DISEASE DIAGNOSIS THROUGH BLOOD ANALYSIS USING IMAGE PROCESSING

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Abstract: The Department of Haematology deals in the management of blood-related disorders. In case, there is any problem in the bloodstream, it can affect the overall health of a person. The team of hematology expertise in providing an accurate diagnosis of the problem and its treatment. Numerous blood disorders can affect a person's well-being. Diagnosing blood disease and blood group is essential during emergencies.

Here is a technique dependent on image processing that is exceptionally fast and it has its expansive use in the biotechnological field. We put forward this precise and quickly recognizable way of blood group, count, and disease i.e., leukemia and malaria dependent on digital image processing.

Index Terms **- Disease diagnosis, blood group detection, Digital Image Processing, Feature extraction, clustering, KNN classifier, SVM**

I. INTRODUCTION

Diagnosis of disease through blood is very important to get to know whether the person is infected or not. Presently, malaria and leukemia tests are carried out physically by technicians, which can elicit human errors. Detecting the disease in a short span without human errors is highly essential. An image processing system is developed, where the image is obtained through the slide test of the blood. The slide test images acquired from the pathological laboratory are refined and the existence of clumpings are assessed. Thus, the developed system detects leukemia or malaria using techniques of image processing. The developed system is convenient in emergencies, to diagnose the disease in a patient without or less human faults. This method is developed by processing the images of blood smears that are acquired when the blood is put on the slide. The acquired images from the laboratory are processed and then the presence of agglutinations of cells or pathogens or inert particles are evaluated. Thus, this method developed detects the disease type whether it is leukemia or malaria using image processing techniques. To aid this problem statement we have designed the system where after capturing of image it is transfigured to a high-resolution image, and the final result is given on the screen.

II. RESEARCH METHODOLOGY

2.1 LITERATURE SURVEY

The clustering technique is used in K-Means. After clustering next step is segmentation. In the segmentation of an image, the pixels are divided into groups that solidly correspond with the objects in an image. The abnormal structure of WBCs in the blood cell image is located using Segmentation. Dividing the image into a group of pixels is called image segmentation. the nucleus segmentation is improved by a novel cell detection method that uses both shape information and intensity of blood cells. Images are reliant on appropriate segmentation of white blood cells to determines the accuracy of feature extraction. The segmenting of nuclei of abnormal cells is called WBCs segmentation. If the patient is having white blood cells with the abnormal structure of nuclei is said to be leukemia positive.

The features of images based on color, texture, and shape are extracted through the KNN classifier which finds the most frequent class and groups the undetermined data points out of all examples of k-closest. Once the feature extraction is done, classification is made by assigning pixels in the image into categories or classes of interest and compare it with reference images through the SVM classification algorithm. After this process, the result is determined and displayed on the system.

[1] The paper published in IEEE 2017 where the technique of image processing for detecting malaria parasite is used Here authors put forward a system where malaria parasite is detected automatically from blood images. This system uses image segmentation to identify the malaria parasites from images obtained from Giemsa-stained peripheral blood samples.

[2] Image processing is used on colored images to determine the blood group in an IEEE paper published in the year 2017. The proposed system here is efficient in recognizing the blood group type i.e., A, B, AB, and O using MATLAB algorithms.

[3] The components of blood are determined in a research paper published in the year 2017. This paper has an image analysis system that uses segmentation and validation for the image processing steps that allows the diagnosing of RBC, platelets, and WBC count from the given images of blood obtained from the microscope with the help of an android application which gives precise results.

[4] A paper was published in 2014 to detect leukemia using image processing. In this proposed system higher or less exposure to staining settings may cause trouble in detecting the disease. The standard of the microscopic image also confides in the vulnerability of the microscope staining process. Image enhancement processes comprise a bunch of techniques that try to change

the image into a well-suited form for inspecting by machine or by a human. Detecting Leukemia being the main goal of this paper, feature extraction is done after nucleus segmentation. For prediction of disease shape features of nuclei such as height, width, perimeter, area, color, etc. are contemplated

2.2 EXISTING SYSTEM

Microscope vision is generally used to identify the blood group and malaria. A human can be wrong due to his/her inefficiency, but we can use image processing to reduce these errors by doing the same process which speeds up the process without any or less wrong interpretation. There are many different methods a doctor uses to determine a disease. A diagnosis significantly on laboratory reports or test results. Based on the pathogen involved the diseases are detected. This is also prone to human errors as the physician might go wrong while diagnosing considering both symptoms and laboratory results. Also, the laboratory results take a longer time. So, processing the blood image through image processing can make the results faster.

2.3 METHODOLOGY

To overcome the existing challenges and to minimize the limitations, a system is designed where an image of a blood smear is captured and then converted to a high-resolution image, and the final diagnosed result is obtained.

The blood group, complete blood cell count, Malaria, and leukemia disease can be diagnosed through this system. Images from the microscope (with blood cells) are obtained with the aid of a digital microscope. In tendency to get the digital images of the blood cell or parasite, we use a digital microscope which has an inbuilt camera inside. The input images are sent to the next step called pre-processing. The acquired microscopic image possesses noise due to disproportionate stains and manual interference. Shadowing of nuclei is the main reason for the noise. Our area of study is the blood cell nucleus, the image is processed to remove unwanted data and retain the required ones. Contrast enhancement is one of the image enhancement techniques that improve the quality of the medical image. In this enhancement process, images are refined to fit the further processing steps. Linear contrast enhancement technique is used for enhancing blood cell images. Histogram equalization is the most famous contrast enhancement technique which will fine-tune the image intensity and contrast as per requirement.

