



DISEASE DETECTION BY ABNORMALITIES IN ERYTHROCYTE USING IMAGE PROCESSING

Biotechnology

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ABSTRACT

Erythrocytes, also known as RBCs, are biconcave disks having diameter of 7 to 8 μm . The size, shape and number of RBCs can affect person's health. In laboratories the analysis of blood cells is carried out by human observations. The classical manual methods are time consuming and not precise. This paper gives an algorithm for automatic classification of microscopic blood smear images as normal (normocytic) or abnormal (Microcytic) based on Red blood cells. Different image processing techniques are used for feature extractions and classifications. Slides are prepared and primed to sense the count of "parasitemia" beneath BX53 Olympus microscope. Images obtained by placing the high-definition 1024x1360 resolution camera. For dataset, 40 samples from each normal person and abnormal person were collected. Various image processing techniques such as DWT, Pixel count ratio and histogram for feature extraction and LDC, QDC are used for classification. LDC classifier gave 91 % and QDC classifier gave 89 % accuracy for the feature vector of pixel count ratio of binary image

KEYWORDS

Erythrocytes, microscopic blood smear, pixel count ratio, image processing technique

INTRODUCTION

Red Blood Cell (RBC) is the most important component of human blood. Most of the part in human blood is composed by RBCs. Function of Erythrocytes, also known as RBCs, is to transmit oxygen in the body. RBCs are biconcave disks having diameter of 7 to 8 μm . In one cubic millimeter of human blood, 4-6 million Red blood corpuscles circulate. Healthy Red blood cells in human body are divided in four groups based on gender and age. The typical range of RBCs for newborn is approximately 4.8-7.2, for children 3.8-5.5, for women 4.2-5.0 and for men 4.6-6.0 x 10⁶ million per cubic millimeter. If it is less then person will suffers from oxygen deficiency. And due to this, people may suffer from heart and lung disorders as well as difficulty in breathing. The size, shape and number of RBCs can affect person's health. So, by observing the RBCs, type of disorders can be identified. In laboratories the analysis of blood cells is carried out by human observations. The classical manual methods are time consuming and not precise. This thesis/paper gives an algorithm for automatic classification of microscopic blood smear images as normal (normocytic) or abnormal (Microcytic) based on Red blood cells.

In the past years, biomedical image processing is undergoing a regime change with lowinvasive devices. With the latest advanced technologies, there are many various computer-aided techniques to accelerate the clinical diagnosis test. Now a days, there are many major concerns such as reducing time factor for blood analysis as well as making it independent without any human/manual interpretation. In addition, critical path is latest test cannot detect the infection burden at low-level blood stage. Today, for the successful clinical test only proper medication can be given. Various new kits are available which suffer from defects or flaws such as temperature easiness, which indicates count of false negativity and considerably differ their sensitivity. To overcome those flaws or defects in kits available a new programmed diagnostic tool is a vital aspect in fighting infections. Medicinal knowledge can focus their courtesy on the patients with an optimistic test by reducing the human/manual interruption.

Image acquisition is an essential method of Digital Image Processing. It could be easier being given photograph this is already in virtual shape. Mostly, image acquisition degree includes pre-processing, together with scaling and many others. Matlab supported file codecs which includes JPEG (Joint photographic professional organization), GIF (Graphics interchange layout), BMP (Windows bitmap), and so on.

AIMS & OBJECTIVES

1. To classify normal RBC and abnormal RBC in microscopic blood smear images.
2. To create a database
3. To extract discriminating cell properties and classify
4. To assist diagnosis
5. To reduce the time factor and manual intervention through the proposed approach

METHODOLOGY

The full form of name MATLAB is "Matrix Laboratory". MATrix LABoratory (MATLAB) is for technical calculating, which is a highly specified language. MATLAB incorporates 1)Computation, 2)Visualization, and 3)Programming in which problems & solutions are stated in used to mathematical sign. Usages of MATLAB are as follows:

- 1) Math and calculation
- 2) Algorithm improvement
- 3) Modelling, Simulation, & Prototyping
- 4) Data analysis, exploration, and imaging
- 5) Scientific and engineering graphics
- 6) Application improvement, with Graphical User Interface building.

