A REVIEW ON SICKLE CELL ANEMIA DETECTION

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Abstract - *Blood consists of three different types of components namely Red blood Corpuscles (RBCs), White Blood Cells (WBCs) and Platelets. Out of these three, the most important is the RBCs. This is because RBCs play a vital role of oxygen supply to different body parts. When any disorders exist the shape of the mature RBCs vary from normal RBCs. Sickle Cell Anemia is one such RBC disorder. The person having sickle cell disease experiences severe pain and many more infections leading to even death of the person. Early detection can reduce the pain and hence techniques have to be introduced for the accurate detection of these disorders.*

1.INTRODUCTION

A blood cell which is also called as hematopoietic cell or hematocyte consists of RBC which is about 40 – 45% of its volume, WBC which is about 1% and platelets. The main function of RBCs is to carry the oxygen from the lungs to different body parts through blood vessels and collect carbon dioxide back to lungs. The transportation of oxygen is facilitated by the Hemoglobin which is an iron contained protein which is responsible for the color of RBCs. In adults, about 2.4 million RBC are produced every second. Matured RBCs are unique which does not have a nucleus.

Red blood cells are having a biconcave shape which is having a lifespan of about 120 days. But the sickle cells are having a lifespan of only 10-20 days. These sickle shaped cells block or slows down the blood flow in the blood vessels and carries less oxygen leading to anemia. There are different types of anemia which are iron deficiency anemia and vitamin deficiency anemia. Out of these two haemolytic anemia occurs due to the damage in red blood cells caused by the antibodies produced by the immune system. Inherited types of hemolytic anemia are sickle cell anemia and thalassemia.

Sickle cell disease is the blood disorder which is characterized by the sickle hemoglobin. Sickle cell disease occurs when a person inherits two abnormal $\boldsymbol{\beta}$-globin gene which makes hemoglobin. A person with a single abnormal $\boldsymbol{\beta}$-globin gene will not have the symptoms of the disease and is said to have sickle cell trait. Patients having these disorders are having severe pain and infections in addition to the conditions like anemia, cardiac, pulmonary, renal and brain complications. The symptom of sickle cell anemia varies in different persons. They suffer from hand and leg enlargements or inflammations, chronic contamination, eye sight problem and difficulty in

breathing. Early diagnosis and treatment can relieve pain and prevent death but there is no permanent treatment for people suffering from sickle cell anemia.

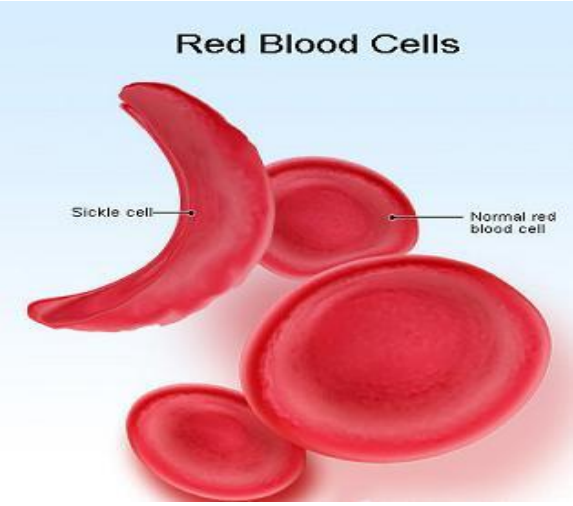

Fig - 1: Comparison of normal and sickled RBC

Digital image processing techniques provides various methods for the accurate identification of shape and size of the cells in the blood.

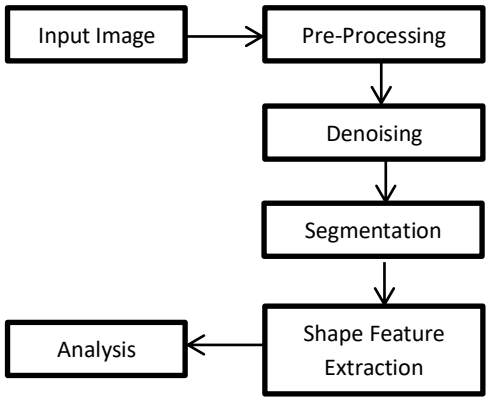

Fig - 2: Stages of digital image processing

2.RELATED WORKS

In [1], Tajkiya Saima Chy and Mohammad Anisur Rahaman proposed a method using image processing. In this through the methods of gray scale image conversion, image enhancement and median filter pre-processing is done. After that in order to segment the RBCs threshold segmentation is done and to remove undesired objects from image some morphological operations are applied. Here the extracted features are metric values, standard deviation, variance, aspect ratio, mean, metric values and entropy. Then as the final stage the support vector machine (SVM) classifier is trained to test the image.

In [2], Hany A. Elsalmony used circular Hough transform (CHT), watershed and other morphological tools to count the sickle cell anemic cells depending on the segmentation of their shapes and also applied an algorithm to detect benign and distorted blood cells. Also by applying the techniques in data mining, neural network and decision tree he introduced an algorithm for checking and analyzing the cell data variable like area, convex area, perimeter, eccentricity etc.

In [3], Arun N.S, Hariharan S proposed a method to detect the sickle cells using edge detection. Edge detection is an important image processing function that identifies the points in a digital image where there is a sharp brightness change or any discontinuities. With higher accuracy, an automated system for detecting the shape of the deformed cells was designed. They computed the highest, lowest and mean radius of each cell and compared that with different types of edge detection methods such as Canny, Sobel, Roberts, Prewitt, Zero crossing and Laplacian of Guassian.

In [4], Mengjia Xu, Papageorgiou, Sabia Z. Abidi and others proposed a new method for the

classification of red blood cells in sickle cell anemia using deep convolution neural network. Firstly in order to find the RBC region from the background, an automatic hierarchical RBC extraction method is used and then by applying an improved automatic seed generation based improved random walk method the touching RBCs in the ROI image has been separated. Then to normalize the segmented single RBC patches' variant size to uniform size, mask based RBC patch-size normalization method is applied. Finally to realize RBC classification, a deep convolution neural network is employed.

In [5], Vaunthara Acharya and Preetham Kumar introduced a method to separate the red blood cells from other blood components using image processing technique. It processes the blood smear image and examines it to classify the red blood cells into 11 different categories. In order to obtain the red blood cells alone from the blood smear image, it is necessary to separate the white blood cells. For this process the K-Medoids algorithm is used to obtain the WBCs and granulometric analysis is used to separate the WBCs and the RBCs. Thus obtained image without WBCs are given to the stage of feature extraction. Different features like deviation, diameter, perimeter, area, shape geometric factor and elongation are calculated. Based on these feature values disorders of the cell are classified to respective classes. For this purpose a decision system has also developed.

3. CONCLUSION

Sickle cell anemia is a RBC disorder in which the red blood corpuscles shape changes to sickle or crescent shape. This type of disease is commonly found in some tribe community in Idukki district of Kerala, some Mediterranean countries, some parts of America, and Saudi Arabia. These disorders can even cause death of the affected person. Hence early detection is very important. In this review, different methods for the detection of sickle shaped RBC cells has been discussed.

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