DETECTION OF CANCER IN HUMAN BLOOD SAMPLE BASED ON MICROSCOPIC IMAGES

Abstract

Identification of blood disorders is practiced by visualization of the blood sample through a microscope by the naked eye of a human. In this project a computerized technique has been developed to help the doctor in identifying different types of Leukemia. Initially the RGB image is converted to L*a*b colour space and is segmented using K-Mean clustering . To this clustered image the features are extracted and is classified into different types of leukemia. This technique is used to identify the diseases and diagnose them at an early stage. Images are used as inputs, as they are cheap and do not need any kind of expensive testing nor lab equipment's. The project will be using features in the microscopic images and examine any kind of changes on color, texture, geometry and statistical analysis of the images. The changes that are found in these features will be used as our classifier input .Images are used as they are cheap and do not require expensive testing and lab equipments. The system will focus on white blood cells disease, leukemia. The system will use features in microscopic images and examine changes on texture, geometry , color and statistical analysis.

Key words: White Blood Cancer, Blood smear images, White Blood Cells, Blast Cells, Leukemia, Microscopic images ,K-Mean clustering,Leukemia Detection in WBC, Feature Extraction.

Contents

Chapter I

1.Introduction

Medical imaging is one of the most important visualization and interpretation methods in biology and medicine . Modern humans have been the cause of development of new , powerful instruments for detecting, storing , transmitting, analyzing, and displaying medical images. This has led to a huge growth in the application of digital image processing techniques for solving medical problems. The most challenging aspect of medical imaging lies in the development of integrated systems for the use of the clinical sector. Design, implementation , and validation of complex medical systems require interdisciplinary collaboration between physicians and engineers.

Main objective of analyzing through images is to gather information, detection of diseases , diagnosis diseases, control and therapy, monitoring and evaluation.At the moment, identification of blood disorders is through visual inspection of microscopic images of blood cells.From the identification of blood disorders, it can lead to classification of certain diseases related to blood .

One of the most feared by the human disease is cancer.The existence of abnormal blood can be detected when the blood sample is taken and examined by hematologists. Microscopic images will be inspected visually by hematologists and the process is time consuming and tiring .

The process require human expert and prone to errors due to emotion disturbance and human physical capability that is of course have its own limit. Moreover, it is difficult to get consistent results from visual inspection. Visual inspection also can only give qualitative results for further research .

Chapter II

2. Background

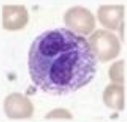
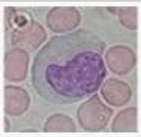
Blood is a body fluid in humans and other animals that delivers necessary substances such as nutrients and oxygen to the cells and transports metabolic waste products away from those same cells. Stem cells will mature and become some kind of blood cells. Each blood type has their own function. Blood components consist of:

Red blood cells (erythrocytes) - carry oxygen to tissues and back to the lungs with carbon dioxide.

White blood cells (leukocytes) - Defending the organism from infection. There are several types of white blood cells.

Platelets – helps blood clotting to control bleeding.

Plasma - The fluid in blood containing dissolved ions needed for cell function and consists of sodium, potassium,chloride, hydrogen, magnesium and iron.

Type	Microscopic appearance	Diagram	Approx. % in adults	Diameter (µm)	Nucleus	Granules	Lifetime
Neutrophil			62%	10–12	Multilobed	Fine, faintly pink (H&E stain)	6 hours–few days (days in spleen and other tissue)
Eosinophil			2.3%	10–12	Bi-lobed	Full of pink-orange (H&E stain)	8–12 days (circulate for 4–5 hours)
Basophil			0.4%	12–15	Bi-lobed ortri-lobed	Large blue	A few hours to a few days
Lymphocyte			30%	7–8 & 12–15	Deeply staining, eccentric	NK-cells and cytotoxic (CD8+) T-cells	Years for memory cells, weeks for all else.
Monocyte			5.3%	15–30	Kidney shaped	None	Hours to days

body . Those white blood cells crowd out the red blood cells and platelets that your body needs to be healthy . The extra white blood cells don't work right

It is classified as

- **Acute leukemia** happens when most of the abnormal blood cells don't mature and can't carry out normal functions. It can get bad very fast.
- **Chronic leukemia** happens when there are some immature cells, but others are normal and can work the way they should. It gets bad more slowly than acute forms do.

A myeloid stem cell further divided to form a red blood cell, platelets, and one of the white blood cells. A lymphoid stem cell also produces one of several types of white blood cells, such as B cells or T cells.

Leukemia Cells:

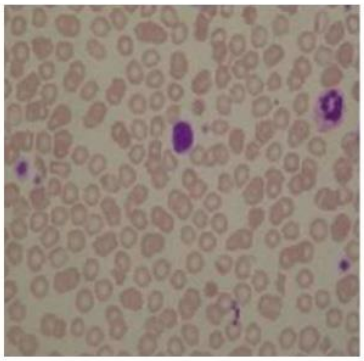
A person whose suffer with leukemia, the abnormal white cells blood cells produce in the bone marrow.

The abnormal and unshaped white cells are leukemia cells. Unlike and abnormal blood cells is leukemia. Leukemia cells don't die when they should.

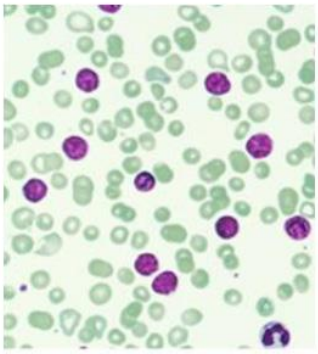
Abnormal white blood cells attack to the normal white blood cells, normal red blood cells, and normal platelets. This makes it difficult for normal blood cells to do their work.

Types of Leukemia

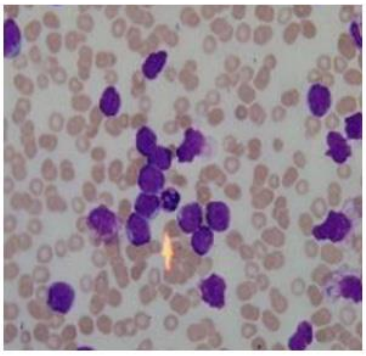
Leukemia type based on the speed of disease develops in the human body and spreading quickly captures the human body. In generally there are two types of leukemia chronic leukemia and acute leukemia.



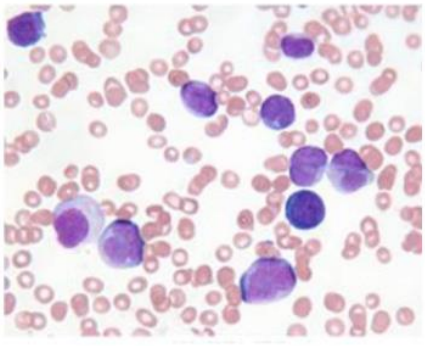
HEALTHY



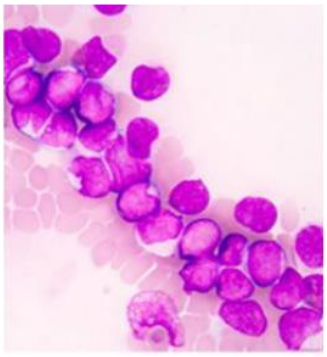
Chronic Lymphocytic Leukemia
(CLL)



Acute Lymphocytic Leukemia
(ALL)



Chronic Myeloid Leukemia
(CML)



Acute Myeloid Leukemia
(AML)

A. Chronic leukemia:

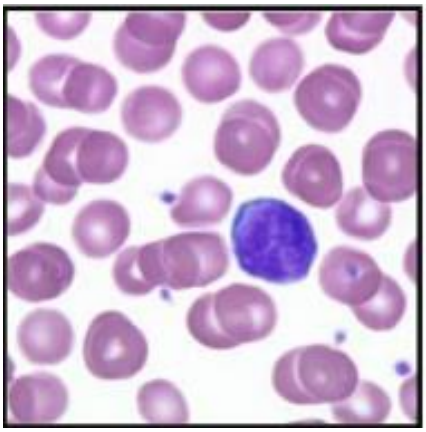
Chronic leukemia capture human body very slowly, initially chronic leukemia inflected in human body patient not occurred any symptoms. Meaning of this thing is normal white blood cells works normally and abnormal or leukemia cells not affect the working of normal cells. In this way very slowly chronic 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 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 LymphocyticLeukemia cells shown in figure.



Symptoms of Chronic lymphocytic leukemia :

Chronic lymphocytic leukemia is a slow-growing disease and many signs of Chronic lymphocytic leukemia are not getting clear symptoms in the initial stage, symptoms are accrued countable at the last stage of Chronic lymphocytic leukemia that mean in this stage patient suffered to the leukemia but medical science or doctors does not get any helps the patient. Some of the conditions that may arise as Chronic lymphocytic leukemia slowly develops and spreads may include:

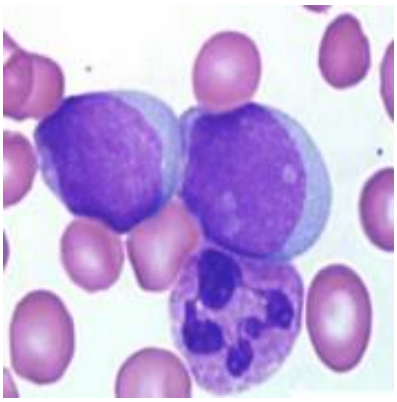
1) Anemia: Working of red blood cells transports oxygen provided the human body. If the abnormal white blood cells affect the working of red blood cells, the symptoms of anemia occurred to the patient like as weakness, fatigue, lack of energy and shortness of breath.

