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Simplified Stem Cell Differential: An Inexpensive Way of Classifying Type and Stage of Cancer

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Abstract--- *An automatic approach for stem cell detection and classification of diseases which happen to stem cells (RBC and WBC) is proposed. The proposed work comprises of planning and creating automated framework which will help the clinical experts in precisely distinguishing the sort and sub-kinds of the ailment. This strategy can be viably utilized in any asset poor condition by undeveloped individuals. Right now have taken minuscule blood images from a smartphone-microscope and are cautiously preprocessed to set them up for highlight extraction and further order. Notwithstanding this we have utilized four AI calculations to be specific lab shading space change, fluffy grouping, enlightening strong nearby paired example, dim level co-event lattice and probabilistic neural systems. After exhaustive perception it is noticed that PNN works better to recognize and order foundational cells liable for leukaemic malignancy. Combining the highlights separated from middle of the road layers, our methodology can possibly improve the general order execution. This mechanized leukemia recognition frame work is seen as progressively compelling, quick, precise and perfect than manual diagnosing strategies.*

Index Terms--- *Anemia, Feature Extraction, Gray Level Co-Occurrence Matrix, k-means Clustering, Lab Color Space Conversion, Leukaemia, Local Binary Pattern, Probabilistic Neural Networks, Cielab Colour Space Conversion.*

I. INTRODUCTION

Cancer is primary source of demise in India and over the world. Though there are many types of cancer, out of which blood cancer is proven to be more fatal, especially if detected in latter stages. It is very fatal because of the difficulty in diagnosing the disease as the symptoms are very normal like fever, loss of appetite and bone pain etc., there difficulty in diagnosing because in other types of cancer we have noticed tumors which can be detected in MRI or CT scans but blood cancer cannot be detected in such scans. Blood cancer starts in bone marrow and it spreads throughout the body through blood vessels. Sudden changes in DNA causes the WBC to divide abnormally. This sudden changes in DNA occur due to various reasons like carcinogenic agents like tobacco, too much amount exposure to benzene compounds, chemicals having carcinogens as their main compounds and also due to direct exposure of ultraviolet rays from sun.

Just the external piece of bone is extremely thick, inside it has springy bone which includes RBC, WBC, platelets, blood framing tissues, undifferentiated cells and fat cells. Undifferentiated cells are arranged into myeloids

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and lymphoids. Red Blood Cells are used to supply oxygen to every single other piece of the body, White platelets are utilized to battle against germs and Platelets are utilized for coagulating of blood if there should arise an occurrence of cuts or wounds. White platelets are characterized into five sorts in particular eusinophils, basophils, neutrophils, monocytes and lymphocytes. Malignant growth emerging because of lymphocytes is lymphoblastic and that emerging because of neutrophils is myelogenous. Since lymphocytes are created by Lymphoids of foundational or stem cells and every other cell in our body are produced by myeloids. Neutrophils and Lymphocytes contains around 90 % of WBC. On the off chance that the cell division is exceptionally quick, at that point it is Acute and if the cell movement is moderate it is Chronic. Contingent on intense or incessant Leukemia is ordered into Acute Lymphoblastic Leukemia, Acute Myelogenous Leukemia, Chronic Lymphoblastic Leukemia, and Chronic Myelogenous Leukemia.

Firstly Complete Blood Count (CBC) test is done to know the count of all the stem cells present in blood. If any abnormality is found then we go for Microscopic Images of blood. In-general to perform such tests we require high end machinery and resources, it cannot be performed in ambulances and resource poor areas like local clinics and hospitals. To overcome this difficulty Smartphone imaging platform is introduced by using a smart phone, microscope, optical filter, led and three-layered microfluidic paper design. This paper is comprised of fiberglass preloaded with Acridine orange in first layer for covering of entire blood into layer 2, Whatman GF/D borosilicate for catching the greater part of WBC in layer 2 and Whatman CH1 cellulose wicking cushions for pulling remaining (RBC and plasma) through the gadget by slender activity. This example is lit up by 466nm LED light and separated utilizing 500nm long pass channel. Blood tests are as often as possible utilized to assess the presentation of human wellbeing. Out of which CBC is increasingly clear test to measure and distinguish the platelet types. Here CBC is performed utilizing advanced mobile phone imaging stage where finger prick of blood i.e 1-4 µl of blood is gathered and dropped on the three-layered microfluidic paper plan. First layer has little micropores loaded up with acridine orange color, It scatters the applied blood test to give an in any event, covering of blood into layer 2. Layer 2 gathers a large portion of the WBC and remaining RBC and plasma are gathered by Layer3 through slim activity of wicking pad.

