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An Automatic Detection and Counting of Leukocytes Using Microscopic Images with Digital Image Processing

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Abstract: ***Complete Blood Count (CBC) is an important and primary blood test that is required by many physicians to get an overall view about patients with many diseases. The blood examination will indicate several diseases like cancer, HIV/AIDS, diabetes, anemia, and coronary heart disease which are popular diseases. The blood count offers a measure of the concentration of the Red Blood Cells (RBC), White Blood Cells (WBC), and platelets. Leukemia may be a cluster of medical specialty malady that sometimes affects blood, bone marrow, lymph nodes which characterized by overproduction of abnormal white cells which are unable to fight infection. Careful microscopic examination of stained blood smear or bone marrow aspirate is that the solely thanks to effective destination of leukemia. Recently several scientists have performed tremendous analysis in serving to the hematologists within the issue of segmenting the blood cells within the early of prognosis. This projected work aims to segment the blood cell images of patients suffering from acute leukemia using a Fuzzy C-Means (FCM) and Adaptive K-Means (AKM) clustering algorithm. The integrated clustering techniques have produced comprehensive output images with minimal filtering process to remove the background scene. And compare the performance of these two clustering algorithms.***

Keywords: leukocyte, complete blood count, red blood cells, white blood cell, fuzzy c-means, adaptive k-means

1. Introduction

Hematological analysis has been an crucial analysis space throughout the last decades. Several diseases like Leukemia and Anemia or even tropical diseases like Malaria can be diagnosed using the information contained in the blood stream, its components, their proportions and chemical information. Leukemia for instance is one of the top causes in child morbidity, and is one of the most frequent chronicle diseases in adults .The main components in the blood are Red Blood Cells that transport oxygen, Platelets which stop bleeding and Leukocytes or White Blood Cells (WBC) which are the main defense systems of our body.

Leukocytes are divided in five classes associated with their morphological and genetic options contained in two major groups. There square measure Granulocytes and Agranulocytes, this division responds to the properties of their semipermeable membrane. Granulocytes are divided in three groups, Neutrophiles, Eosinophiles and Basophiles, each distinction made because of the color they showed when they were stained with a special tinction called Romanowsky in each one of their granules. The agranulocytes are divided in two teams, the lymphocytes and the monocytes; they contain no granules in their cytoplasm or membrane. A Leukocyte may be represented victimization its nuclei color, number of lobes, size, visual texture, cell membrane and shape. The proportion and morphology of every one in all these cells is extremly necessary to diagnose diseases as a result of they mirror the performance and current state of specific organs and tissues like the Bone Marrow. A specific blood volume or a blood drop was adjoin a crystal or a Neubauer chamber so as to research every cell morphology and to count all of them, this was very time consuming and the expert was often exhausted soon during the analysis; bringing a considerable possibility of making mistakes in the diagnosis White blood cells (WBCs) in peripheral blood and bone marrow play a big role within the auxiliary identification of various diseases, such as AIDS, leukemia, and other blood-related diseases. The leukocyte count, conjointiy called the Differential Blood Count (DBC), is associated degree of indicator of sure diseases. In DBC, medical examiners count a hundred or two hundred WBCs on slides stained with blood and consequently cipher the proportion prevalence of every form of WBCs.

2. Review of Related Literature

White Blood Cells Identification and Classification from Leukemic Blood Image counting and classification of blood cells permits the analysis and destination of a huge range of diseases. Through the analysis of white blood cells (WBCs) the ALL - Acute Lymphocytic Leukemia, a blood cancer which will be fatal if left untreated, will be detected. Nowadays the morphological analysis of blood cells is performed manually by good operators. This involves various drawbacks, such as slowness of the analysis and a non-standard accuracy, dependent on the operator skills. In literature there area unit solely few samples of machine-driven systems so as to research and classify the blood cells, most of which only partial. This paper presents a whole and absolutely automatic technique for WBCs identification and classification from microscopic images. The projected technique first of all individuates WBCs from that, subsequently, are extracted morphological features necessary for the final stage of classification.

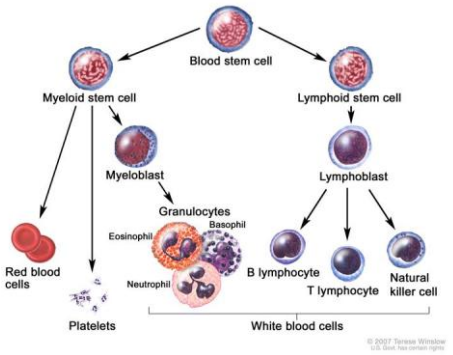


Figure 1: WBC Identification Method

The WBC identification method was improved through the use of digital image processing. However, the algorithm of the existing methods involves too many steps which complicates the image processing phase. Thus, we considered counting leukocytes by incorporating the HSV (Hue, Saturation, Value) saturation components of microscopic images.

3. Methodology

Image segmentation is one in every of the first steps in image analysis for object identification. The main aim is to acknowledge undiversified regions at intervals an image as distinct and happiness to totally different objects. Segmentation stage doesn't worry concerning the identity of the objects. The segmentation method is supported finding the utmost homogeneity in grey levels at intervals the regions known. This projected work aims to segment the blood cell images of patients full of leukemia employing a Fuzzy C-Means (FCM) and Adaptive K-Means (AKM) clustering algorithm. The integrated clustering techniques have produced comprehensive output images with minimal filtering process to remove the background scene. And compare the performance of these two clustering algorithms. K-Means produce tighter clusters than hierarchical clustering, especially if the clusters are globular. Data point must exclusively belong to one cluster center here data point is assigned membership to each cluster center as a result of which data point may belong to more than one cluster. An overview of the process followed in this study is shown in Fig. 2.

