



AUTOMATIC DETECTION OF LEUKEMIA IN HUMAN BLOOD SAMPLE BASED ON MICROSCOPIC IMAGES USING DIGITAL IMAGE PROCESSING

Engineering

Naufa N N

M.Tech, Dept of ECE, College of Engineering Trivandrum(CET)

ABSTRACT

Leukemia disease is one of the leading causes of death among human. Its cure rate and prognosis depends mainly on the early detection and diagnosis of the disease. This project is about the method of automated leukemia detection. In manual method, trained physician counts WBC to detect leukemia from the images taken from the microscope. But, this method is time consuming and not much accurate, because it completely depends on the physician's skill. To overcome these drawbacks an automated technique of detecting leukemia is developed. Identification of blood disorders is done through visual inspection of microscopic images by examining changes like texture, geometry, colour and statistical analysis of images. Changes in these features will be used as a classifier input. In this technique image processing, segmentation, deletion and fill hole operations are used to obtain the cancerous blood cell and the project will be done by using Matlab

KEYWORDS

Leukemia, image processing, segmentation, Matlab

INTRODUCTION

Medical imaging has become one of the most important visualization and interpretation methods in biology and medicine over the past decade. This time has witnessed a tremendous development of new, powerful instruments for detecting, storing, transmitting, analyzing, and displaying medical images. Leukemia is a type of cancer that affects the white blood cells. This affected white blood cells capture the bone marrow and the bone marrow is the soft material inside the of most bone. The abnormal white blood cells stay in bone marrow and reproducing in an uncontrolled way. In this way the normal healthy white blood cells in converted to abnormal uncontrolled cells the effect of this thing is human body is less able to fight off infections. The abnormal white blood cells also affect red blood cells and platelets. This affected red blood cells leads to less oxygen being delivered to the organs and tissues of your body it cause anaemia, and it can make to feel tired and breathless to the patient.. And affected platelets due to abnormal cells can lead to problems with the blood-clotting system, and results in bleeding and bruising much more easily than usual.

In this paper main point of concern is to detect leukemia. So we are only concentrating on the count of WBC(leucocytes). There are two type of stem cell, myeloid and lymphoid stem cell which are shown in the fig.1. Myeloid stem cell emerges into myeloid blast. This myeloid blast is the reason for generating of RBC(erythrocytes), WBC (leucocytes) and platelets. Lymphoid stem cell also induces lymphoid blast which will generate only the white blood cell(WBC). Bone marrow produces abnormal white blood cells(WBCs). These abnormal cells should die after some time but in reality they do not die and they become numerous in count. The normal white blood cells are interrupted by those abnormal white blood cells in doing their normal work. And this type of situation is named as disease like „Leukemia“. Leukemia can be classified into Chronic and Acute leukemia

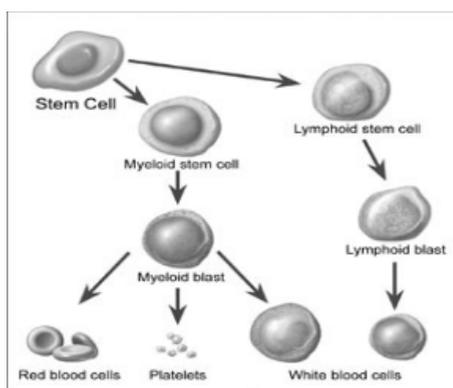


Fig 1: Stem cell type

Leukemia Cells:

A person whose suffer with leukemia, the abnormal white cells blood produce in the bone marrow. The abnormal and unshaped white

cells are leukemia cells. Unlike and abnormal blood cells is leukemia. Leukemia cells don't die when they should. Abnormal white blood cells attack to the normal white blood cells, normal red blood cells, and normal platelets. This makes it difficult for normal blood cells to do their work.

Types of Leukemia

Leukemia type based on the speed of disease develops in the human body and spreading quickly captures the human body. In generally there are two types of leukemia chronic leukemia and acute leukemia.

1. Chronic leukemia: Chronic leukemia capture human body very slowly, initially chronic leukemia inflicted in human body patient not occurred any symptoms. Meaning of this thing is normal white blood cells works normally and abnormal or leukemia cells not affect the working of normal cells. In this way very slowly chronic leukemia capture maximum area of human body and patient start to getting the symptoms. And in this case patient visit the doctor, leukemia is in its final stage. There are two common types of chronic leukemia:

I. Chronic Lymphocytic Leukemia – Chronic Lymphocytic Leukemia – Chronic Lymphocytic Leukemia generally catch the older patients that mean that person who suffer last twenty to twenty-five the patient of blood pressure, diabetes this types of disease, meaning of this thing is the person whose age is more than fifty year occurs this types of leukemia. In initial stage this leukemia is not any symptoms so patient not find the leukemia in initial stage. If patient create problems like as weakness, fatigue, and weight loss patient immediately visit the doctors. Chronic Lymphocytic Leukemia cells shown in figure2

