

# Classification of Red Blood Cells using Texture Analysis

Dharang Sharma<sup>1</sup> Kunal Gupta<sup>2</sup>

<sup>1</sup>Research Scholar <sup>2</sup>Assistant Professor

<sup>1,2</sup>Amity School of Engineering and Technology, Noida, India

**Abstract**— Red blood cell count plays a vital role in medical diagnosis. If the numbers of red blood cells are less or more in count, it could lead to several diseases. There are several methods to count red blood cells that involve conventional as well as automatic methods. Conventional methods require high skills and experience pathologist to determine the shape and count of red blood cells. This method involves manually counting the number of cells under a microscope that is conducted by a pathologist that usually generates inaccurate results. There are also some automatic methods present that are basically the hardware solutions such as ‘Automated Haematology Counter’ but developing countries such as India are not capable of installing such expensive machines in every hospital laboratory. As a solution, in this project an automated RBC counting and classification system is proposed to speed up the time consumption and to reduce the potential wrongful identification RBC. This paper presents the preliminary study of automatic blood cell counting based on digital image processing. The number of blood cell count the may be use to diagnose the patient as well as detection of important oncogenic patterns.

**Keywords:** Red Blood Cell, Image Processing Techniques, Textures, Feature Extraction

## I. INTRODUCTION

We all get huge flow of multimedia information through Internet every day. This flow of information can be useful only when it can be manipulated, classified, archived and accessed selectively. Text Indexing is a tedious process and is subjective to describing content of Image. Main problem related to this is difficulty in locating the required image in a varied and large set of collection. Indexes which are based on text for big images is very time consuming project. Each Image and video has to be analysed manually by its domain expert to allow description of content in text.

Content Based Image Retrieval depends on the feature characterization like colour or shape or texture which can be obtained automatically from its base image. This particular paper recapitulates major findings of usage of data mining techniques which can help identifying features that contribute to cancer. It also helps understanding in occurrence of their patterns of occurrence, as they exist in biological and clinical data. Research findings herewith actually led to formulation of novel feature selection and prediction techniques.

The immense volume of images has challenged many researchers to explore feasible methods for prediction of Cancer using texture analysis so that these applications can be used effectively in the field of medicine.

Exploration of data mining methodologies led to the detection of important oncogenic patterns by formulation of novel feature selection and predictive techniques.

Prediction of oncogene patterns from gene expression data was exigent due to the large number of genes and very low number of instances. Existing methods failed to

identify the minimal set of oncogenes on gene expression data that required multi-class categorization.

As digital images bring impressive moments to our daily life, there is an ever increasing need to ensure effectively retrieve multimedia content in a wide range of environment. The massive volume of images has challenging many great researchers to investigate on the feasible methods for Cancer prediction using texture analysis applications; such applications could be used in medicine.

The conventional image database search based on semantic annotation or keywords, editing keywords or labelling images are time-consuming tasks, and sometimes semantic views are normally different for each user[12].

This system consists of three main phase:-

- 1) Features extraction
- 2) Retrieving methods, and
- 3) Ranking results and present images

## II. RELATED WORKS

Wide variety of approaches has been used in image retrieval. These approaches have different costs and complexities. Two commonly used techniques are based on color and texture.

Color histogram, is one of the earliest algorithms based on the color information of image. Although this method has low computational cost but it does not provide any information about the spatial distribution of colors. Color correlogram, is another useful technique in which the relation between different color levels is considered in spatial domain. Despite of its advantages, color correlogram depends on scaling, and illumination changes [1].

On the other hand, there are several approaches based on image textural information. Co-occurrence matrix and Gabor filter are two such methods that have been used many times [2]. Despite of their high performance, they have high computational complexity [3].

