COMPUTER-ASSISTED ALL, AML, CLL, CML DETECTION AND COUNTING FOR DIAGNOSIS OF BLOOD CANCER

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ABSTRACT

Leukemia could be a cancer of white blood cells (WBCs) which damages blood and bone marrow of shape. It can be fatal illness if not diagnose at earlier stage. Typically, the complete blood count (CBC) or morphological image analysis is employed to manually diagnose the malignant neoplastic disease cells. These ways are time consuming and fewer correct that must be mounted. In this paper we've planned an automatic technique for the detection of Acute lymphocytic leukemia (ALL), Acute myeloid leukemia (AML), Chronic lymphocytic leukemia (CLL), Chronic myeloid leukemia (CML) by microscopic blood image analysis. This approach initially sections out the various kinds of cells from the image i.e. White blood cells, red blood cells and platelets. Afterward Lymphocytes are separated from the white blood cells. Then form and color options are extracted from these lymphocytes that are given to KNN to classify the cells into traditional and blast. After that the counting of the WBC cells are also detected for accurate diagnosis. This automated malignant neoplastic disease detection system found to be more practical, fast and correct as compared to manual identification ways.

Keyword: - *Leukemia, Acute lymphocytic leukemia (ALL), Acute myeloid leukemia (AML), Chronic lymphocytic leukemia (CLL), Chronic myeloid leukemia (CML), Lymphocytes.*

1. INTRODUCTION

Acute lymphoblastic leukemia is a type of cancer associated with blood in which leukocytes (WBCs) start growing abnormally. These abnormal cells strike the blood and bone marrow due to which immune system of human body become vulnerable. Furthermore, it suppresses the production of normal red blood cells and platelets hence lead towards anemia, the blood deficiency. Moreover, these abnormal leukocytes predominantly spread into the human blood swiftly and can also capture other different body parts like kidney, liver, spleen, brain and lymph nodes. Leukemia is classified as either Lymphoblastic or Myelogenous depending on the type of white blood cells being infected. If the infected cells are granulocytes and monocytes, then the leukemia will be classified as Myelogenous (AML) and if the infected cells are lymphocytes, then the leukemia will be classified as Lymphoblastic (ALL). According to French American British (FAB) classification, ALL is further categorized into 3 subtypes, which are L1, L2 and L3. L1 type cells are normally small in size and are homogeneous with little cytoplasm. Their nucleus is discoid and well structured. L2 type cells have shape dissimilarity and are over-sized as compared to L1. Their nucleus is not regular and contains variations in their cytoplasm. L3 type cells are of identical shape and normal size with round or oval nucleus. They have adequate amount of cytoplasm which includes vacuoles. They are usually larger in size than L1.

1.1 OBJECTIVE

The main objective of this project is to detect and count the cancer blood cells in microscopic blood smear images. The microscopic blood smear images are preprocessed, converted and enhanced to be more helpful for the detection of healthy and cancer blood cells. The cancer blood cells are classified to find the accurate type of blood cancer. The cancerous blood cells are counted to find the severity of the blood cancer.

1.2 SCOPE

The scope of this project is to create a computer assisted cancer detection software. It helps the doctor to identify the type and severity of the blood cancer (leukemia) from the microscopic blood smear images. It detects the type of cancer and counts the number of cancer blood cells. This project was initiated to identify the type of blood cancer. Initially only one type of blood cancer can be detected. But with this project four type of blood cancer can be identified. This project entirely depends upon the clear picture of the microscopic blood smear.

2. EXISTING SYSTEM

This Existing System uses the histogram equalization and median filtering to perform pre-processing of blood images. Then fuzzy c-mean was carried out for the segmentation of white blood cells. After extracting features using Gabor texture extraction method, classification was carried out using support vector machine (SVM) to classify normal and blast cells.

3. PROPOSED SYSTEM

In this paper we propose a method for the detection of Acute lymphoblastic leukemia, Acute myeloid leukemia, Chronic lymphocytic leukemia, Chronic myeloid leukemia from microscopic blood images by using image processing techniques. Preprocessing was applied over the images to remove any noise, and then segmentation is performed to detect lymphocytes from the image. Watershed is used to separate the grouped lymphocytes for counting of cells, after extracting shape and color features; KNN is used to classify normal and blast cells.