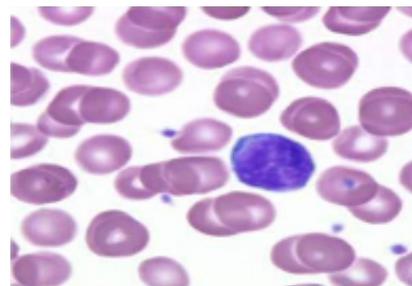


Figure-2: Chronic Lymphocytic Leukemia (CLL)

II. Chronic Myelogenous Leukemia (CML) – In above discussion Chronic Lymphocytic Leukemia generally detected in the old patients meaning of that it obtain at the senior citizen. In chronic Myelogenous Leukemia can detected at any age patient but in many case this leukemia detected in the age between ages 35 to 45 years. In chronic Myelogenous Leukemia initial symptoms are weight loss and fatigue and which may cause left upper abdominal pain. Chronic Myelogenous Leukemia cells shown in figure-3. Initial symptom chronic myeloid leukemia obtains in bone marrow white blood cells

and after spread in the whole body of patient

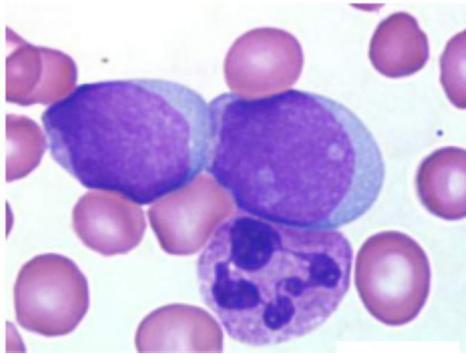


Figure-3: Chronic Myelogenous Leukemia (CML)

2. Acute leukemia: The acute leukemia cells cannot do any kind of the work to normal white blood cells. In acute leukemia the number of leukemia cells increases rapidly and very quickly rich the last stage of patient that mean medical science and doctors not help the patient to fight the leukemia.

There are two common types of acute leukemia:

I. Acute Lymphocytic Leukemia (ALL) – Acute lymphocytic leukemia usually obtain in the kids age that is 1 to 12 years children and at the oldest age. Initial symptoms of patients are fatigue, fever and bleeding. Acute lymphocytic leukemia cells shown in figure-4.

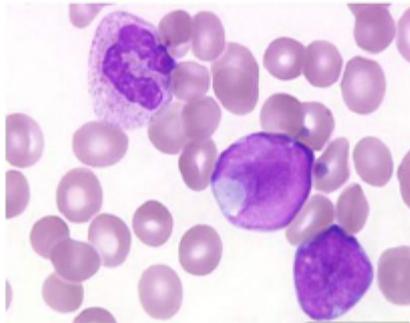


Fig 4: Acute Lymphocytic Leukemia (ALL)

II. Acute Myelogenous Leukemia (AML)

Acute myelocytic leukemia is mostly obtain in kids less than 1 year of age and rarely obtain in older children but also seen in the older age patients. In acute myelocytic leukemia the first symptoms 25% patients are bone pain and joint pain. And 50% patients seen enlarged spleen, but lymph node enlargement is rare. Acute myelocytic leukemia cells shown in figure-5.

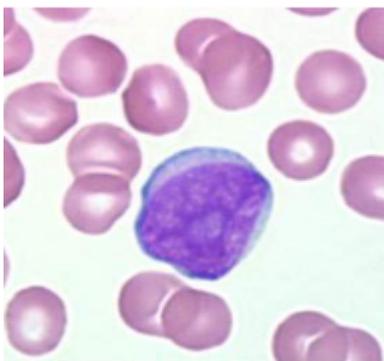


Fig 5: Acute Myelogenous Leukemia (AML)

PROPOSED METHOD

The Proposed method to detect Leukemia automatically from the microscopic image is shown below:

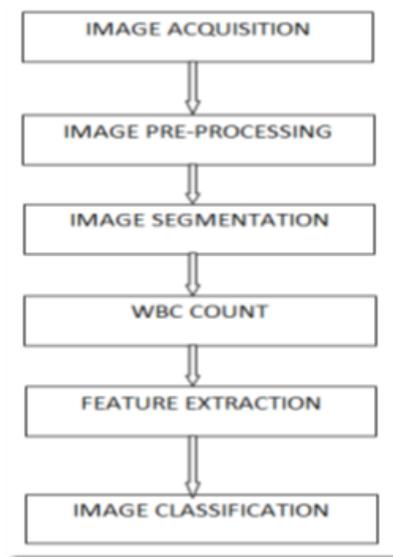


Image Acquisition:

In this part a good quality of images are taken by microscopic setup.

Image Pre-Processing:

The images which are taken may have some noise, blurriness etc. In this part of image processing we are trying to remove those unnecessary things for making the images more suitable for the next step of computational process. Pre-processing techniques usually include enhancing contrast, removing noise, isolating regions etc. The median filtering technique is used here to remove noise. And for removing blurriness from the image wiener filter is used.

