



**DETECTION OF LEUKEMIA IN HUMAN  
BLOOD SAMPLE BASED ON MICROSCOPE IMAGE**

**JAHWAR YOUSIF ARIF  
(171129116)**

**Master Thesis  
Department: Computer Engineering  
Supervisor: Assist.Prof.Dr. Ahmet Çınar**

**July-2019**

REPUBLIC OF TURKEY  
FIRAT UNIVERSITY  
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

DETECTION OF LEUKEMIA IN HUMAN BLOOD SAMPLE BASED ON  
MICROSCOPE IMAGE

MASTER THESIS  
JAHWAR YOUSIF ARIF  
(171129116)

Department Of Computer Engineering

Submission Date to the Institue: 23 July 2019

Thesis Presentation Date: 19 July 2019

Supervisor:

Asist.Prof.Dr: Ahmet ÇINAR (F.U.)

Other Juries:

Prof. Dr. Ali KARCI (I.U)

Assoc. Prof. Dr. Taner TUNCER (F.U.)

July - 2019

## ACKNOWLEDGMENT

First of all, praise be to Allah (C.C.), who is obviously the one has always guided me to work on the right path of life, and giving me the strength to achieve my ambition, without his grace, this project could not become a reality.

I'm highly grateful to have had the opportunity to study at Computer engineering / Fırat University, and I'm ineffably indebted to all my lecturers and professors especially my supervisor, Assist.Prof.Dr. Ahmet Çınar, without whom I would not be able to complete this thesis.

Also, I would like to thank to my parents and family for their support and encouragement. Besides, I would like to express a special thanks to all my friends who've helped me during my studies until this point list of content

**Jahwar Yousif Arif**

**Elaziğ-2019**

## SUMMARY

Leukemia happens when part of unusual white blood cell produced by the Bone Marrow, the documentation of blood sicknesses is performed complete painterly inspection of microscopic images of blood cells. This thesis depicts a preparatory report to build up a recognition of leukemia writes utilizing infinitesimal pictures of blood tests. Examination through pictures is essential in light of the fact that from the pictures, infections can be identified and analyzed at a before organize. From that point, you can play out different activities, for example, controlling, controlling and counteracting sickness. The pictures are utilized in light of the fact that they are shabby and don't require costly tests and research facility gear. The framework will center around white platelet sickness, leukemia. Indeed, even the hematologist experiences issues arranging them leukemic cells, its manual arrangement of platelets takes quite a while as well as loose. In this manner, early distinguishing proof of leukemia returns gives the fitting treatment to the patient. As an answer to this issue, the framework will utilize the capacities in minute pictures and will look at changes in surface, geometry, shading and measurable investigation. Variations to these features will be used as a classifier entry.

Leukemia is that the most elementary blood malady, basic in grown-ups. a bigger half malignant growth cell starts in body elements however sickness is that the variety of diseases that start and develop in platelets. Blood is pressing substance while not that metabolic component of the body very influenced. cells are destroyed therefore that new cells will have their spot. In disease, previous cell doesn't kick the bucket and stays within the blood, therefore, new cells that are created can't inspire enough house to measure. Has metameric the image exploitation K suggests that algorithm and artificial neural the results are studied by scrutiny numerous fault metrics and stretch complexness of each the systems. Image division is done exploitation feedforward neural network have fewer din and an awfully slow conjunction rate. during this analysis, K-means algorithm and artificial neural network are deliberate to get a group of processes that will be joint so as to attain a much better presentation in Image Segmentation. A comparison has been done to search out the most effective rule for Image Segmentation.

**Keywords:** White Blood Cells (WBC), Red Blood Cells (RBC), Bone Marrow (BM), Artificial Neural News Network (ANN), Image Segmentation (IS).

## ÖZET

### **Mikroskop Görüntüleri Üzerine Tabanlı İnsan Kan Örneklerinde Lösemi Tesbiti**

Lösemi, kemik iliği tarafından üretilen olağandışı beyaz kan hücrelerinin bir parçası olduğunda, kan hastalıklarının belgelendirilmesi, kan hücrelerinin mikroskopik görüntülerinin resim olarak tam olarak incelenmesiyle gerçekleşir. Bu tezde kan testlerinin sonsuz resimlerini kullanarak lösemi işaretlerinin tanınması için bir hazırlık tezi hazırlanmıştır. Resimlerle inceleme, resimlerden enfeksiyonların önceden organize edilmeden tespit edilip analiz edilebileceği gerçeği ışığına dayalı olarak gerçekleştirilmiştir. Bu noktadan sonra, örneğin hastalıkları kontrol etmek ve karşı koymak gibi farklı aktiviteler olabilir. Resimler, eski oldukları ve pahalı testler ve araştırma olanakları gerektirmediği gerçeğinden yola çıkılarak kullanılmıştır. Tezin ana çerçevesi, beyaz trombosit hastalığı, yani lösemi etrafında odaklanmıştır. Nitekim, hematolog bile lösemik hücreleri düzenlerken sorunlar yaşar. Trombositlerin manuel olarak düzenlenmesi oldukça uzun bir zaman alır. Bu şekilde, lösemi dönüşlerinin erken ayırt edici ile hastaya uygun tedavi sağlanabilir. Bu sorunun cevabı olarak, çerçeve, dakika resimlerindeki kapasiteleri kullanacak ve yüzey, geometri, gölgeleme ve ölçülebilir incelemedeki değişikliklere bakacaktır. Bu özelliklerin varyasyonları sınıflandırıcı girişi olarak kullanılacaktır.

Lösemi, yetişkinlerde temel olan en temel kan rahatsızlığıdır. Daha büyük bir yarı kötü huylu büyüme hücresi vücut elementlerinde başlar, ancak hastalık trombositlerde başlayan ve gelişen hastalıkların çeşitliliğidir. Hücreler imha edilir, bu nedenle yeni hücrelerin kendi yerleri olacaktır. Hastalıkta, hücre kan içinde kalır, bu nedenle, oluşturulan yeni hücreler ölçmek için yeterli işlem yapılamaz.

Görüntü bölütleme işlemi için ve jhastalık tespit işlemi için K adet durum vardır. Bunların sınıflandırma ve ayırt edilme işleminde yapay sinir ağı önerilir. Görüntü bölme işlemi ileriye doğru beslemeli yapay sinir ağı ile daha az gürültü ve çok yavaş bir birleşme oranına sahip olacak şekilde yapılır. Bu analiz sırasında, K-means sınıflandırıcı ve yapay sinir ağı daha iyi bir sonuç elde etmek için ortak bir şekilde kullanılmıştır. Sonuç kısmında değerlendirme verilmiştir.

**Anahtar Kelimeler:** Beyaz Kan Hücreleri , Kemik İliği,, Yapay Sinir Ağları,, Görüntü Bölütleme

## LIST OF CONTENT

	<u>Page No</u>
<b>ACKNOWLEDGMENT</b> .....	<b>II</b>
<b>SUMMARY</b> .....	<b>III</b>
<b>ÖZET</b> .....	<b>IV</b>
<b>LIST OF CONTENT</b> .....	<b>V</b>
<b>LIST OF FIGURES</b> .....	<b>VII</b>
<b>LIST OF TABLES</b> .....	<b>VIII</b>
<b>ABBREVIATIONS</b> .....	<b>IX</b>
<b>1. INTRODUCTION</b> .....	<b>1</b>
1.1. Leukemia .....	2
1.1.1. There Are Many Types of Leukemia.....	4
1.2. Acute leukemia (AL) .....	4
1.2.1. Acute Lymphocytic Leukemia (ALL) .....	4
1.2.2. Acute Myeloid Leukemia (CML).....	5
1.3. Chronic Leukemia (CL).....	6
1.3.1. Chronic Lymphocytic Leukemia (CLL).....	6
1.3.2. Chronic Myeloid Leukemia (CML).....	6
<b>2. DEVELOPED METHODS</b> .....	<b>8</b>
2.1. Checking of RBC's and WBC's utilizing Image Processing Technique.....	8
2.2. WBCs Segmentation and Organization to Detect Acute leukemia .....	8
2.3. Diagram of Developed Methods.....	9
2.4. Modules .....	10
2.4.1. Image Acquisition.....	10
2.4.2. Image Pre-processing.....	10
2.4.3. Image Segmentation .....	12
2.4.4. Feature Extraction.....	13
<b>3. INFORMATION ABOUT LEUKEMIA</b> .....	<b>16</b>
3.1. Early signs .....	16
3.2. Symptoms .....	16
3.3. Diagnoses.....	17
3.4. Cause.....	17

3.5.	Risk factors .....	19
3.6.	Survival.....	20
3.7.	How leukemia forms.....	22
3.8.	Rare forms of leukemia .....	23
3.9.	Diagnosis .....	24
3.9.1.	Treatment.....	25
3.10.	Deaths .....	27
3.11.	Several segmentation methods .....	27
3.11.1.	A careful division mode for White Blood Cell images .....	28
3.11.2.	Threshold Based Automate Ding Method: ALL and AML Blast Cells Detection.....	29
<b>4.</b>	<b>CLASSIFICATION.....</b>	<b>31</b>
4.1.	Artificial Neural Networks (ANN).....	33
4.2.	K-Means Clustering Algorithm .....	34
<b>5.</b>	<b>EXPERIMENTAL RESULTS .....</b>	<b>38</b>
5.1.	Input Image.....	39
5.2.	Gray Conversion.....	40
5.3.	Edge Detection.....	41
5.4.	Segmentation .....	42
5.5.	Feature Extraction.....	43
5.6.	Detection System .....	44
5.7.	Clear All Step .....	45
<b>6.</b>	<b>CONCLUSION .....</b>	<b>46</b>
	<b>REFERENCES .....</b>	<b>47</b>
	<b>CURRICULUM VITAE .....</b>	<b>52</b>

## LIST OF FIGURES

	<b><u>Page No</u></b>
<b>Figure 1.1.</b> Production of Blood Cell .....	3
<b>Figure 1.2.</b> Acute Lymphocytic Leukemia All .....	5
<b>Figure 1.3.</b> Acute Myeloid Leukemia .....	5
<b>Figure 1.4.</b> Chronic Lymphocytic Leukemia .....	6
<b>Figure 1.5.</b> Chronic Myeloid Leukemia .....	7
<b>Figure 2.1.</b> Detection by mean of image proccsing developed methods.....	9
<b>Figure 2.2.</b> Leukemia detection phases .....	11
<b>Figure 2.3.</b> Original Image, b) enhancement image.....	12
<b>Figure 2.4.</b> The separate picture of the Bone Marrow smear.....	13
<b>Figure 3.1.</b> Cause of leukemia.....	18
<b>Figure 4.1.</b> Basic Model of Reinforcement Learning .....	31
<b>Figure 4.2.</b> Proposed Method Lgorthem .....	32
<b>Figure 5.1.</b> Implmented Cancer Detection Program .....	38
<b>Figure 5.3.</b> Gray Conversion operation.....	40
<b>Figure 5.4.</b> Edge Detection operation .....	41
<b>Figure 5.5.</b> Segmentation image operation.....	42
<b>Figure 5.6.</b> Feature Extraction image operation.....	43
<b>Figure 5.7.</b> Detection System operation .....	44
<b>Figure 5.8.</b> Clear steps.....	45

## LIST OF TABLES

	<u>Page No</u>
<b>Table 1.</b> Death of leukemia in 2017 .....	27
<b>Table 2.</b> Parameter Output.....	44



## **ABBREVIATIONS**

<b>AL</b>	: Acute Leukemia
<b>AL</b>	: Acute Leukemia
<b>ALL</b>	: Acute Lymphocytic Leukemia
<b>AML</b>	: Acute Myeloid Leukemia
<b>ANN</b>	: Artificial Neural Network
<b>BM</b>	: Bone Marrow
<b>CL</b>	: Chronic Leukemia
<b>CL</b>	: Chronic Leukemia
<b>CLL</b>	: Chronic Lymphocytic Leukemia
<b>CML</b>	: Chronic Myeloid Leukemia
<b>IG</b>	: Image Segmentation
<b>LL</b>	: Lymphocytic Leukemia
<b>ML</b>	: Myeloid Leukemia
<b>RBC</b>	: Red Blood Cells
<b>RL</b>	: Reinforcement Learning
<b>ROI</b>	: Region Of Interest
<b>WB</b>	: White Blood
<b>WBC</b>	: White Blood Cells

## 1. INTRODUCTION

Medical images have developed one of the most significant methods of conception and interpretation in environmental science and medicine in the last decade. This time we saw a huge advancement of new and effective apparatuses to identify, document, transmit, dissect and envision restorative pictures. This has prompted extraordinary development in the use of computerized picture preparing systems to take care of therapeutic issues. The most difficult part of restorative pictures is the improvement of incorporated frameworks for the utilization of the clinical segment. The plan, usage, and approval of complex therapeutic frameworks require close interdisciplinary cooperation amongst doctors and architects. Accordingly, we have to utilize an innovation that recognizes distinctive kinds of platelets in a brief timeframe in a crisis [1].

The distinguishing proof of blood issue is performed through visual examination of minute pictures of platelets. From the recognizable proof of blood issue, it can prompt the order of certain blood-related maladies. A standout amongst the most dreaded by human infection is a malignancy. Leukemia is a kind of plasma disease and, if distinguished late, will bring about death. Leukemia happens when a high number of irregular white blood are delivered by the bone marrow.

The extent of white blood cell in our body is 1000: 1. It implies that there is 1 of white blood cell among 1000 red platelets. Along these lines, if the quantity of white platelets increments fundamentally in an extensive number, at that point the individual capitulates to leukemia. Plasma is the fundamental wellspring of data that stretches a sign of variations in well-being and the advancement of particular infections. Variations within the range or arrival of the ready elements can drive the soundness of someone [2].

A body of the individual United Nations agency is experiencing malignant neoplastic disease delivers too several platelets of a particular type than another which ends up in variations from the norm within the cells. These abnormal cells seem to be distinctive than typical platelets and don't work lawfully (generally white platelets). They likewise horn in different platelets, commonly red platelets and platelets. sorts of irregular white platelets will remodel into leukemia: humor cells and myeloid cells.

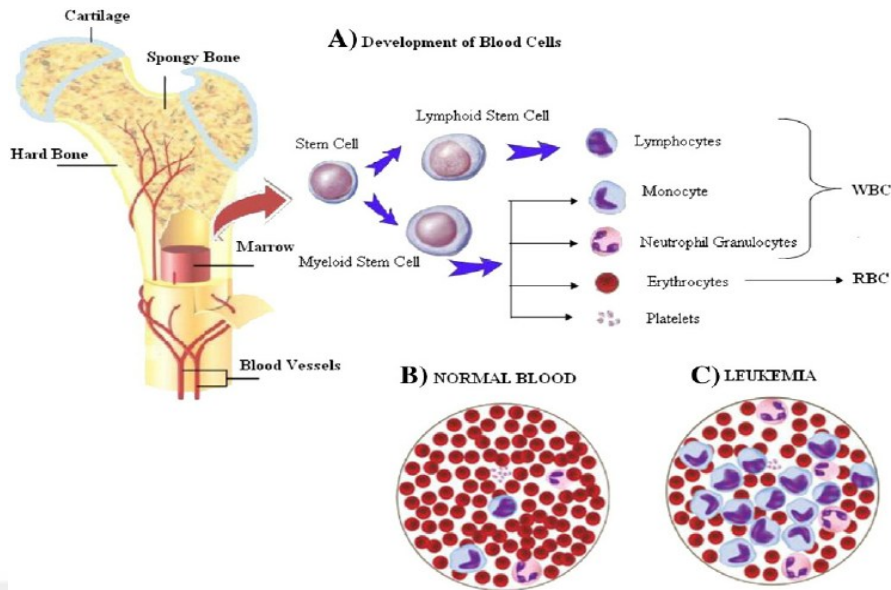
Leukemia causes thanks to tumor cells is named Lymphocytic Leukemia and, within the event, that it's found within the myeloid cells, it's known as xylogenous. Malignant

neoplastic disease is massed in a pair of numerous ways: Acute or perpetual that is assembled obsessed with however snappy the cells produce. humor or myeloid is another type of malignant neoplastic disease that's classified relying upon the type of white blood platelet that has remodeled into Leukemia. In intense malignant neoplastic disease, the anomalous blood cells are generally youthful impacts (youthful cells) that don't work appropriately. These cells develop rapidly. Intense leukemia rapidly deteriorates except if it is dealt with promptly. In ceaseless leukemia, youthful platelets are available, yet develop, utilitarian cells are additionally created. In perpetual leukemia, impacts develop gradually. It takes more time for the ailment to deteriorate.