Now remove the second layer of three-layered microfluidic device and keep it under the smartphone imaging platform. Illuminate the second layer by 466nm LED light source and use an optical long pass filter of 500nm between smart phone microscope and Whatman GF/D layer. Now capture the image using smartphone and process it using Matlab.

II. RELATED WORK

Different strategies for robotized blood malignancy recognition dependent on minuscule pictures have been accounted for in the related works throughout the years. The creator Mohamadreza [1] proposed a strategy for programmed recognition of intense lymphoblastic leukemia dependent on broadening the multifractal highlights. For division of cores the creators utilized k-means and watershed calculations. For arrangement creators have utilized Support vector machine, it is seen that general outcomes speak to 99% exactness, 99% explicitness and 97% affectability.

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The author Komal Nain Sukhia [2] found a programmed and novel methodology for intense lymphoblastic leukemia arrangement. The proposed strategy includes pre-handling and division utilizing desire boost calculation, highlight extraction utilizing head segment investigation and characterization utilizing inadequate portrayal. It is seen that precision overperforms existing plans.

The author Rohit Agrawal [3] proposed a technique for recognition of White Blood Cell disease utilizing picture handling. The creators proposed technique comprises of planning and building up a strategy for mechanized framework which will help the clinical experts in accurately diagnosing the sort and sub kind of the infection. The creators have utilized the calculations like Gaussian dispersion, Otsu thresholding, GLCM and CNN. The general precision is seen to be 97.3%.

The author Sara Hosseinzadeh Kassani [4] proposed a half and half profound learning engineering for leukemic B-lymphoblast arrangement. Right now creators proposed a profound learning technique to recognize youthful leukemic impacts and ordinary cells. From the outcomes got it is shown that proposed model is proficient for forecast of B-lymphoblast order with 96.7% precision, 95.17 % explicitness and 95.58% affectability.

The author Bhagya T [5] have proposed a technique for examination of picture division calculations for the powerful location of leukemic cells. The creators have drawn an examination between four distinctive division calculations like Otsu thresholding, Watershed calculation, Canny edge recognition and k-implies bunching calculation. The previously mentioned calculations are applied to various leukemic picture datasets in order to locate the best calculation.

The author Nuruddin Qaisar Bhuiyan [6] have proposed a strategy for programmed identification of intense lymphoblastic leukemia and relative examination of information acquired from pictures. Notwithstanding cautious pre-preparing the creators have utilized four AI calculations like Random Forest, Support vector machine, Logistic relapse and Decision tree are applied and results got are examined to give a correlation between the exhibitions of calculations as far as various measurements.

The author Farrukh Masud [7] proposed a technique for helping the PC in identification and analysis of intense lymphoblastic leukemia. It is discovered that the techniques utilized are more powerful and exact than the manual methodologies. The picture dataset is acquired from ALL-IDB-1, it is then pre-handled to section out various kinds of cells in the picture, at that point shape and shading highlights are separated. After extraction the acquired information is taken care of to help vector machine and it is seen that over all precision is 93.7%, affectability of 92% and particularity of 91%.

III. PROPOSED FRAMEWORK

The proposed framework includes collection of images from the open source library i.e dataset from the journal used as a input images. The previous authors were able to capture the image without a need of technician and high-end equipment using a smartphone, microscope and three-layered paper model. The images captured in this way is collected and a dataset is created, which we use as a input for our study. In this study first we perform a digital Complete Blood Count (CBC) then based on the count on RBC and WBC we come to a conclusion whether

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we are having Anemia or Leukemia. Anemia is low count of RBC, which results in less supply of oxygen to all other parts of the body ultimately the organ fails to function properly and patient dies. Leukemia is low count of WBC, as White Blood Cells are responsible for fighting germs and forming immune system. Due to sudden changes in DNA, the cells begin to divide enormously. These cells divide when they are immature, as a result these unhealthily dividing cells starts killing healthy WBC. This weakens the immune system, leading to long term infections and bleeding through nose. These images captured undergoes pre-processing, segmentation, feature extraction and classification. In this classification we will get to know type of WBC affected, based on this we will be able to predict type of cancer i.e whether ALL, CLL, AML or CML. After that based in nuclei segmentation, further we will be able to classify the type of lymphocyte or myeloid. Lymphocytes are subdivided into B-lymphocytes and T-lymphocytes. Myeloids are subdivided into neutrophils, basophils, eusinophils and monocytes. But neutrophils will be present in large amounts in blood. This will help the medical professionals in diagnosing the disease in early stages, so they can be treated early. A cancer detected early is a life saved.

