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LEUKAEMIA DIAGONSIS USING TONGUE IMAGE ANALYSIS

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ABSTRACT

Leukaemia occur when lot of abnormal white blood cells produced by the bone marrow. Hematologist makes use of microscopic study of human blood , which leads to need of methods, including microscopic color imaging, segmentation classification and clustering that can allow identification of patients suffering from Leukaemia. The microscopic image will be examined visually by hematologist and the process is time consuming. The proposed method uses the microscopic image to perform bilateral filtering and cellular automata. Image is segmented based on color codes and analyzed. This method can overcome the constraints in existing system.

Index terms: cellular automata, bilateral filtering
Hematologist

INTRODUCTION

The term disease implies discomfort, or absence of ease within the body. Whenever the normal functioning of the body or any of its part becomes impaired, diseases occur and may require medical treatment. In general, diseases can be classified on the basis of their cause and cell of origin i.e. infectious, immunological, endocrine, genetic, neoplastic, and traumatic etc. Physicians across the globe are interested in understanding the biology of a diseases, and how it can be prevented, or treated. Among all diseases the quest for understanding cancer, a malignant neoplastic disorder is in the research forefront for several investigators including biologists, clinicians, and chemists. It can be defined as several groups of diseases, each with its own rate of growth, diagnosis, treatment, and cure. However all cancers are characterized by uncontrolled growth of abnormal cells, invade surrounding tissues, metastasize (spread to distant sites), and eventually killing the host where it originates . Cancer can develop in individuals of any race, gender, age, socioeconomic status, or culture and can involve any type of cells, tissues or organs of the human body. Globally cancer is the second leading cause of death, after cardiovascular diseases and 12.7 million people are diagnosed with cancer out of which 7.6 million deaths occurred in the year 2008 itself . As per American Cancer Society a total of about 1,660,290 new cancer cases and 580,350 cancer deaths are projected to occur in the United States in 2013 . Although these figures are based on American cancer registries and confined to the United States, proportional statistics are also expected for other countries across the globe. Scientific evidence suggests that most of the cancers caused by infectious agents, smoking, heavy use of alcohol and obesity could be prevented. Moreover, early diagnosis through regular screening programs and removal of precancerous growth can provide complete cure in many cancers. Cancer mortality rate decreased by 1.8% per year in males and by 1.5% per year in females during the most recent 5 years due to the development in the field of diagnostic instrumentation, and progress in therapeutics..

LEUKAEMIA

Leukaemia also known as liquid cancer which develops from cells in the blood, bone marrow, and lymphatic system. It is different from other cancers as it does not produce solid masses or tumors. In leukaemia, the abnormal white blood cells flood the marrow, providing no room for red blood cells and platelets. This can affect a patient in several ways i.e. decrease in red blood cells can result with anemia, drop in platelet count decreases the clotting

ability of the blood. Moreover due to abnormal nature of white blood cells, they lack the ability to fight infections. The usual symptoms of leukemia include fatigue, frequent infections, and easy bruising and bleeding. Depending on the clinical course, leukemia disease can be preliminary classified as either acute with rapidly progressing disease with a predominance of highly Leukemia also known as liquid cancer which develops from cells in the blood, bone marrow, and lymphatic system. It is different from other cancers as it does not produce solid masses or tumors. In leukemia, the abnormal white blood cells flood the marrow, providing no room for red blood cells and platelets. This can affect a patient in several ways i.e. decrease in red blood cells can result with anemia, drop in platelet count decreases the clotting ability of the blood. Moreover due to abnormal nature of white blood cells, they lack the ability to fight infections. The usual symptoms of leukemia include fatigue, frequent infections, and easy bruising and bleeding. Depending on the clinical course, leukemia disease can be preliminary immature blast cells, or chronic which denotes slowly progressing disease with increased numbers of more mature cells [17]. However, additional classification of leukemia are developed to further identify differences in the response to treatment, prognosis and are based on the hematopoietic cell of origin i.e. myelocytic (myeloid) or lymphocytic (lymphoid).

A. FAB Classification

A group of seven French, American and British hematologists in 1976 formulated a classification of leukemia based on morphology and cytochemistry establishing a worldwide consistency in diagnosis [18]. As per FAB classification, there are three subtypes of ALL i.e. L_1, L_2, and L_3 and each has distinct blast morphology.