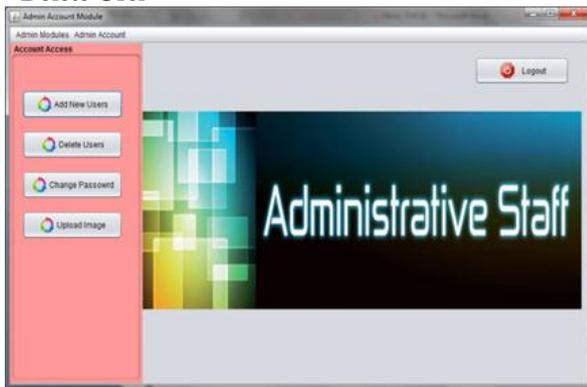
Another common approach in feature extraction is analyzing edges of image. Jain and Vailaya [4] used a method based on edge directions. This method first finds the edges of the image and then quantizes them to build an edge direction histogram (EDH). The performance of this approach is limited, because it does not consider the correlations between edges. Shanbehzadeh [5] improved this method and considered correlations between neighbouring edges by using a weighted function. The result was a directional histogram of similar edges (DHSE). Mahmoudi, presented a new progressive method in this area in [6]. In this method, orientations of edges are quantized and organized in an auto-correlogram matrix and an edge orientation auto-correlogram is produced (EOAC).

## III. IMPLEMENTATION DETAILS

### A. Admin

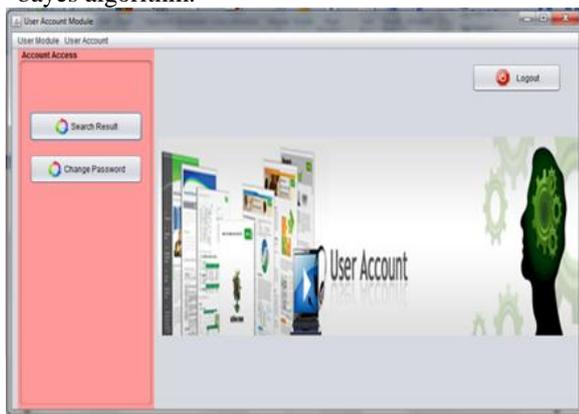
- Register user
- Register image with its description

- View User
- Delete User



#### B. User

- Uploading image by user as query image.
- Searching visually similar images.
- Details of similar images will displayed
- Updating image database.
- Retrieving similar images as output with image name and distance calculated from the Query image using naive bayes algorithm.



### IV. METHODOLOGY

Image contains ton of knowledge that cannot be defined by the text. Each image contains ton of information, using that ton of knowledge is mined. Varied strategies are projected by researchers. During this technique the pictures are pre-processed before they're keep in information. This pre-processing enhances the image quality and removes the noise. Then these pictures are clustered using varied parts of RGB model, once that the highest hierarchic pictures are again clustered victimization support vector machine algorithm (SVM)[13]. Then, the query image and also the target pictures are compared using these options and the similar image is retrieved.

There are many steps taken certain red blood cell classification and investigation from previous works. The matter domain during this case is to extract the corpuscle from a somatic cell image mechanically. Whereby, the goal is to classify corpuscle between traditional and irregular form. The muse ways that is taken in digital image process will be similar one to a different. Image processing isn't a one-step process: most solutions follow a consecutive processing scheme.

The proposed system consists of Image database of peripheral blood images, from which the relevant features are extracted and stored in feature database. The expert knowledge from pathology experts in the form of disease class for each peripheral blood image is also recorded in the feature database itself. This classification task for each image is done offline by the pathology experts.

Figure 1 shows Image Retrieval from the image collections involves the following steps-

- 1) Image Pre-processing
- 2) Image Segmentation
- 3) Feature Extraction
- 4) Image Matching
- 5) Resultant Retrieved Images