When miniscule pictures will be assessed externally by hematologists and the procedure is boring and exhausting the procedure requires human master and motivated to mistakes because of sensation bother acne and human physical ability that is, obviously, take its own idea of confinement. Studies demonstrate that the greater part of the current procedures utilizes all data about plasma for e.g. various red platelets, hemoglobin equal, unkind capacity corpuscle and numerous extra as the stricture for grouping maladies, for example, thalassemia, growth and so on [3].

### **1.1. Leukemia**

Leukemia is a kind of cancer of the blood or bone marrow characterized by an abnormal increase of unripe white blood cell called "blasts" leukemia is wide expression coverage the vision of illness. Bone marrow is delicate material found amidst each bone. Foundational microorganisms will develop and turn out to be some sort of platelets. Figure 1.1 depicts producer of blood cell as diagram.



**Figure 1.1.** Production of Blood Cell [4].

Undifferentiated cells would progress and early progress into some segments of plasma. They advance into also myeloid immature being or humor foundational microorganism. Myeloid undifferentiated organisms, in the end, progress and tense myeloid impact. This impression can be edge red thrombocyte, thrombocyte and some kinds of white blood. humor immature microorganisms likewise can develop and might form lymphoid impact and this impact will within the future structure some kinds of white platelets. White platelets from the myeloid impact distinction from the humor impact. The investigation can consider malignant neoplastic disease on the grounds that the infection is unsafe and might prompt end. For someone World Health Organization has a malignant neoplastic disease, the bone marrow produces uncommon white platelets. Contrasted and typical cells, abnormal white platelets won't pass away after they ought to. consequently, the number of irregular white thrombocyte turns out to be varied and step in typical white platelets to complete their obligations. This, in addition, causes unevenness of the blood frameworks within the build. malignant neoplastic disease will be assembled enthusiastic about however apace this will create and finally ends up extreme. malignant neoplastic disease is either Chronic or Acute [4,5].

### **1.1.1. There Are Many Types of Leukemia**

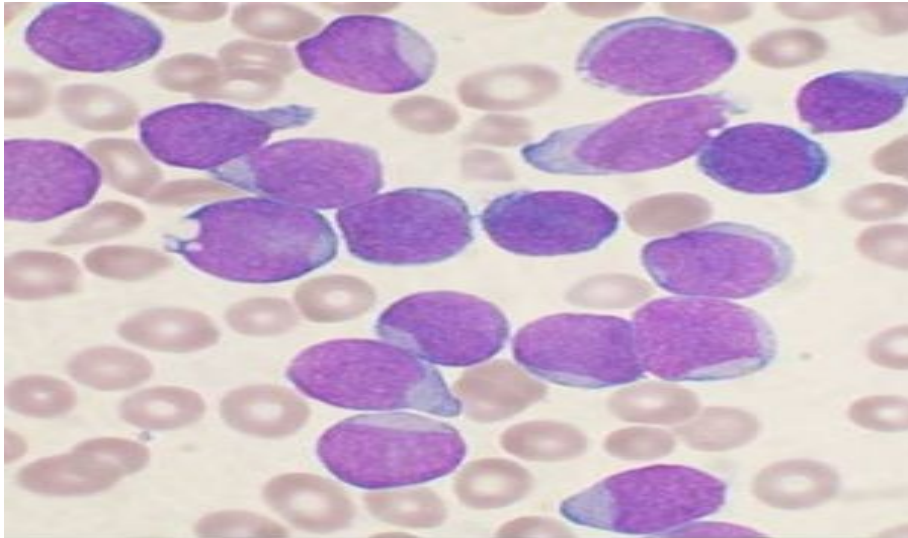
- **Red blood cells:** Carry oxygen to materials and back to the lungs with carbon dioxide.
- **White blood cells:** Defensive the organism from infection. There are many sorts of white blood cell.
- **Platelets:** Assistances blood clotting to control blood loss.
- **Plasma:** The fluid in blood comprising broke down elements required for prison cell capacity and comprises of sodium, potassium, chloride, hydrogen, magnesium, and iron.

### **1.2. Acute leukemia (AL)**

It is described by the fast movement of sickness and the creation of immature white blood cells. This winds up serious in less time so it's hard to treat and fix and for the most part influences youngsters. Two progressively basic sorts are intense Lymphocytic Leukemia and intense Myeloid Leukemia.

#### **1.2.1. Acute Lymphocytic Leukemia (ALL)**

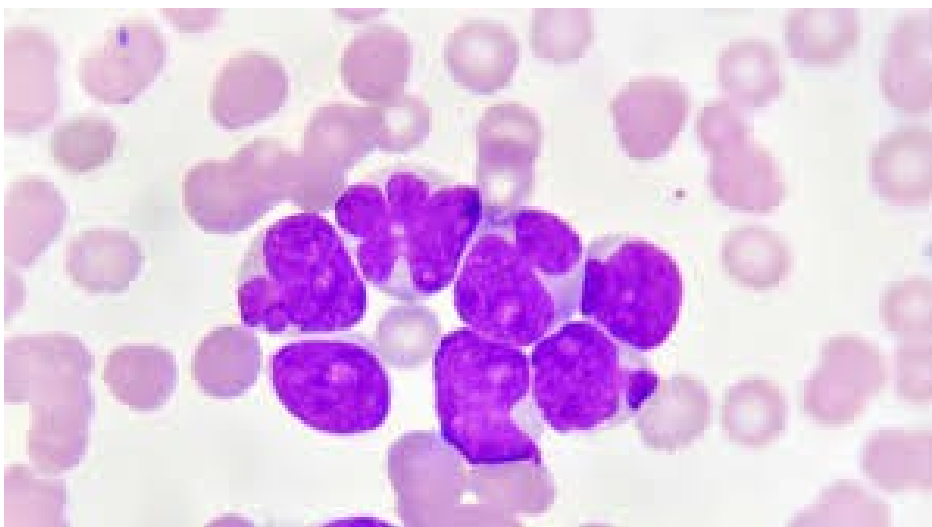
It happens in offspring of oldness 1-12 years and grown-ups of oldness 40 years. Here leukemia cell of white blood cell becomes influenced. Acute lymphocytic leukemia most regular in males contrasted with blood [6]. Figure 1.2 shows Acute lymphocytic leukemia.



**Figure 1.2.** Acute Lymphocytic Leukemia All [6]

### **1.2.2. Acute Myeloid Leukemia (CML)**

It happens in kids of oldness 1 year and ripeness patients. Figure 1.3 shows acute myeloid leukemia. Expansion of irritation and bone marrow are the main indications of intense myeloid leukemia. In this myeloid line of undifferentiated prison cell is influenced [7].



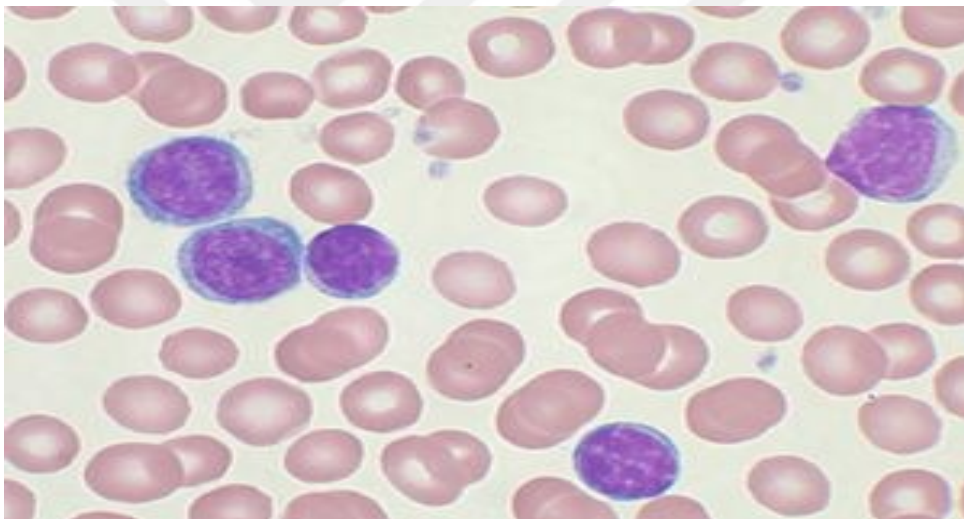
**Figure 1.3.** Acute Myeloid Leukemia [7]

### **1.3. Chronic Leukemia (CL)**

The human body does not demonstrate at all side effects at the beginning times. Means at the beginning period unusual cells don't influence the working of ordinary cells. It advances gradually and influences a vast zone of platelets and getting side effects last stage. At the last stage, it is hopeless.

#### **1.3.1. Chronic Lymphocytic Leukemia (CLL)**

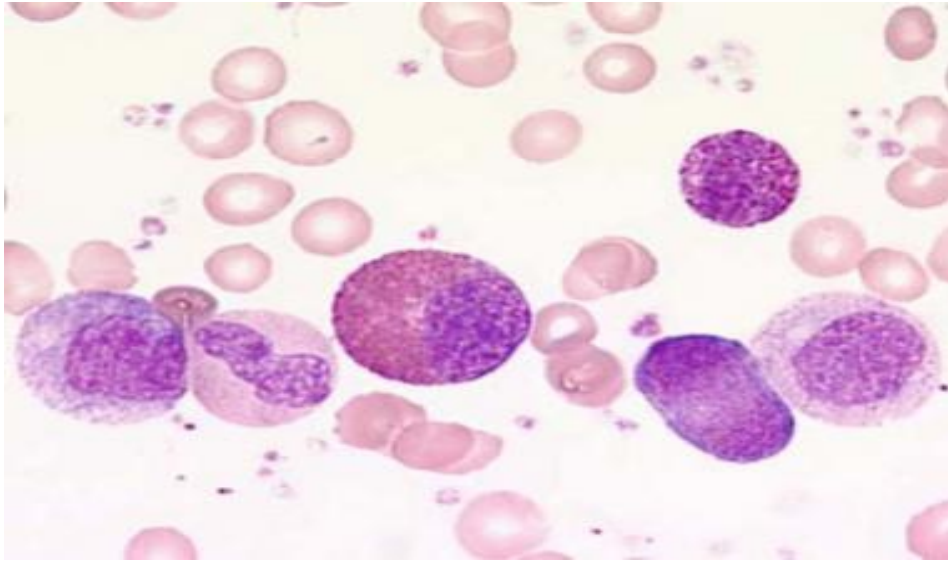
It happens in older resident patients who experience the ill effects of maturity infections. Lymphocytes are influenced. It doesn't demonstrate any indications at the beginning period. Figure 1.4 shows chronic lymphocytic leukemia



**Figure 1.4.** Chronic Lymphocytic Leukemia [7]

#### **1.3.2. Chronic Myeloid Leukemia (CML)**

It happens in central age patients of time of life 35-45 years. Hereditary variations happen at the beginning period of myeloid cells [7]. Figure 1.5 shows chronic myeloid leukemia.



**Figure 1.5.** Chronic Myeloid Leukemia [7]

## **2. DEVELOPED METHODS**

This chapter is about developed methods.

### **2.1. Checking of RBC's and WBC's utilizing Image Processing Technique**

The proportion of White Blood Cell and Red Blood Cells are vital for the specialist to analyze different ailments, for example, anemia, leukemia and so on. Along these lines, the exact tallying of platelets assumes a critical job. The old customary strategy utilized in emergency clinic research facilities includes manual tallying of platelets utilizing a gadget called Hemocytometer. Be that as it may, this procedure is incredibly repetitive, tedious, and prompts erroneous outcomes. Despite the fact that equipment arrangements, for example, the Automated.

Hematology Counter leaves, they are over the top expensive machines and exorbitant in each emergency clinic research center. So as to defeat these issues, this paper introduces a picture handling procedure to recognize and to check the quantity of red blood and white platelets in the blood test picture utilizing round Hough change and edge strategies [8].

### **2.2. WBCs Segmentation and Organization to Detect Acute leukemia**

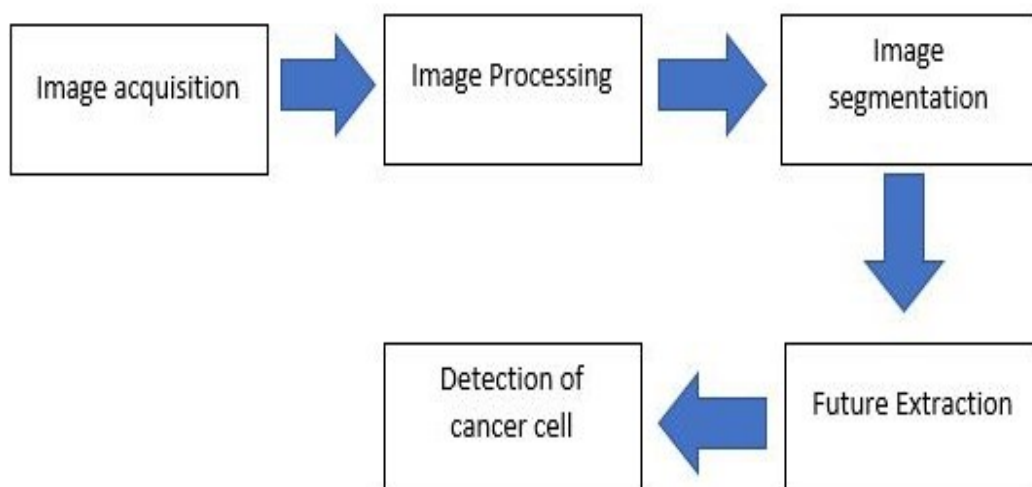
So, on enhance quiet conclusion totally different image making ready programming are created to get rid of valuable knowledge from restorative footage. hematologist makes the microscopic study of human blood that prompted a demand for ways, as well as magnifying instrument shading imaging, division, characterization, and bunching that may allow the characteristic proof of patients experiencing malignant neoplastic disease. malignant neoplastic disease is known with the impact of White blood corpuscle white blood cell the nonspecific plan of the signs and facet effects of Acute lymphocytic leukemia overtimes prompts the incorrect analysis thus hematologists, in addition, discover hassle for impact cell arrangement thus manual characterization of platelets is tedious and liable to mistake. Consequently, quick, precise and programmed recognizable proof of assorted platelets is needed. This paper has planned programmed Otsu's edge living substance

division technique aboard image improvement and variety juggling for the white blood cell division.

Various image process techniques are created by specialists to acknowledge malignant neoplastic disease in microscopic footage of human blood tests. a number of them use the thresholding technique in deciding the proportion of platelets for malignant growth cell detection. In the thresholding technique, picture handling systems have been used to check the number of platelets in the biomedical picture. With this checked estimation of platelet, the proportion of platelets for leukemia is determined. The first picture is changed over to a grayscale picture for which a limit estimation of force is set so as to separate Red Blood Cell to and White Blood Cell (thresholding changes over a grayscale picture to parallel picture). In the event that outcomes are not fulfilled the procedure is rehashed by setting another limit esteem. The outcomes obtained utilizing the thresholding system demonstrates that the proportion of Red blood Cell and White Blood Cell for the typical picture to the irregular picture has an alternate scope of proportion. [9].

### 2.3. Diagram of Developed Methods

From the literature review, coming up next are the means to be pursued for programmed identification of blood cancer growth appeared [10]. Figure 2.1 shows of detection cancer cell by means image processing.



**Figure 2.1.** Cancer detection by means of image processing techniques[10]

## **2.4. Modules**

There are four modules in developed methods.