B. WHO Classification

The classification schemes by WHO requires additional evaluation of leukemic blasts by flow cytometric immunophenotyping, cytogenetics and molecular analysis [19]. Such methods provide significant information on the heterogeneity of ALL and have been very useful in the confirmative diagnosis, treatment and prognostic evaluation of ALL patients [20]. Based upon all the four (morphology, immunophenotyping, cytogenetics and molecular analysis)

Precursor B-lymphoblastic leukemia
Precursor T-lymphoblastic leukemia
Mature b-lymphoblastic leukemia

SYMPTOMS

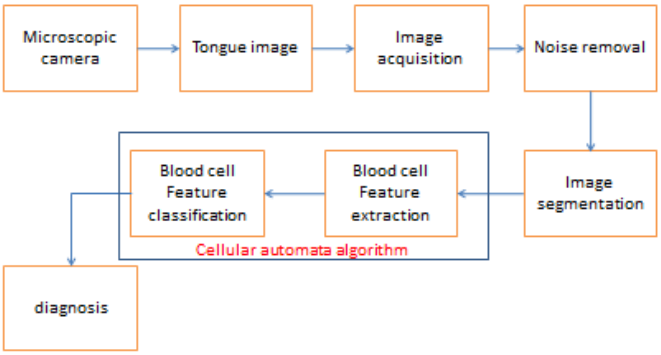
Symptoms	Signs
Fatigue	Lymphadenopathy
Fever	Hepatomegaly
Purpura and gum bleeding	Thrombocytopenia
Bone/ joint pain	Splenomegaly
Weight Loss	Sternal tenderness

AUTOMATED LEUKEMIA DETECTION

There have been a few studies done on the recognition and classification of leukemia blasts in the peripheral/bone marrow blood samples. The automatic detection and sub classification methods can be divided into two categories.

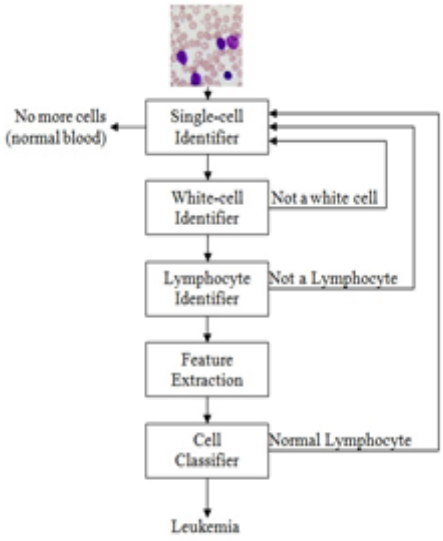
The first category uses the genetic information, fluid properties while the second category uses the perceptible information present in the blood microscopic images

BLOCK DIAGRAM



PROPOSED SYSYTEM

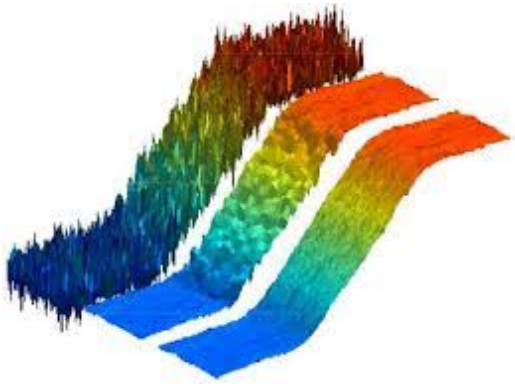
The proposed system will be on microscopic images to detect Leukaemia. The early and fast identification of Leukaemia greatly aids in providing the appropriate treatment. Initial segmentation is done using Statistical parameters such as mean, standard deviation which segregates white blood cells from other blood components i.e. erythrocytes and platelets. Geometrical features such as area, perimeter of the white blood cell nucleuses investigated for diagnostic prediction of Leukaemia.



BILATERAL FILTERING

The bilateral filter is a non-linear technique that can blur an image while respecting strong edges. Its ability to decompose an image into different scales without causing haloes after modification has made it ubiquitous in computational photography applications such as tone mapping, style transfer, relighting, and DE noising. This text provides a graphical, intuitive introduction to bilateral filtering, a practical guide for efficient implementation and an

overview of its numerous applications, as well as mathematical analysis. Its formulation is simple: each pixel is replaced by a weighted average of its neighbors. This aspect is important because it makes it easy to acquire intuition about its behavior, to adapt it to application-specific requirements, and to implement it. It depends only on two parameters that indicate the size and contrast of the features to preserve. It can be used in a non-iterative manner. This makes the parameters easy to set since their effect is not cumulative over several iterations.