IV. METHODOLOGY USED

Pre-Processing

In pre-processing as a first step we remove the noise from the image, resize the input image to [256 256] pixel size so that it will be easy for further processing of the image and then covert the image to lab color space conversion. Because the image captured from a digital microscope is in RGB format, which makes it very difficult for segmentation. So convert the image in RGB format to lab color space conversion and then covert the image into grey scale.

Segmentation

For segmentation we use k-means clustering. K-Means is one of the most significant algorithms utilized for image segmentation and forming a cluster head. The k-means bunching calculation is used to separate the district of enthusiasm against the ground truth marks indicated. It is of high intrigue that all the ground truth parts are extricated during the time spent division. It is seen that K-mean procedure utilizes centroid determination technique demonstrated to section more precisely.

K-Means Clustering Algorithm

K-means clustering is example of unsupervised machine learning, it is used to divide the image into k clusters. Segmentation in this process is of two types Cell Segmentation and Nucleus & Cytoplasm Segmentation. The time complexity of k-means clustering algorithm is close to linear and can be used for a large-datasets. The principle of minimum distance is used for classifying the pixels into multiple classes. For segmentation we need to convert the image in RGB format to grey color space conversion. The entire clustering process can be divided into two stages; in the first stage define k centroids and in the next stage map each pixel value into its nearest centroid value

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Feature Extraction

Feature extraction in image processing is a system of reclassifying a huge arrangement of repetitive information into a lot of highlights of decreased measurement. Changing the information into the arrangement of feature is called feature extraction. Feature Selection extraordinarily impacts the classifier execution; along these lines, a right selection of highlights is an extremely significant advance. So as to develop a powerful list of capabilities, a few distributed articles were considered, and their element choice approach was watched. It was noticed that specific highlights were broadly utilized as they gave a decent arrangement. We executed these highlights on entire pictures in our framework. Those highlights were considered to help the classifier execution.

Local Binary Pattern

Local Binary Pattern is a simple and most efficient shape operator. The Local Binary Pattern is utilized to relate all the pixels remembering the center pixel with the neighboring pixels for the part to improve the attributes against the illumination variation. A LBP code for an area was created by increasing the edge esteems with loads given to the relating pixels, and summarizing the outcome. LBP codes are gauged utilizing slope vector to produce the histogram of hearty LBP and discriminative highlights are resolved from the powerful neighborhood double example codes. LBP is spoken to regarding set of standardized histogram canisters as nearby surface highlights. It is utilized to separate the neighborhood edge surface of unique mark invariant to changes of difference and shape. LBP is a dim scale surface example which describes the spatial structure of a nearby picture surface. The state of the core, as per hematologists, is a basic element for separation of myeloblasts.

GLCM

Texture is characterized as a component of the spatial variety in pixel forces. The GLCM and related surface component estimations are image analysis strategies. Grey level pixel appropriation can be portrayed by second-request measurements, for example, the likelihood of two pixels having specific dark levels at specific spatial connections. This data can be portrayed in 2-D Grey level co-occurrence grids, which can be registered for different separations and directions.

