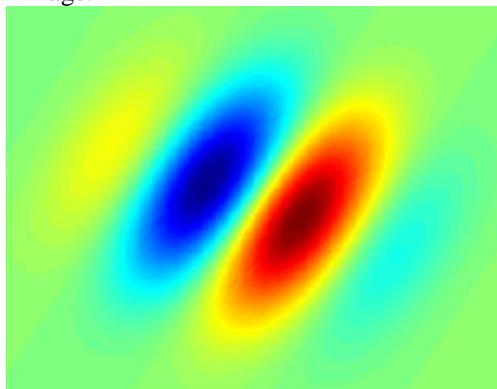


Fig3.3.a: Example of a two-dimensional Gabor filter

D. *Neural networking(recognize FNN):-*

In image processing, we use neural networking for pattern recognition by making use of feed forward neural networking. Feed forward networks have one-way connections from input to output layers. They are most commonly used for prediction, pattern recognition, and nonlinear function fitting. Feed forward networks include feed forward back propagation, cascade-forward back propagation, feed forward input-delay back propagation, linear, and perceptron networks. Back propagation, an abbreviation for "backward propagation of errors", is a common method of training artificial neural networks used in conjunction with an optimization method such as gradient descent. The method calculates the gradient of a loss function with respects to all the weights in the network. Radial basis networks provide an alternative, fast method for designing nonlinear feed forward networks. Dynamic networks use memory and recurrent feedback connections to recognize spatial and temporal patterns in data. They are commonly used for time-series prediction, nonlinear dynamic system modelling, and control system applications.

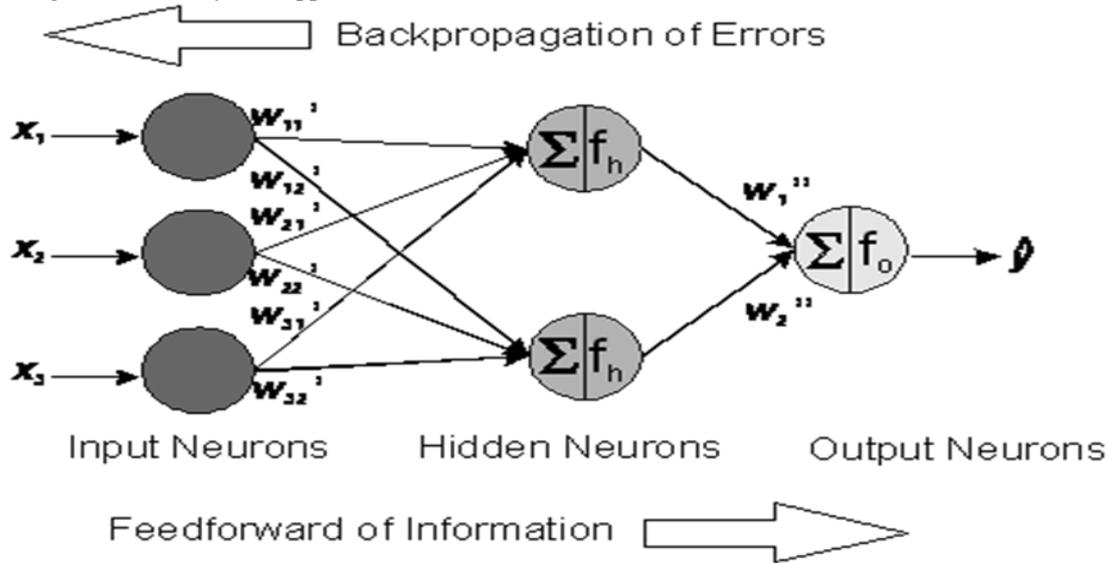


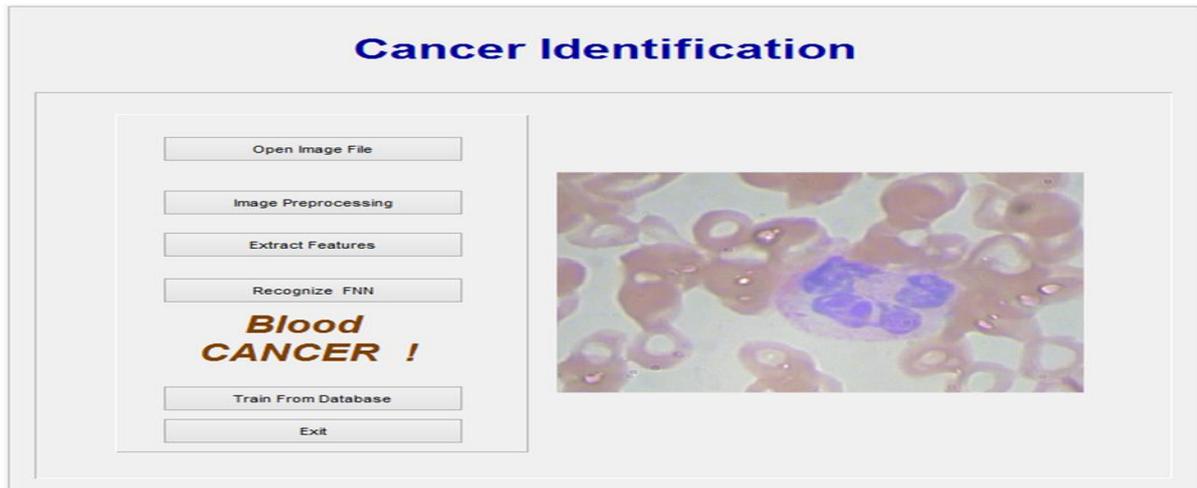
Fig3.4.a: Multilayer feed forward neural network for three input variables

E. *Cancer detection:-*

After completing all the stages of process and scanning this module can detect the type of cancer of the given blood sample by making use of MATLAB functions and microscopic images of blood sample of the patient. by this process we can efficiently save time and provide more accurate results.

IV. CONCLUSION

In this work it proposed an innovative method for a completely automatic identification of cancer from microscopic images, in order to provide an automated result as support for medical activity. The results obtained show that the proposed method is able to identify the WBCs present in the image in a robust way, separating the cells and selecting the nucleus and cytoplasm. In Further developments of proposed method is training of neurons in neural networking. So, that system can identify CANCER. Results is shown below:



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