BF[I] p = 1 Wp q∈S Gσs (||p − q||) Gσr (|Ip −Iq|)Iq

Wp = q∈S Gσs (||p − q||) Gσr (|Ip − Iq|).

Applications

DE noising This is the original, primary goal of the bilateral filter, where it found broad applications that include medical imaging, tracking, movie restoration, and more. We discuss a few of these, and present a useful extension known as the cross-bilateral filter. Texture and Illumination Separation, Tone Mapping, Retime, and Tone Management Bilateral filtering an image at several different settings decomposes that image into large-scale/small-scale textures and features. These applications edit each component separately to adjust the tonal distribution, achieve photographic stylization, or match the adjusted image to the capacities of a display device3D Fairing (Section 3.5): In this counterpart to image DE noising, bilateral filtering applied to 3D meshes and point clouds smooths away noise in large areas and yet keeps all corners, seams, and edges sharp.

De-noising

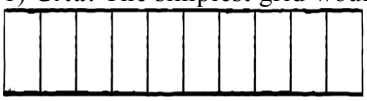
The bilateral filter has become a standard interactive tool for image de-noising. For example, Adobe Photoshop provides a fast and simple bilateral filter variant under the name “surface blur” (Figure 3.1). Instead of Gaussian functions, it uses a square box function as its spatial weight, and a “tent” (linear) function as the range weight. Unlike Gaussian convolution that smooths images without respecting their visual structures, the bilateral filter preserves the object contours and produces sharp results.

CELLULAR AUTOMATA

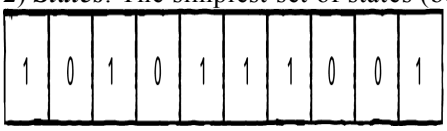
The development of cellular automata systems is typically attributed to Stanislaw Ulam and John von Neumann, who were both researchers at the Los Alamos National Laboratory in New Mexico in the 1940s. Ulam was studying the growth of crystals and von Neumann was imagining a world of self-replicating robots. That’s right, robots that build copies of themselves. Now consider a set of simple rules that would

allow that pattern to create copies of itself on that grid. This is essentially the process of a CA that exhibits behavior similar to biological reproduction and evolution.

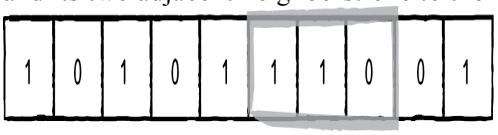
1) ***Grid***. The simplest grid would be one-dimensional: a line of cells.



2) ***States***. The simplest set of states (beyond having only one state) would be two states: 0 or 1

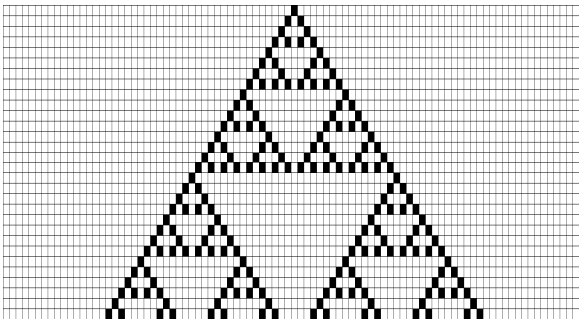


3) ***Neighborhood***. The simplest neighborhood in one dimension for any given cell would be the cell itself and its two adjacent neighbors: one to the left and one to the right.



CELL state at time t = f(CELL neighborhood at time t - 1)

```
b = zeros(sz);
    a = pad( a, 2, 2);
    for i=2:sz+1,
        for j=2:sz+1,
            w=a(i-1:i+1,j-1:j+1);
            s=sum(w(:))-a(i,j);
            if  (s>2 && s<8)
b(i-1,j-1)=1
```