2) Leukopenia: Working of white blood cells producing antibodies and warding off disease. If the abnormal white blood cells affect the working of normal white blood cells, the symptoms of leukopenia reduced immunity, more frequent infections and fevers.

3) Thrombocytopenia: Working of blood platelets are the particles in the blood that aid with clotting. If the abnormal white blood cells affect the working of normal blood plates, the symptoms including easy bruising, bleeding or nose bleeds, and bleeding.

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-5. Initial symptom chronic myeloid leukemia obtains in bone marrow white blood cells and after spread in the whole body of patient.



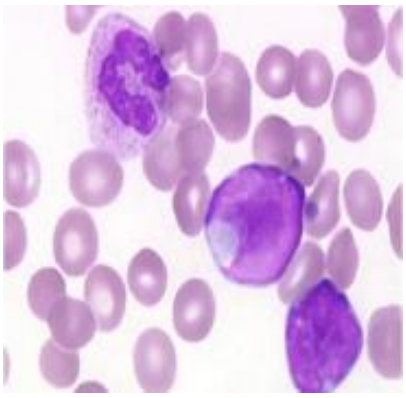
B. Acute leukemia:

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 .



Acute lymphocytic leukemia symptoms like as weakness, Fatigue, Fever, Headaches, Pale skin, Vomiting, Body aches and Loss of appetite.

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 .

Acute myelogenous leukemia symptoms

1) Frequent infections and fever: The important role of white blood cells is to ward off infections and protect our bodies from foreign germs and bacteria. Acute myelogenous leukemia reduces the number of healthy white blood cells therefore the body is not as capable of defending against foreign germs and bacteria. For this region patients of acute myelogenous leukemia may have an increased rate of infections and fevers.

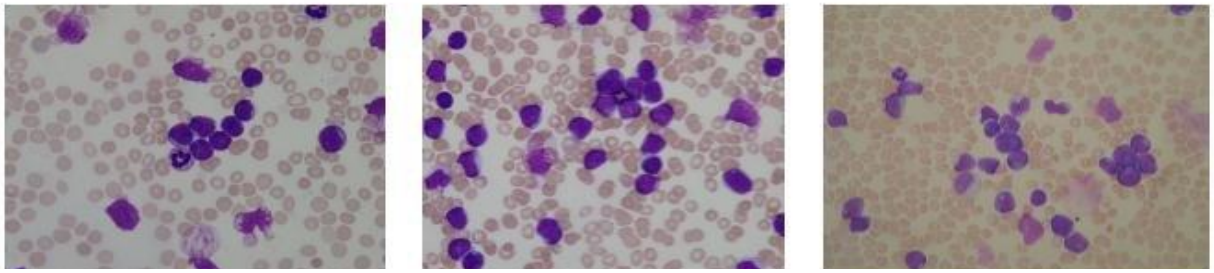
2) Anemia: The important role of red blood cells carries oxygen throughout the body. The abnormal blood cells caused by acute myelogenous leukemia may lead to feeling tired and/or weak and having shortness of breath.

3) Easy bleeding or bruising: In human body the role of platelets control bleeding. If the

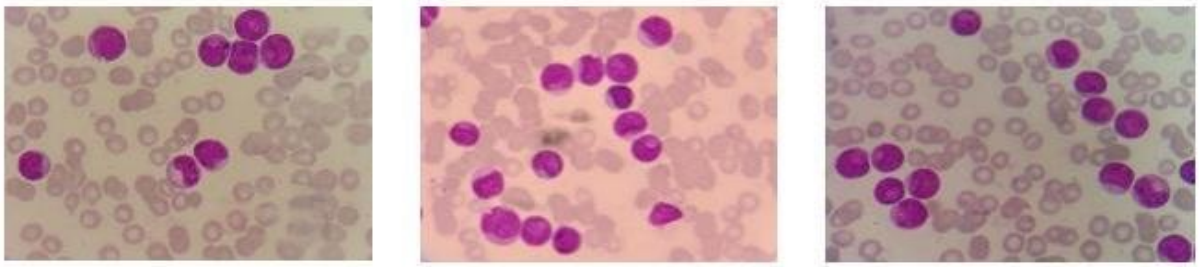
abnormal blood cells affected the normal plates working and in case of patients have any minor cuts or bruises blood flow slow healing.

4) Joint and bone pain: The increased number of leukemia cells can cause pain in bones, joints or bones.

Acute Lymphoblastic Leukemia (ALL)



Acute Myeloid Leukemia (AML)



2.2. Causes of lukemia

The satisfactory causes of leukemia are unidentified and in most case, it's unsettled why leukemia has developed . Research into possible causes is going on all the time. Like other cancers, leukemia isn't transferable and can't be approved on to other people. There is integer of factors that may amplify a person's risk of budding leukemia . Having a scrupulous hazard factor doesn't denote you will definitely get this category of disease and personnel lacking any recognized risk factors can still develop it. The recognized risk factor of generating this type of cancer i.e. leukemia are clarified here :

i. **Exposure to radiation:** People who exposed to high level of release, such as nuclear developed accidents, have the main risk of developing leukemia than people who have not been

exposed. On the other hand, a small numeral of people in the UK will be uncovered to emission levels high adequate to augment their risk.

ii. **Smoking**: Smoking increases the risk of initial leukemia. This may be due to the intense levels of benzene in cigarette smoke

iii. **Exposure to benzene:** In very unusual cases, leukemia may begin due to the long term contact to benzene (and possibly other solvents) used in industry.

iv. **Cancer treatments:** Now and then, a few anti-cancer treatments such as chemotherapy or radiotherapy can be a basis for leukemia to build up after some years of this behaviour. The risk increase when persuaded types of chemotherapy drugs are mutual with radiotherapy. While leukemia develops since of earlier anticancer treatment, this is called lower leukemia or treatment related leukemia.

v. **Blood disorders:** People with certain blood disorders, such as myelodysplasia or myeloproliferative disorders have a distended risk of initial AML.

vi. **Genetic disorders**: People with a certain hereditary disorder, excluding Down's syndrome and Franconia's anaemia, have an inflated risk of embryonic leukemia.

2.3 General diagnosis of leukemia

- Blood tests. A complete blood count looks at the number and maturity of different types of blood cells. A blood smear looks for unusual or immature cells.
- Bone Marrow Biopsy. This test involves marrow taken from your pelvic bone with a long needle. It can tell your doctor what kind of leukemia you have and how severe it is.
- Spinal tap. This involves fluid from your spinal cord. It can tell your doctor whether the leukemia has spread.
- Imaging tests. Things like CT, MRI, and PET scans can spot signs of leukemia.