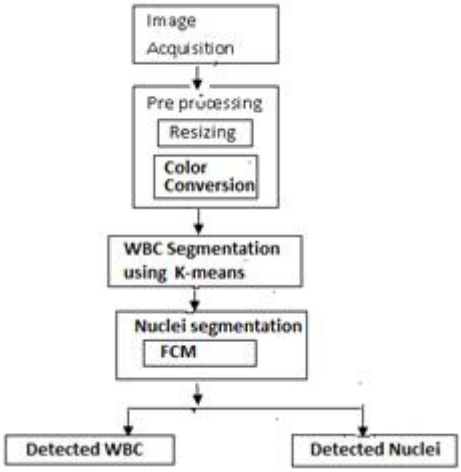


Figure 2: Proposed method for leukocyte segmentation process

a) Image Acquisition

Image Acquisition is a process of getting an input image for automatic segmentation of leukocytes and nuclei in microscopic blood cell images using digital image processing algorithms.

b) Pre Processing

Pre processing is a common name for operations with the images at the lowest level of abstraction both input and output is the input images. The aim of pre processing is an improvement of image data that suppress unwanted image data distortions

Segmentation Using K-Means Cluster

K-means clustering may be a style of unattended learning, which is used when you have unlabeled data. The goal of this algorithm is to find groups in the data, with the number of groups represented by the variable *K*. The algorithmic rule works iteratively to assign every datum to at least one of *K* teams supported the options that area unit provided. Data points are clustered based on feature similarity. The results of the *K*-means clustering algorithm are1.The centroids of the *K* clusters, which can be used to label new data 2.Labels for the training data point is Rather than shaping teams before watching the information, clustering allows you to find and analyze the groups that have formed organically. FUZZYCMEANS: Fuzzy c-means (FCM) is a method of clustering which allows one piece of data to belong to two or more clusters.. It performs clustering by iteratively searching for a set of fuzzy clusters and also the associated cluster centres that represent the structure of the information as best as doable. Given a number of clusters c, FCMC partitions the data X = {x1,x2,…,xn} into c fuzzy clusters by minimising the within group sum of squared error objective function.

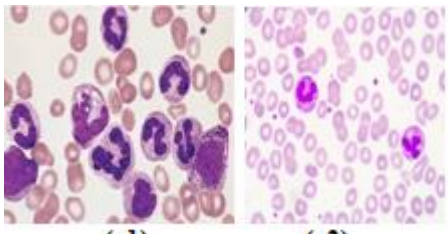
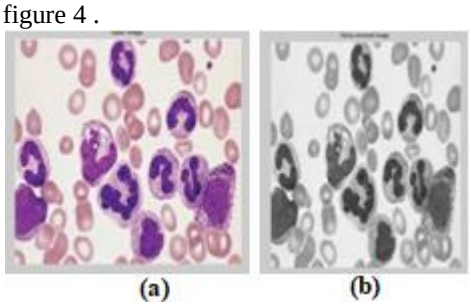


Figure 3: Sample image (a1) RGB Image 1 (a2) RGB image2

4. Result and Discussion

The proposed methodology was able to successfully count the leukocyte present on a image.it was observed that the highest accuracy the proposed method was able to generate is 100% .we are taking the sample image a1 and getting result in figure 4 .



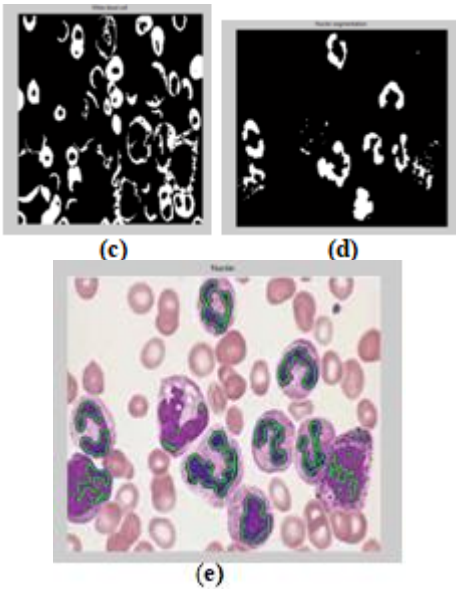


Figure 4: Leukocyte nucleus (a) RGB image(or) Input image (b) Noise removed image (c) white blood cell (d)Nuclei segmentation (e) Nuclei.

5. Conclusion

This paper presents a software based solution for counting the blood cells. Proposed method of cell counting is fast, cost effective and produces accurate result. It can be easily implemented in medical facilities anywhere with smallest investment in infrastructure. If the blood cells having additional irregularities, in such cases automated analyzer also fails to give accurate results. In these condition doctors prefer manual counting to analyse result created by automatic instrument. Means, if patient having anaemia symptoms the blood cells counted by automated analyzer is not matching with the symptoms then doctors prefers to try and do manual counting so as to diagnose the problem.so Based on the result the proposed method was able to produce an overall accuracy of 99.8% .So the proposed system is a lot of economical in terms of your time consumption, cost and also user friendly.

6. Future Recommendation

The WBC image segmentation is the most important task for WBC classification in the automatic WBC different counting system. For future work, the results can be extended to separate the identified overlapping cell therefore it can applied for differential white blood cell counting for diagnosing diseases based on different types of white blood cell such as Monocyte, Lymphocytes, Neutrophills, Basophills and Eosinophils.

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