V. COMPUTATIONAL RESULTS

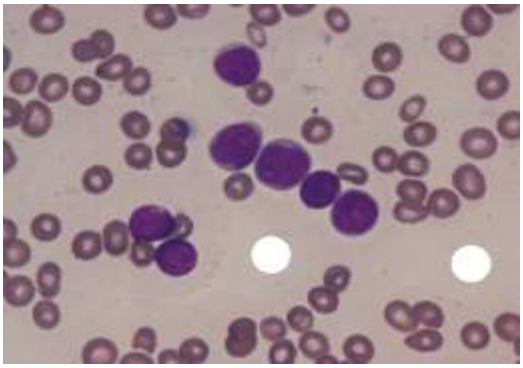

Figure 1: Original Microscopic Image

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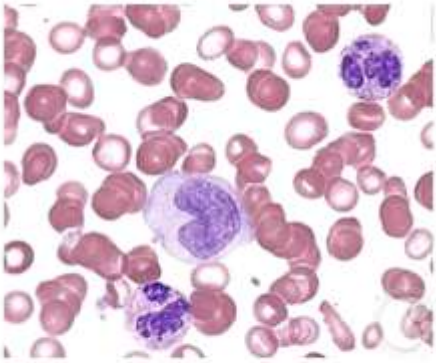
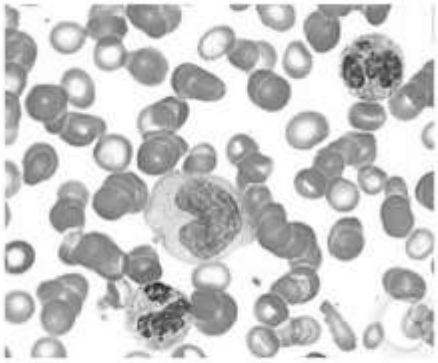
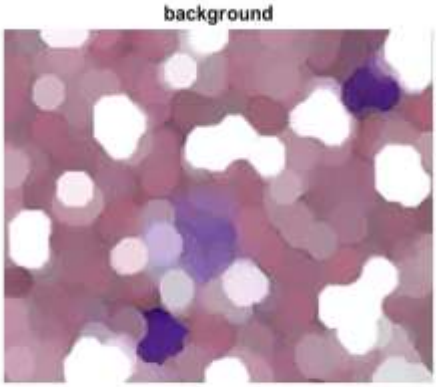
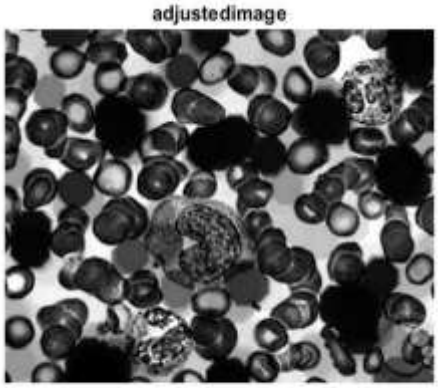
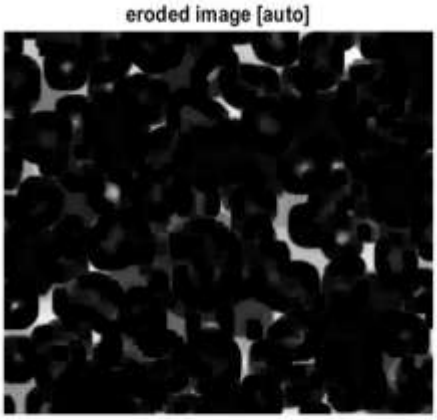
Here are the computational results of microscopic images of the blood. As a First thing we capture images using smartphone-microscope and is given as sample input as we have already trained database with different images like cancerous and non-cancerous, anemia and non-anemia. Then we do digital CBC based on the results of that we diagnose Anemia or Leukaemia.