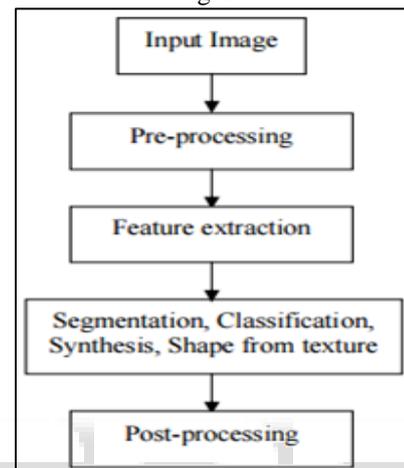


Fig. 1: Basic steps to analyse red blood cell

#### A. Image Pre-Processing

The key function of preprocessing is to improve the image in ways that increase the chances of success of the other processes. Pre-processing typically deals with techniques for enhancing contrast, removing noise and isolating regions. Grayscale image, binary image, hsv image whose texture indicates the likelihood of alpha-numeric information. Fig (b) and Fig (c) in table1, shows the example of preprocessing in which first preprocess the image by enhancing the contrast and then converting it into grayscale image. Acquired images have all blood elements colors close to background color, red blood cells are clustered with white blood cells and the presence of noise and stain in the blood slides is significant (Hengen et al., 2002). To overcome or reduce the effect of such factors, the images posterior standardized by increasing their contrast [7]. Fig. (b) in table1, shows contrast stretching on blood cell image. After contrast stretching image is converted in to Grayscale Image. Original blood cells images are in colour. To ease the process of ratio determination, the original images will be converted into grayscale colour. Grayscale represents the intensity of the image. In Matlab 7.0, this can be done by using RGB2GRAY function. The RGB2GRAY converts RGB image to grayscale by eliminating the hue and saturation information while retaining the luminance. Fig.(c) in table1, shows Grayscale image.

#### B. Image Segmentation

In this step the unwanted background of the image is removed by applying proper thresholding to contrast stretched image

and converting it to binary image. In binary image some small spots or points are observed so to remove them Opening is performed followed with closing on the binary image. For evaluating the Fourier descriptor we are complementing the resultant binary image. The key role of segmentation is to extract individual characters and words from the background. There are various segmentation techniques are use by individual authors, combination of the watershed technique and a parametric deformable model , Hough transform techniques are introduced in the literature. These methods are more complex and require more processing time in comparison with other methods. However, their advantage is provide more accurate segmentation.[8].

### C. Feature Extraction

Feature extraction is followed by morphological operations, feature extraction also called description deals with extraction features that result in some quantitative information of interest of features that are basic for differentiating one class of objects from another. In terms of character recognition, descriptors such as lakes (holes) and bays are powerful features that help differentiating one part of alphabets from another. The features considered are based on (i) Shape (ii) Color (iii) Texture. Shape features are areas of cell and nucleus, ratio of nucleus to overall cell area, cell perimeter, compactness and boundary of the nucleus. Texture features include contrast, homogeneity and entropy derived from the gray-level co-occurrence matrix. Color histogram, mean and standard deviation of the color components in CIE-Lab domain, form the color features.

Feature extraction can be achieved by using various techniques. Features are extracted by Local Binary Pattern (LBP) and co-occurrence matrix are , using a Sequential Forward Selection (SFS) algorithm , or by using classifiers like Artificial NURAL network (ANN), support vector machine (SVM) .

Magudeeswaran V, Karthikeyan P and Thirumurugan P give the various 27 features of cell images in their paper. This included 4 geometrical features, 16 statistical features and 7 moment invariant features [9]. In literature authors uses different feature extraction techniques, By using proper feature extraction technique accurate results are obtain. Feature extraction can be achieved by using various techniques.

### D. Image Matching

In blood cell analysis differential count of RBCs & WBCs is also have importance in order to diagnosis of various deace. For differentiating different types of WBCs and that of RBCs, there are also various segmentation and classification techniques are use. For example classification by using various classifiers like NN, KNN, W-KNN, Bayes,SVM,NNet[7], different types of artificial neural networks (ANNs) such as feed-forward back- propagation[4] and , local linear map , fuzzy cellular neural network are often used in the literature. Also to differentiate Blood cells Statistical and dynamic features of cell image may be considered.

### E. Resultant Retrieved Images

It finds the previously maintained information to find the matched images from database. The output will be the similar images having same or closest features as that of the query image.

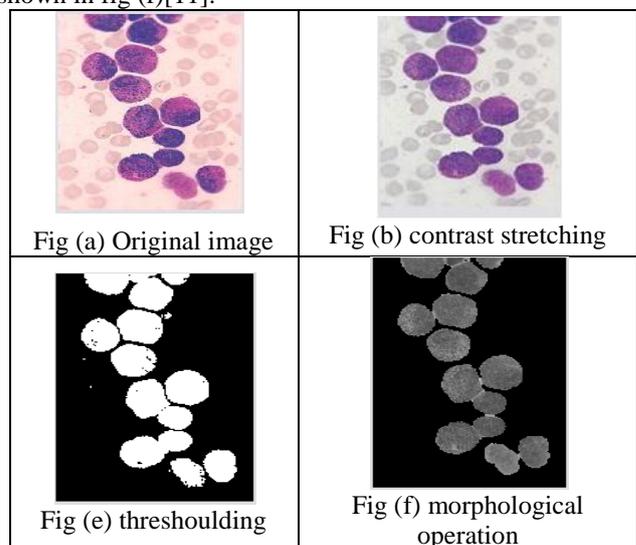
Content based framework is used for retrieving the matching images as well as for classification of the disease. Along with the images retrieved their matching percentage score is also displayed. Images are displayed in descending order of their matching percentage score.