Image Segmentation:

This is one of the most important part in the image processing technique. To identify and count white blood cells separation. Segmentation subdivides an image into its constituent regions or objects. Segmentation is the procedure partition an image into its constituent parts or objects. The level to which the subdivision is carried depends on the problem being solved.

Image Cleaning:

In this part WBCs which are on the edge of the image are removed to get better result

WBC Count:

In this part WBCs are counted automatically. There some algorithms exist to count WBCs in an automatic way. We are using shape based feature technique algorithm to count WBCs.

Feature Extraction:

In this part some features are extracted from the processed image. In this phase we are trying to find out the features of the nucleus of the leucocytes(WBCs). Feature extraction is the process of collecting some data from the image so that we can check these values of data with the standard value so that we can differentiate easily that the image has cancerous cells or not.

DESIGN

The design of this project cost is very less due to the use of basic methods like clustering segmentation, for edge detection and morphological methods such as erosion and dilation for smoothing. All these methods are low cost and simple and give us the desired output if applied in the correct sequence and in the correct way with appropriate parameters. Initially we discuss the fundamental steps for making the image more suitable for human perception and comprehension. Once we get a more detailed and descriptive image, we perform a set of operations on the image so as to predict the presence of Lymphoblasts in the collection of cells in our given sample and we try to extract that cell using morphological methods. We perform processes such as scaling, noise correction, threshold, edge detection, geometric feature extraction

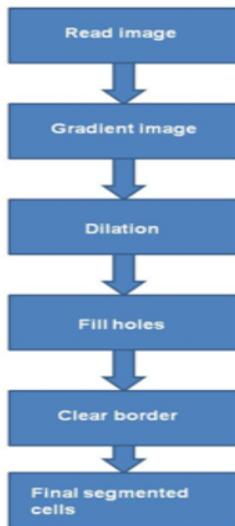
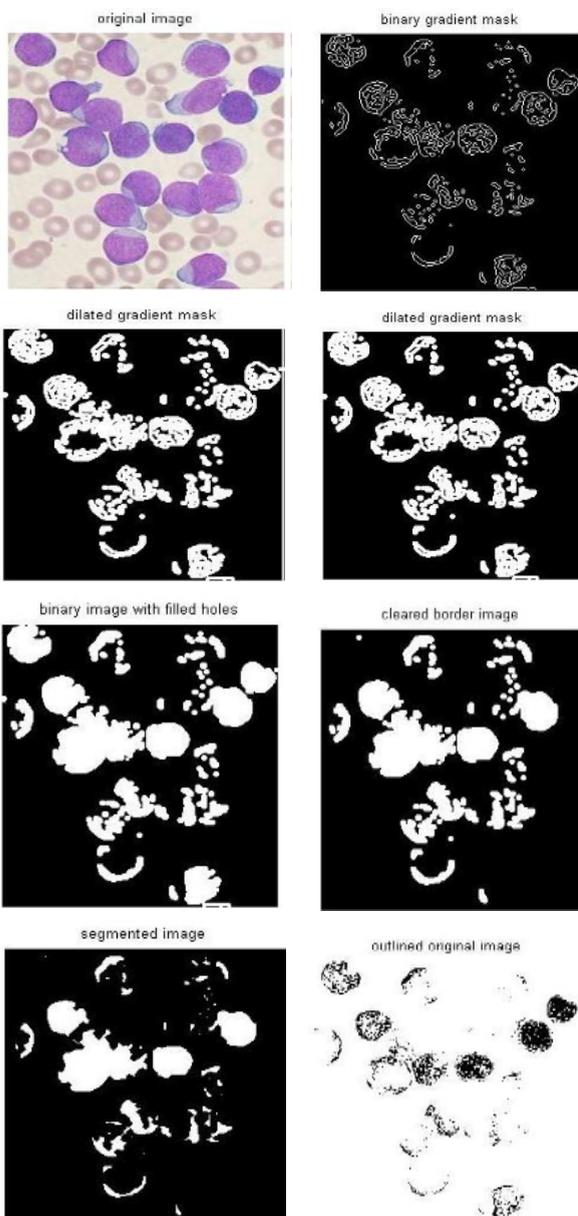


Figure-6: Implementation design

Figure for obtain images using MATLAB



CONCLUSION

The main aim of this method is, automatic detection of leukemia using microscopic blood sample images and to classify the types of leukemia(AML,CML,ALL,CLL). In this method blood cell image processing segmentation, deletion, fill hole and clear border operations are used to obtain the edge of the cancerous blood cell.To detect whether the person has leukemia or not on the basis of WBC Count and to identify the type of leukemia.Information extracted from the microscopic images of blood samples can benefit to people by predicting, solving and treating blood diseases immediately for a particular patient. Above explain method use only detection of leukemia in human blood cells..Since, Pathological tests are costly and timely, so this process is not use for every month or short duration

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