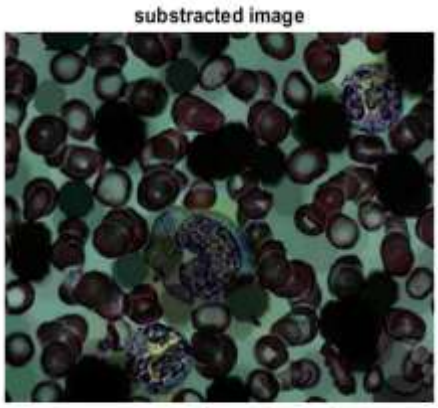












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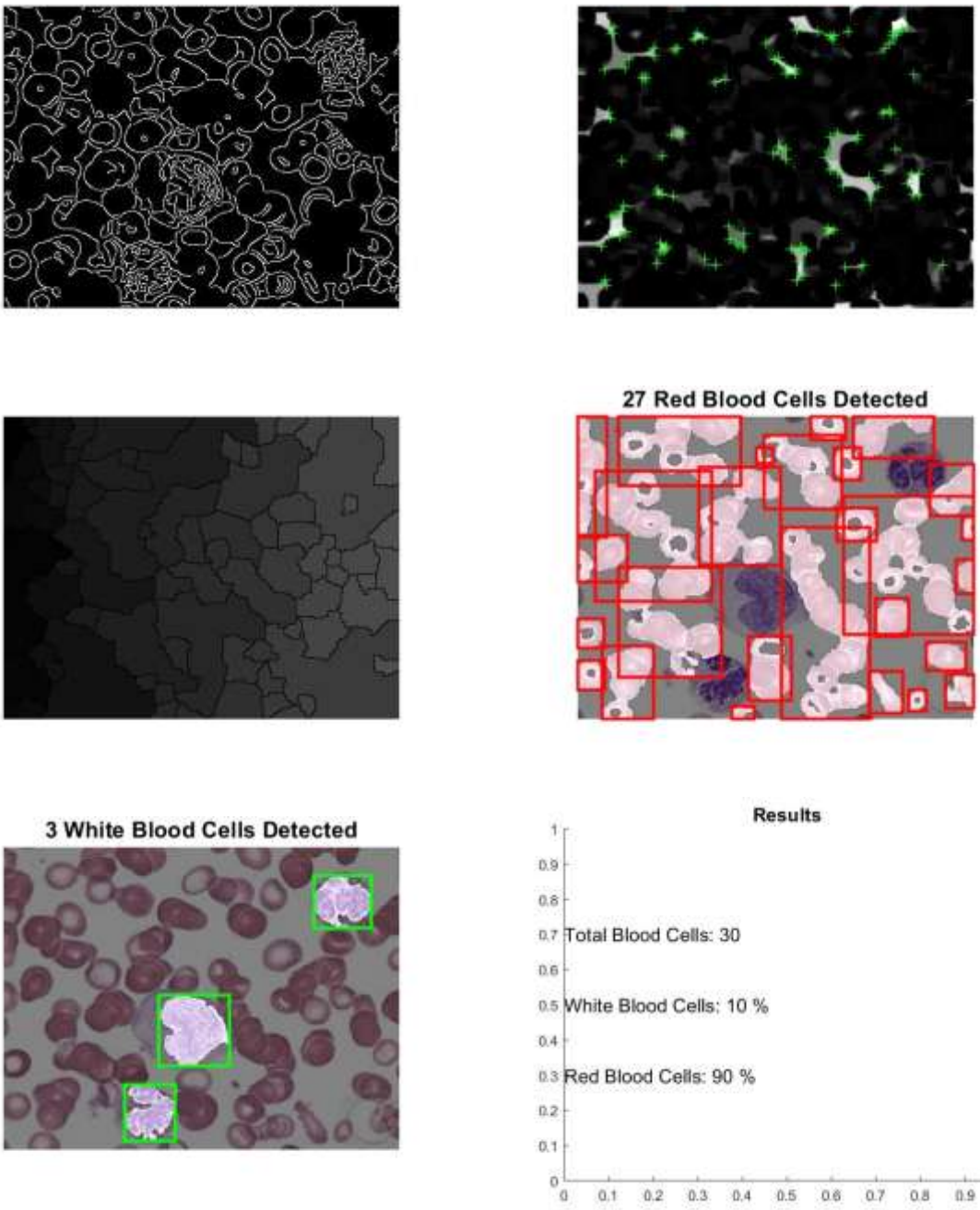

VI. CONCLUSION

A programmed approach for undeveloped cell recognition and order of maladies which happen to immature microorganisms (RBC and WBC) is proposed. Right now have proposed an in-costly technique for catching minuscule pictures utilizing a cell phone, optical filter, led and magnifying lens. We have proposed a completely programmed framework that would precisely distinguish different undifferentiated organisms for example Complete Blood Count, if any variation from the norm is found in WBC we go for minute blood pictures and if any anomaly is found in RBC we do additionally tests to affirm Anemia. Our structure adequately sees all these subtypes reliant on

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the features isolated. From the beginning, we have taken blood microscopic picture as a data and perform preprocessing. This is performed to grow the idea of the image so as to encourage the further techniques. The image is changed over to lab color space. Division was performed using K-Means clustering. For incorporate extraction we have used GLCM (shortened as Gray level Co-event frework) which helps with isolating surface features, for instance, entropy, separate, relationship, homogeneity, essentialness, etc. Our system has ability to learn reliant on real, surface and morphological features which helps with setting up the classifier. We have used PNN classifier at the last stage to arrange. Right now have proposed a disentangled method for differentiating the stem cells, i.e. we do a digital CBC. If any abnormalities are found in CBC test then we go for microscopic blood test. The second slide is examined to see any leukemic cells are present in WBC and third slide is examined to see if the blood sample is diagnosed of Anemia. If the Leukemic cells are found then we find out the type of WBC affected. Based on that we determine whether it is Acute Leukemia or Chronic Leukemia by repeating the test after certain frequency. Lymphocytes are responsible for acute leukemia whereas neutrophils are responsible for chronic leukemia. In this model we have used K-means and canny edge detection for segmentation, LBP as shape operator GLCM for extracting various features in the image and PNN training for microscopic images also we have used supervised learning and PNN classifier. Here PNN stands for Probabilistic Neural Networks. PNN algorithm is fast and compatible than many other algorithms. Further advancements can be made by using any new algorithms and its can be commercialized.

P.S: This is just a prototype and not meant for personal use, its highly recommended to consult a doctor.

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