The features extracted from query image are matched with feature database. The matching percentage score of each image of database with query image is calculated.

## V. RESULTS AND DISCUSSION

Table 1. Shows the results of the blood cells image pre-processing applied to the blood cell image for blood cell counting.

Fig.(a) shows the captured blood cell image at a resolution of 600 x 400. The preprocess image of blood cell is shown in Fig. (b). Fig. (c) shows the gray scale image. Based on Fig. (c), Since the blood cell slides were stained with chemicals to enable the nucleus of the white blood cells to take a unique color, the gray level intensity in WBC is darker compared to the RBC. The threshold value was selected manually and used to segment the WBC or RBC from the image background. After applying the thresholding method, the binary images of WBC and RBC for each blood cell images were obtained as shown in Fig.(e). Object pixels (WBC and RBC) will have the value of 1 and the background pixels will have the value of 0. There are small spots of object appearing in the WBC background images. This noise was removed to enhance the quality of the images in order to obtain the accurate number of WBC and RBC in blood cell counting. The blood plasma and dust particles in WBC images were cleaned by removing all object containing fewer than 100 pixels and applying the median filter before thresholding as shown in fig(d). After getting binary image, morphological operations are apply for final counting as shown in fig (f)[11].



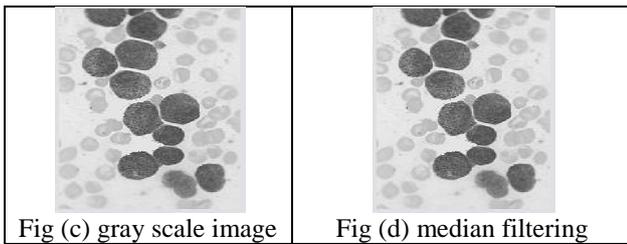


Table 1: the results of the blood cells image pre- processing applied to the blood cell image for blood cell counting

## VI. SUMMARY

RBC classification using image process has been tried several previous works. As we all know blood corpuscle analysis using image process isn't a brand new factor in diagnosis. Researchers specialise in the development of the accuracy and promising end in their analysis by using many various ways. There's a challenge in machine vision system to attain the standard level of human vision system. There are still weaknesses and constraints thanks to the image itself like colour similarity, weak edge boundary, overlapping condition, image quality, contrast, brightness, illumination and noise. Thus, a lot of study should be done to handle those matters to provide sturdy analysis approach for diagnosis purpose. This twelve project is hoped will build an improved answer and facilitate to enhance the present ways in order that it may be more capable, robust, and effective whenever any sample of blood cell is analyzed.

## VII. CONCLUSION

Geo Spatial Image Retrieval method is used to retrieve the images which are closer and appropriate with its varied feature, which helps in better accuracy of retrieval that is Red Blood Cells utilising texture analysis. Activity of human indicates that the search uses the contents of the image itself and not relying on metadata which is inputted by human beings. The measurement of similarity and visual feature representation are in fact two critical tasks in Red Blood cells utilising analysis of texture. The objective of this work is actually to find out similar images from the given database and is based on the features extracted from the given query or image.

Day by day the research is increasing drastically in this field and hence more and more techniques are being developed to enhance and increase the work capacity to get better results. This can help save lives at a huge scale at an exponential rate.

Using the primitive algorithms with advanced working system can also help in achieving effective results with can easily admissible to the area of need or the personnel which has been proven in this very project. The use of fairly primitive algorithms with advanced working systems gives very efficient results.

## ACKNOWLEDGMENT

We are extremely is, which were indispensable in the completion of this project report. We are also thankful to computer science engineering department of Amity University, Noida, for their valuable time, support, comments, suggestions and persuasion, required facilities,

Internet access and important books. I am very thankful to the guide Prof. Kunal Gupta for his valuable guidance and for providing all the necessary facility.

