Detection of Leukemia in Human Blood Cell Images Using Image Processing with SVM classifier

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Abstract: *Leukemia is commonly referred for different types of blood cancer of different stages. It occurs when our bone marrow forms more white blood cells tissue. Due to irregular and incomplete growth the cells become deadly and harmful for healthy body functioning. Hence it is necessary to diagnose this lethal disease at early stage. Many procedures are being researched regarding this field which aids in detection of this disease at very early stage. One such methodology is used in this proposed system of using image processing with SVM which helps in detection of Leukemia at early stage with reliable results. The proposed methodology uses different techniques of image processing such as segmentation, edge detection and feature extraction and to classify the results it uses the SVM which gives more precise results and are reliable. All this is performed in MATLAB software. For feature extraction step we have preferred to take 5 features which are referred as contrast, correlation, homogeneity, energy and local binary patterns. These features help classifier to give output precisely.*

Keywords: *Edge Detection, Feature Extraction, Image Processing, Leukemia, MATLAB, SVM.*

I.Introduction

Cells are the functional and basic building blocks of human body. Our mere existence starts from single cell that is zygote, which goes on cell division and form such a complex human body. Hence cells and their division plays very vital role for the growth of the body. But if this growth does not occur in proper way it can create chaos in our body functioning. If the cell division occur regressively than their will be undifferentiated cell mass present in body. Cells will have no time for maturation and proper growth they will be left only as the mass of cell which has no function in body programming. And these cells form their colonies and become cancerous cells which in return obstruct the healthy cells functioning. One such case is present when bone marrow produces more number of white blood cells that in return creates problem reduces healthy functioning of red blood cells too and the colonies form grow rigorously. This case referred as Leukemia, a term use for blood cancer. As the blood is used to transport nutrients and oxygen to different tissue in human body it can also transport the undifferentiated mass of cell making the cancer metastatic. So the detection becomes more important than before. The cancer can be broadly two type

A. Types Of Leukemia

Acute or Chronic, depending on these two we can classify leukemia in 4 types

Acute Lymphoblastic Leukemia

Acute Myeloid Leukemia

Chronic Lymphoblastic Leukemia

Chronic Myeloid Leukemia

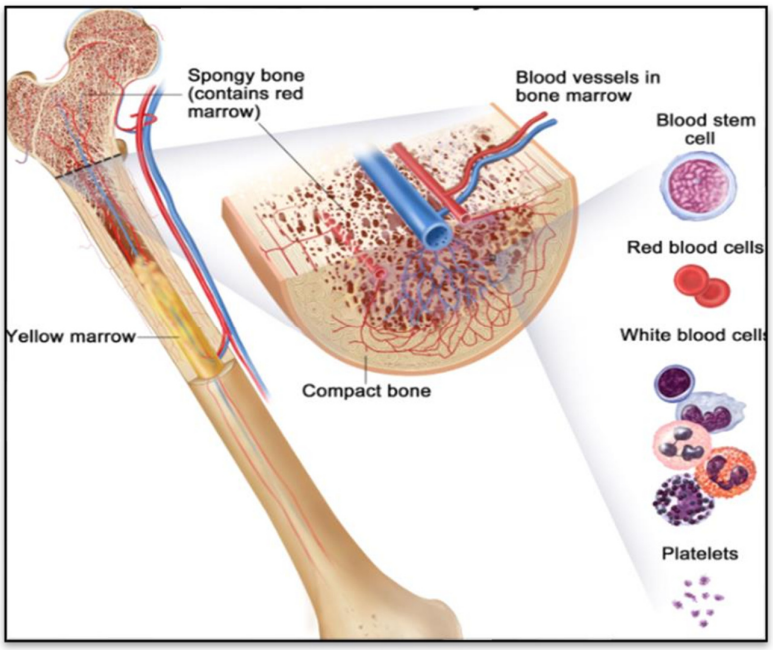


Fig 1: Bone Marrow producing cells

These different leukemia has different stages too depends on their cell production and detection.

II. Proposed Methodology

A. Steps Involved

Step 1: For any image processing system the first step is always to acquire the images on which the programming need to be done

Step 2: After the image acquisition comes to convert the image into gray scales that the image information lies only between the range of 0-255

Step 3: Following gray scale comes segmentation step in which the image is segmented to get the proper information of ROI

Step 4: On getting the ROI we have to complete the step of edge detection as it makes the edges sharp and thin which help in object recognition and feature extraction.

Step5: In feature extraction we extract 5 features and let it pass to the classifier to give the outputs

Step 6: Once the feature gets extracted the images are passed to classifier where it classifies the images using SVM.

B. Techniques used in edge detection and feature extraction

In edge detection we have used sobel and canny method. These are used for better reading of edges as they make edges sharp for the betterment of the output.

In feature extraction we have taken 5 different features which includes:

GLCM- Gray level co- matrix is usually used for detection of texture change. It's a useful feature which detects the texture difference and gives an accurate result.