### **2.4.1. Image Acquisition**

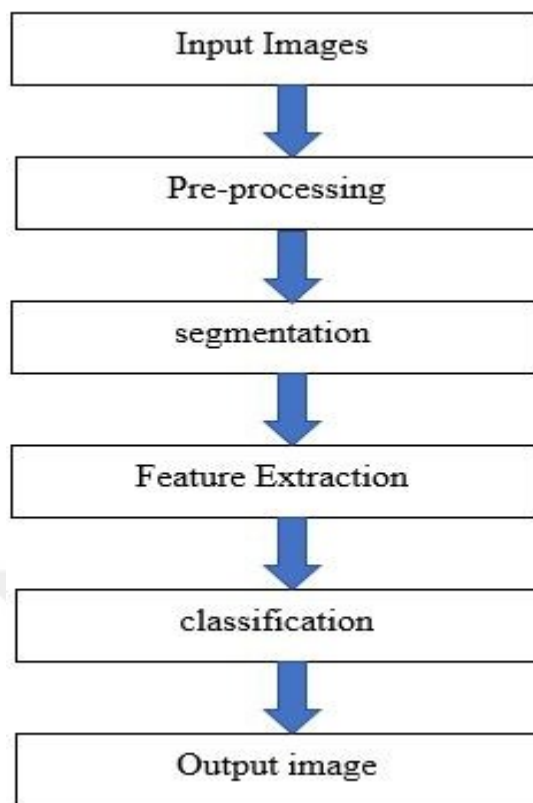
Blood pictures after transparencies will be acquired from close-by medical clinics with powerful amplification.

It contains single nucleoli within the nucleoli whereas in Acute Myeloid leukemia, the impacts are larger and fitful structure and usually completely different nucleoli with the distance of Auer rode. Same that the leucocyte shows up ideally darker over the inspiration whereas red protoplasm Red Blood Cell shows up in an exceedingly middle of the road power level it demonstrates that white cells are the darker parts in photos with Red Blood Cell appear by all accounts, to be pale. Platelets are lots littler than white and red cells [11].

### **2.4.2. Image Pre-processing**

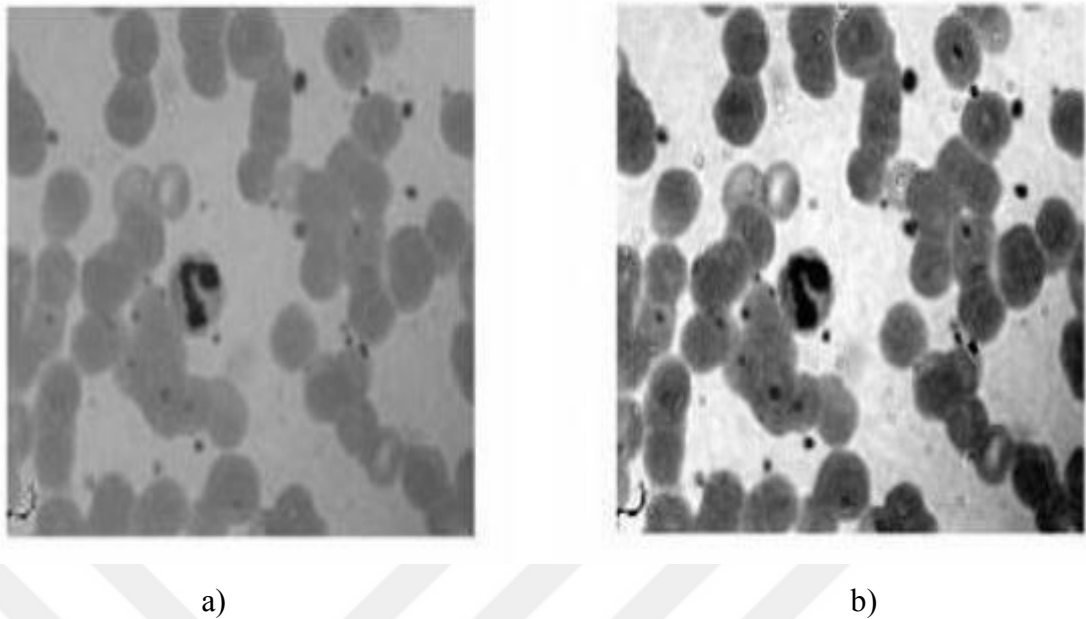
During picture acquisition, pictures are spared in JPEG organization to use less computational necessities and to guarantee not to have over-division in the watershed calculation as a picture will have more subtitles. As it is generally the situation, obtained pictures have all blood components hues near the foundation shading, red platelets are grouped with white platelets and the nearness of clamor and stain in the blood slides is significant. To survive or diminish the impact of such factors. back institutionalized the picture by expanding their difference.

Amid picture securing and exorbitant recoloring, the pictures will be bothered by clamor. The clamor might be because of light or shadows that influence a district of intrigue Region of Interest to show up as an obscured picture locale. The foundation will be prohibited since Region of Interest will be white platelets. Picture upgrade was done as the differentiation improvement method, is skilled to enhance the restorative picture quality. Figure 2.2 leukemia detection phases developed methods.



**Figure 2.2.** Leukemia detection phases [12]

Input picture is filtered with a Wiener channel to expel the foundation commotion which is straightforwardly embedded inside the picture amid picture securing. A Wiener channel (a kind of direct channel) fits himself to the nearby picture fluctuation. Anywhere the difference is expansive, wiener achieves small levelling. Where the difference is little, wiener achieves all the more levelling. For upgrade of the clamor free picture Laplacian channel is dug in. Laplacian is a subsidiary administrator who honed the picture however, it drives consistent regions to zero. Thus, including the first picture back reestablished the dim dimension tonality of the info picture. Thus, the picture is set up for the division of White Blood Cell from the picture foundation the intensity inconsistency in every district of a cell is the most concerning issue in the cell division and order, especially in dim scale pictures. In, Nippon connected a 15x15 middle channel is utilized to facilitate the issue [12]. Figure 2.3 depicts original image and enhancement image.



**Figure 2.3.** a) Original Image, b) enhancement image [12]

### 2.4.3. Image Segmentation

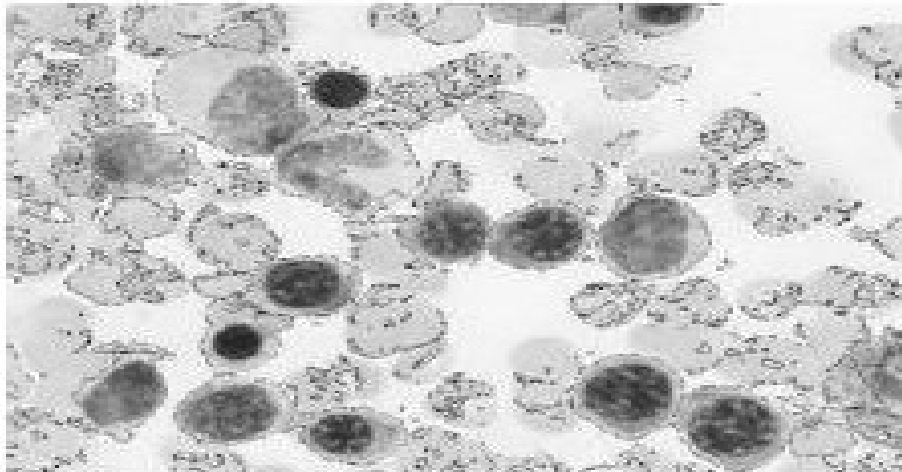
- Three important steps are associated with sectioning the picture agreed:
- Division of cellular element,
- Symmetry of stone and cytoplasm, and
- Season of interfere blood Cell.

The morphological activities go for extricating significant constructions of the picture by examining the picture with additional arrangement of a realized shapes invited organizing component, picked as the consequence of earlier information regarding the geometry of the applicable and immaterial picture constructions. The most realized morphologically activities incorporate disintegration, expansion, opening, and shutting. The morphological way to deal with picture division consolidates areas developing and edge discovery procedures.

Its groups of the pixels about the provincial minimalist of the picture. The breaking points of the touching social occasion are effectively arranged along the pinnacle lines of the angle picture. In our examinations, the watershed change action is performing to procure the outcome. The turning point change takings its source from the topo graphics comprehension of grayscale picture. As shown by the law of fascination, the marine let fall on such shallow will gush unhappy till accomplishes a base [13]. The entire course of action of motivations

behind the superficial, whose sharpest slantways accomplish A assumed least, includes the catchment reason related with this base. The watersheds are the zones detaching bordering catchment dishes. In the numerically use of the turning point count, the main picture is changed thusly, as to yield an image whose minima mark noteworthy picture matters and whose peak outlines contrast with picture article limits. Thusly, the picture is allotted into imperative areas that may relate for example to the individual effect cells. In our examinations, the Watershed estimation is using for use using MATLAB organize. The association strategy for the picture division and cells parcel contains the going with phases. Figure 2,4 shows separated Bone Marrow smear.

- Conversion of the authentic picture into ashy gauge:
- Conversion of the ashy picture to binary one by put on the unfair division.
- Implementation of closure and wearing away processes to even the outlines and to eliminates the deformation.
- Age group of the map of range from the dark pixels to the near snowy pixels.
- Enforcement of the turning point algorithm for the picture split[14].



**Figure 2.4.** The separate picture of the Bone Marrow smear [14]

#### **2.4.4. Feature Extraction**

The most important problem in the age of highlights of platelets is to describe them in a way empowering the acknowledgment of various shoot types with the most elevated precision. The highlights to be extricated from the core are geometrical highlights like region, span, edge, symmetry, concavity, conservativeness, strength, capriciousness,

extension, structure factor, Texture Features which incorporates homogeneity, vitality, connection, entropy, differentiate, precise second energy, Color Features like mean shading esteems, Statistical Features like mean esteem, fluctuation, skewness and kurtosis of the histograms of the picture lattice and the angle framework for Red Blood Cell or HSV or L\*a\*b shading space (either fitting) .

Eight form features and benefits are extracted from the core of White Blood Cell and a proportion between the region of the core and cytoplasm is additionally considered. Shape highlights are a zone, edge, smallness, erraticism, introduction, robustness, structure issue, and roundness. Overall Form highlights are extracted utilizing the standard system present-day in the MATLAB picture Processing Toolbox.

Structure factor and plumpness are determined as pursues, to demonstrate the initial application of the automatic portioned pictures, we determined the zone of the core in each picture to be the component to the Bayes classifier. [15].

➤ **Geometrical Feature:**

Contain region, elbow, circumference, symmetry, concavity, compactness, hardness, strangeness, protraction, form worker will be acquired.

➤ **Texture Features:**

Include identity, power, engagement, entropy, disparity, corner another momentum will be gained.

➤ **Color Features:**

The RGB color area will be convert into HSV or L\*a\*b color area. Their middle color values will be gained.

➤ **Statistical Features:**

The middle value inconstancy, skewness, kurtosis of the histograms of the picture model and the inclination medium for (RGB and) or HSV or L\*a\*b shading space (whichever proper) will be acquired. In light of that, Acute Lymphatic Leukemia is little, impact cells are unvarying, cytoplasm is inadequate, rounded and more often than not curb only nucleoli inside the center. While in Acute Myeloid Leukemia, the effects are greater and sporadic structure commonly different nucleoli with the proximity of Auer rode. said that the White Blood Cell shows up ideally darker over the establishment Red Blood Cell seems in a center power level. exhibits that White Blood are the shadier parts in pictures with Red Blood Cell have every one of the reserves of being pale. Platelets are ample tinier than White Blood and RC [16,17].

The task of division of the picture is centered around the programmed acknowledgment and detachment of every prison cell for further preparing, so as to get steady highlights, valuable in acknowledgment of the phone. Following plan has been created on the power appropriation of the picture. The histograms and edge structures of such power have been settled for three shading parts RGB in view of this the going with landscapes have stood delivered: the mean regard and contrast of the histogram and the slant cross-section of the picture of the center and the entire cells (24 highlights), skewness and kurtosis of histogram and tendency medium of the entire cells (12 highlights). All of these landscapes take been resolved for 3 tones. features have been made in this means. Each and every numerically examination of the features age has remained executed on the phase of MATLAB.

From the areas got in the division system, by dismembering their format, shading, and a novel association with esteem to various districts to choose if a separated zone is a center or a leukocyte. The highlights that be situated utilized to see cell segments are: circuitousness to measurement the outskirts multifaceted nature of an indirect article ( $\text{circularity} = \frac{\text{perimeters}^2}{4\pi\text{area}}$ ), weirdness to discovery how much the thing veers off from being able circuitous ( $\text{fancy} = \text{dist.}(\text{middle, emphasis})$ ), shading to choose whether a area is shadier than other, and direction degree to set up whether a locale comprises or is contained by additional area.

The important data analysis is restrained in the geometric format and parameters identified together with them. Different cell contrast significantly with dimensions. For instance, the orthochromatic erythroblasts have a range of 8-10 micrometers, though megakaryocyte may be awake to 100 micrometers. The conditions of diverse effects are whichever rounded, oval or kidney-shaped. The subsequent geometrical features of the cell are careful [18].

- The proportion of the circumference and radius of gyration.
- Region – the numbering of pixels on the inside of the cell, characterized independently aimed at the cores and for entire cells; as the highlights, we expect the region of the core and the proportion of the territories of the core and the entire cells.
- The region of cambered portion of the kernel.
- Compactness – givens by the formulation:  $\frac{\text{circumference}^2}{\text{area}}$ .
- Cavity – the seriousness level of concavity in a cell.
- Cavity points – the numbering of concavity, irrespectively of their amplitude.

### **3. INFORMATION ABOUT LEUKEMIA**

This chapter is about leukemia's symptoms, early signs and general information.

#### **3.1. Early signs**

They may include:

- Existence tiring all the time.
- Weighing wastage.
- Have temperature or chills.
- Getting recurrent contagion.

#### **3.2. Symptoms**

- Early display of leukemia comprise.
- Fever.
- Tiredness.
- Sching skeleton
- Headaches.
- Leather eruption.
- Tumescence glands.
- Weighing damage.
- Swollen gum.
- An enlarge spleens or livers.
- Slow- recovery cut off, nosebleeds, or frequent contusion.

A large number of these indications go with this season's cold virus and other normal restorative issues. In the event that you have any of these manifestations, see your specialist. The person in question can analyze the issue. At the point when to see a specialist Make a meeting with your specialist on the off chance that you have any persevering signs or side effects that stress you. Leukemia manifestations are regularly dubious and not explicit. You may ignore early leukemia manifestations since they may take after indications of this

season's cold virus and other regular sicknesses. Once in a while, leukemia might be found amid blood tests for some other condition [19].

### **3.3. Diagnoses**

A determination is generally founded on rehashed total plasma totals and an extracted inspection subsequent perceptions of side effects. Once in a while, plasma tester might not prove that an individual has L, predominantly in the beginning periods of malady or amid discount. A lymph's hub operation can be achieved to study specific kinds of leukemia in specific conditions.

Following analysis, plasma knowledge tester can be used to choose the level of livers and food harm or the influences of chemotherapy on the individual. At the opinion when anxieties arise about different evils as of leukemia, authorities may use an X-beam, MRI, or ultrasounds. These canisters conceivably demonstrate leukemia penalties for such frame helpings as frames (x-beam), the cerebrums (MRI), or the offal, anger, and livers (ultrasounds scan). CT outputs container be used to checkered lymphangia hubs in the torso, however, this is extraordinary.

In spite of the utilization of these strategies to analyze regardless of whether an individual has leukemia, numerous individuals have not been analyzed in light of the fact that a large number of the side effects are unclear, non-explicit, and can allude to different sicknesses [20,21].

### **3.4. Cause**

Leukemia happens when the DNA of juvenile platelets, for the most part, white cells turns into a hurt some way. This makes the platelets develop and separate consistently so that there are too many. Strong platelets fail miserably definitely and are superseded by new cells, which are made in the marrow. The uncommon platelets don't kick the basin when they should. They gather, having more space. As progressively dangerous development cells are conveyed, they prevent the strong white platelets from creating and working ordinarily, by sticking out space in the blood. Fundamentally, the terrible cells swarm out the incredible cells in the blood. Figure 3.1 shows cause of leukemia.

There is no single known clarification behind any of the different sorts of leukemia's. The few known causes, which are not by and large factors inside the control of the run of the mill individual, address ordinarily a couple of cases the reason behind most events of leukemia is dull. The specific leukemia's likely have grouped causes.