Chapter III

3.METHODOLOGY

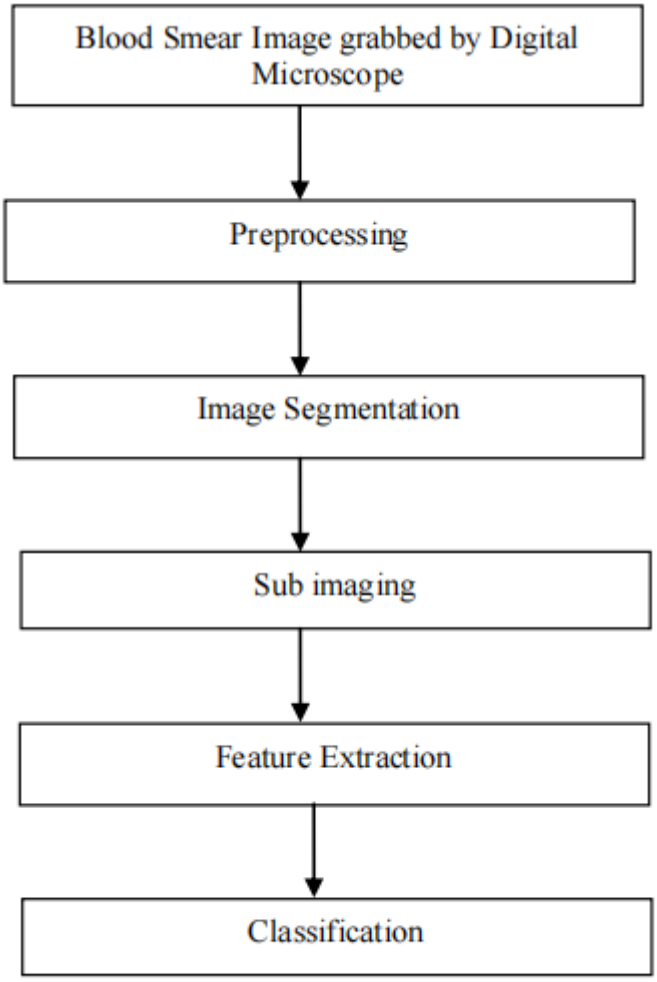


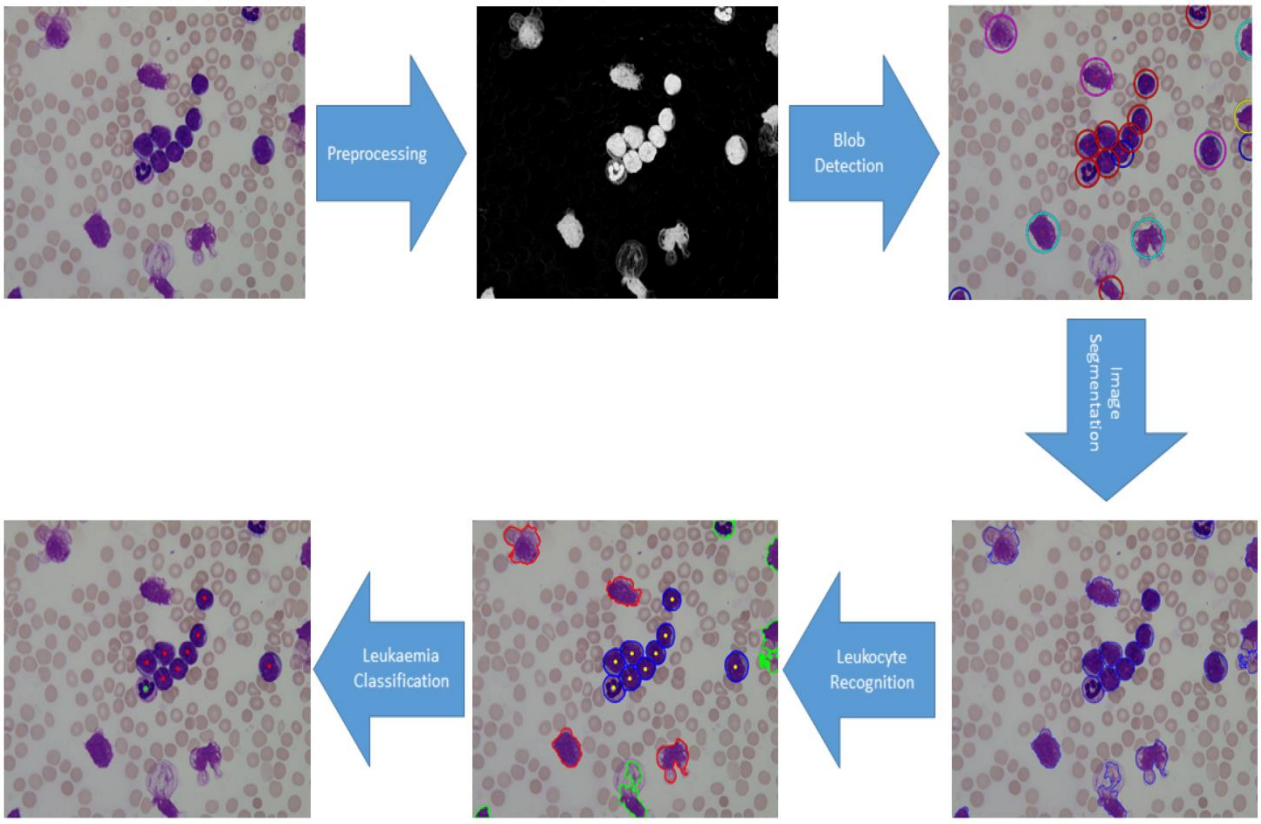
Figure 1. System overview

The images from a database which are pre-defined are taken. The image taken is 8bit RGB image. These pre-defined images are used to train the system and form a particular range for a particular type of leukemia.

In the preprocessing step the input RGB image is converted into L*a*b colour space domain which helps in better segmentation of the image.

The colour image segmentation is performed by using K-Means algorithm. The image in this step will be clustered into three clusters. The ROI is identified and is formed as one cluster.

This cluster is passed through various calculations and the few features are extracted out. Based on the values of these extracted features we decide the range of the values which fall under a particular type of leukemia. Once the system is trained and the range has been decided it will be saved in the system. These range of values will be dumped in a classifier. This classifier is nothing but a comparator. When a new unknown image is given as input all the above mentioned steps are performed and the features of that image are extracted and recorded. The classifier will compare these features with the existing three categorized features and define the type of the leukemia.



1. Image Acquisition

Blood image from slides will be obtained fromPheripheral blood smewar microscopic image segmentation . Pheripheral blood smewar microscopic image segmentation is the process of correctly and accurately extracting different parts of an image.

Leukocytes exhibit wide variations of cell morphology and size that make them difficult to be segmented accurately.

2. Preprocessing

Preprocessing is required due to excessive staining or shadow in image. This is the second step shown in the above figure. The image has three different parts for observation, one RBC, Second WBC and third background. In the image, area of interest is WBC. The WBCs are examined to check whether they are infected or not. There are two different methods for input images, color images & gray scale images.

Selective median filtering & unsharp masking& Contrast Enhancement techniques are used. For color images contrast enhancement techniques, partial contrast, bright stretching and dark stretching are used .

Based on the result, the partial contrast stretching methodis considered as the best technique among all contrast stretching techniques that helps to improve quality of image.The images are layered, and the pre-processing steps have been implemented using Adaptive Filtering. The pre-processing image makes promises for the subsequent stages. During the preprocessing phase, we created a dull size estimate of the first picture.

The image is divided by the kernel size then the sum of all elements will be 1. The pixel values being replaced by mean or arithmetic average of neighboring pixels in the Ih*Iw (Ih= image hight and Iw=Image width) window. The built-in dark scale is revered and then spread with dim selfesteem, which preprocesses the image with an ordinary shadow course.

This action is performed to distribute the processing power of the image, and we accomplish this through histogram homogenization techniques. The proposed method creates a histogram estimate of the image. The resulting aspect is used to partition the system.Enhancement is to process an image so that the result is more suitable than the original image.

3. Segmentation:

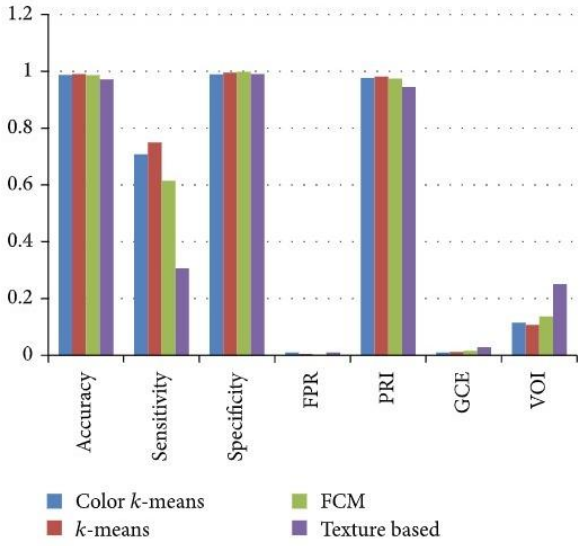
This is one of the most important part in the image processing technique. To identify and count white blood cells separation from the other cells are very much important

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.Segmentation is the method which is used to separate groups of objects.Through segmentation separation is done. Segmentation can be done in many way but we are using here the K-means clustering technique for segmentation.

K-means is one of the simplest algorithm that gives us good results to solve the clustering problem that we come across. The aim of this clustering is to decide the partitioning of the images based on some user-defined clusters that is updated after each iteration or cycle, this clustering is convergent. K –means clustering is a cyclic procedure that is used for dividing the given image into k number of clusters. K-Means is a least squares apportioning strategy that partition an accumulation of articles into K groups. K-Means [5] algorithm is an unsupervised grouping algorithm that characterizes the information focuses into different classes in view of their characteristic separation from one another. The algorithms expect that the data features shape a vector space and tries to discover common grouping in them. The main thought is to characterize k centroids, one for every cluster.

At the point when no point is pending, the initial step is finished and an early gathering age is finished. As of right now we have to recalculate k new centroids as barycenters of the bunches coming about because of the past step. After we have these k new centroids, another tying must be done between the same information set focuses and the closest new centroid. A circle has been created. As an aftereffect of this circle we might see that the k centroids change their area orderly until no more changes are finished.

Comparision of various segmentation methods on the basis of average ,sensitivity, FPR, PRI, GCE, and VOI for 20 sample images from histology dataset.



The algorithm iterates over following steps:

1. Compute the intensity distribution (also called the histogram) of the intensities.
2. Initialize the centroids with k random intensities.
3. Repeat the following steps until the cluster a label of the image does not change anymore.
4. Cluster the points based on distance of their intensities from the centroid intensities. Equation (1)
5. c (i)= arg min j ||x (i) − µj ||(1)
6. Compute the new centroid for each of the clusters .

Where k is a parameter of the algorithm (the number of clusters to be found), i iterates over the all the intensities, j iterates over all the centroids, and µj is centroid intensities.