In this matrix we define probability of two pixels which are joined with each other and have values i and j.

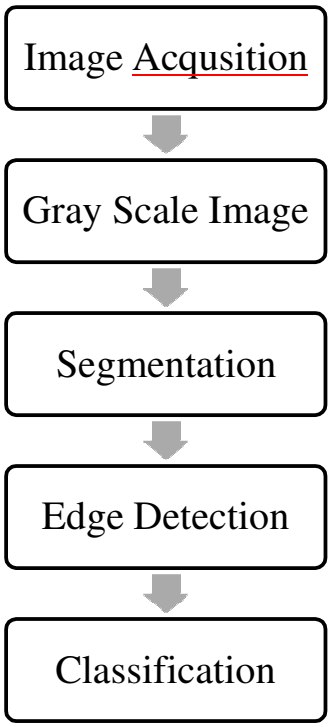
In this co- matrix we usually extract data such as:

- Homogeneity
- Energy
- Correlation
- Contrast

With these four extracted feature we have also extracted Local Binary Patterns of an image, which is also used for texture extraction.

C. Flow Diagram

Flow diagram shows the stepwise methodology we take while performing any task or project. It makes the work easy to understandable.



III. Results and Discussions

The images we acquire always have some noise and are prone to some artifacts. Hence to get proper and accurate result we need to preprocess it for that reason we have converted the image into gray scale image. To get the proper ROI we have segmented the image and then we have used edge detection In the proposed system the segmentation and edge detection both together made the detection easy as the algorithm used can differentiate

between normal and leukemia cells. Edge detection helped in this by making the edges sharp which in turn helped the system to identify the problem easily, With the SVM classifier the work become easy as it is an advance tool in this growing technology field. Machine Learning is a vast filed which helps in precision and accuracy and makes system

automatic. SVM is such a type which helped this system to identify problem and classify it. The further work which can be carry on this system that the classification can be held by using deep analysis. It can make the result more accurate and reliable.

Subject 1:

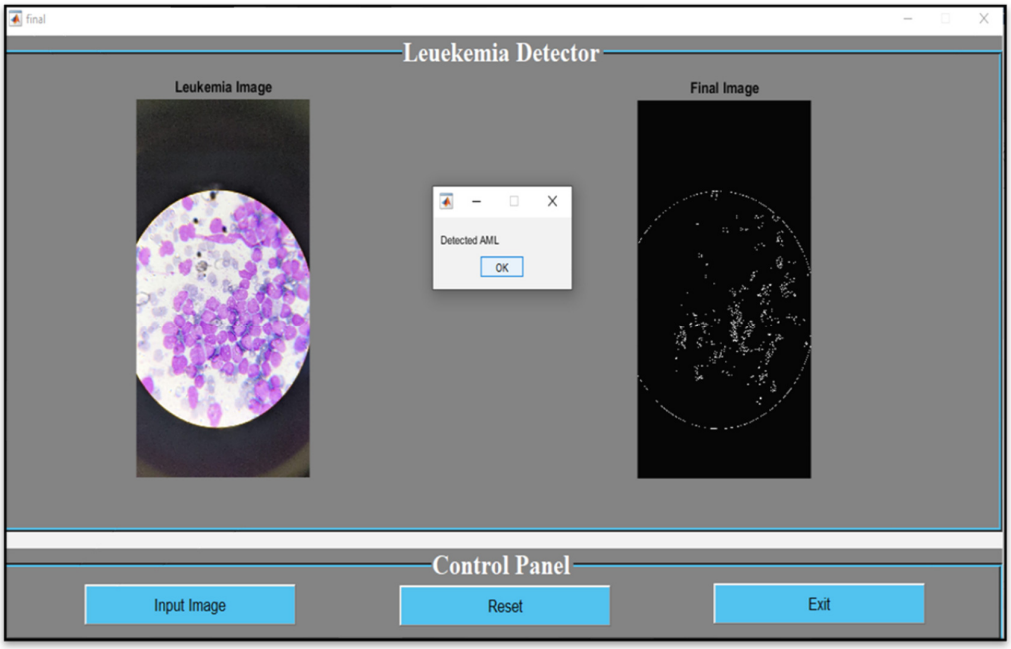


Fig.2.Detected AML

In figure 2 the system has detected Acute myeloid leukemia. It is one of the very serious condition which develop rapidly.