4. MODULES

4.1 INPUT IMAGE:

Read and Display an input Image: Read an image into the workspace, using the imread command. In image processing, it is defined as the action of retrieving an image from some source, usually a hardware-based source for processing. It is the first step in the workflow sequence because, without an image, no processing is possible. The image that is acquired is completely unprocessed.

4.2 PRE-PROCESSING

Pre-processing is a common name for operations with images at the lowest level of abstraction. Both input and output are intensity images. The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing. Image pre-processing methods use the considerable redundancy in images. Neighboring pixels corresponding to one object in real images have essentially the same or similar brightness value. Hence the distorted pixel can often be restored as an average value of neighboring pixels.

1. RESIZING THE INPUT IMAGE:

   All the input images are resized into same dimensions. If the specified size does not produce the same aspect ratio as the input image, the output image will be distorted.

2. CONVERTING COLOUR FORMAT:

For many applications of image processing, color information doesn't help us. If you get into the business of attempting to distinguish colors from one another, then one reason for converting RGB image to BLACK AND WHITE or GRAYSCALE or RGB image to HSV formats in image.

4.3 SEGMENTATION

Image segmentation is a commonly used technique in digital image processing and analysis to partition an image into multiple parts or regions, often based on the characteristics of the pixels in the image. In computer vision, Image Segmentation is the process of subdividing a digital image into multiple segments (sets of pixels, also known as super pixels. Segmentation is a process of grouping together pixels that have similar attributes. Image Segmentation is the process of partitioning an image into non-intersecting regions such that each region is homogeneous and the union of no two adjacent regions is homogeneous Pixels in a region are similar according to some homogeneity criteria such as color, intensity or texture so as to locate and identify objects and boundaries (lines,curves,etc) in an image. Segmentation accuracy determines the eventual success or failure of computerized analysis procedure.

1. COLOUR SPACE CONVERSIONS:

Color space conversion is the translation of the representation of a color from one basis to another. This typically occurs in the context of converting an image that is represented in one color space to another color space, the goal being to make the translated image look as similar as possible to the original. Here we use rgb to ycbcr color space conversion for white blood cell segmentation.

2. MORPHOLOGICAL OPERATIONS:

Morphological image processing is a collection of non-linear operations related to the shape or morphology of features in an image. Morphology is a broad set of image processing operations that process images based on shapes. Morphological operations apply a structuring element to an input image, creating an output image of the same size.

Some segmentation techniques are,
A) ROI (Region of Interest)
B) WATER SHED SEGMENTATION

4.4 FEATURE EXTRACTION

In machine learning, pattern recognition and in image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it can be transformed into a reduced set of features (also named a feature vector). Determining a subset of the initial features is called feature selection. The selected features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data.

a) Shape features
b) Color features
c) Geometrical features
d) Texture features

A) SHAPE FEATURES:

Visual features of objects are called the shape characteristics or visual features. For example, circular object or triangular objects or other shapes, perimeter boundary of the object, the diameter of the border and so on. The visual features showed intuitively are all belongs to shape features.

B) COLOR FEATURES:

Global features include color and texture histograms and color layout of the whole image. Local features include color, texture, and shape features for sub images, segmented regions, and interest points. These features extracted from images are then used for image matching and retrieving.

C) GEOMETRICAL FEATURES:

Geometric features are features of objects constructed by a set of geometric elements like points, lines, curves or surfaces. These features can be corner features, edge features, Blobs, Ridges, salient point's image texture and so on, which can be detected by feature detection methods. Here we use area, diameter, density features for calculations.

D) TEXTURE FEATURES:

An image texture is a set of metrics calculated in image processing designed to quantify the perceived texture of an image. Image Texture gives us information about the spatial arrangement of color or intensities in an image or selected region of an image. Here we use GLCM (Grey Level Co-occurrences Matrix) for texture feature analysis.