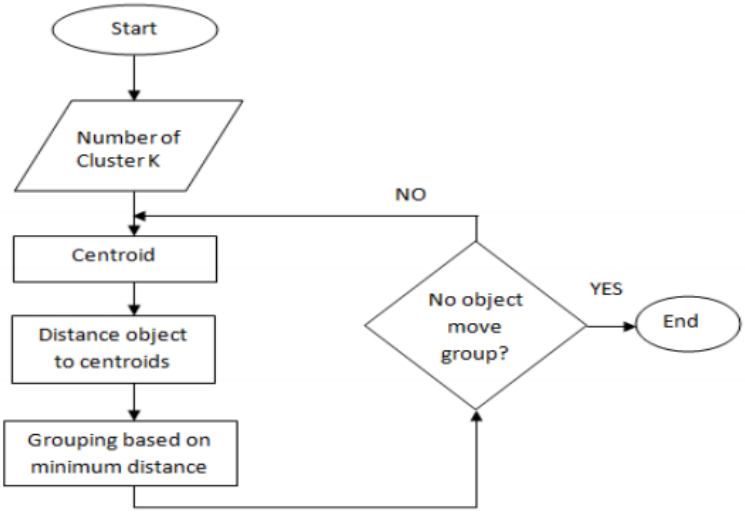
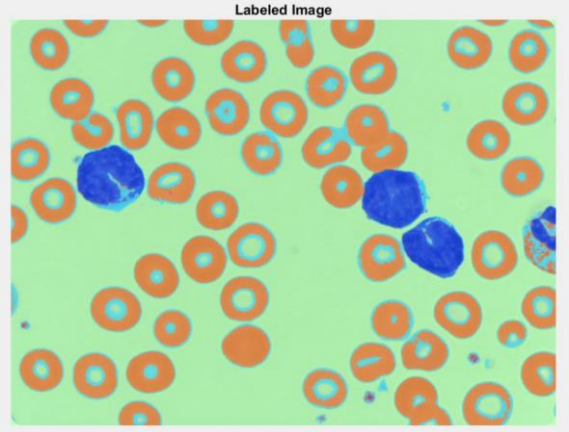


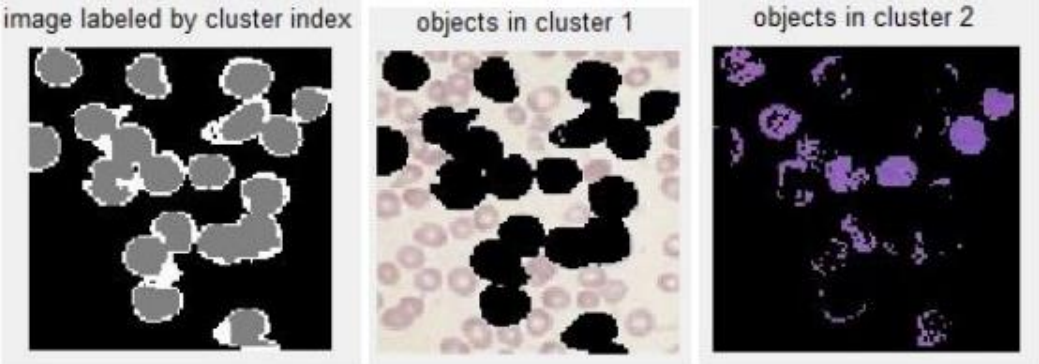
Fig. 2 K-Mean Segmentation

CODE FOR SEGEMNTATION :

```
I = imread('F1.jpg');
imshow(I)
title('Original Image')
[L,Centers] = imsegkmeans(I,4);
B = labeloverlay(I,L);
imshow(B)
title('Labeled Image')
```

OUTPUT :





4 IDENTIFICATION

Some blood images have some adjacent cells. It is really difficult to extract some features if the cells are grouped and not well separated. The feature like area are very difficult to extract if the nucleus of the cells are joined together. So our duty is to separate well these cells before studying them further. Some methods are exist to separate those grouped cells. Roundness

measurement technique is used here. We are using this technique because we can identify the grouped cells easily by only analyzing the shape of them. Roundness will check whether the shape of the cell is circular or not. Roundness can be extracted by using the equation.

$$\text{Roundness} = \frac{4 \times \pi \times area}{convex\_perimeter x^2}$$

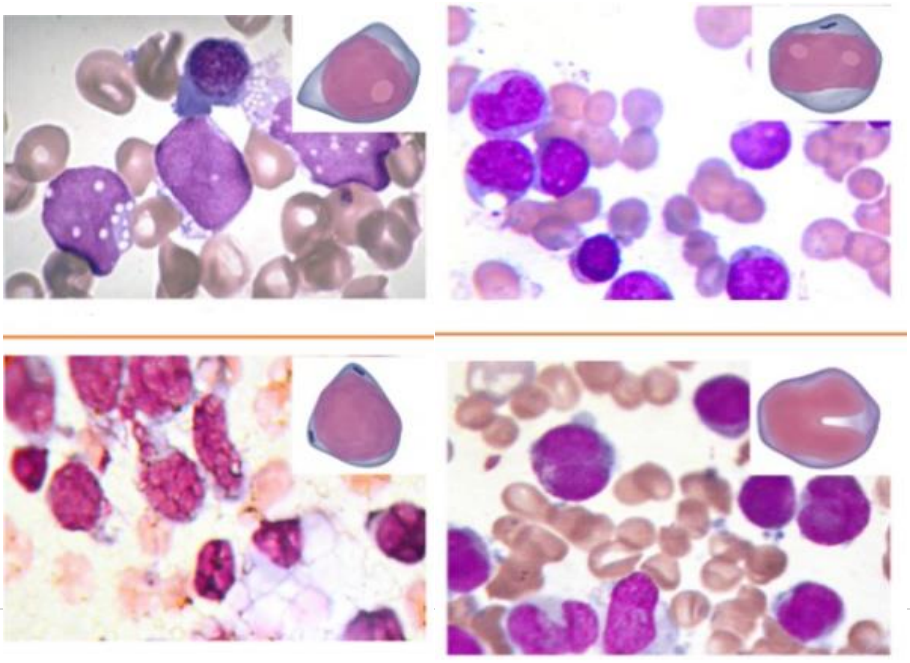
The theoretical value of the roundness is 1 for circular objects and less than 1 for non circular objects. But practically after some experiments it is found that 0.9 can be used as threshold value to distinguish single and grouped cells. The objects having the value more than the threshold value are treated as single cells and objects having the value less than the threshold value are treated as grouped cells.

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. We get some idea from the Viola-Jones object detection algorithm to detect and count WBCs.



5. 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. Some of the necessary features which are to be calculated are given below:-

Geometric Features:-

These consists of geometrical features like Area,perimeter,centroid,eccentricity,compactness,convexity, concavity,rectangularuty,elongation,solidity etc

Texture Features:-

These are texture based features such as energy, entropy, homogeneity, correlation etc.

Colour Features:-

the RGB color spaces will be transformed into HSV or L*a*b color spaces.Their mean color values will be obtained.

***Statistical Features**:-*

These feautures include those variables which depend on the provided data.The mean value, variance, skewness, kurtosis of the histograms of the image matrix and the gradient matrix for RGB or HSV or L*a*b color space (whichever appropriate) will be obtained.

Based o, ALL is small, blast cells are uniform, cytoplasm is scanty, round and usually contains single nucleoli inside nucleus. While in AML, the blasts are larger and irregular form and usually multiple nucleoli with the presence of Auer rodesaid that, the WBC appears rather darker than the background while red blood cell (RBC) appears in an intermediate intensity level. indicates that white cells are the darker elements in images with RBC appear to be pale. Platelets are much smaller than white and red

Cells.They Include Mean, variance, standard-deviation, skewness etc. Rectangularity tells about the bounding box fitness.

$$rectangularity = \frac{area}{major\ axis \times minor\ axis}$$

Convexity is nothing but the difference between the object from its convex object.

$$elongation = 1 - \frac{major\ axis}{minor\ axis}$$

$$convexity = \frac{perimeter_{convex}}{perimeter}$$

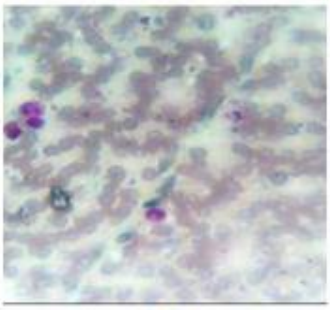
The ratio of area of an object and area of the circle with same perimeter is called as compactness.

$$compactness = \frac{4 \times \pi \times area}{perimeter^2}$$

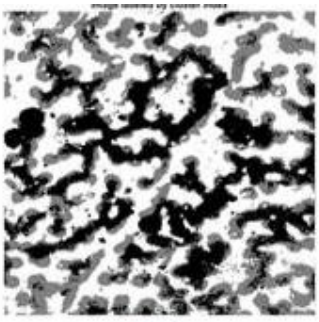
The ratio of area and the convex area of each object is named as solidity.

$$solidity = \frac{area}{convex\ area}$$

Actually solidity is used to remove the object from the image which has irregular boundaries. If the value of solidity is 1 then we can say that the object has regular surface and if the solidity value is less than 1 then the object does not have regular boundaries.ut after a lot of experiments we can set the threshold value of solidity as 0.85. So the object in the image having the value less than that is removed.

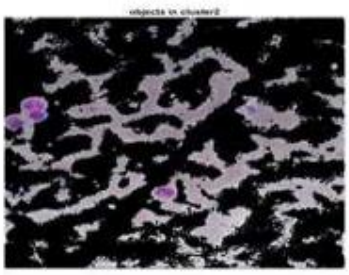


(a)

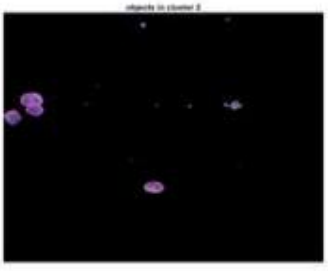


(b)

(c)



(d)



(e)

6. Image Classification:

Classification is the task of assigning to the unknown test vector to a known class. In this step, a reinforcement learning algorithm is proposed. The RL approach will classify the types of leukemia into ALL, AML, CLL and CML. The Basic Model Of RL The idea behind RL is an intelligent agent learns on how to act with its environment in order to maximize rewards that it gets with respect to predefined measures.

All the features are calculated and extracted are listed in a column with their values. We will get a matrix called feature extracted matrix. The image to be tested called as test image. The values of the test image features are checked with the previously calculated values based on the values of the input test image while the SVM classifier will classify that whether the test image has infected cell or not. We are also using PNN(probabilistic neural network) with the extracted feature matrix to know whether the cell is infected or not.

The image which is tested in proposed method is called as input blood image shown in the fig(a).After that image preprocessing is done that means noise reduction, contrast enhancement, edge cleaning etc. are done and then convert the image into the gray scale image. After that the proposed system converts the gray image into the cluster index image which is shown in the fig(b).

