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Detection of leukemia using Machine Learning

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Abstract: The counting of blood cells plays a very important role in the health sector. The old conventional method used in hospital laboratories involves the manual counting of blood cells using a device called a hemocytometer. But this process is extremely monotonous and time-consuming, which leads to inaccurate results. In order to overcome these complications, this project presents an automated software solution, enriched with image processing and machine learning techniques, to detect and count the number of RBC, WBC, and platelet cells in the blood sample images and to classify diverse types of leukemia. This approach identifies various color feature statistics with geographical measures for machine learning centered on supervised learning.

Keywords: Counting of blood cell, Health sector, image processing, RBC, WBC, Platelets cells.

I. INTRODUCTION

Leukemia is a term for a group of blood cancers that commonly begin in the bone marrow and cause aberrant blood cell production in huge numbers. Blasts or leukemia cells are the term for these immature blood cells. A higher risk of infections as well as bone discomfort, weariness, and bleeding and bruising are possible symptoms. These symptoms are brought on by a deficiency of healthy blood cells. The diagnosis is typically made by blood tests or a bone marrow biopsy. The exact cause of leukemia is unknown. It is thought that a combination of environmental (non-inherited) and genetic variables are involved. Smoking, ionizing radiation, petrochemicals (including benzene), previous chemotherapy, and Down syndrome are risk factors. Additionally, those who have a family history of the disease are more vulnerable. The four main types of leukemia are acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL), and chronic myeloid leukemia (CML). Several less frequent varieties also exist. Cancers of the hematopoietic and lymphoid tissues, which include leukemias and lymphomas, are a more general classification of tumors that impact the blood, bone marrow, and lymphatic system. Treatment may involve some combination of chemotherapy, radiation therapy, targeted therapy, and a bone marrow transplant, in addition to supportive care and palliative care as needed. Watchful waiting may be used to treat some forms of leukemia. The success of treatment depends on the type of leukemia and the person's age. Outcomes have improved in the developed world. The five-year survival rate is 65% in the United States. Depending on the kind of leukemia, the five-year survival rate for children under 15 in first-world nations is more than 60% or even 90%. The likelihood of the disease returning is low in children with acute leukemia who are cancer-free after five years. Leukemia. The likelihood of the disease returning is low in children with acute leukemia who are cancer-free after five years.

II. RELATED WORK

Diagnosing Leukemia using Machine Learning Algorithms

Leukemia-related platelet production that occurs quickly and is odd and white. The high number of strange white platelets is not ready to battle contamination, and they impede the capacity of the bone marrow to create red platelets and platelets. Machine learning techniques are widely used in the diagnosis and classification of different leukemia types in patients. In this paper, we have described the different machine learning algorithms like support vector machines, k-nearest neighbor, neural networks, nave bayes, and deep learning algorithms that are used to classify leukemia into its sub-types and presented a comparative study of these algorithms cannot handle big datasets; works with numerical data.

A Brief Survey on Leukemia Detection Systems

Every year, over 9,00,000 individuals worldwide are diagnosed with leukemia, i.e., blood cancer, but many people are unaware of the dangers involved with such often incurable diseases. Most blood cancers are rare, life-threatening illnesses within limited patient populations; together, they account for 7% of all malignancies. Patients may feel abandoned and have difficulty finding the necessary assistance and information due to the complex and often sparse nature of leukemia. If treatment for acute leukemia is not started right once, the patient may pass away from the condition in a matter of

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months. Any sort of cancer must be identified early in order to receive prompt treatment and improve prognosis. Manual detection of leukemia in labs by medical personnel examining blood samples takes time and resources. Customarily, the patients suffering does not have the liberty to exhaust their time, as they need immediate care. We require systems that can utilize the most recent advances in artificial intelligence to deliver quicker and more precise outcomes. This is a survey paper focusing on some existing leukemia detection and categorization systems, surveys, and theses published by various individuals over the years using various techniques and algorithms under artificial intelligence. Without using classifiers such as support vector machine [SVM] classifiers, great results cannot be expected.

III. PROPOSED METHODOLOGY

In medical diagnosis, the complete blood count (cbc) is considered a significant aspect. This can be used to evaluate the health level of the person and detect disorders like leukemia. There are mainly three classifications of cells. Red blood cells (rbc), white blood cells (wbc), and platelets the abnormal count of cells can be used as an indication to detect the presence of disease in a person. When compared to the manual process, automated analyzers provide faster and more reliable count results, but they cannot count the abnormal cells and overlapped cells present in the blood image.