Some feature extraction methods are,

A) GLCM (Grey level co-occurrence matrix)

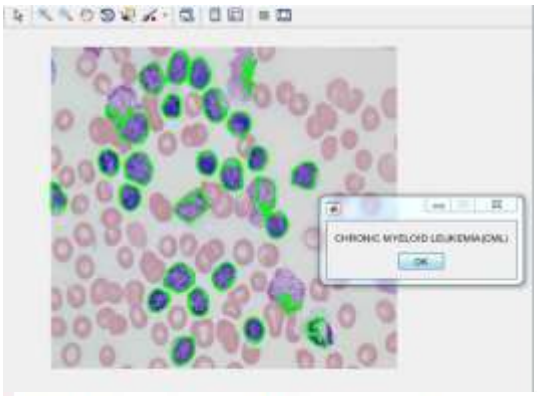
B) LBP (Local Binary Pattern)

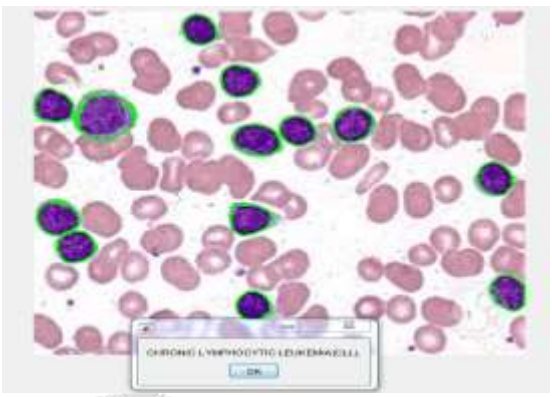
C) PCA (Principal Component Analysis)

4.5 CLASSIFICATION:

Image classification refers to the task of extracting information classes from a multiband raster image. The resulting raster from image classification can be used to create thematic maps. The recommended way to perform classification and multivariate analysis is through the Image Classification toolbar. There are many classification algorithms are available and we use the classification algorithm that is given below,

A) KNN (K-NEAREST NEIGHBOUR ALGORITHM)





Total number of WBC cells detected in image =

28

Total number of WBC cells detected in image =

13

5. CONCLUSIONS

In this paper, efforts have been made for the detection and counting of Acute lymphoblastic leukemia, Acute myeloid leukemia, Chronic lymphocytic leukemia, Chronic myeloid leukemia from microscopic blood smear images by using image processing techniques. Preprocessing was applied over the images to remove any noise, and then segmentation is performed to detect lymphocytes from the image. Watershed is used to separate the grouped lymphocytes after extracting shape and color features; KNN is used to classify normal and blast cells. In future, we can further improve this system to detect other types of leukemia and other blood related diseases.

6. FUTURE ENHANCEMENT

In future, with more time and with more comprehensive research the proposed system can be made more accurate. Also new leukemia detection algorithms can be added so as to give the doctor a wider variety of options to choose from.

7. REFERENCES

[1] Hematology.org, Acute Lymphocytic Leukemia: Learning Objectives', 2017. [Online]. Available: http://www.hematology.org/Educators/Learning-Objectives/690.aspx. [Accessed: 23- may- 2018].

[2] Dana-farber.org, 'What Are the Differences Between Lymphocytic and Myelogenous Leukemia?', 2016 [Online]. Available: https://blog.dana- farber.org/insight/2016/07/what-are-the-differences-between-lymphocytic-and-myelogenous-leukemia. [Accessed: 23- may- 2018].

[3] Curesearch.org, Acute Lymphoblastic Leukemia (ALL) in Children – In Treatment', 2010[Online]. Available: https://curesearch.org/Acute- Lymphoblastic-Leukemia-In-Treatment. [Accessed: 28- may- 2018].

[4] Cancer.org, 'Treating Acute Lymphocytic Leukemia (ALL)', 2007[Online]. Available: https://www.cancer.org/cancer/acute- lymphocytic-leukemia/treating.html. [Accessed: 28- may- 2018].

[5] Karthikeyan.T, and N. Poornima. Microscopic image segmentation using Fuzzy C means for leukemia diagnosis." Leukemia 4, no. 1 (2017).

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