IMAGE	MANUAL COUNT	AUTOMATIC COUNT	ACCURACY
Image1	4	4	100%
Image2	6	6	100%
Image3	8	7	87.5%
Image4	3	3	100%
Image5	5	5	100%
Image6	4	4	100%
Image7	9	8	88.8%
Image8	11	10	90.9%
Image9	15	12	80%

The accuracy of this system was calculated to be 94.11%

After that k-means clustering algorithm is used to extract three cluster from the image which are background, red blood cell cluster, white blood cell cluster. Background cluster image is shown in the fig(c).Red blood cell cluster image is shown in the fig(d).And the most important one for our study white blood cell cluster is shown The proposed system performance for WBC detection.

3.1 RESULT ANALYSIS

The images have been classified into three different categories of Leukemia which are mentioned below. Further to this, these categories have been defined with a range of the features that have been extracted.

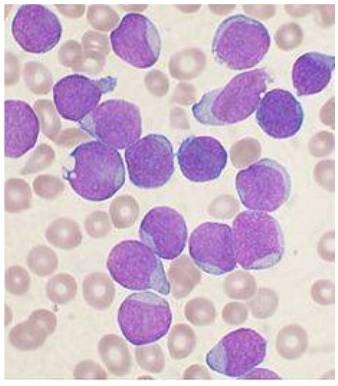
- Acute Leukemia (AL)

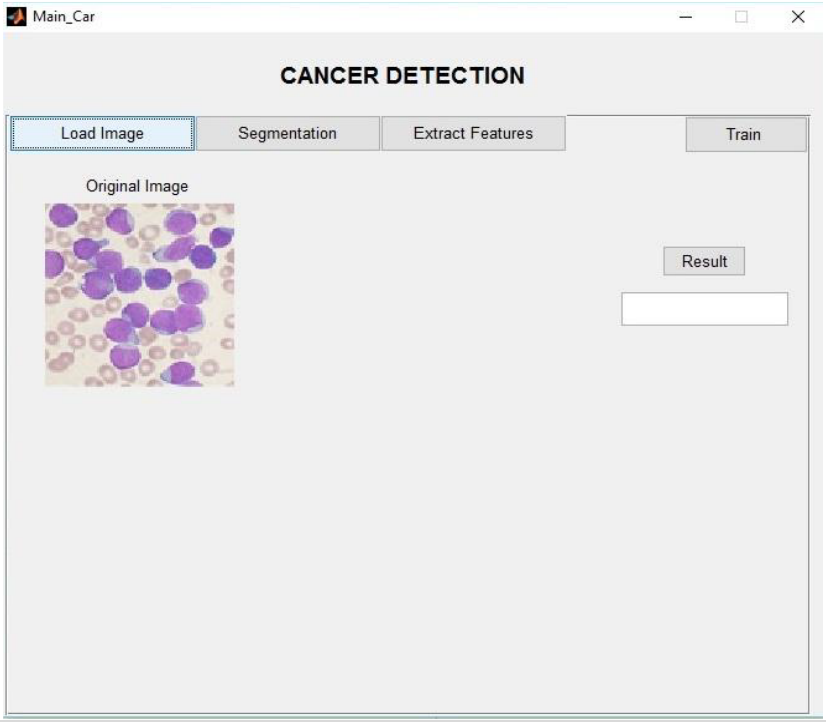
- Chronic Lymphocytic Leukemia (CLL)

- Chronic Myelogenous Leukemia (CML)

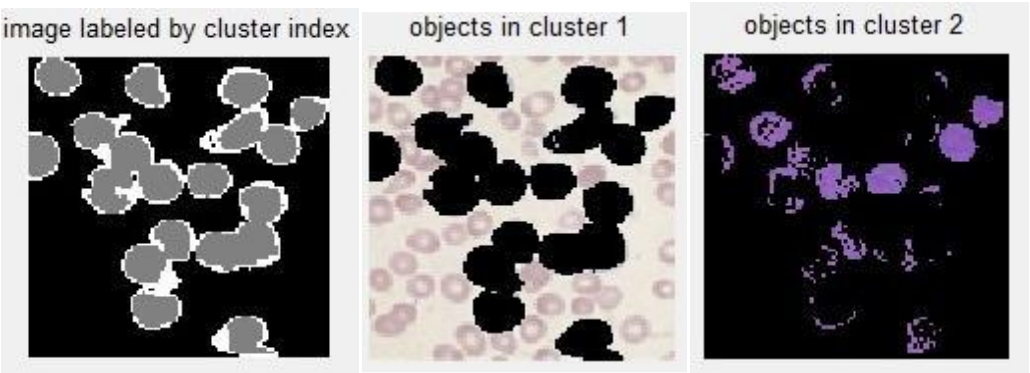
Acute Leukemia

In order to decide the range for the images which have to be categorized as acute leukemia, the input image is given which is pre-defined as acute leukemia. Fig shows the input image.