The next process is clustering, here the pre-processed image data is considered as objects. The objects are partitioned into clusters or groups so that the objects are similar within the cluster with each other and dissimilar to other clusters.

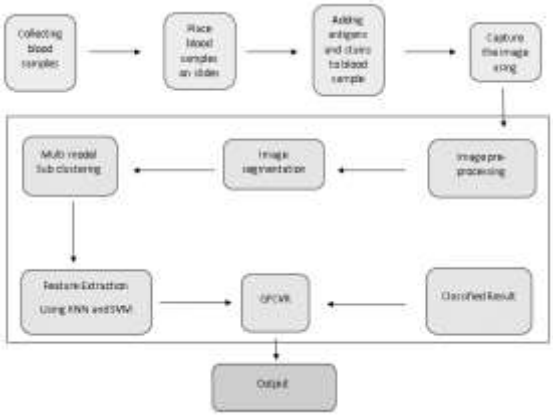

Fig-1: Image Acquisition and processing of image

This system diagnoses two diseases-Malaria and leukemia and two tests are done for detecting blood groups and complete blood count.

1.Detection of blood group:

To know the type of blood, blood typing is conducted. Depending on whether or not, certain protein is present in the red blood cells the type of blood is determined. These proteins are called antigens. Sometimes blood group is dependent on the parent's blood group. ABO blood typing is often used to determine the blood type. The 4 major blood types are A, B, AB, O.

2.Complete Blood Count:

A blood test is used to check the overall health of an individual and detect a wide variety of disorders, including anemia, infections, and leukemia, etc. This test is known as the Complete blood count or CBC test. A CBC test estimates various elements and features of blood. In this system, feature extraction is applied to extract the blood count. An abnormal decrease or increase in the count of the cell as disclosed in a complete blood count indicates that one may have an underlying medical state that designates for further evaluation.

3.Detection of Malaria:

Malaria parasites can be recognized by inspecting a blood drop of the patient under the microscope, spread out as a "blood smear" on the slide. In advancement to inspection, the specimen is stained (stains used here are jsp1 and jsp2 stains) which gives the parasites a unique appearance. This acquired image is processed for detecting whether it is malaria positive or negative.

4.Detection of Leukemia:

By examining the sample with the help of CBC the doctor can determine whether the patient has abnormal cells which may suggest leukemia.

Overall Process:

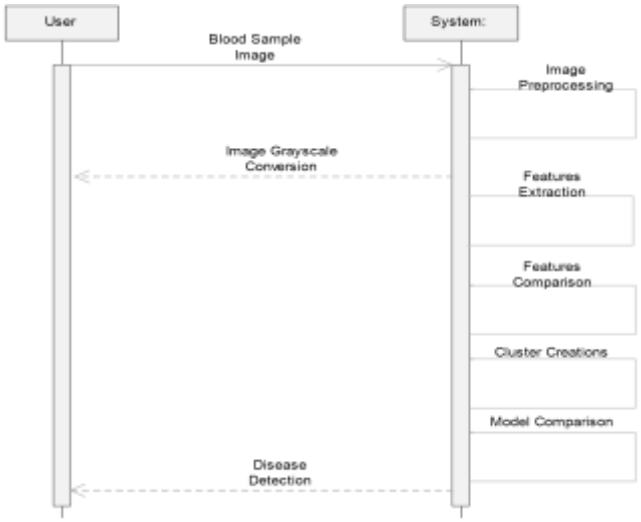

Fig 2: Workflow of the proposed system

The proposed method works as follows (Fig 2)

1. The patient will communicate with the disease-diagnosing person and select the disease to be tested.
2. Patient will provide the blood sample for the respected test.
3. The collected sample is prepared for the test by reacting it with stains and antigens.
4. Diagnosing person will capture a microscopic image of a reacted blood sample through Digital Microscope.
5. The captured images are sent to Diagnosing system for analysis.
6. Our system displays the result to the diagnosing person once the analysis is complete.
7. The final result is reported to the patient for further clinical action.

2.4 Implementation Details

The system is developed in python IDLE 3.9 using image processing technique and Tkinter. The GUI is developed in Tkinter. The image processing techniques are used for processing the image acquired from a digital microscope. The steps like segmentation and feature extraction are carried out.

III. RESULTS AND DISCUSSION

3.1 Results

The technique of processing the images like the HSV luminance plane is used to detect background color. Range to detect cluster or patch based on the region of the adherences of the blood lies between 0 to 255, which is the scope to detect a cluster of HSV Luminance plane method. The final result is computed based on the combination of patch and cluster of the designated four images.

A separate folder is created for each patient with an id and the image acquired the processed grayscale images are stored in the same file the result is displayed with the time taken as it is the main constraint in real-time.

The results can be obtained by clicking on the buttons. A separate result for each disease is obtained. In the console, we can get all the output with time and other factors.

3.2 Conclusion

In this project, we have given a cost-efficient model to detect leukemia and malaria, from where the image blood smear is used to determine CBC and blood type. K-means clustering requires a comparatively lesser dataset and is further compound than the Sobel method in implementation. The segmentation is implemented using K-Means clustering. With an extensive alteration in the combination of blood cells, we have created a dataset of blood smear images. Leukemia, malaria, blood group, and CBC is integrated into one system. Largely, the system is fruitful and has a performance proportionately near to a human pathologist. Thus, the use of this system may entitle faster and cost-effective treatment for patients.

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