Subject 2

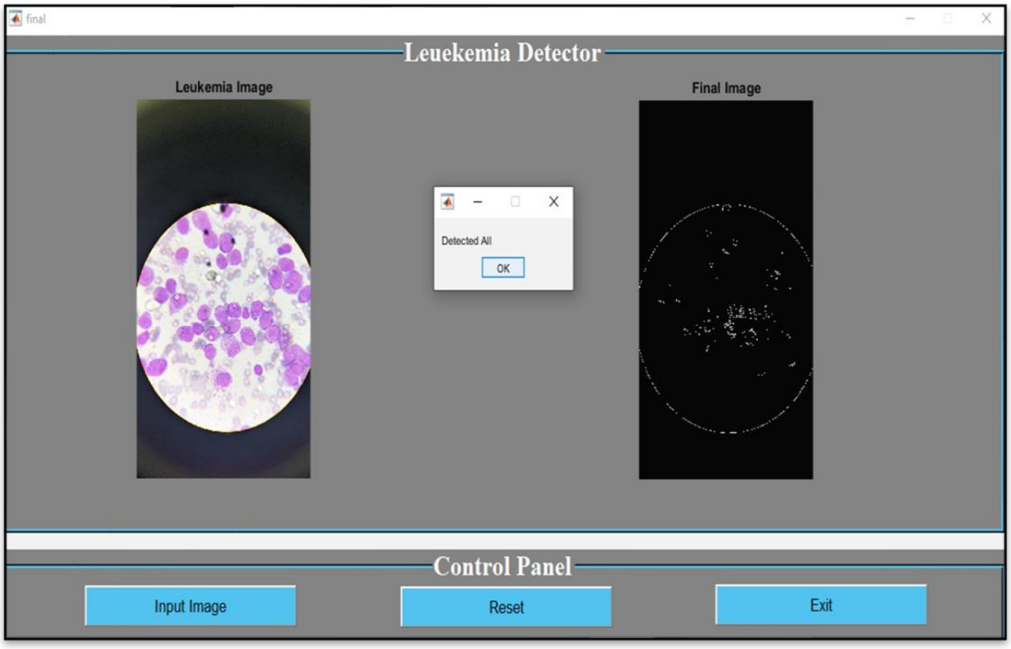


Fig. 3. Detected ALL

In figure 3 the system has detected Acute Lymphoblastic Leukemia. It is most commonly to be detected in young adults between the age group of 20-25 and more common in men.

Subject 3:

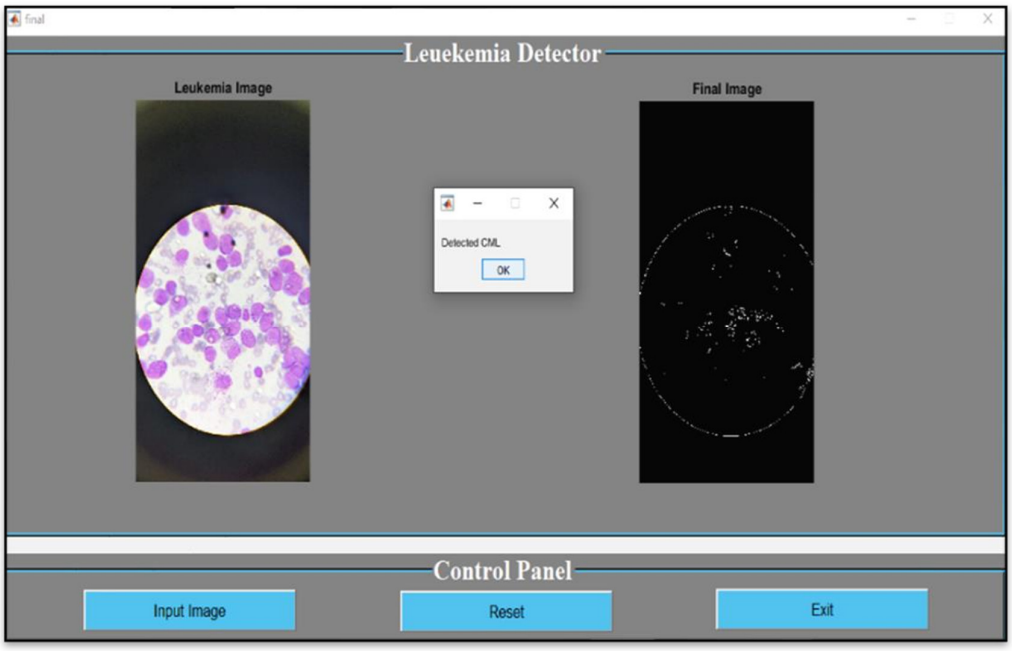


Fig.4. Detected CML

In figure 4 the system has detected Chronic myeloid leukemia. In general, we can say that about 15% of leukemia in adults can be CML. Generally caused by the genetic mutation in the body.

IV. Conclusion

Blood is major delivering substance present in the body. If cancer is being detected in the blood then the chances of detecting cancer at other sites are most common. The blood as a transporting fluid will take those cells to other body parts and make our healthy organs prone to cancer. Hence detection of this disease is prominent. The system which we designed is automatic and gives result very fast. The output is reliable and precise. The techniques we have used falls under the category of image processing. Image processing is being most likely to be used in many profession, for accurate and reliable result. It is user friendly and takes images as input no hectic and tiring process to get the output as required. The image processing techniques used in this system makes this system more accurate and reliable to use and overcome the problem faced. On top of all this the classification is being done by SVM classifier, well known for it's properties to classify the image accurately.

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