Image Acquisition

In acquisition image, initial step is slides are prepared by an expert for manual examination. Rinse under tap water after staining slide and dried out. Slides are primed to sense the count of "parasitemia" beneath BX53 Olympus microscope by lab specialists. Images were found by placing the high-definition numerical camera with a microscope extra time. For this work, a 1024x1360 resolution camera was used with medium contrast and 400X zooming for 17 acquiring the sample images. For dataset, 40 samples from each normal person and abnormal person were collected.]Figure 2 (b)

PR Toolbox

Pattern Recognition toolbox can be implemented in MATLAB for classification. It gives accuracy of classification from feature matrix. Type of classifier is decided by the user which may be LDA, QDA, KNN, SVM etc. The dataset from feature matrix is divided for training and testing. In dataset, rows represent samples and columns represent features. The percentage of dataset used for training is also given by user. In the proposed system, PR Toolbox version 5.0 is implemented with LDA and QDA classifiers and results are analyzed.

LDA Classifier

Linear Discriminant Analysis classifier is a simple statistical binary classifier. Classification is done using linear decision boundary. Discriminant function is evaluated from mean of features and covariance matrix of each class which are calculated from feature matrix. Decision boundary is decided from discriminant function. LDA assumes that covariance matrices of two classes are equal. It also considers that the conditional probability of features in feature space is a Gaussian function. The features are divided in classes by calculating Maximum a Posteriori.

QDA Classifier

Quadratic Discriminant Analysis classifier is similar to the LDA classifier but the decisionboundary is non-linear. QDA assumes that

covariance matrices of two classes are not same. Some rearrangement is done to form quadratic decision boundary.

Performance Analysis

Feature vectors of 10 images out of 40 are shown in table1 & 2 for normocytic and microcytic respectively. In the feature table, first four features are of DWT and last one is of ratio thresholding. For classification, 71 % data from feature vectors of complete dataset (40 images) is considered for training and remaining for testing. The results are also analyzed by varying percentage of training data.

Table 1 Sample features for 10 normocytic cells

Feature 1	Feature 2	Feature 3	Feature 4	Feature 5
1183.572	3.529696	-2.3625	-0.64335	0.184682
1135.237	0.441299	-0.25597	-0.09444	0.250938
1090.393	1.839754	2.046983	-0.12556	0.165206
1236.792	1.249937	1.011163	-0.21412	0.207712
1321.873	1.485383	3.695586	-0.17425	0.137962
1308.392	1.062217	1.702513	-0.02872	0.159087
911.2841	0.687386	0.481296	-0.34298	0.167035
1462.196	-0.19089	0.408419	0.636231	0.153946
1270.016	-0.72689	1.003075	-0.00801	0.094883
1302.149	-0.22361	2.355821	-0.14962	0.245285

Table 2 Sample features for 10 microcytic cells

Feature 1	Feature 2	Feature 3	Feature 4	Feature 5
1347.866	1.399781	3.609928	0.155362	0.22303
1208.956	1.996502	3.777429	0.18306	0.34214
1214.304	0.550428	0.227133	-0.0362	0.390252
1224.755	1.311289	0.761091	-0.12605	0.39395
1203.633	-1.05412	3.996344	-0.06163	0.197701
1184.14	-0.83507	0.522412	-0.58708	0.347437
1569.549	0.203232	0.09997	0.174431	0.507506
1361.907	-2.56932	2.421977	-0.05496	0.262204
1228.649	-1.05551	2.568563	-0.11925	0.474277
1277.614	-0.67776	3.03327	0.002146	0.38142

CONCLUSION

Proposed system helps to identify the abnormal cells from blood cell image. Red blood cells have been classified in two classes, normal and abnormal using image processing techniques in MATLAB. Cells are distinguished based on their central pallor width, cell appearance in different color models. Features are extracted from cropped cells of RGB, Binary, HSV and S component image. Various image processing techniques are applied such as DWT, Pixel count ratio and histogram for feature extraction and LDC, QDC are used for classification. Different classifiers are studied and their results are compared to improve accuracy. Features extracted from pixel count ratio are leading to accurate results than others. LDC classifier gives 91 % and QDC classifier gives 89 % accuracy for the feature vector of pixel count ratio of binary image. For all type of feature vectors LDC classifiers works better than QDC classifier.

Future Scope

Using the image processing and segmentation technique also the

following sub-imaging technique, one can obtain the images of particular affected RBCs, i.e. Sickel-cells, Anisopoikilocytes and Ovalocytes and further apply feature extraction process to determine the characteristics of affected RBCs and thus make an artificial neural network to automatically diagnose sickle-cells disease affected person. This proposed system is useful to detect red blood cells automatically without specialist involvement.

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