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Edge Detection based Classification of Leukocytes in Blood

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Abstract— Nowadays patient get diagnosed with various types of disease and there proper and immediate treatment is required. Study classification of various shape features which will lead to identify diseases with the help of edge detection methods.. The proposed system by blood sample segmentation by undergoing different stages of segmentation with image extraction of various shape features by using Cosine Similarity Method.

Keywords— blood cell count, Euclidean distance, Cosine Similarity shape extraction of white blood cells, Canny Edge Detection.

I. INTRODUCTION

In medical field the classification of micro-based white blood cell is advancing day by day by using various new techniques. For the purpose of accuracy, various automatic image processing method are used based on various blood sample is proposed. White blood cell includes lymphocyte, monocyte, neutrophil, eosinophil, and basophil. Its current identification of various white blood cells which provides the appropriate results of the patient samples. The previous system used or the traditional system used is very time consuming. Hence automatic extraction of white blood cells very fast and having accurate results. This proposed system, image of blood sample is processed is segmented by using canny edge detection further followed by cosine similarity Method ,we can find out types of Granulocytes and Agranulocytes present in the blood and the cells are being classified whether cell contain any abnormality or not.

II. METHODOLOGY OF PROPOSED SYSTEM

A. Proposed Block Diagram

Figure 1 shows the block diagram of a proposed system. The image who WBC counts is to be detected is given to the system.

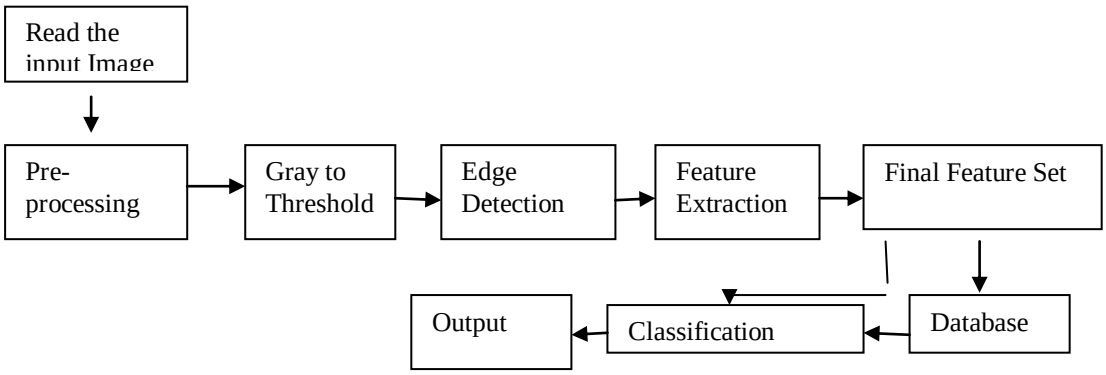

Fig1 Proposed Block Diagram

B. Methodology

Following method extraction of micro-based white blood cells

1) Preprocessing
2) Thresholding
3) Canny Edge Detection Method
4) Euclidean Distance
5) Cosine Similarities

C.Image Segmentation

Segmentation plays a very vital role in the shape extraction of the white blood cell.Thresholding is initial step of image segmentation which is followed by edge Detection technique. Edge Detection is simplest way of detecting the edges in the image by finding gradient in the given image.

Type of image Segmentation used in the proposed system:-

Canny edge Detection:Canny edge detection is technique to extract useful structural information from different vision objects it reduce the amount data of data to be processed. Canny Edge Detection is required for shape detection, face recognition and for much huge application in medical science.

Read input image then converted into canny edge detected image which is further given for the classification as follows:

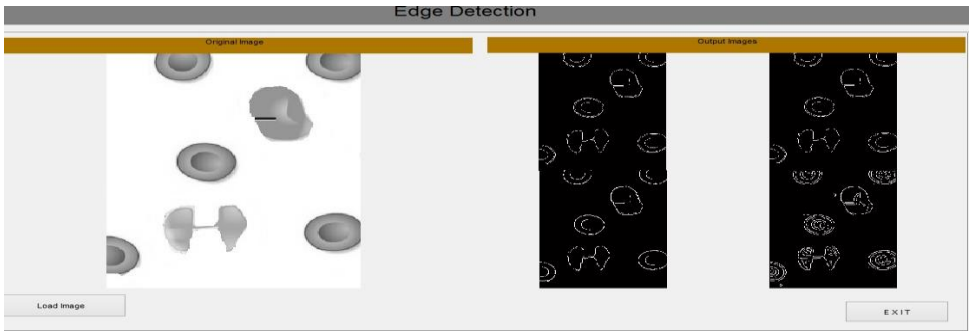

Fig 2. Example of Canny Edge Detection Example

D. **Euclidean Distance**

The Euclidean distance or Euclidean metric is used for the extraction of shape feature extraction of blood cell containing abnormalities.The Euclidean distance between points p and q is the length of the line segment connecting them.