After applying cellular automata

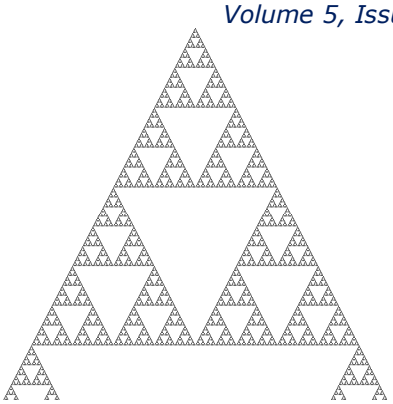
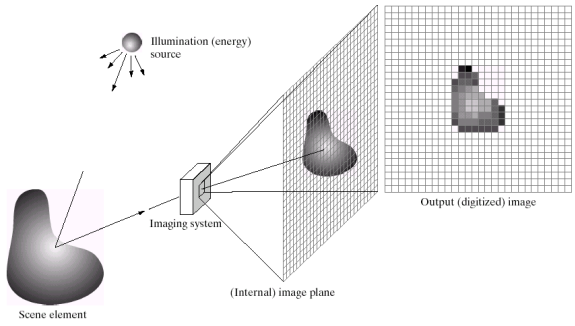


IMAGE AQUSIATION

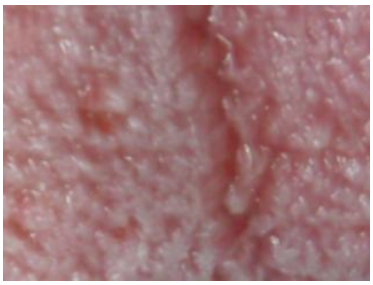
Digital imaging or digital image acquisition is the creation of photographic images, such as of a physical scene or of the interior structure of an object. The term is often assumed to imply or include the processing, compression, storage, printing, and display of such images

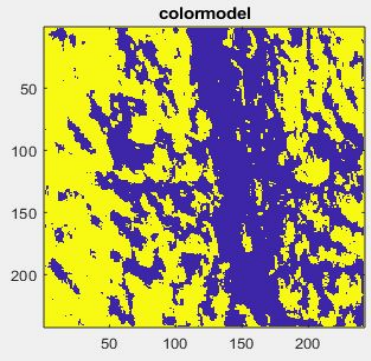


RESULTS

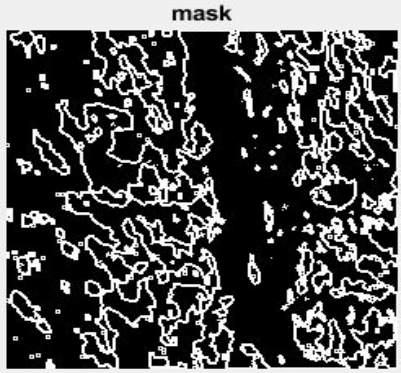
The acquired tongue image from the suspected patient is subjected to image segmentation based on RGB color model. First of all color model is obtained.

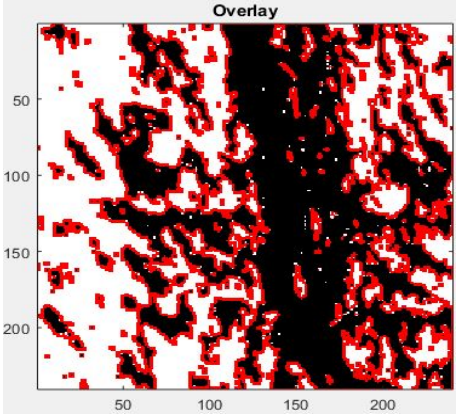
Normal image



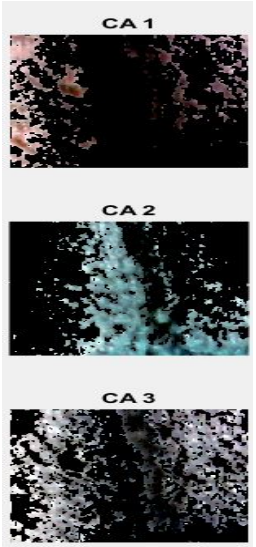


Color model highlights all elements in the image based on the program and cellular automata. Cellular automata see for similarities between the pixels and engulf them in accordance with criteria with we mentioned in program. Applying mask to image gives us a detailed expansion of the image and in depth of pixel.





Overlay of the below image enable us to get the image ready to perform cellular automata. We can clearly see the white dot inside the black area which tells us those area are not affected



Three iterations of CA is performed to attain stability in result

CONCLUSION

The main aim of this project is to diagnosis leukaemia in the early stages and avoid complication , also ensure blood free testing methodology nucleus segmentation followed by feature extraction to detect Leukaemia. Shape features of nuclei such as area, perimeter, etc. are considered for better accuracy of detection.

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