Figure 3.1. Cause of leukemia [23]

Leukemia, as different contaminations, results from changes in the DNA. Certain progressions can trigger leukemia by initiating oncogenes or deactivating tumor silencer qualities and consequently bothering the control of cell passing, separation or division. These movements may occur all of a sudden or in perspective on the prologue to radiation or threatening development causing substances

Among adults, the acknowledged causes are customary and counterfeit ionizing radiation, several contaminations. For instance, human T-lymph tropic disease, and a couple of engineered mixes, unmistakably benzene and alkylating chemotherapy administrators for past malignancies Use of tobacco is connected with a little augmentation in the threat of making extraordinary myeloid leukemia in adults. Accessory and case-control ponders have associated prologue to a couple of petrochemicals and hair hues to the headway of a couple of kinds of leukemia. Diet has obliged or no effect, in spite of the way that eating more vegetables may introduce a little cautious preferred standpoint.

Diseases have furthermore been associated with a couple of kinds of leukemia. For example, human T-lymph tropic contamination (HTLV-1) causes grown-up T-cell leukemia

A few events of maternal-fetal transmission (a child gets leukemia since its mom had leukemia amidst the pregnancy) have been spoken to. Youngsters bound to moms who use indulgence medications to induce ovulation are more than twice as slanted to make leukemia amidst their childhoods than various kids [22,23].

### **3.5. Risk factors**

Prelude to ionizing radiation assembles the danger of a couple of sorts of leukemia excepting Chronic Lymphatic leukemia. Restorative radiation, for instance, that used in dangerous development treatment, is a liberal wellspring of radiation presentation. Leukemia may in like manner occur as a manifestation of chemotherapy. Children with Down turmoil and certain other hereditary variations from the norm are at expanded danger of leukemia. Laborers in the elastic assembling industry likewise have an expanded hazard. Ongoing examinations propose that corpulence builds the risk of leukemia.

A couple of components are most eagerly associated with unequivocal sorts of leukemia. Family heritage is a standout amongst the most grounded risk factors for Chronic Lymphatic leukemia. Cigarette smoking is a peril factor for Acute Myeloid Leukemia, and there is compelled verification that parental smoking and maternal prologue to paint constructs the risk of youth leukemia. Prologue to explicit synthetics, for instance, formaldehyde and benzene (a section in tobacco smoke and gas that has ended up being progressively controlled in view of its malignancy causing nature), also fabricate the danger of Acute Myeloid Leukemia.

Ailment with human T-cell leukemia disease type I (HTLV-I) can cause an unprecedented sort of leukemia rang developed T-cell leukemia/lymphoma. The normality of HTLV-I defilement is geologically restricted and is most ordinary in southern Japan and the Caribbean; spoiled individuals in the US will, when all is said in done, be relatives of laborers from endemic Reign [24].

- Synthetic ionizing irradiation.
- Germs, such as the humanitarian T-lymph orbit germs (HTLV-1).
- Benzene ring and around petrochemical.
- Alkylating agent's chemotherapy drugs used in former carcinoma.

- Verse dyes.
- Smoking.

Leukemia can be hard to analyze early in light of the fact that indications frequently look like those of other, less genuine conditions. At the point when a doctor suspects leukemia, the finding can be made utilizing blood tests and a bone marrow biopsy.

### **3.6. Survival**

Survival rates change considerably by leukemia type, running from a 5-year relative survival of 25% for patients determined to have Acute Myeloid Leukemia to 82% for those with Chronic Lymphatic leukemia. Advances in treatment have brought about an emotional enhancement in survival in the course of recent decades for most sorts of leukemia. For instance, from 1975-1977 to 2002-2008, the 5-year relative survival rate for Acute Lymphatic leukemia expanded from 41% to 68% by and large, and from 58% to 91% among kids. In extensive part because of the revelation of focused malignancy drugs like Imatinib, the 5-year survival rate for Chronic Myeloid Leukemia expanded from 31% for cases analyzed amid 1990-1992 to 56% for those analyzed amid 2002-2008 [25].

Intense Lymphocytic Leukemia Acute Lymphocytic leukemia, otherwise called intense lymphoblastic leukemia is a disease of the white platelets, portrayed by the overproduction and constant augmentation of threatening and juvenile white platelets (alluded to as lymphoblast or impacts) in the bone marrow. It is lethal whenever left untreated because of its fast spread into the circulatory system and other imperative organs

Acute Lymphatic leukemia delivers an absence of sound platelets because of an unusual number of dangerous and juvenile white platelets. It basically influences youthful kids and grown-ups more than 50. Early analysis of the infection is essential for the recuperation of patients particularly on account of kids.

Sadly, the underlying manifestations of Acute Lymphatic leukemia are very not explicit: summed up shortcoming, sickliness, visit fever and diseases, weight reduction or potentially loss of hunger, over the top wounding or seeping from wounds, nosebleeds, bone agony, joint agonies, shortness of breath, developed lymph hubs, liver or potentially spleen. On the off chance that the portrayed manifestations are available, blood tests, for example, a full blood check, renal capacity, electrolytes, and liver compounds and blood tally must be

finished. Clinical doubt alone might be the main motivation to play out a bone marrow biopsy, which is the following stage in the symptomatic procedure. Bone marrow is inspected for impacts, cell checks and different indications of infection. Neurotic examination, cytogenetic and aminophenol typing are basic symptomatic investigation. When the impact cells attack begins, impact cells can be identified in fringe blood [26].

Demonstrates the magnifying instrument picture of a blood film (left) and it plots three instances of ordinary lymphocytes and three lymphoblastic cells (right). Pictures have been digitalized by the optical magnifying lens by utilizing a CCD and after that gained by a casing grabber framework. Important cells present in the blood are the red platelets, and the white cells (leucocytes). Leukocyte cells containing granules are called granulocytes (formed by neutrophil, basophil, and eosinophil). Cells without granules are called a granulocyte (lymphocyte and monocyte). Acute Lymphocytic Leukemia side effects are related just to the lymphocytes. Subsequently, the perception of the fringe blood am by master administrators is one of the indicative methodology accessible to assess the nearness of intense leukemia. This examination experiences gradualness and furthermore shows a not institutionalized exactness since it relies upon the administrator's abilities and tiredness. Alternately, the morphological examination just requires a picture – not a blood test and henceforth is reasonable for ease, standard-exact, and remote indicative frameworks. In the present analytic worldview, infinitesimal imaging innovation has gigantic commitments in creating productive restorative pictures, which basically turn into the reason for therapeutic specialists to settle on better choices.

By and by, specialists like radiologists and pathologists, imagine the irregularities assuming any, in the pictures through magnifying lens dependent on their abstract learning from the perspective of force, morphology, surface and so on based highlights. Generally, little scale contrasts in the highlights are ignored by human eyes, particularly for the fringe indicative situation. It is progressively advantageous to build up a PC helped mechanized screening plan for naturally portraying the variations from the norm, particularly in confounded situations where specialists neglect to take a choice. In doing this, tiny data should be dissected quantitatively keeping up the organic uprightness in the framework. Leukemia is a gathering of blood illnesses influencing the platelets and most generally white platelets.

Leukemia is portrayed by overproduction of irregular (or youthful) white cells that can't battle disease. There are two primary sorts of intense leukemia: Acute Lymphocytic

Leukemia and Acute Myelogenous Acute Myeloid Leukemia Intense leukemia is a quickly advancing ailment that influences for the most part cells that are unformed (not yet completely created or separated). ALL is the greatest widely recognized kind of L in youthful children. This illness additionally influences grown-ups, particularly those matured 65 and extra seasoned [27].

### **3.7. How leukemia forms**

Generally speaking, L is thought to ensue when a few platelets get changes in their DNA the rules inside each cell that deal with its movement. There may be distinctive changes in the cells that by and by can't be totally appreciated that could add to leukemia.

Certain varieties from the standard reason the cell to create and parcel even more rapidly and to continue living when customary cells would kick the basin. After some time, these abnormal cells can swarm out sound platelets in the bone marrow, inciting less strong white platelets, red platelets and platelets, causing the signs and reactions of leukemia [28].

The achievement of action relies upon the sort of Leukemia and the stage of the individual. Results have enhanced in the created world the normal five-year existence rate is 57% in the US In kids below 15, the five-year survival rate is more prominent (60 to 85%), contingent upon the sort of Leukemia in kids with intense Leukemia who are malignant growth free following five years, the disease is probably not going to reappear.

Results rely upon whither it is intense or perpetual, the particular irregular white platelet type, the nearness, and seriousness of sickliness or thrombocytopenia, the level of flesh variation from the norm, the nearness of metastasis and lymph hub and bone marrow invasion, the accessibility of treatments and the abilities of social insurance group. Action results might be healthier when individuals are preserved at bigger focuses with more prominent experience.

Leukemia is rarely associated with pregnancy, affecting just around 1 out of 10,000 pregnant women How it is managed depends essentially on the sort of leukemia. Pretty much all leukemia's appearing in pregnant women are extraordinary leukemia's Acute leukemia's conventionally require quick, strong treatment, regardless of imperative threats of pregnancy mishap and birth surrenders, especially if chemotherapy is given in the midst of the developmental unstable first trimester Chronic myelogenous leukemia can be treated with relative security at whatever point in the midst of pregnancy with Interferon-alpha hormones

Treatment for unending lymphocytic leukemia, which are phenomenal in pregnant women, can every now and again be postponed until after the completion of the pregnancy.

In 2010, all around, approximately 281,500 people kicked the basin of leukemia. In 2000, about 256,000 children and adults the world over developed a kind of leukemia, and 209,000 passed on from it. This addresses about 3% of the practically seven million passing's in view of malady that year and about 0.35% of all passing's from any reason. Of the sixteen separate goals, the body saw, leukemia was the twelfth most essential class of neoplastic illness and the eleventh most customary explanation behind threatening development related end. Leukemia happens even more commonly in the mad world.

By the progression of quantitative minuscule procedures, such issues can be overwhelmed by encouraging the PBS (fringe blood smear) investigation and by creating canny CAD frameworks for early forecast of harmful illnesses like leukemia. In India and even in many created nations, leukemia is a standout amongst the most well-known hematological malignancies. Information, as detailed by the American Cancer Society<sup>7</sup>, is appeared table 1 for a various type of leukemia [29].

### **3.8. Rare forms of leukemia**

Lymphatic and hypogenous leukemia's are the most widely recognized. Be that as it may, malignant growths of different kinds of bone marrow cells can create. For instance, megakaryocytic leukemia emerges from megakaryocytes, cells that structure platelets. (Platelets help blood to cluster.) Another uncommon type of leukemia is erythroid leukemia. It emerges from cells that structure red platelets. Like interminable and intense leukemia's, uncommon types of the infection can be arranged into subtypes. The subtype relies upon what markers the cells carry on their surface.

Make a meeting with your specialist on the off chance that you to have any diligent signs or manifestations that stress you. Leukemia side effects are regularly ambiguous and not explicit. You may neglect early leukemia indications since they may look like side effects of this season's cold virus and other normal sicknesses. Infrequently, leukemia might be found amid blood tests for some other condition [30].

### 3.9. Diagnosis

Your specialist may not speculate leukemia dependent on your side effects alone. Notwithstanding, amid your physical examination, the person may find that you have swollen lymph hubs or an expanded liver or spleen. Routine blood tests, particularly platelet checks, may yield anomalous outcomes.

- A Bone Marrow biopsy (a specimen of Bone Marrow is removed and examined).
- Check for abnormality cells.
- Exam for authentic irregularities.

Genetic exams can help decide precisely what kind of leukemia you have.

Every one of the four primary sorts have subtypes.) These modern tests may likewise offer pieces of information with respect to how you will react to a specific treatment.

Finding is typically founded on rehashed total blood checks and a bone marrow examination following perceptions of the side effects. Now and again, blood tests may not demonstrate that an individual has leukemia, particularly in the beginning periods of the malady or amid reduction. A lymph hub biopsy can be performed to analyze particular sorts of leukemia in specific circumstances.

Blood science tests can be utilized to decide the level of liver and kidney harm or the impacts of chemotherapy on the individual. At the point when concerns emerge about different harms because of leukemia, specialists may utilize an X-beam, MRI, or ultrasounds. These containers possibly demonstrate L impacts on such form portions as frames (X-beam), the cerebrum (MRI), or foods, spleen, and liver (ultrasounds). CT outputs can be utilized to checkered limping hubs in the chest, however, this is extraordinary.

Regardless of the utilization of strategies to analyze regardless of whether an individual has leukemia, numerous individuals have not been analyzed in light of the fact that a considerable lot of the side effects are dubious, non-explicit, and can allude to different sicknesses [31,32].

When all is said in done, constant leukemia advances more gradually than intense leukemia. Without medications called tyrosine kinase inhibitors or a bone marrow transplant, individuals with CML can live for quite a long while until the malady demonstrations like AML.

Regardless of whether tyrosine kinase inhibitors can defer or keep the change of unending leukemia to intense leukemia stays to be seen.

By and large, interminable leukemia advances more gradually than intense leukemia. Without medications called tyrosine kinase inhibitors or a bone marrow transplant, individuals with CML can live for quite a long while until the ailment demonstrates like AML. Regardless of whether tyrosine kinase inhibitors can defer or keep the change of interminable leukemia to intense leukemia stays to be seen.

Hematologists base Chronic Lymphocytic Leukemia handling on together the phase and indications of the unique discrete. Huge gathering of individuals with Chronic Lymphocytic Leukemia has a poor-quality infection, which does not profit by treatment. People with Chronic Lymphocytic Leukemia -related complexities or further developed malady regularly advantage after action. All in all, the signs for action are:

- Drop platelet counting.
- Progress to a far along phase of illness.
- Aching, illness -related overgrowth of spleens.
- An accretion in the average of lymphocyte production line.

A few people have a hereditary inclination toward creating leukemia. This inclination is shown by family ancestries and twin examinations the influenced individuals may have a solitary quality or different qualities in like manner. At times, families will in general build up indistinguishable sorts of leukemia from different individuals; in different families, influenced individuals may create diverse types of leukemia or related blood malignant growths

Notwithstanding these hereditary issues, individuals with chromosomal variations from the norm or certain other hereditary conditions have a more serious danger of leukemia for instance, individuals with Down disorder have a fundamentally expanded danger of creating types of intense leukemia, and Franconia sickliness is a hazard factor for creating intense [33].

### **3.9.1. Treatment**

Chemotherapy is the best technique for treating leukemia. Different anticancer medications are utilized, either in blend or as single operators. Imagine (Greeves), nicotinic (Taiga), and masitinib (Sprucely) are extremely powerful medications that are focused at the hereditary variation from the norm that is the sign of Chronic Myeloid Leukemia. Imagine and masitinib are likewise FDA-endorsed to treat a kind of Acute Myeloid Leukemia with

the equivalent hereditary deformity. Individuals determined to have Chronic Lymphocytic Leukemia that isn't advancing or causing side effects may not require treatment. Later clinical preliminaries have demonstrated those grown-ups with Chronic Myeloid Leukemia, who are treated with double the ordinary portion of daunorubicin experience higher and increasingly quick rates of reduction. Anti-infection agents and transfusions of blood parts are utilized as strong medications. Under suitable conditions, foundational microorganism transplantation might be valuable in treating specific sorts of leukemia.

#### - Treatment Approach

For a great many persons through Chronic Lymphocytic Leukemia, it is serious by current medications, so action is coordinated on the way to smothering the illness for a long time, as opposed to absolutely and for all time dispensing with it. The essential chemotherapeutic arrangement is blend chemotherapy with chlorambucil or cyclophosphamides, in addition to a corticosteroid, for example, prednisone or prednisolone. [34].

#### - Response to Treatment

Now and again individuals react preferred to medicines over others. On the off chance that an individual gets chemotherapy medicines and their malignant growth doesn't return inside five years, they're generally viewed as restored. On the off chance that an individual's disease returns or doesn't react to medicines by any stretch of the imagination, their treatment result isn't as great.

A visualization or survival standpoint depends on various components. Quite a bit of it depends on the results and investigation of you of blood tests, imaging thinks about, cerebrospinal liquid examinations, and bone marrow biopsies. A few people with poor visualization live a lot a greater number of years than a specialist predicts while others may not live as long.