In Cartesian coordinates if p = (p1, p2,..., pn) and q = (q1, q2,..., qn) are two points in Euclidean n-space, then the distance (d) from p to q, or from q to p is given by the Pythagorean formula

$$\mathrm{d}(\mathbf{p},\mathbf{q}) = \mathrm{d}(\mathbf{q},\mathbf{p}) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2}$$

$$= \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2}.$$

p = (p_1, p_2... p_n)
q = (q_1, q_2... q_n)
Where p and q are two points in the Euclidean Space
p_1, p_2,..., p_n & q_1, q_2,..., q_n are the Cartesian co-ordinates of p and q,
d=distance between p and q or q

Euclidean distance is susceptible to image being clustered by their L2-norm (magnitude, in the 2 dimensional cases) instead of direction. I.e. vectors with quite different directions would be clustered because their distances from origin are similar. When classifying irrational image we'd like to categorize them by their overall sentiment, so we use the angular distance. Therefore we make use of cosine similarity method than Euclidean distance method for better accuracy.

E. Cosine Similarity

Cosine Similarity is a measure of similarity between two vectors of an inner product space that measures the cosine of the angle between them.The cosine of 0º is 1 and it is less than 1 for the other angle. If the two vectors with the same orientation have a cosine similarity 1.If the two vectors at 90º have a similarity of 0.

It can be defined by the formula such as if a and b are two vectors, then the cosine similarity cosΘ is represented by using dot product and magnitude as

$$sim(A,B) = \cos(\theta) = \frac{A \cdot B}{\|A\|\|B\|}$$

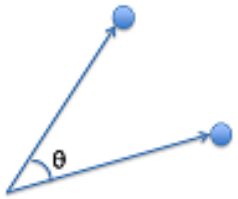

Fig 3.cosine similarity where A and B are two vectors of attributes

Ai=Component vector of A
Bi=Component vector of B
Cos(Θ)=Cosine of two vector

F. Algorithm for the feature extraction of white blood cell

Input : white blood cell sample
Output: Classification of various types of micro-based white blood cell

- Read the various white blood cells from the database.
- Apply Canny Edge Detection Method.
- Apply Cosine Similarity Method.
- Comparison of database with the feature set.
- Various types of white blood cell obtain with their inner count present in the database.
- Classification of each cell into Granulocytes and Agranulocytes are obtained.
- Further giving total number of WBC present in the blood.

III.RESULTS OF THE PROPOSED SYSTEM

A .Result with Image 1(Basepaper Image) with the Proposed System or cosine similarity Technique