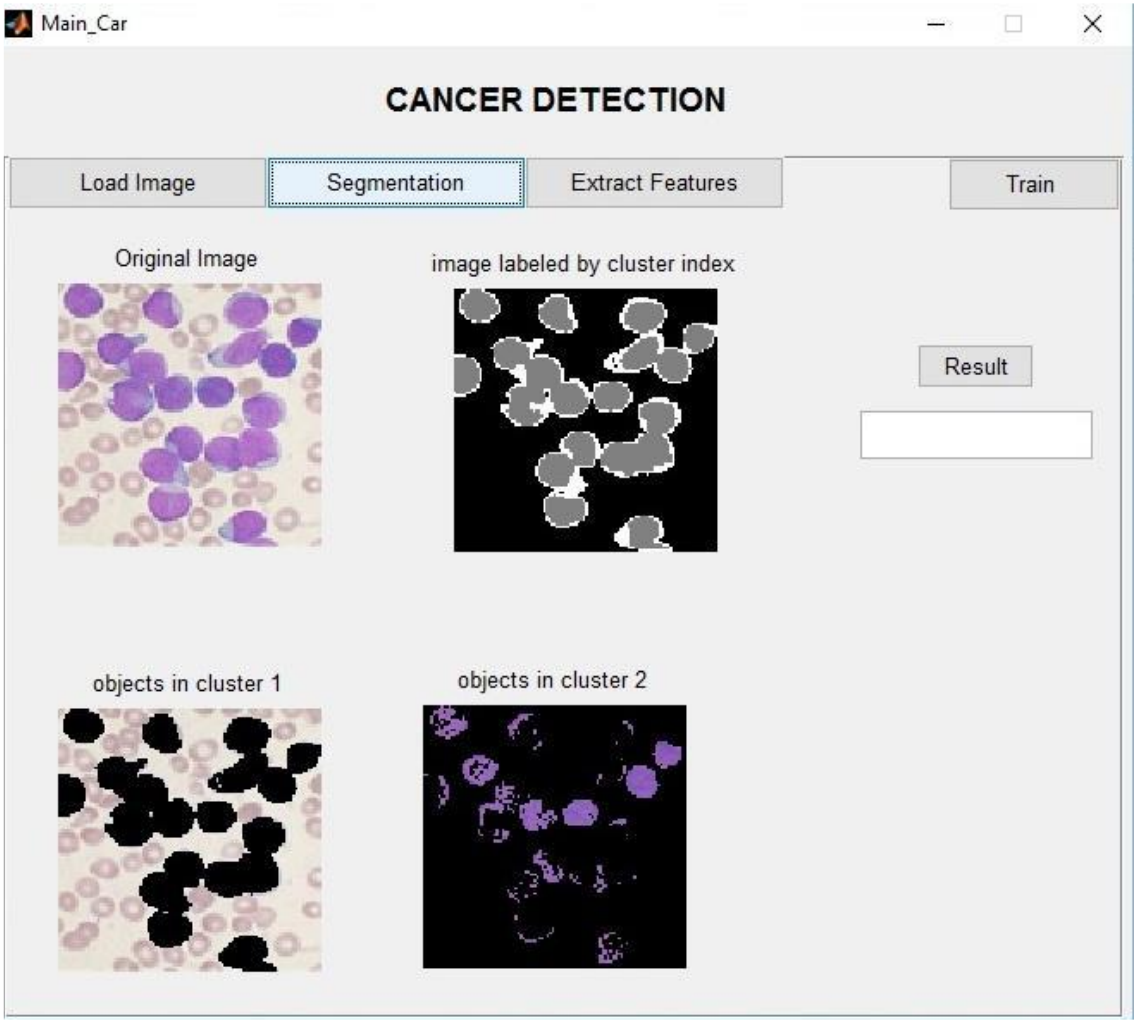


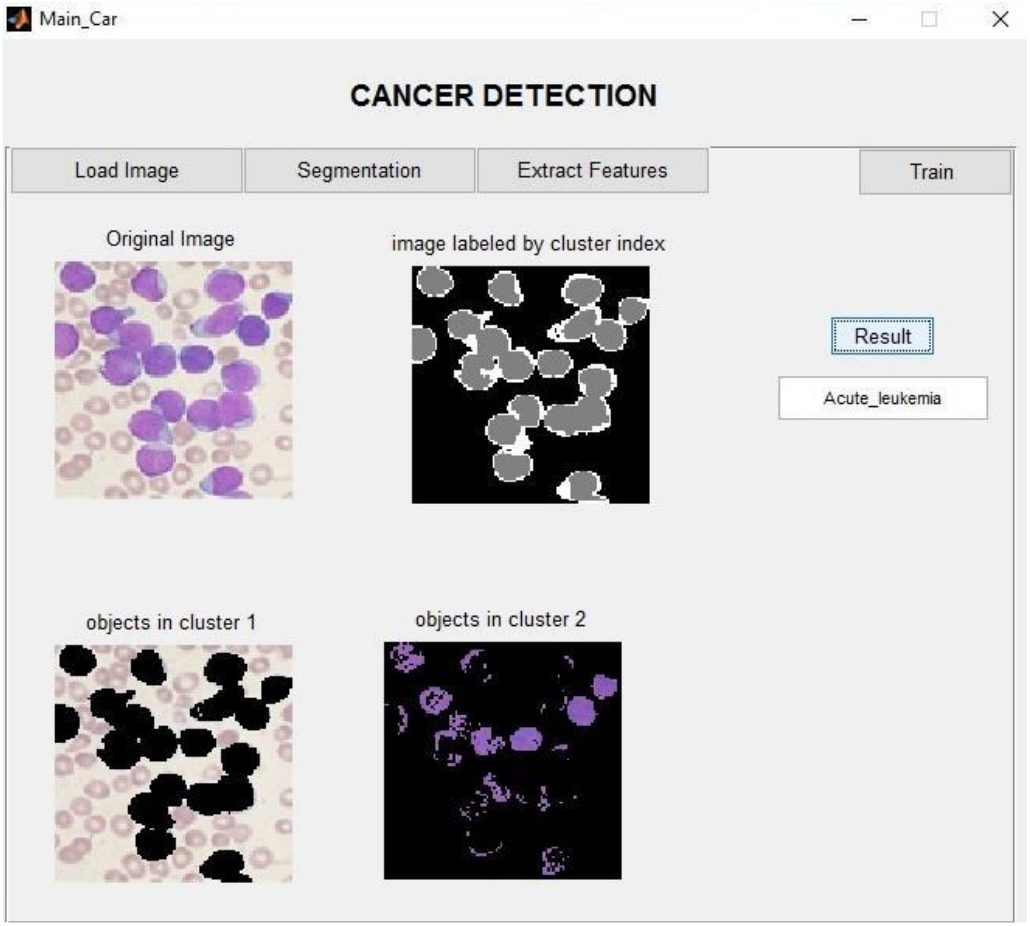


This input image was segmented with k-mean. The three cluster which were drawn out are shown below in fig .The segmented clusters are shown in GUI .



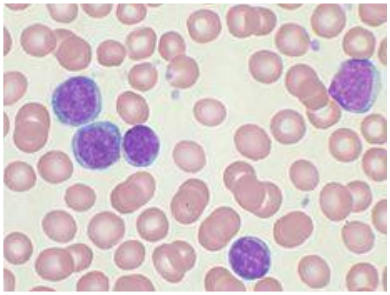
After the image is segmented, features are extracted out of the segmented image as discussed earlier.

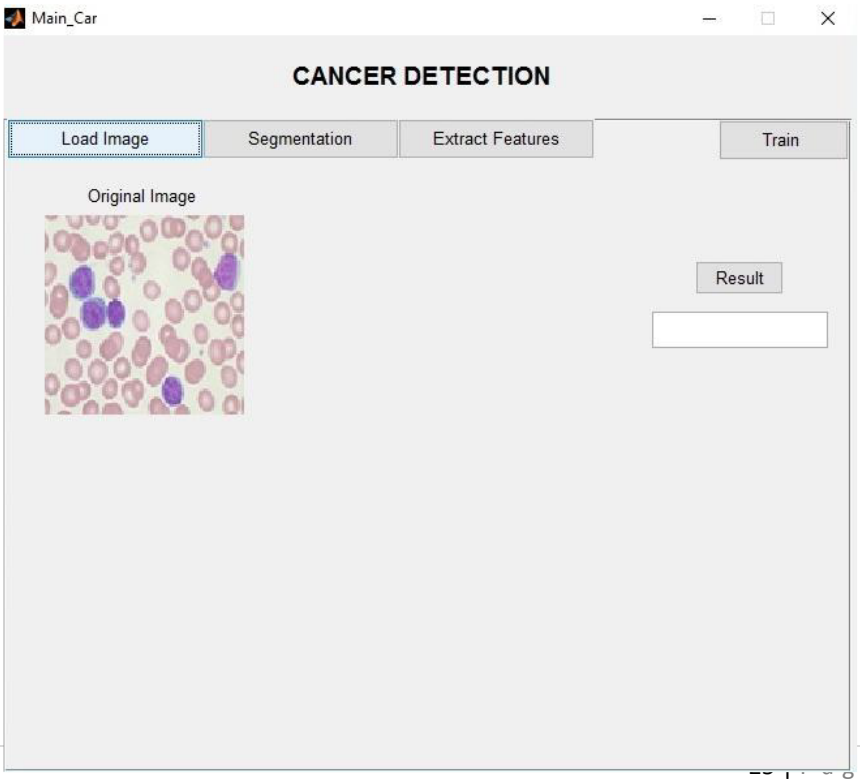




Chronic Lymphocytic Leukemia

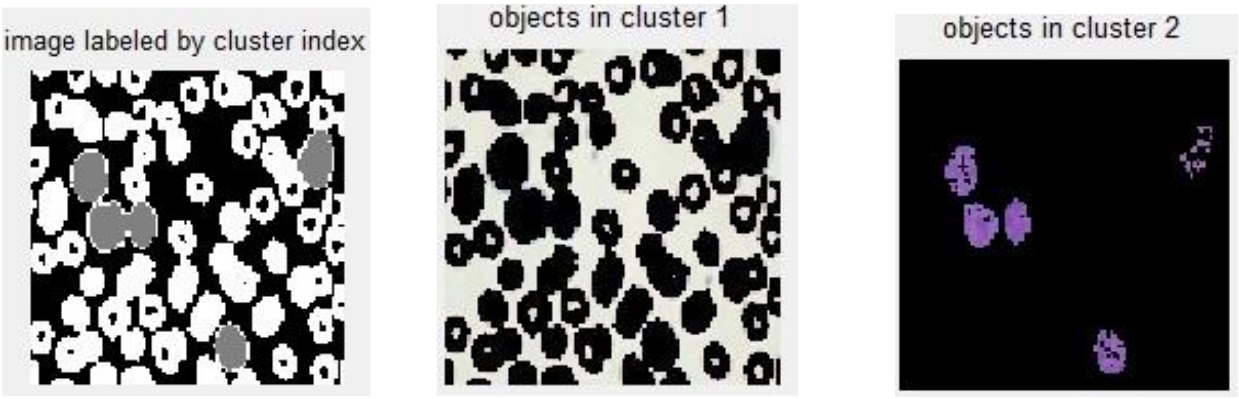
Similar to that of the previous section, the procedure is the same. The first step is loading of the image.