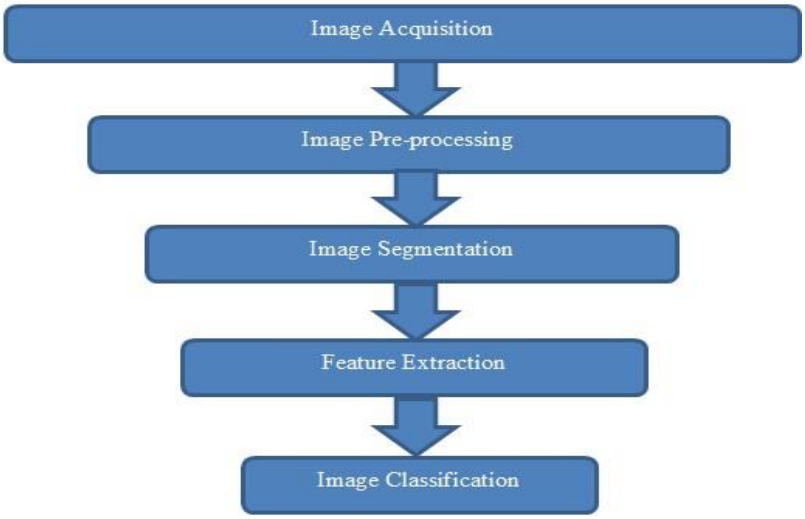

IMAGE ACQUISITION

A computer is connected to the digital microscope, and digital images of the microscopic objects are produced. Processed to remove superfluous noise and minor substances that are not measured as blood cells.

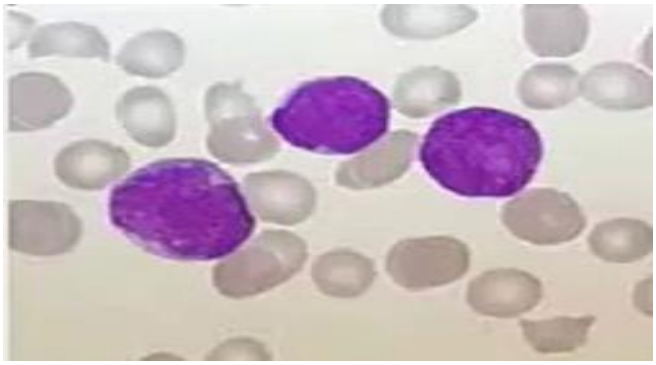

FIG: SAMPLE IMAGE OF CANCER CELLS IMAGE ENHANCEMENT

For better segmentation results of the blood cells, the obtained image must be enhanced. This is achieved with a few images processing techniques, including contrast adjustment, gray-scale conversion, edge detection, and spatial smoothing filtering.

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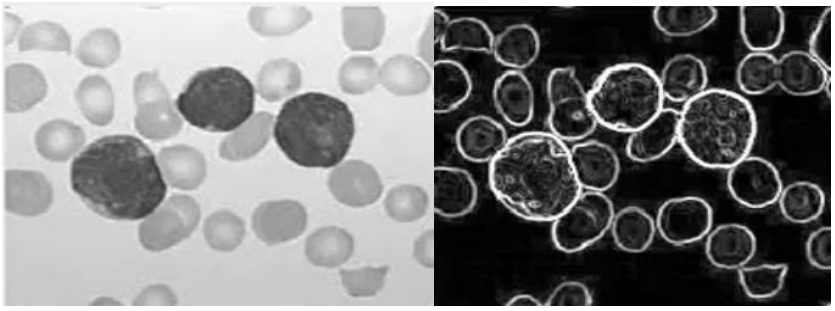

FIG: GREY-SCALE IMAGE FIG: EDGE DETECTION IMAGE

IMAGE SEGMENTATION

This process involves selecting the region of interest in the image. This term describes the region made up of blood cells. Circular hough transform is applied and not much of the image segmentation is needed because the applied transform looks only for the circular objects in the image.

FIG: SEGMENTED IMAGE

FEATURE EXTRACTION

Geometry, texture, and colour features are taken from the input image at the crucial step of feature extraction in order to classify the image. In the geometric features, the mean of area, diameter, radius, perimeter, eccentricity, and solidity.

FIG: FEATURE EXTRACTED IMAGE

DETECTION OF BLOOD CELLS

The circular hough transform searches for the blood cells in the image and then detects them. The "draw circle" feature circles the cells that have been recognized. Even the overlapped circles are detected.

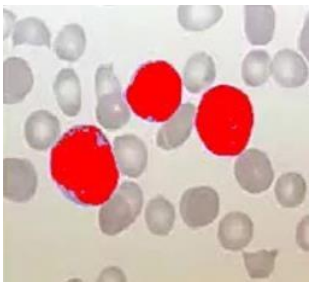

FIG: DETECTED CANCER CELL IN RED

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COUNTING CELLS

The total quantity of blood cells in the image can be determined by counting the drawn cells.

PERFORMANCE ANALYSIS

Although leukemia is considered a dangerous type of cancer, the recent advances and developments in diagnostic tools and treatment options have resulted in a cure rate of almost 70%.Precision, recall & accuracy the comparative analysis of detection using various classifiers is observable. The precision of a classification model is its ability to isolate the pertinent class. Recall is the ability of a classification model to find all the relevant cases within a dataset.

TABLE I COMPARISON MATRIX

Figures of Merit	CNN	FNN	kNN	SVM
Precision	96.67%	96%	96.61%	97.37%
Recall	100%	95.23%	90.47%	96.57%
Accuracy	98.33%	95.40%	93.30%	98.71%

IV. CONCLUSION

Detection of ALL and CLL from the dataset using image processing techniques followed by morphological feature extraction, which is the main theme of the project, The project mostly concentrates on measuring nucleus boundary irregularities using two methods, i.e., Hausdorff dimension and contour signature. Along with this, shape, color, and texture features are also considered for better detection accuracy.

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