Different medications incorporate rituximab mixture or self-infusion with Interferon-alpha. In restricted cases, the individual may profit by splenectomy (expulsion of the spleen). These medicines are not regularly given as the main treatment on the grounds that their prosperity rates are lower than cladribine or endostatin.

#### - Typical Treatment Approach

Individuals who need handling for the most part get it is possible that multi-week of cladribine, given day by day by intravenous implantation or a straightforward infusion under

the skin, or a half year of endostatin, allowed at regular intervals by intravenous imbue ment. Much of the time, one round of treatment will create a drawn-out abatement

Different medicines incorporate rituximab implantation or self-infusion with Interferon-alpha. In constrained cases, the individual may profit by splenectomy (expulsion of the spleen). These medicines are not commonly given as the principal treatment in light of the fact that their prosperity rates are lower than cladribine or endostatin [35,36].

### 3.10. Deaths

As per the most recent WHO date distributed in 2017 leukemia passing's in turkey achieved 3,564 or 0.89 of absolute passing's. The age-balanced passing rate is 4.67 per 100,000 of populace rank turkey #44 on the planet. Audit different reasons for death by tapping the connections beneath or pick the full wellbeing profile [37].Table 3.1. is about death of leukemia in 2017.

**Table 3.1.** Death of leukemia in 2017

Death	%	Rate	World rank
186.7	46	7.74	1
3,564	0.89	4.67	44

### 3.11. Several segmentation methods

A few division strategies have been adjusted for cytoplasm, cell, and core division from infinitesimal biopsy pictures like edge based, area based, and bunching based calculations. Notwithstanding, the choices of division strategies rely upon the sort of highlights to be protected and extricated. For the division of Region of interest (locale of intrigue), the ground truth (GT) of the pictures is physically trimmed and made from the histology dataset. The  $k$ -implies bunching based division calculations excited as a result of the conservation of the ideal data. From the got outcomes through experimentation it is seen that the bunching based calculations explicitly  $k$ -implies based technique are the most appropriate for minuscule biopsy pictures. For testing and experimentation reasons, twenty (20) infinitesimal biopsy pictures accessible from histology datasets were utilized. These pictures were arbitrarily chosen for the division. The ground truth (GT) pictures are

physically made by editing the area of intrigue Region of interest. The visual aftereffects of surface-based division, FCM division,  $K$ -implies division, and shading based division are introduced in Figures 3(a) to 3(d). Therefore, from the visual outcomes got and detailed in Figures 3(a) to 3(d), it is seen that the  $k$ -implies bunching based division strategy performs better in the vast majority of the cases when contrasted with other division approaches under thought for infinitesimal biopsy picture division [38].

Iterative Threshold calculation is utilized for division purposes particularly from uproarious pictures. This calculation beats the issue of cell extraction and division from substantial loud pictures. This calculation works over the balanced limit of pictures iteratively giving vigor to the picture.

This framework identifies and arranges jungle fever parasites in Giemsa recolored blood slides pictures. At that point after parasitemia assessment is finished. A morphological way to deal with cell picture division is more exact than the traditional watershed-based calculation is appeared in this paper. Greyscale granulomeres are connected dependent on opening with plate formed components, level and non-level. The nonfat circle formed organizing component improves the roundness and the red cells minimization.

These frameworks order and distinguish jungle fever parasites by utilizing tiny pictures of platelets. Morphological methodology and the real necessities in building up this framework is the best procedures for platelet pictures division. [37].

### **3.11.1. A careful division mode for White Blood Cell images**

An exact technique for division for tallying white platelets consequently is displayed here. Initial, a straightforward thresholding approach is connected and the calculation is inferred about blood smear pictures from the earlier data. The names are balanced at that point so as to deliver important outcomes. This methodology utilizes learning of the platelet structure. This strategy is progressively powerful when contrasted with customary techniques which use data of neighborhood setting. It can perform exact division of white platelets however they have unshared limits.

The convenience of a programmed morphological strategy to perceive the Acute Lymphocytic Leukemia with the assistance of pictures of fringe blood magnifying instrument. The displayed system individuates the leucocytes from the other platelets, after that it chooses the lymphocyte cells (the cells causes intense leukemia), morphological files

from those cells are assessed then after and finally characterization is performed whether the nearness of the leukemia is there or not.

The manufactured a framework to identify leukemia cells of pictures of bone marrow. Utilizing the Support Vector Machine (SVM) classifier and platelet pictures highlight that is identified with geometry, surface, and factual examination, the framework was fabricated. The weight is on choice and age of highlights for getting out the best acknowledgment. Textural parameters, for example, entropy, differentiate, mean esteem and precise second force have been utilized. Geometrical parameters are smallness, border, concavity focuses, and symmetry range, territory, and filled region. For the measurable investigation, parameters are mean esteem and for core standard deviation and for slope lattice cytoplasm, mean and standard deviation are considered. Kurtosis and Scenes for picture and slope framework. Preparing information mistake is 11.87%, blunders of testing information is 21.13%. 30 best highlights are chosen and this produces blunder rate of preparing information up to 13.07% and mistakes of testing information to 18.71%.[38].

In the programmed procedure, the division strategy for white platelet White Blood Cell depends on HSV (Hue, Saturation and Value) shading space will be utilized so as to dispose of the white platelets White Blood Cell from the foundation. A straightforward morphological administrator, for example, disintegration is utilized for the covering cells. Results demonstrate that the proposed framework has given the most elevated normal precision of 97.8% for checking both ALL and Acute Myeloid Leukemia cases.

### **3.11.2. Threshold Based Automate Ding Method: ALL and AML Blast Cells Detection**

A mechanized technique to distinguish Acute Leukemia shoot cells from human minute blood pictures. It contains four fundamental modules,

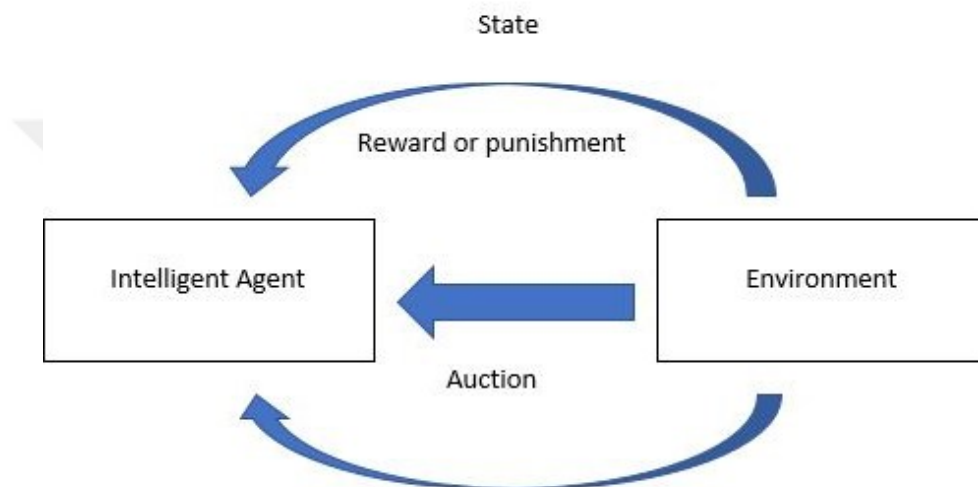
- 1) De-noising module performs two arranged clamor decrease by 2D PCA and LPG.
- 2) The complexity improvement area incorporates shading space transformation and morphological sifting dependent on pixel intensities.
- 3) In the limit choice module, edge esteem is resolved using two techniques to be specific, Edge Sensitive Variation Thresholding and Otsu's Thresholding.

4) Blast cells are fragmented dependent on edge esteem acquired from these two strategies. Morphological activities and Connected Component Analysis are utilized to check the number of impact cells present in the pictures [39,40].



#### 4. CLASSIFICATION

Rating is the errand of assigning to the obscure test vectors to an identified lesson. In this progression, a support learning calculation is suggesting. The Reinforcement Learning approach will arrange the sorts of leukemia into Acute Lymphatic Leukemia, Acute Myeloid Leukemia, Chronic Lymphatic leukemia and Chronic Myeloid leukemia. The essential model of Reinforcement Learning is as shown in Figure 4.1.

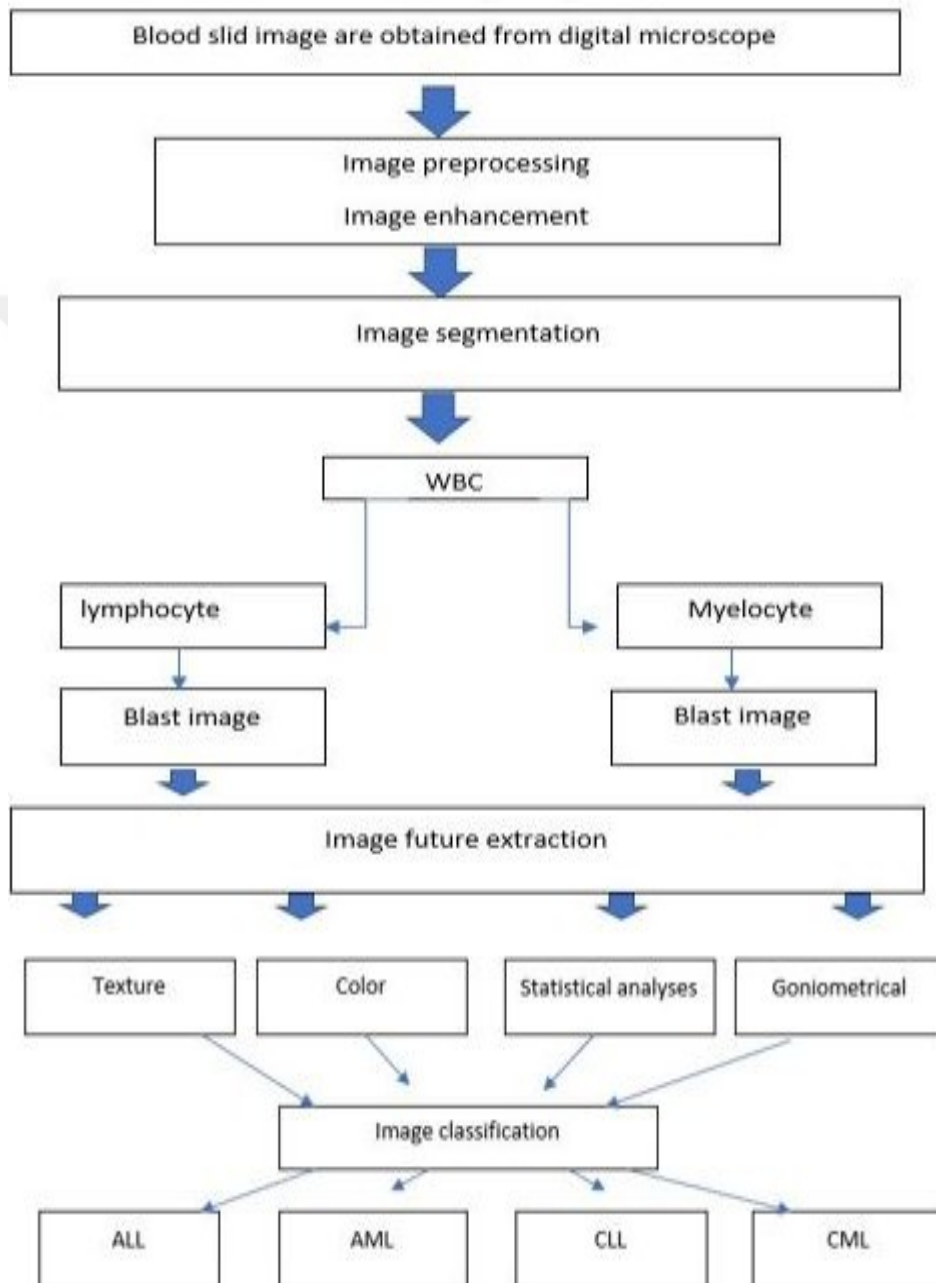


**Figure 4.1.** Basic Model of Reinforcement Learning [41]

The idea behindhand Reinforcement Learning is a wise operator acquires on the proper behavior with its climate so as to expand plunders that it gets regarding predefined measurement. The operator will demand experimentation learning in its activity to accomplish the ideal objective. An operator will initially become familiar with the condition of the earth and connect with the earth. The earth gets the activity from the operator and changes into another state. The operator gets the new condition of the earth and gets a reward or discipline from nature. The operator will get the reward/discipline from the earth depends on the activity done towards an environment.

The specialist will get information and figures out how to respond to the most noteworthy reward. It likewise ought to pick activities that will in general increment the general total of the estimations of the prizes. The operator will utilize a system that we called as activity arrangement so as to pick an activity towards the earth. In the event that a specific framework's activity reasons the favorable rewarding of the earth, the framework producing

this activity will reinforce this pattern, as this is a favorable criticism procedure. Something else, the framework creating this activity will reduce the pattern. Reinforcement Learning incorporates a sample - founded calculation that is the Sarsi strategy and founded - unessential calculation that are Sequential Change and Q-learning.



**Figure 4.2.** Proposed Method Algorithm [41]

There is likewise a capacity estimate where Reinforcement Learning can utilize this technique with regulated adapting, for example, neural system or liner work when unthinkable portrayal isn't plausible particularly in constant state space [41] .Figure 4.2 shows proposed methods algorithm.

There are more than twelve extraordinary sorts of leukemia, anyway four sorts happen for the most part consistently. These groupings rely upon whether the leukemia is extraordinary as opposed to unending and myelogenous versus lymphocytic, that is: Acute Myelogenous (granulocytic) Leukemia Acute Myeloid Leukemia Chronic Myelogenous (granulocytic) Leukemia Chronic Myeloid leukemia. As an end, the examination theory can be viewed as in Figure 4.2.

#### **4.1. Artificial Neural Networks (ANN)**

The scope of this teaching package is to make a brief induction to Artificial Neural Networks (ANNs) for people who have no previous knowledge of them. We first make a brief introduction to models of networks, for then describing in general terms ANNs.

As an application, we explain the back propagation algorithm, since it is widely used and many other algorithms are derived from it. The user should know algebra and the handling of functions and vectors. Differential calculus is recommendable, but not necessary. The contents of this package should be understood by people with high school education. It would be useful for people who are just curious about what are ANNs, or for people who want to become familiar with them, so when they study them more fully, they will already have clear notions of ANNs. Also, people who only want to apply the back propagation algorithm without a detailed and formal explanation of it will find this material useful. This work should not be seen as “Nets for dummies”, but of course it is not a treatise. Much of the formality is skipped for the sake of simplicity. Detailed explanations and demonstrations can be found in the referred readings. The included exercises complement the understanding of the theory. The on-line resources are highly recommended for extending this brief induction

ANN may be a model created to imitative the capability to review the mind of somebody. In Neural Network, neurons gathered into layers, known as neurons layer. Typically, each vegetative cell of a layer is related to all of the neurons within the back or front layer (aside from data and yield).

Data announce on a Neural Network unfold layer - by - layer going from contribution to yield while not or through a minimum of one hidden the layer. Contingent upon the calculation utilized, information will likewise be unfolded toward the rear (back propagation). The related figure demonstrates the Neural Network with 3 layers of neurons One kind of neural network is a Multilayer Perceptron (MLP). MLP has an information layer, some shrouded layer, and a yield layer.

Input  $x_k$ ,  $k = 1, K$  to neuron duplicated by the load which and summed with a consistent predisposition. The outcome is the contribution to initiate the capacity  $g$ . This actuation work is taken for the reason that numerical hyperbolic tan (digression) or sigmoid capacity is ordinarily utilized. hyperbolic digression as characterized. With the goal that the yield point to be this way: By connecting a few points in arrangement and parallel, the MLP system will be shaped, as in [42].