## VIII. FUTURE WORK

Red Blood Cells using texture analysis is actually utilised to retrieve the images which are found similar to any given input or query image given as an input. The described system will eventually extract colours of the given image provided in the database in jpeg/jpg formats only. It will estimate the distance between the image given in the query and other images in the database and find the extent of their similarity. Image processing and things like interpolation is done utilising JAI (java advanced imaging) API .Database images being looked for are collected from its parent directory of the image which is given. It allows search of similar images on the basis of its colour, shape, texture and other features so that better accuracy can be obtained.

The future work of this project includes:

- Obtaining 100% of accuracy
- We are at present extending this system, to deal with features like its texture, and also kind of images

## REFERENCES

- [1] H. Abrishami Moghaddam, T Taghizadeh Khajoie, A.H. Rouhi, M. Saadatmand Tarzjan, Wavelet Correlogram: A new approach for image indexing and retrieval, Pattern Recognition 38, pp. 2506 – 2518, 2005.
- [2] L.G. Shaprio, G.C. Stockman, Computer Vision, Prentice Hall, 2001.
- [3] D.A. Cluasi, H. Deng, Fusion of Gabor Filter and Co-occurrence Probability Features for Texture Recognition, IEEE Transactions on Image Processing, Vol. 14, No. 7, pp. 925-936, 2005.
- [4] Vailaya, A. Jain, H.J Zhang, On Image Classification: City Images vs. Landscape, Proceeding of the IEEE workshop on Content-Based Access of Image and Video Libraries, pp. 3-8, 1998.
- [5] J. Shanbehzadeh, F. Mahmoudi, A. Sarafzadeh, A.M. Eftekhari-Moghaddam, Image Retrieval Based on the Directional Edge Similarity, Proceeding of the SPIE: Multimedia Storage and Archiving Systems, Vol. IV, Boston, Massachusetts, USA, pp. 267-271, 1999.
- [6] F. Mahmoudi, J. Shanbehzadeh, A.M. Eftekhari-Moghaddam, H. Soltanian-Zadeh, Image Retrieval Based on Shape similarity by edge orientation autocorrelogram, Pattern Recognition 36, pp. 1725 – 1736. 2003.
- [7] Fabio Scotti , —Automatic Morphological Analysis for Acute Leukemia Identification in Peripheral Blood Microscope Images!, ICoCIMS 2005 – IEEE, 2005.
- [8] J. M. Sharif, M. F. Miswan, M. A. Ngadi, Md Sah Hj Salam, Muhammad Mahadi bin Abdul Jamil , —Red Blood Cell Segmentation Using Masking and Watershed Algorithm: A Preliminary Study!, ICoBE,penang,Malaysia,2012.
- [9] Magudeeswaran Veluchamy, Karthikeyan Perumal and Thirumurugan Ponuchamy —Feature Extraction and Classification of Blood Cells Using Artificial Neural

- Network| American Journal of Applied Sciences 9 (5):  
615- 619, 2012 ISSN 1546-9239
- [10] Seyed Hamid Reza Tofigh, Kosar Khaksari, and Hamid Soltanian Zadeh, —Automatic recognition of five types of white blood cells in peripheral blood.
- [11] Miss. Madhuri G. Bhamare, D.S.Patil, - Automatic Blood Cell Analysis By Using Digital Image Processing: A Preliminary Study, IJERT, Vol.2 Issue 9, September-2013
- [12] Arul Murugan A, IJECS Volume 2 Issue 4 April, 2013 Page No. 997-1006
- [13] Jing Bai, Lihong Yang, Xueying Zhang, “Parameter Optimization and Application of Support Vector Machine Based in Parallel Artificial Fish Swarm Algorithm”, Journal of Software, pp. 673-679, vol. 8, no. 3, 2013
- [14] An Image analysis based system for detection of RBC disorders using ANN by Yamini Motugada
- [15] M. T. Nasution and E. K. Suryaningtyas, “Comparison of red blood cells counting using two algorithms: Connected component labeling and backprojection of artificial neural network,” 2008 IEEE Photonics Global Singapore, ICGC 2008, 2008.