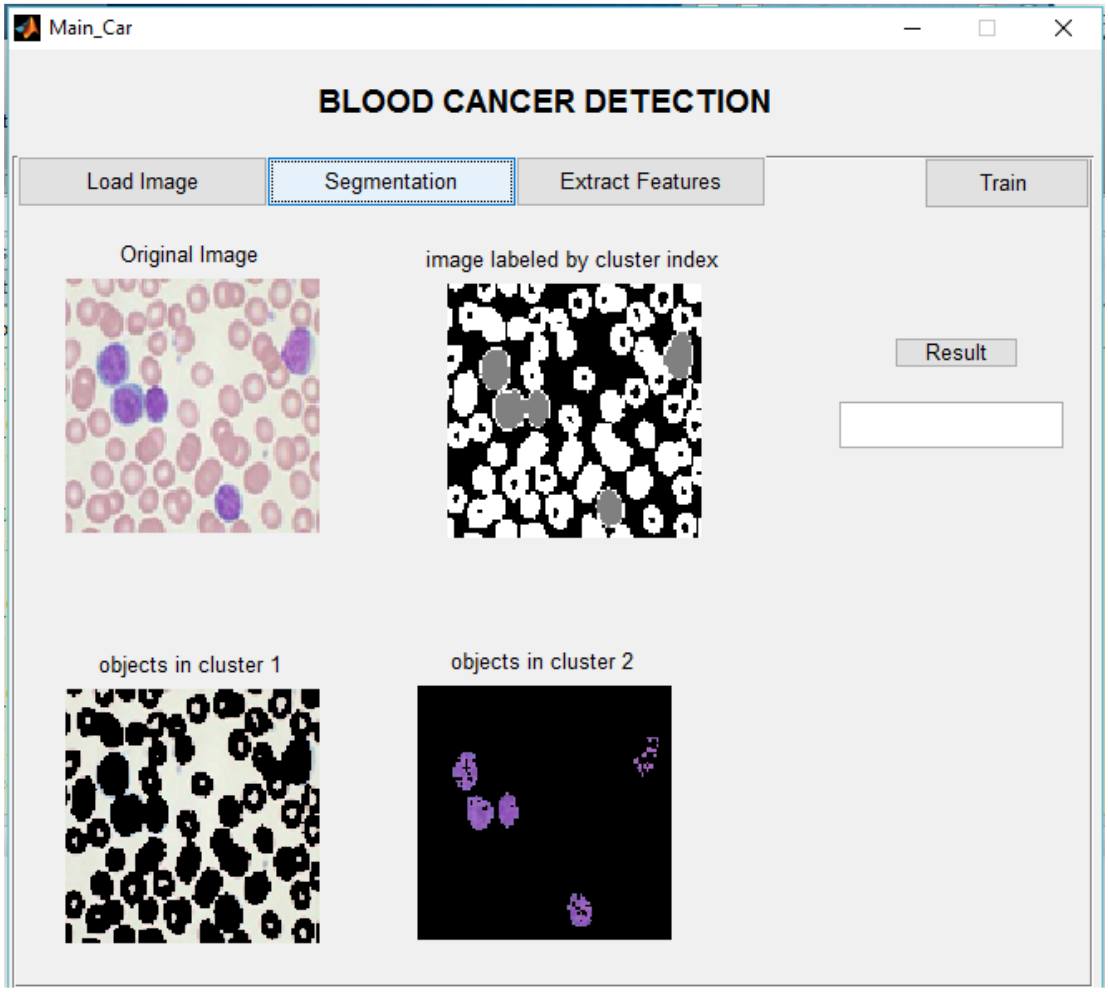




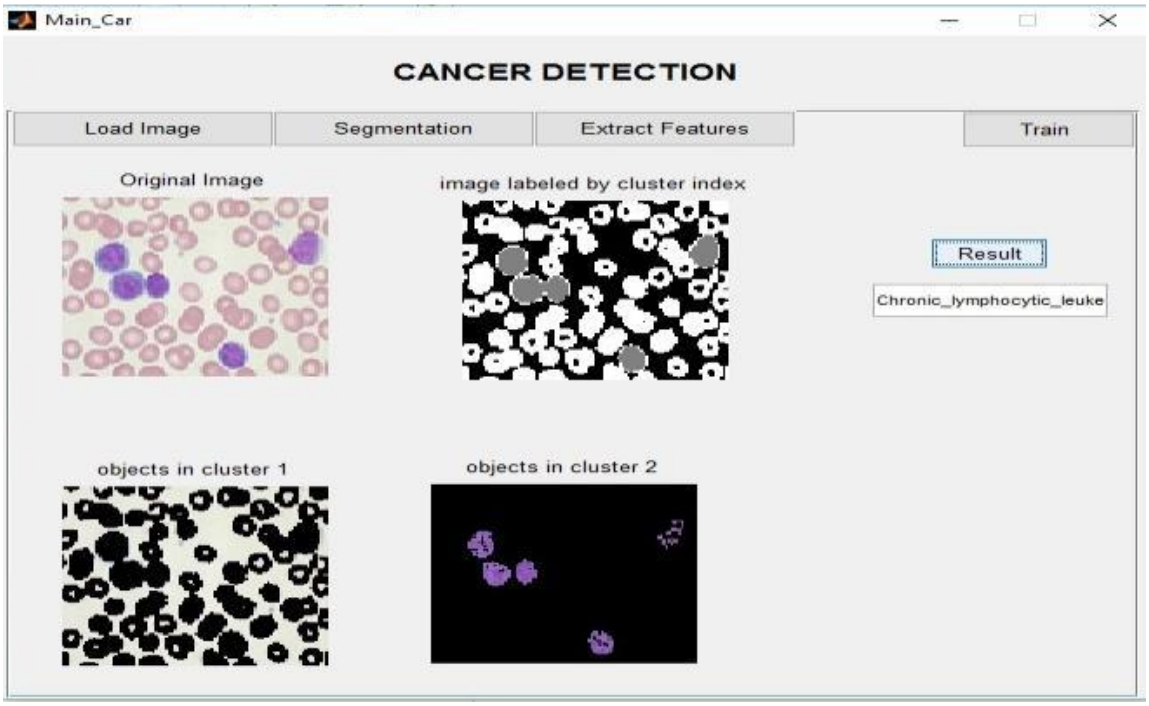
The second step in the procedure is segmentation of the image. Three clusters are formed using k-means algorithm for image segmentation

Fig





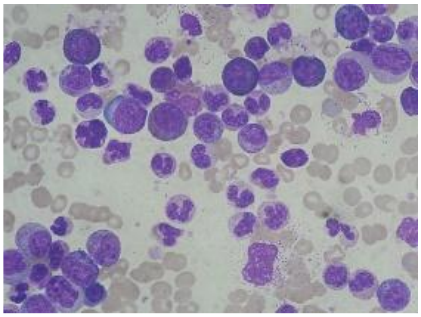
After the segmentation has been done, the feature will be extracted. According to the values that have been extracted the image is classified and the result is displayed.

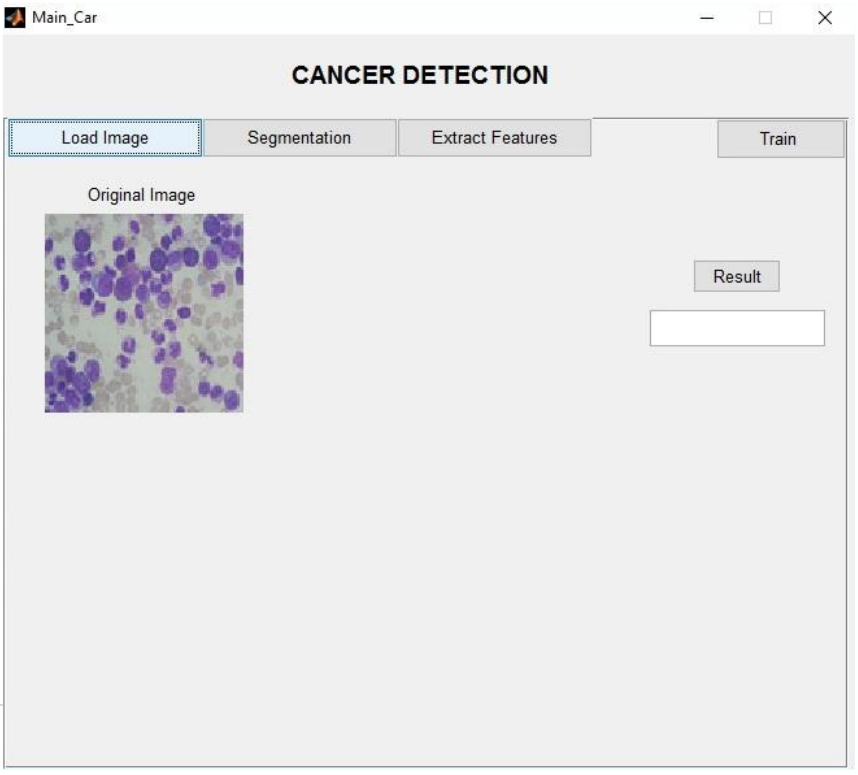


Chronic Myelogenous Leukemia

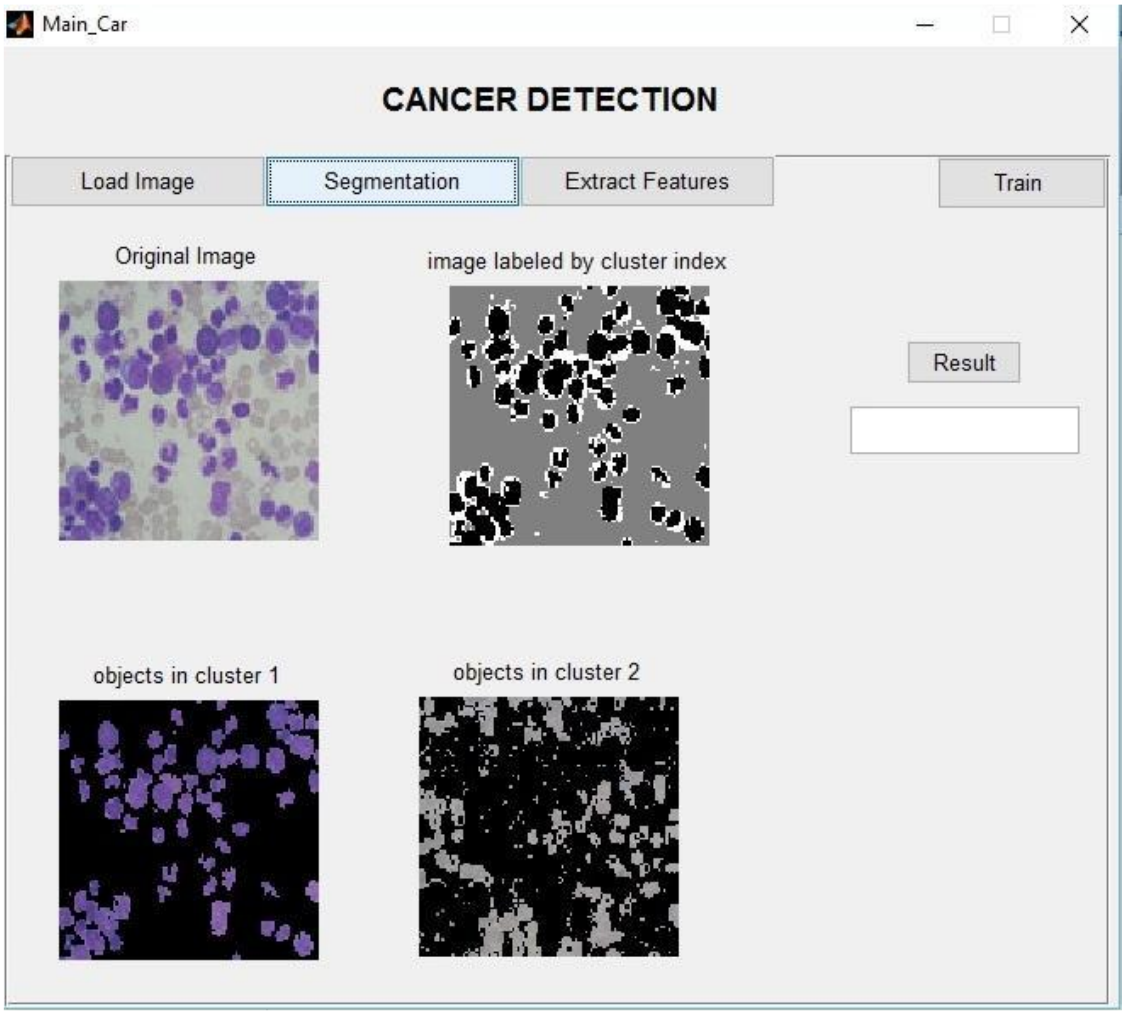
Similar to that of the previous section, the procedure is the same. The first step is loading of the image.