#### **4.2. K-Means Clustering Algorithm**

In the present work, the role of the k-means algorithm is to reduce the computation intensity of the neural network, by reducing the input set of samples to be learned. This can be achieved by clustering the input dataset using the k-means algorithm, and then take only discriminant samples from the resulting clustering schema to perform the learning process. By doing so, we are trying to select a set of samples that cover at maximum the region of each class in the N-dimensional space (N is the size of the training vectors). The input classes are clustered separately in such a way to produce a new dataset composed with the centroid of each cluster, and a set of boundary samples selected according to their distance from the centroid. Reducing the number of used samples will enhance significantly the learning performances, and reduce the training time and space requirement, without great loss of the information handled by the resulting set, due to its specific distribution. The Figure.2 illustrates an example of the application of this selection schema to a 2-dimentional dataset. So, K-Means is an iterative calculation in which it limits the whole of separations from each article to its bunch centroid, overall groups. Give us a chance to consider a picture with a goal of  $x \times y$  and the picture must be group into k number of bunches. Let  $p(x, y)$  be an info pixel to be bunch and  $ck$  be the group focuses. The calculation for k-means grouping is following as:

An illustrative example on the application of the proposed method to a 2-dimensional training set: (a) initial distribution, (b) selected samples after clustering.

The number of fixed clusters (the  $k$  parameter) can be varied to specify the coverage repartition of the samples. The number of selected samples for each class is also a parameter of the selection algorithm. Then, for each class, we specify the number of samples to be selected according to the class size. When the clustering is achieved, samples are taken from the different obtained clusters according to their relative intraclass variance and their density (the percentage of samples belonging to the cluster). The two measurements are combined to compute a coverage factor for each cluster. The number of samples taken from a given cluster is proportional to the computed coverage factor. Let  $A$  be a given class, to which we want to apply the proposed approach to extract  $S$  sample. Let  $k$  be the number of clusters fixed to be used during the  $k$ -means clustering phase. For each generated cluster  $cli$  ( $i: 1..k$ ), the relative variance is computed using the following expression:

$$Vr(cli) = \frac{\frac{1}{Card(cli)} * \sum_{x \in cli} dist(x, ci)}{\sum_{j=1}^k \left[ \frac{1}{Card(cli)} * \sum_{x \in cli} dist(x, cj) \right]} \quad (4.1)$$

When  $Card(X)$  give the cardinality of a given set  $X$ , and  $dist.(x,y)$  give the distance between the two points  $x$  and  $y$ . Generally, the distance between two points is taken as a common metric to assess the similarity among the components of a samples set. The most commonly used distance measure is the Euclidean metric which defines the distance between two points  $x=(p1, \dots, pN)$  and  $y=(q1, \dots, qN)$  from  $RN$  as:

$$Dist(x,y) = \sqrt{\sum_{i=1}^N (pi - qi)^2} \quad (4.2)$$

The density value corresponding to the same cluster  $cli$  is computed like the following:

$$Den(cli) = \frac{Card(cli)}{dxCard(A)} \quad (4.3)$$

The coverage factor is then computed by:

$$\text{Cov}(cli) = \frac{Vr(cli) + Den(cli)}{2} \quad (4.4)$$

We can clearly see that:  $0 \leq Vr(cli) \leq 1$  and  $0 \leq Den(cli) \leq 1$  for any cluster  $cli$ . So the coverage factor  $\text{Cov}(cli)$  belong also to the  $[0,1]$  interval. Furthermore, it is clear that:

$$\sum_{i=1}^k Vr(cli) = 1 \text{ and } \sum_{i=1}^k Den(cli) = 1 \quad (4.5)$$

We can so deduce easily that:

$$\sum_{i=1}^k \text{Cov}(cli) = 1 \quad (4.6)$$

Hence, the number of samples selected from each cluster is determined using the expression:

$$\text{Nu\_samples}(cli) = \text{Round}(s * \text{Cov}(cli)) \quad (4.7)$$

Using (8), the algorithm presented in the figure.3 will permit to select  $S$  sample from a class  $A$  clustered with the  $k$ -means algorithm into  $k$  cluster. The parameter  $\varepsilon$  serve to ensure that the selected samples are placed in separated regions, and are not duplicated. The choice of  $\varepsilon$ 's value depend on the size of the cluster. We have proposed the following heuristic expression to compute an approximate value of  $\varepsilon$ :

$$\varepsilon = \text{Max}_{x \in cli} (\text{dist}(xi, ci)) / 10 \quad (4.8)$$

This expression is only an approximate heuristic. No theoretic background was used to determine the value of  $\varepsilon$ . The performances of the expression were evaluated experimentally. Finally, the resulting set of samples is then used to train the neural network. When dealing with the intrusion detection problem, the proposed technique is applied only to the large classes. With the KDD99 dataset used in our experiments, the technique is

applied to the class: normal, Dos, Probe and R2l. The U2R class is very small according to the other classes mentioned, so the totality of its samples is used during the learning process. The illustrate the general operation schema of the proposed approach. Subset, the experiments show that the learning process is very hard and take hours and hours to converge. The Table.1 lists the class's distributions of our used sets.

Let A be the input class; k: the number of cluster; S: the number of samples to be selected ( $S \geq k$ ); Sam(i): the resulting selected set of samples for the cluster i; Out\_sam: the output set of samples selected from the class A; Candidates: a temporary array that contain the cluster points and their respective distance from the centroid. i,j,min,x: intermediates variables'; Meyerhold parameter.

1-Cluster the class A using the k-means algorithm into k cluster. 2-For each cluster cli (i:1..k) do { Sam(i) := {centroid(cli)}; j:=1; For each x from cli do { Candidates [j].point :=x; Candidates [j].location :=dist(x, centroid(cli)) ; j:=j+1 ;}; Sort the array Candidates in descending order with respect to the values of location field; j:=1; While((card(Sam(i)))  $\epsilon$ ) then Sam(i):=Sam(i)  $\cup$  {Candidates[j].point}; j:=j+1; } if card(Sam(i)) < Num\_samples(cli) then repeat {Sam(i):=Sam(i)  $\cup$  Candidates[random].point }until (card(Sam(i)) = Num\_samples(cli)); 3-For i=1 to k do Out\_sam:=Out\_sam  $\cup$  Sam(i) [43].

## 5. EXPERIMENTAL RESULTS

In this thesis that has been produced to show us the area of cancer or leukemia, firstly you have to run the application to input image that has been saved as shown in figure, after you doing selecting of a image from data. They accentuate or sharpens image attributes for example borders, limits, or distinction to produce a display this is certainly graphic ideal for display and review after that the image will be processed to gray conversion and segmentation image method to evaluate the graphics and certainly will feel described as a processing strategy used to identify or cluster a graphic into several disjoint sections by grouping the pixels to make an area of homogeneity using the pixel traits like grey amount, . Geometrical Feature, Texture Features, Color Features, and Statistical Features other services. Also, there is have an extraction feature variable of leukemia cancer image.so in the result will show for us is there have cancer or not from the application. Figure 5.1 shows implemented cancer detection.

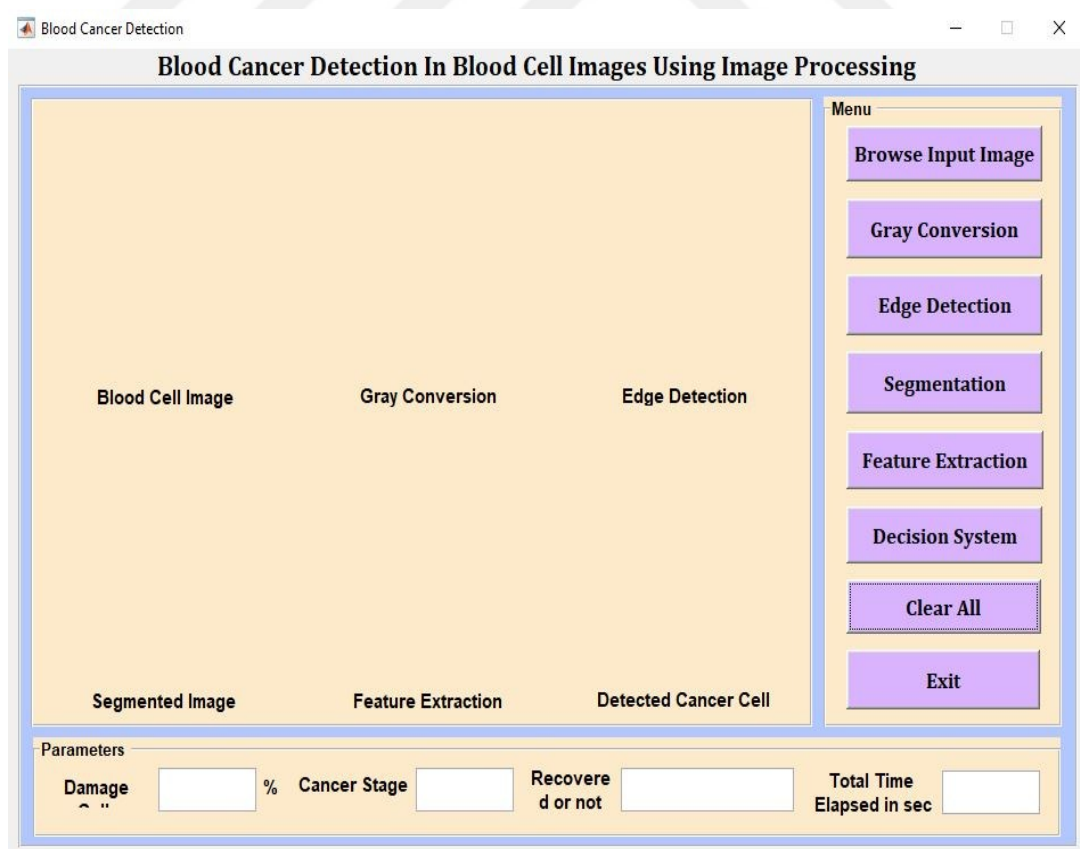


Figure 5.1. Implemented Cancer Detection Program

## 5.1. Input Image

Step one to select an image of MATLAB program cancer detection in the blood cell image as. Figure 5.2 shows input image form.

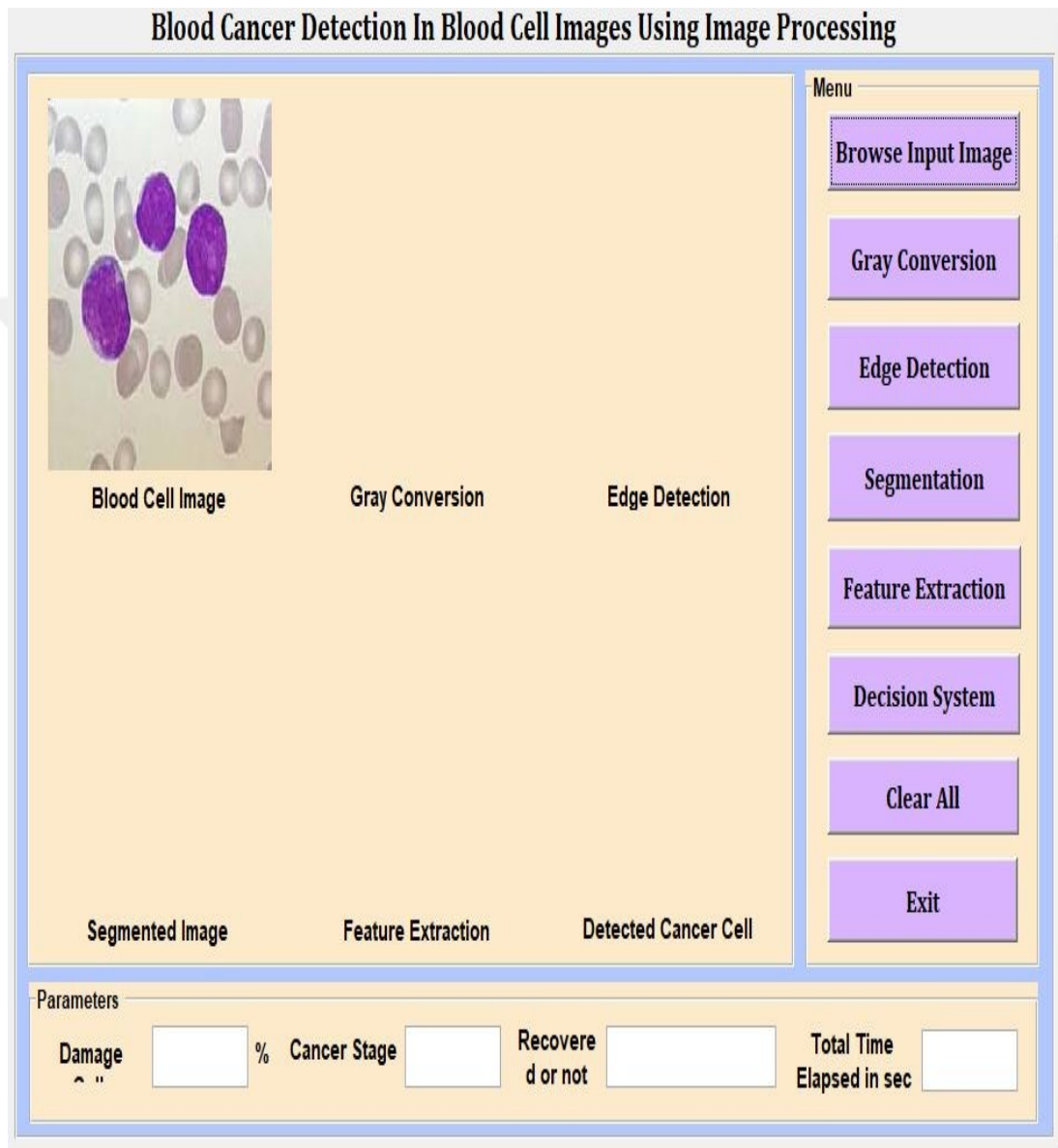


Figure 5.2. Input Image

## 5.2. Gray Conversion

Conversion to Gray Scale: A grayscale image is supposed to contain only 'Gray' color where the red, green and blue color components are said to have same intensity values and so processing becomes flexible when we specify only a single intensity value for each pixel, instead of taking three intensity values needed to be specified for each pixel in a color image. Microscopic images are found to possess the primary colors (RGB). So, for further processing, it must be converted to grayscale. Figure 5.3 shows depicts original image convert to Gray conversion.