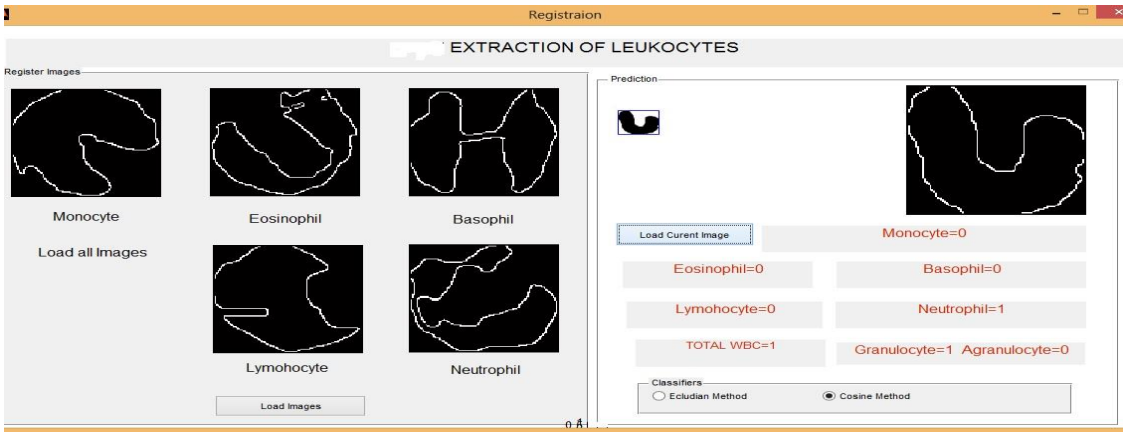

Fig 4.Result of basepaer

B. Result Image 2(Database Image) with Proposed System or cosine similarity

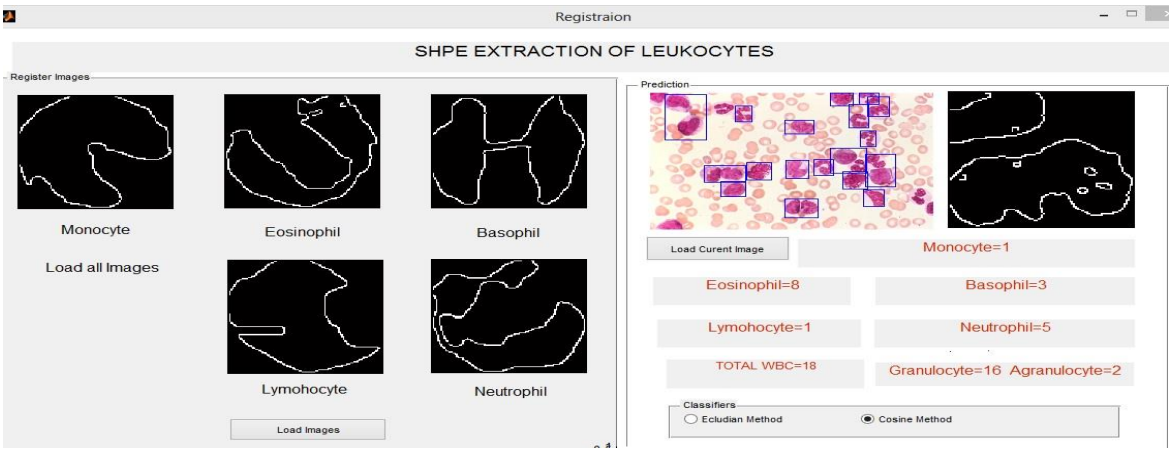

Fig 5.result with Database

The system has been implemented in Matlab.The Image 1 shows the image from basepaper ,the image of neutrophil images defining the various features which undergo various segmentation method such as initially image to grayscale then blurring to thresholding to edge detection. In image 2 which the database image, result in extraction of various types of white blood cell present in the blood.In diagram it gives the various monocyte, eosinophil, Basophiles, lymphocyte, neutrophil in the white blood cell. The image undergoes the cosine similarity method for the detection and extraction of cell.it also gives shapes of WBC present in the blood cell. The most attractive part of the system is it also gives the count WBC count in the patient blood sample. The first image in the prediction images show the load image by the user, which is followed by the segmentation of the image which edge detection. Then by comparison with the register image, the proposed system

gives the count various WBC for the required patient blood sample. It also gives the total count of the WBC present in the blood cell.

C. COMPARISON OF COSINE SIMILARITY WITH EUCLIDEAN DISTANCE

Sr.no	Output by Cosine Similarity							Output By Euclidean Distance						
Name of cell	N	E	L	B	M	Granularcytes	Agranu larcytes	N	E	L	B	M	Granularcy te	Agranularc ytes
Sample 1	1	1	1	1	1	2	3	0	0	1	0	1	0	2
Sample2	5	8	1	3	1	13	5	1	4	0	8	5	5	13
Sample3	4	0	2	3	1	4	6	3	1	0	0	6	4	6
Sample4	2	2	0	0	0	4	0	0	0	0	0	4	0	4
Sample5	6	6	3	1	2	12	5	0	5	1	2	0	5	3

TABLE 1 COMPARISON WITH PROPOSED METHOD

N=NEUTROPHIL

E=EASINOPHIL

L=LYMPHOCYTES

M=MONOCYTE

IV. CONCLUSION

The method cosine similarity give appropriate results and counts of each blood cell. Feature extraction by using a very simple technique.Thus the measuring inner distance or Euclidean Distance does not always show a accurate result in very angle of the image.It also classify the feature into Granulocytes and Agranulocytes.

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