Fig



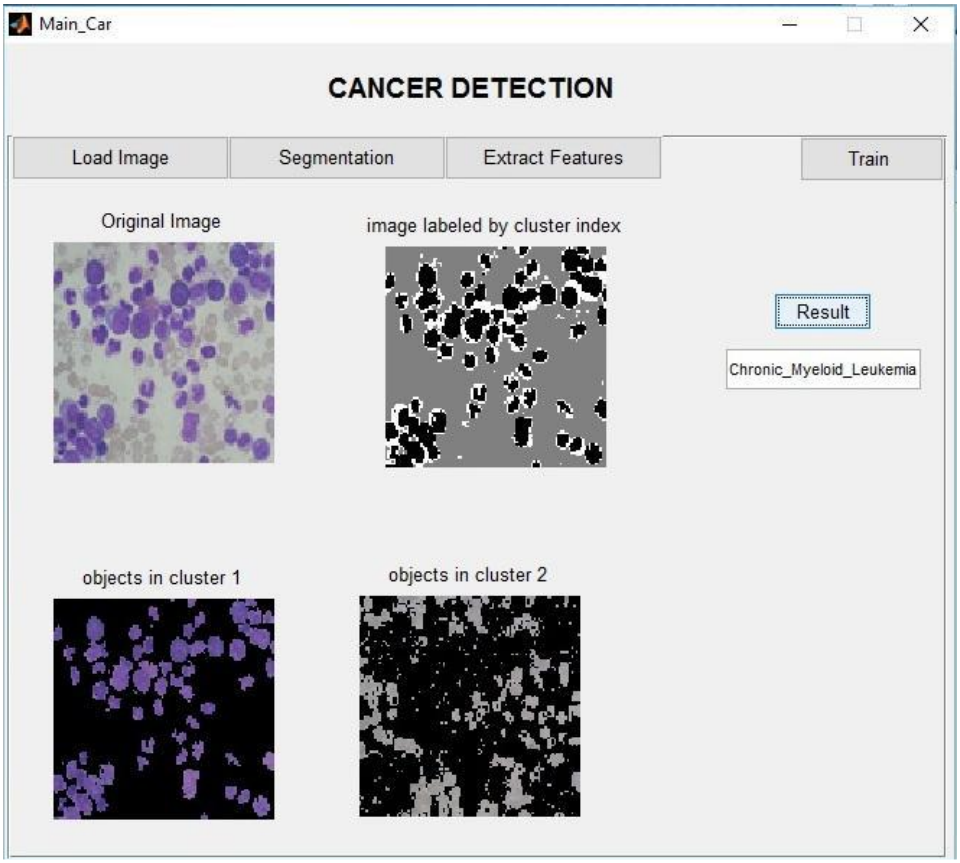


The second step in the procedure is segmentation of the image. Three clusters are formed using k-means algorithm for image segmentation.



After the segmentation has been done, the feature will be extracted. According to the values that have been extracted the image is classified and the result is displayed.

Fig



Adverseness and Fatality of Leukemia

Leukemia strikes all ages and both sexes. In 1995 approximately 20,400 people died from Leukemia. The all time five year survival rate is 38%. This rate has gone to 52% in the mid 1980's. Approximately 25,700 cases were reported in 1995 alone

New Cases

- In 2020, 60,530 people are expected to be diagnosed with leukemia.

Prevalence

- There are an estimated 376,508 people living with or in remission from leukemia in the US.

Survival

- The 5-year relative survival rate for leukemia has more than quadrupled, from 14 percent in whites from 1960 to 1963 to 65.8 percent for all races from 2009 to 2015.

- From 2009 to 2015, the five-year relative survival rates overall were
    - ALL – 71.7 percent overall, 91.9 percent for children and adolescents younger than 15 years, and 94.1 percent for children younger than 5 years
    - AML – 29.4 percent overall and 68.7 percent for children and adolescents younger than 15 years
    - CLL – 88.2 percent
    - CML – 69.7 percent*.

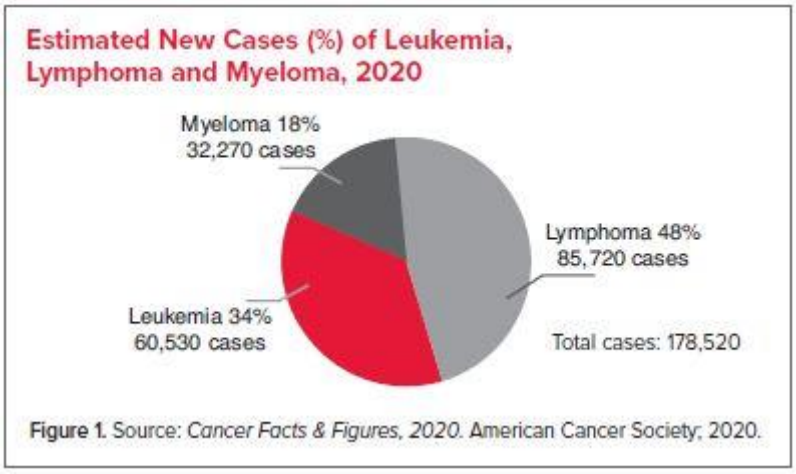
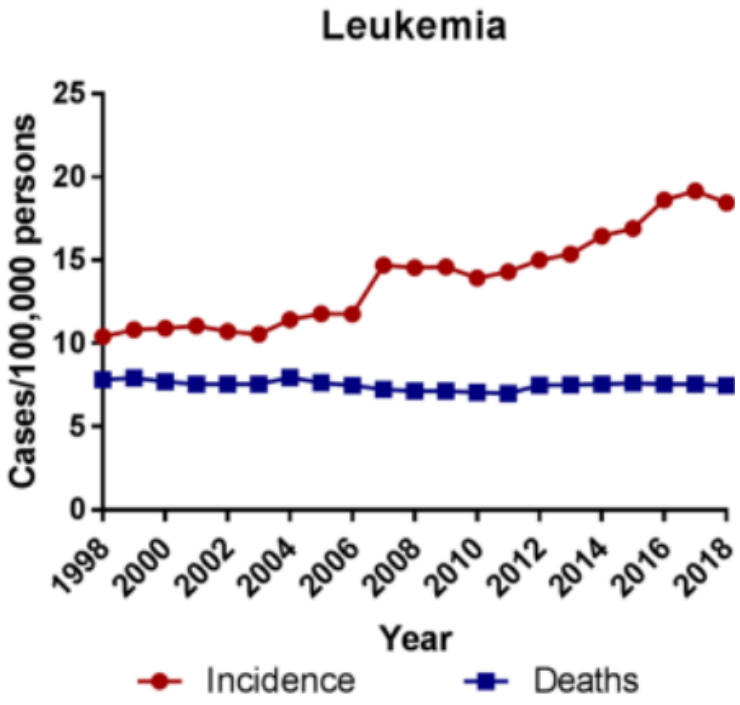


Figure 1. Source: *Cancer Facts & Figures, 2020.* American Cancer Society; 2020.



Future Scope :

Artificial intelligence can detect one of the most common forms of blood cancer - acute myeloid leukemia -- with high reliability., this approach could support conventional diagnostics and possibly accelerate the beginning of therapy.Artificial intelligence can detect one of the most common forms of blood cancer -- acute myeloid leukemia (AML) -- with high reliability.

- Their approach is based on the analysis of the gene activity of cells found in the blood. Used in practice, this approach could support conventional diagnostics and possibly accelerate the beginning of therapy.
- With this being said more advanced methods are possible to be created which can further improve the cost,resource and time efficiency ogf the system,hence making it more accsesible to undevloped countries where medical care is a privilige.

CONCLUSION :

Leukemia is an aggressive cancer that affects the white blood cells and bone marrow and weakens the immune system of the human body. One of the most commonly used diagnosis is based on microscopic blood cells (blood smears) analysis.In this project the main point of concern is automatic counting of WBCs to detect leukemia automatically from the image which is taken from the microscope.

- The manual counting process to detect leukemia is very much time taking and gives inaccurate result also.
- So to save lives this automated proposed method is very important. Actually in two ways we can detect leukemia. one is by automatic counting and on the other way SVM [Support Vector Machine] classifier will tell automatically whether the image has leukemia effected cells or not. For the first one after segmentation counting algorithm is used to count automatically.
- The system will be built by using features in microscopic images by examining changes on texture, geometry, colors and statistical analysis as a classifier input. The system should be efficient, reliable, less processing time, smaller error, highaccuracy, cheaper cost and must be robust towards varieties that exist in individual, sample collection protocols,time and etc Information extracted from microscopic images of blood samples can benefit to people by predicting, solving and treating blood diseases immediately for a particular patient.

Reference :

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2. https://www.hindawi.com/journals/jme/2015/457906/
3. https://homes.di.unimi.it/scotti/all/
4. https://www.britannica.com/science/cell-cycle
5. https://core.ac.uk/download/pdf/82055334.pdf
6. http://www.jatit.org/volumes/Vol46No2/6Vol46No2.pdf