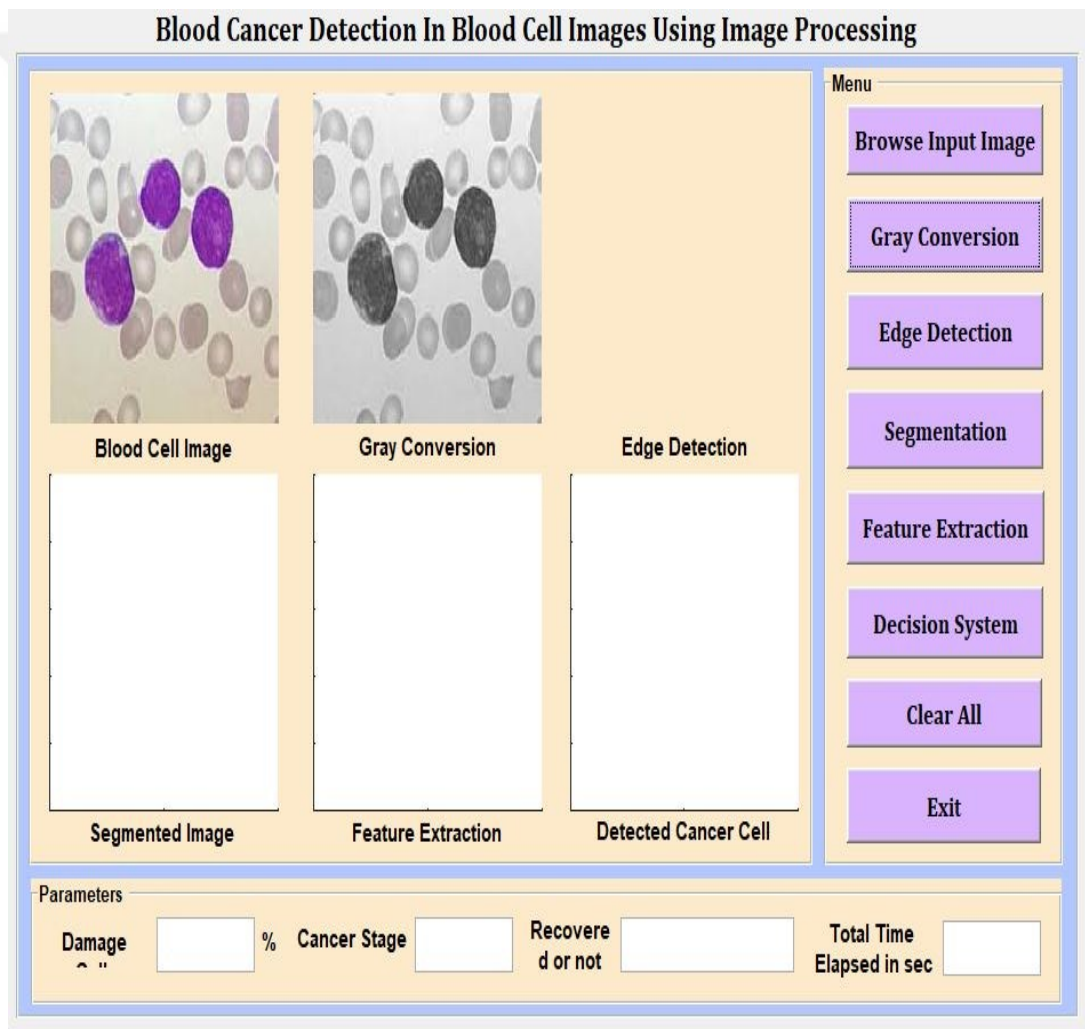


Figure 5.3. Gray Conversion Operation

### 5.3. Edge Detection

Edge identification assumes a critical job in different applications in picture handling, object acknowledgment, and machine vision. The term edge discovery is characterized as the procedure used to distinguish and find the sharp discontinuities in advanced pictures, for example, the photometrical pictures, physical and geometrical portions or locales. The objective of edge location is to perceive the presence of edges or limits in a picture through confining the pixels that show the sudden changes or discontinuities in the power of a picture. It gives methods for examining and restricting the ideal edge highlights to get significant data in the investigation of a picture. Edges are a lot of associated pixels that lie on the limits between a covering object and the foundation of the picture. Figure 5.4 shows convert of gray conversion to edge detection

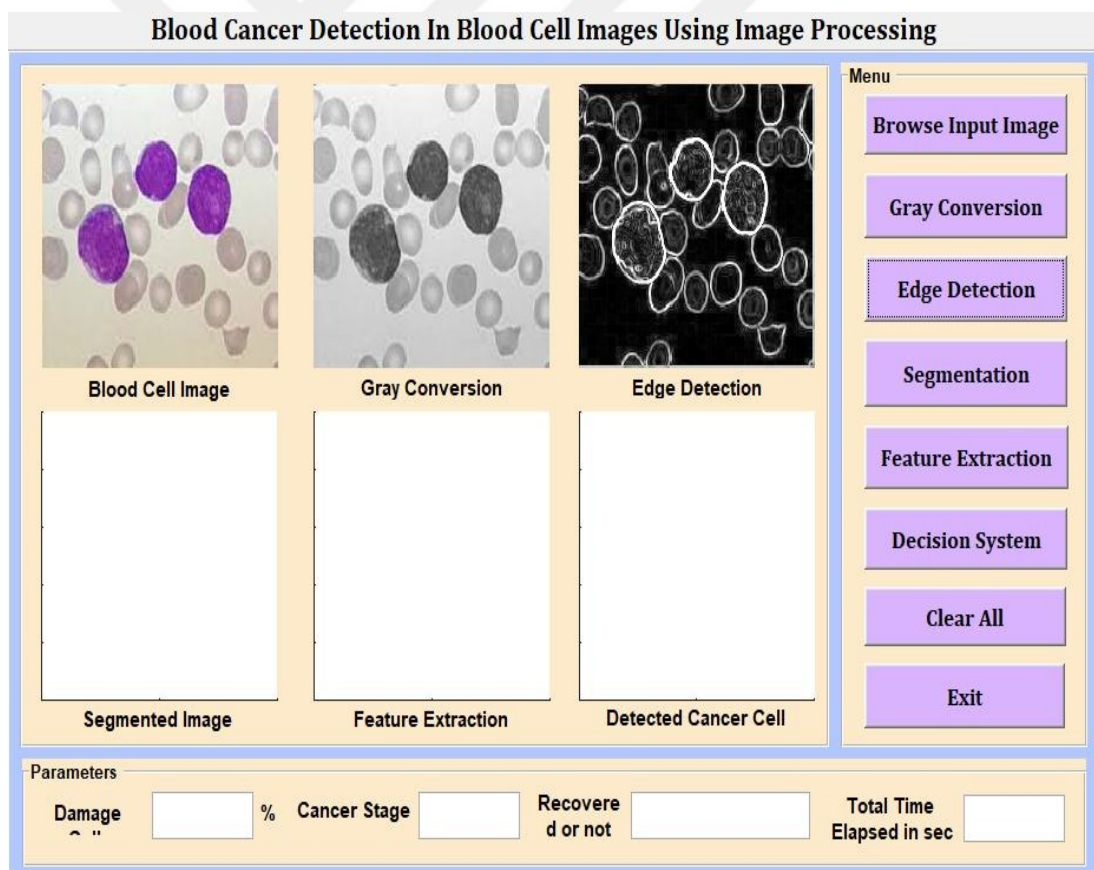


Figure 5.4. Edge Detection Operation

## 5.4. Segmentation

The point of the picture division is a parcel of a picture into numerous fragments. In this specific case, the picture division parcels the white platelet (WBC) from RBCs and plasma in the blood test picture. The picture division procedure is a hot territory of research in the field of Image Processing. A great deal of research work has been done on picture division and there are diverse division calculations however no single calculation will be appropriate for various sorts of pictures. Along these lines, therefore, a calculation intended for one specific picture can't be connected for another kind of picture. Consequently, building up a solitary division strategy for various pictures still remains an evolving work. A programmed picture Segmentation procedure which gives precise outcomes and which devours less time particularly for therapeutic pictures can help in sparing a real existence by right on time a discovery of illness and early treatment spared as appeared in figure. Figure 5.5 shows segmentation process.

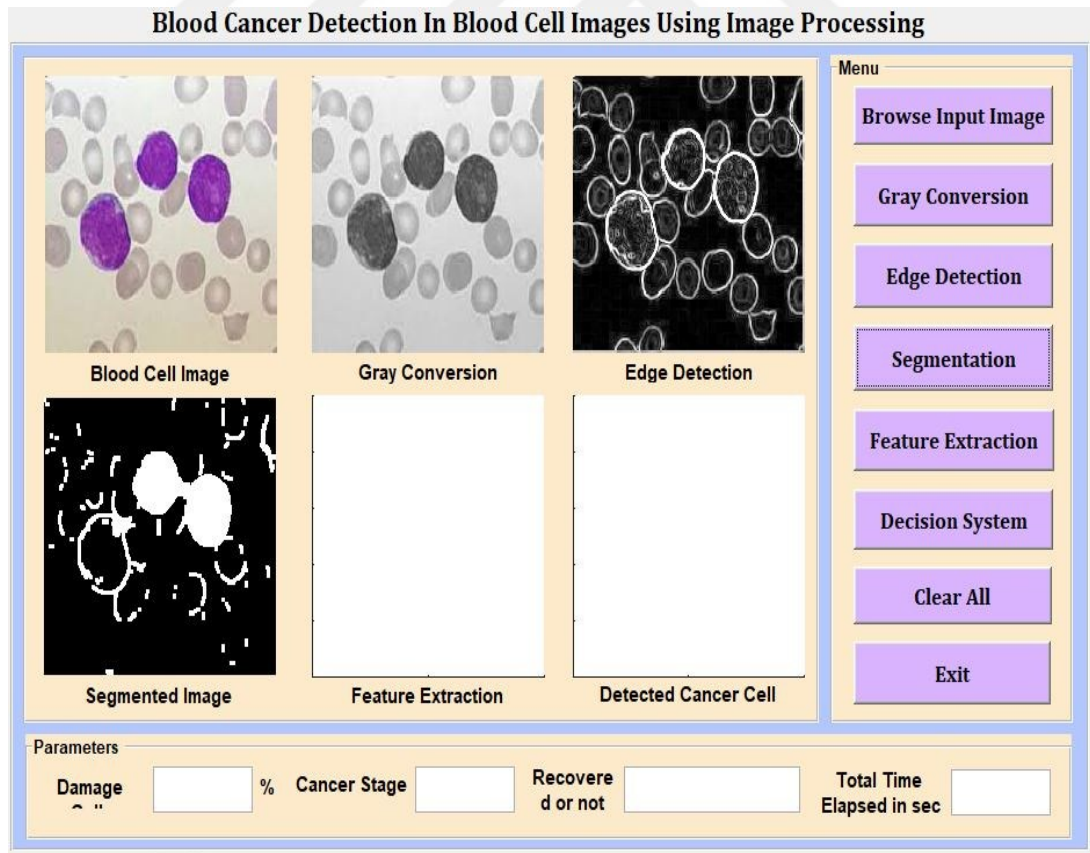


Figure 5.5. Segmentation image operation

## 5.5. Feature Extraction

Feature extraction is the procedure that separates the wants highlights from the pre-handled pictures that contain various irregularities. The distinctive highlights of the picture can be estimate, shape, organization, area and so on. Figure 5.6 shows future extraction form.

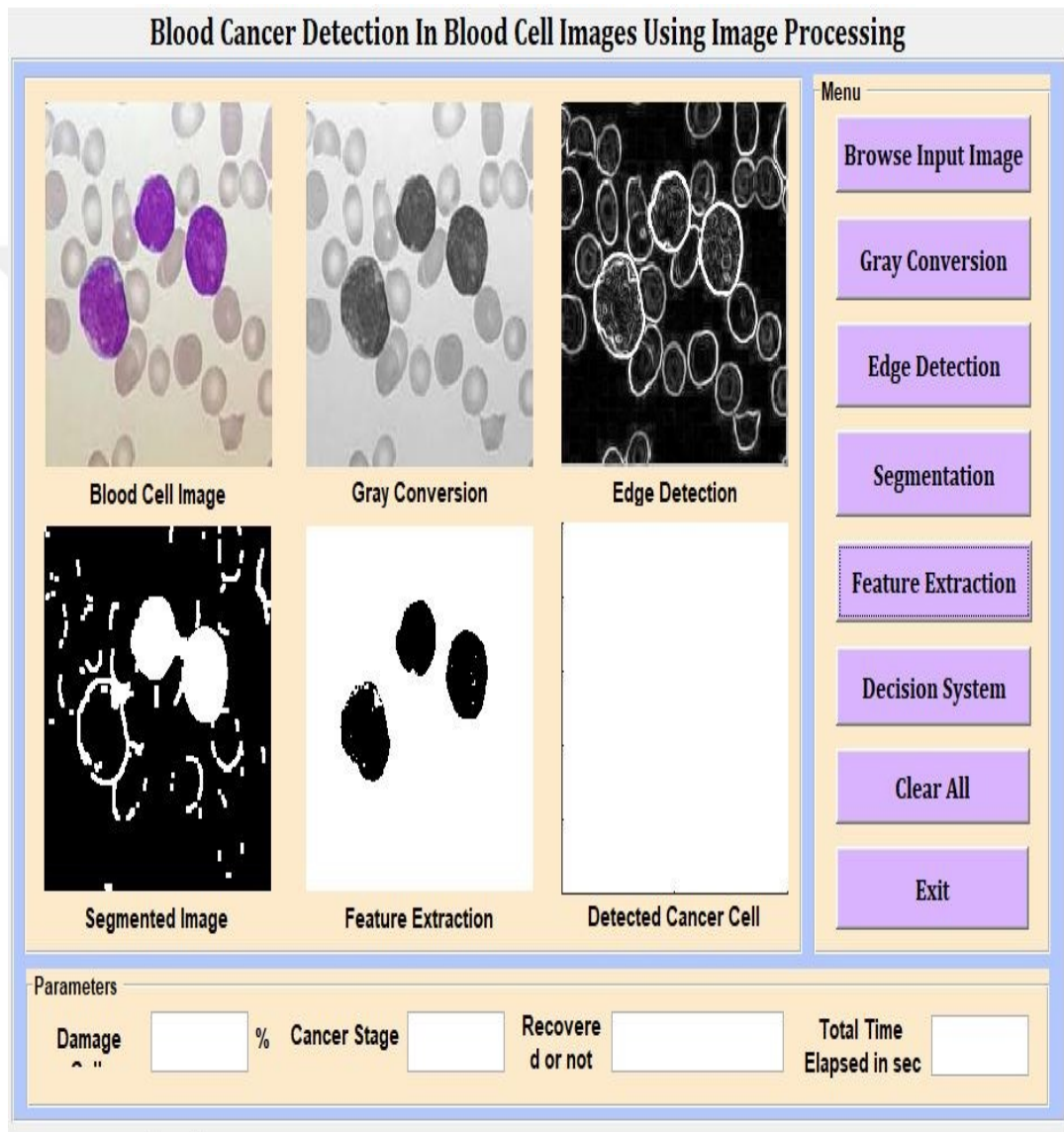


Figure 5.6. Feature Extraction image Operation

## 5.6. Detection System

At this stage, we select an all processing image that has gray conversion and the and edge detection and segmentation and feature extraction program gave us contrast .and these steps convert the image to give result about image select the original image the first one is the decision system from the original and take new result. Figure 5.7 shows convert of Future extraction to detection system.

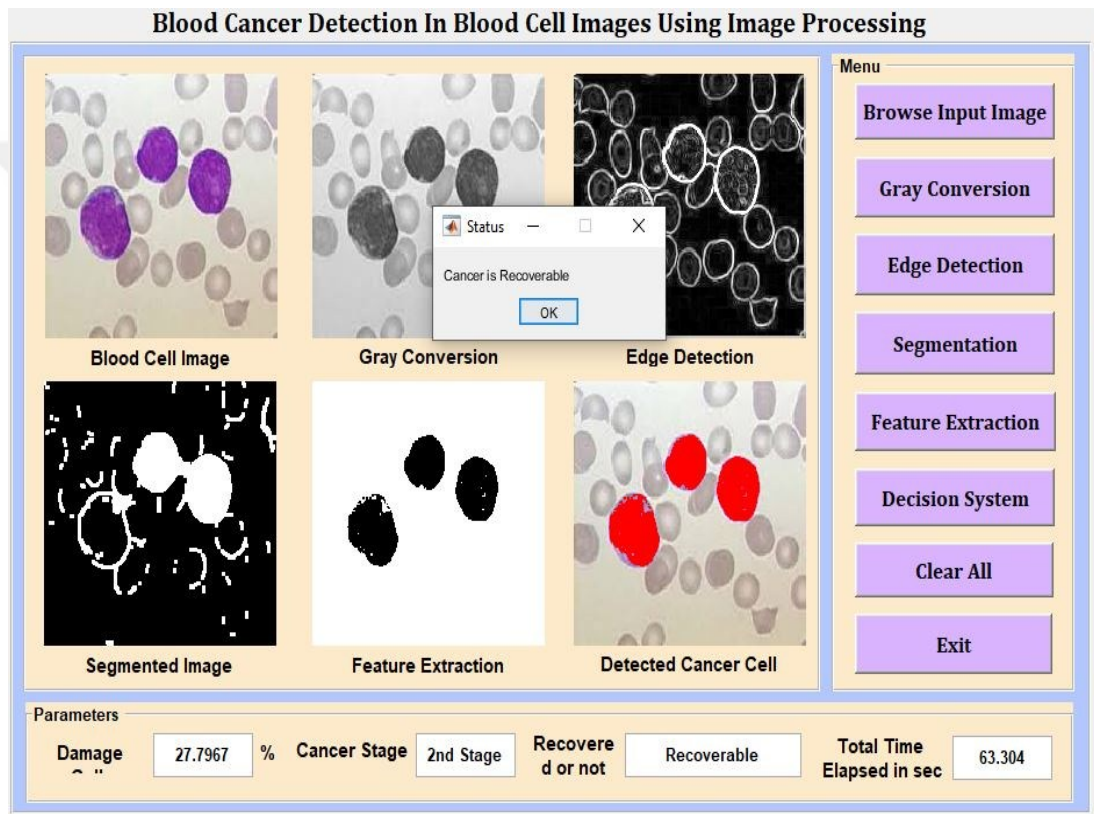


Figure 5.7. Detection System Operation

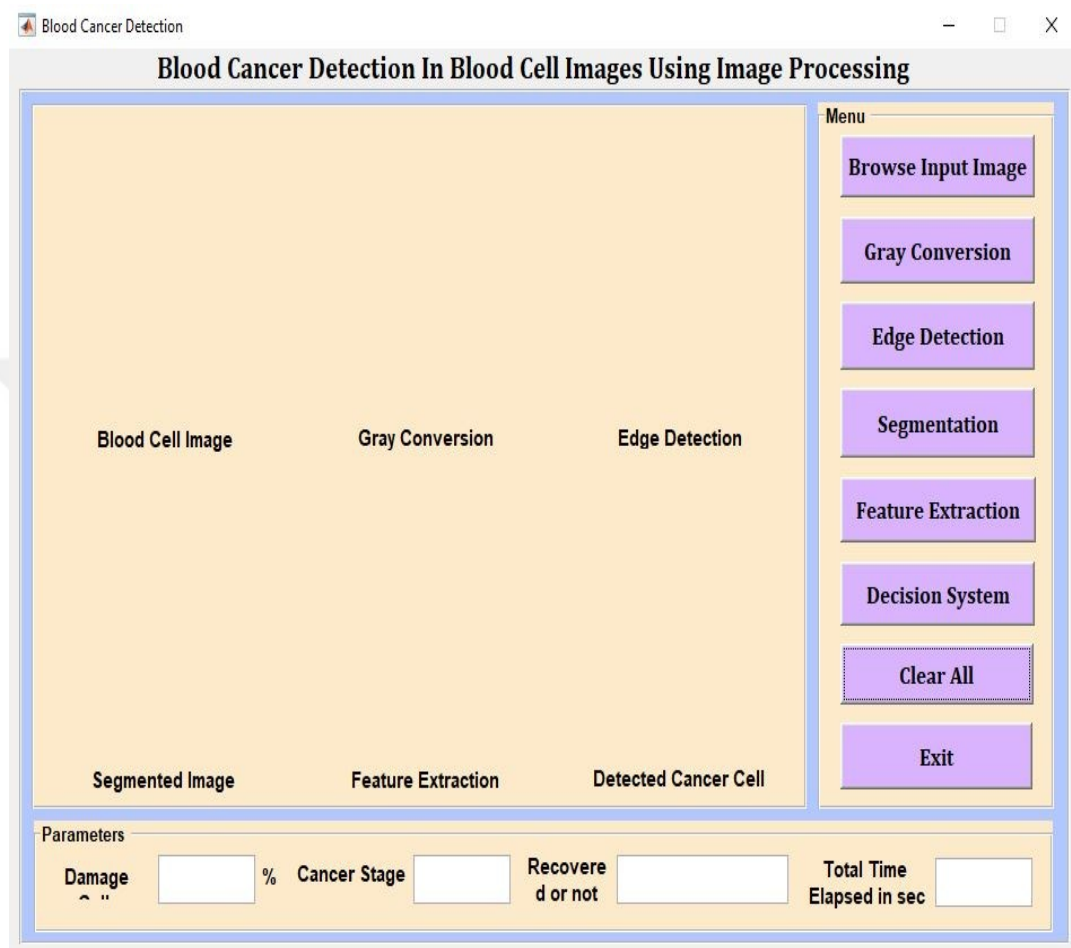
Table 5.1. Parameter Output

Damage	Cancer stage	Recovered or not	Total time
33.83	2 <sup>nd</sup> stage	Recoverable	3.06
23.33	2 <sup>nd</sup> stage	Not recoverable	3.56

Table 5.1. Shows parameter output t damage 33.83 of any image cancer stage second stage and total time 3.06 is resulted is Recoverable. And second image shown to damage 23.33 cancer stage second stage is not recoverable and total time 3.56.

## 5.7. Clear All Step

This step to use clear all operations. Figure 5.8 shows clear all operations.



**Figure 5.8.** Clear steps

Some of the issues that must be settled about platelets are blood sample itself. Because of ecological weights, cells get disfigured to discretionary shapes, Because of maladies covered cells may get joined. This issue of covering can be overwhelmed by the watershed strategy. Another issue with respect to platelets is a gathering of information since gathering more examples isn't a simple undertaking. Sifting and disposal of undesirable particles from the cell area. All the previously mentioned issues must be considered while structuring a framework. In this way, an automatic image analysis system has to be developed to measure morphologic parameters and the evaluation of cervical cells.

## 6. CONCLUSION

This thesis incorporates perceiving the sorts of leukemia using minute blood test pictures. The system will be worked by using features in minute pictures by taking a gander at changes in surface, geometry, shades and real examination as a classification input. The structure would be compelling, strong, fewer dealing with time, tinier screw-up, high precision, more affordable cost and ought to be solid towards collections that exist in an individual, illustration gathering traditions, time et cetera. This examination contains the location of blood malignant growth cells and grouping of the kinds of leukemia from tiny picture tests utilizing picture handling. The proposed technique extricates the highlights in infinitesimal pictures by inspecting changes on different parameters like surface, geometry, hues, and measurable investigation input. The framework ought to have high dependability, precision, and adequacy, less handling time, littler mistake, less expense and should be powerful. Early recognizable proof of leukemia yields in giving the fitting treatment to the patient. Information expelled from tiny pictures of blood tests can benefit people by predicting in, unwinding and treating blood diseases instantly for a particular patient.

## REFERENCES

- [1] **Refael Gonzalez, Richard E. Woods**, “Digital Image Processing”, Pearson Edition Asia, 2nd Edition, 2002. J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.
- [2] **Stanislaw Osowski, Tomasz Markiewicz, Bozena Marianska, Leszek Moszczyński** “Feature generation for the cell image recognition of myelogenous leukemia”.
- [3] **C.D., Ruberto, A., Dempster, S., Khan, B., Jarra**, “Analysis of Infected Blood Cell Images Using Morphological Operators”, Image and Vision Computing, Vol. 20, 2002, pp. 133-146.
- [4] **F. Scotti**, “Automatic morphological analysis for acute leukemia identification in peripheral blood microscope images,” in Proc. CIMSA, 2005, pp. 96–101.
- [5] **Mohapatra, S.; Samanta, S.S.; Patra, D.; Satpathi, S.**; IPCV Lab., Nat.Inst. of Technol., Rourkela, India, “Fuzzy Based Blood Image Segmentation for Automated Leukemia Detection”, in Devices and Communications (ICDeCom), Pages 1-5. (2011).
- [6] **Monica Madhukar, Sos Agaian, Anthony.T.Chronopoulos**, “ New Decision Support Tool for Acute Lymphoblastic Leukemia Classification”, Image Processing: Algorithms and Systems X; Proc.SPIE 8295,(2012).
- [7] **H. Ramoser, V. Laurain, H. Bischof, and R. Ecker**, “Leukocyte segmentation and classification in blood-smear images,” in Proc. IEEE EMBS, 2006, pp.3371–3374.
- [8] **G. Ongun, U. Halici, K. Leblebicioglu, V. Atalay, M. Beksac, and S. Beksac**, “Feature extraction and classification of blood cells for an automated differential blood count system,” in Proc. IJCNN, 2001, vol. 4, pp. 2461–2466.
- [9] **W., Wongseree, N., Chaiyaratana**, “Thalassaemic Patient Classification Using a Neural Network and Genetic Programming”, IEEE, 2003, pp. 2926-2931.
- [10] **W. Shitong, K. F. L. Chung, and F. Duan**, “Applying the improved fuzzy cellular neural network IFCNN to white blood cell detection,” Neurocomputing, vol. 70, no. 7–9, pp. 1348–1359, Mar. 2007.

- [11] **T. Markiewicz, S. Osowski, B. Marianska, L. Moszczynski**, “Automatic Recognition of the Blood Cells of Myelogenous Leukemia Using SVM” Proceedings of International Joint Conference on Neural Networks, Montreal, Canada, July 31 – August 4, 2005, pp. 2496-2501.
- [12] **Ms. Minal D. Joshi and Prof. A.H.Karode**, “Detection of acute leukemia using white blood cells segmentation based on blood samples”, IJECET Volume 4, May June, 2013.
- [13] **S. Haykin**, “Neural networks, comprehensive foundation”, Prentice Hall, New Jersey, 1999 [2] H. Hengen, S. Spoor, M. Pandit, “Analysis of blood & bone marrow smears, SPIE Med. Imag., San Diego, 2002 [3] K. Lewandowski, A. Hellmann, “Haematology atlas”, Multimedia Medical Publisher, Gdansk, 2001
- [14] **O. Lezoray, H. Cardot**, “Cooperation of color pixel classification schemes and color watershed”, IEEE Trans. Image Processing, vol. 11, pp. 783-789, 2002 [5] O. L. Mangasarian, P. Lagrangian, “Support Vector Machines”, Journal of Machine Learning, 161-177, 2001
- [15] **P. Soile**, “Morphological image analysis, principles and applications”, Springer, Berlin, 2003
- [16] **V. Vapnik**, “Statistical Learning Theory”, Wiley, N.Y., 1998 .
- [17] T. Wagner, “Texture analysis” ( in Jahne, B., Haussecker, H., and Geisser P., (Eds.), Handbook of Computer Vision and Application), Academic Press, pp. 275-309, 1999.
- [18] **W. Wolberg, W. N. Street, O. L. Mangasarian**, “Machine learning to diagnose breast cancer from image-processed features”, Rep. of Uni. Wisconsin, 1994 .
- [19] Matlab user manual – Image processing toolbox, MathWorks, Natick, 1999.
- [20] **C.R., Valencio, M.N., Tronco, A.C.B., Domingos, C.R.B.**, “Knowledge Extraction Using Visualization of Hemoglobin Parameters to Identify Thalassemia”, Proceedings of the 17th IEE Symposium on Computer Based Medical Systems, 2004, pp.1-6.
- [21] **R., Abdullah, M.Y., Masher, N.F.M, Nasir, H., Rosline, H., Mahsin, H., Adilah**, “Blood Cell Image Segmentation: A Review”, Biomed2008, Proceedings 21, 2008, pp. 141-144.

- [22] **N., Ritter, J., Cooper,** “Segmentation and Border Identification of Cells in Images of Peripheral Blood Smear Slides”, 30th Australasian Computer Science Conference, Conference in Research and Practice in Information Technology, Vol. 62, 2007, pp.161-169.
- [23] **D.M.U., Sabina, L.D.F., Costa, L.D.F., E.G., Rossetti, M.A., Sago,** “A Texture Approach to Leukocyte Recognition”, Real Time Imaging, Vol. 10, 2004, pp. 205-206.
- [24] **M.C., Colunga, O.S., Siordia, S.J., Maybank,** "Leukocyte Recognition Using Algorithm", MICAI 2009, LNAI 5845, Springer Verlag Berlin Heidelberg, 2009, pp.545-555.
- [25] **K.S., Srinivisan, D., Lakshmi, H., Ranganathan, N., Gunasekaran,** “NonInvasive Estimation of Hemoglobin in Blood Using Color Analysis”, 1st International Conference on Industrial and Information System, ICIIS 2006, Sri Lanka, 8 – 11 August 2006, pp 547-549.
- [26] **W., Shifting, W., Min,** “A new Detection Algorithm (NDA) Based on Fuzzy Cellular Neural Networks for White Blood Cell Detection”, IEEE Transactions on Information Technology in Biomedicine, Vol. 10, No. 1, January 2006, pp. 5-10.
- [27] **H., Shin, M.K., Markey,** “A Machine Learning Perspective on the Development of Clinical Decision Support System Utilizing Mass Spectra of Blood Samples”, Journal of Biomedical Informatics 39. 2006, pp. 227-248.
- [28] **M., Chitsaz, C., S., Woo,** “Software Agent with Reinforcement Learning Approach for Medical Image Segmentation”, Journal of Computer Science and Technology, Vol. 26, No. 2, 2011, pp. 247-255.
- [29] National Cancer Institute, <http://www.cancer.gov/cancertopics/wyntk/leukemia> [3 October 2011].
- [30] Through the Microscope: Blood Cells– Life’sBlood .<http://www.wadsworth.org/chemheme/heme> [3 October 2011].
- [31] **T., Bergen, D., Stickman, T., Wittenberg, T., Zerfab,** “Segmentation of leukocytes and erythrocytes in Blood Smear Images”, 30th Annual International IEEE EMBS Conference, Vancouver, Canada, August 20 - 24, 2008, pp.3075-3078.

- [32] **S. Osowski, R., Siroic, T., Mickiewicz, K., Siwek**, “Application of Support VectorMachine and Genetic Algorithm for Improved Blood Cell Recognition”, IEEE Transaction Son Instrumentation and Measurement, Vol.58, No. 7, July 2009, pp. 2159-2168.
- [33] **C.D., Ruberto, A., Dempster, S., Khan, B., Jarra**, “Analysis of Infected Blood Cell Images Using Morphological Operators", Image and Vision Computing, Vol. 20, 2002, pp. 133-146.
- [34] **W., Wongseree, N., Chaiyaratana**, “Thalassa emic Patient Classification Using aNeural Network and Genetic Programming”, IEEE, 2003, pp. 2926-2931.
- [35] **F.B., Tek, A.G., Dempster, I., Kale**, “Parasite Detection and Identification for Automated Thin Blood Film Malaria Diagnosis", Computer Vision and Image Understanding, Vol. 114, 2010, pp. 21-32.
- [36] **Y.M., Hirimutugoda, G., Wijayarathna**, “Artificial Intelligence-Based Approach for Determination of Hematologic Diseases”, IEEE, 2009.
- [37] **S., Mohapatra, D., Patra, S., Satpathi**, “Image Analysis of Blood Microscopic Images for Leukemia Detection”, International Conference on Industrial Electronics, Control and Robotics, IEEE, 2010, pp. 215-219.
- [38] **N., H., A., Halim, M., Y., Mazhar, R., Hassan**, “Automatic Blasts Counting for Acute Leukemia Based on Blood Samples", International Journal of Research and Reviews in Computer Science, Vol. 2, No. 4, August 2011, pp. 971-976.
- [39] **F., Sahba, H., R., Tizhoosh, M., M., A., Salama**, 2006. “A Reinforcement Learning Framework for Medical Image Segmentation", International Joint Conference on Neural Networks, Vancouver, Canada, July 16 -21,2006, pp. 511-517.
- [40] **C.R., Valencio, M.N.,Tronco, A.C.B.,Domingos,C.R.B.**, “Knowledge ExtractionUsing Visualization of Hemoglobin Parameters to Identify Thalassemia”,Proceedings of the 17th IEE Symposium on Computer Based Medical Systems, 2004, pp.1-6.
- [41] **R., Adollah, M.Y., Mashor, N.F.M, Nasir, H., Rosline, H., Mahsin, H.,Adilah**, “Blood Cell Image Segmentation: A Review”, Biomed2008, Proceedings 21, 2008, pp. 141-144.

- [42] **N., Ritter, J., Cooper,** “Segmentation and Border Identification of Cells in Images of Peripheral Blood Smear Slides”, 30th Australasian Computer Science Conference, Conference in Research and Practice in Information Technology, Vol. 62, 2007, pp. 161-169.
- [43] **D.M.U., Sabino, L.D.F., Costa, L.D.F., E.G., Rizzatti, M.A., Zago,** “A Texture Approach to Leukocyte Recognition”, Real Time Imaging, Vol.10, 2004, pp. 205-206.



## CURRICULUM VITAE

Jahwar Yousif Arif

- **Born:** May 31 1988, Zakho/Duhok/Iraq
- **Marital status:** Married
- **Address:** Zakho, Duhok
- **E-mail:** [jahwar.arif@uoz.edu.krd](mailto:jahwar.arif@uoz.edu.krd)
- **Language:** Kurdish (mother tongue), Arabic, English



### • **Qualification:**

BSc (Computer Science) Dep/College of Science, University of Zakho/ZAHKO

### • **Employment**

2017 Up to Now Master Student Computer Engineering/ University of Firat