Acute Myelogenous Leukemia Diagnosis in blood microscopic images using probabilistic neural network

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***Abstract*- The project presents the classifications and detection of acute myelogenous leukemia in blood microscopic images using supervised classifiers. AML is a fast-growing cancer of the blood and bone marrow Input blood microscopic image is converted into gray scale for better features extraction. Then the segmentation process is done by k-means clustering method The system will be used to classify the queried images automatically to decide the abnormality.The performance of the system is evaluated through sensitivity, specificity and accuracy. White cell composition of the blood reveals important diagnosis information about the patients as well as patient follow-up. The haematologist requires two types of blood count for diagnosis and screening. The first one is called the Complete Blood Count (CBC) and the second one is called the Differential Blood Count (DBC). CBC could be done by instruments called cytometer and could successfully be performed automatically. On the other hand, DBC is more reliable but currently it is a manual procedure to be done by hematology experts using microscope. In DBC, an expert counts 100 white blood cells on the smear at hand and computes the percentage of occurrence of each type of cell counted. The results reveal important information about patient's health status.**

Keywords- ; Acute Myelogenous Leukemia, Lloyd's clustering, Discriminative Robust Local Binary Pattern (DRLBP), Support Vector Machine (SVM)

I. INTRODUCTION

The bone marrow and results in high numbers of abnormal white blood cells. These white blood cells are not fully developed and Leukemia is a group of cancers that usually begins in are called blasts or leukemia cells. Symptoms may include bleeding and bruising problems, feeling very tired, fever and an increased risk of infections. These symptoms occur due to a lack of normal blood cells. Diagnosis is typically by blood tests or bone marrow biopsy. Different kinds of leukemia are believed to have different causes. Both inherited and environmental (non-inherited) factors are believed to be involved. Chemotherapy treatment itself can be life-threatening since only relatively few patients specific and leukemia-specific factors are considered in current protocols; choice of chemotherapy, intensity and duration often depends on either the availability of a clinical based classification. To make this classification easier, we implement Discriminative Robust Local Binary Pattern to extract texture features. The features like color, shape trial, the treating physician's experience or the collective experience of the treating center, with significant international protocol variability [7].

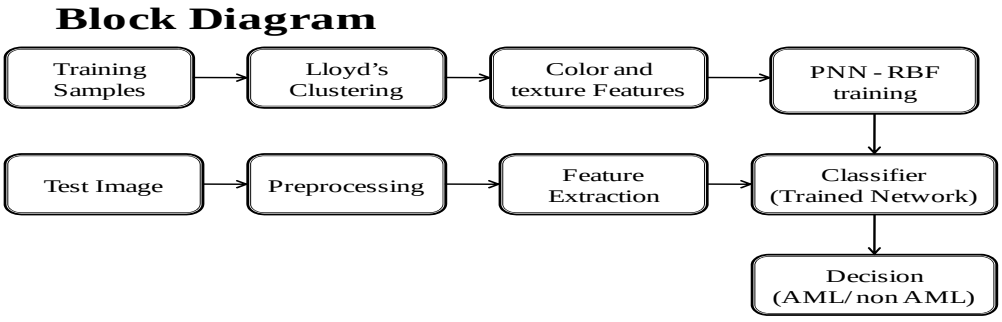
The presence of the excess number of blast cells in peripheral blood is a significant symptom of leukemia. Acute myelogenous leukemia (AML) is a heterogeneous clonal disorder of haemopoietic progenitor cells ("blasts"), which lose the ability to differentiate normally and to respond to normal regulators of proliferation. This loss leads to fatal infection, bleeding, or organ infiltration, typically, in the absence of treatment, within a year of diagnosis. AML is confirmed when the marrow contains more than 30% blasts.

II. RELATED WORK

In this paper, we attempt for detecting the presence of leukemia using Support Vector Machine and texture are extracted to make the classification easier. DRLBP has high discriminative power compared to other existing methods. The common drawback in the existing system is that it classify only sub images [13].The goal of our paper is to extract many features and to implement a fully automated classifier for detecting AML. The result is then compared with existing models.

The procedure for leukemia detection in blood microscopic images consists of preprocessing, segmentation, feature extraction and classification. The overall working principle is depicted in Fig. 1. The blood smear image consists of red blood cells (RBC), white blood cells (WBC) and platelets. The proposed method preprocesses

the input image to remove noise illumination and convert the RGB images into CIELAB images. The segmentation of the image is done using Lloyd's clustering. Then the multiple features are extracted using Discriminative Robust Local Binary Pattern (DRLBP). Finally, the images are trained and classified using Support Vector Machine (SVM).



1. PREPROCESSING

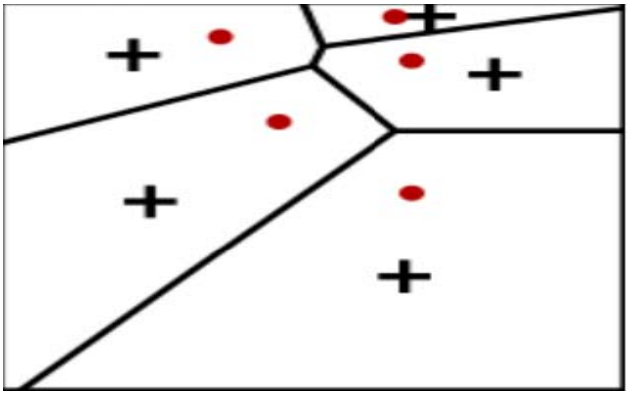
Preprocessing is done to overcome any background nonuniformity due to irregular illumination. Noise may be accumulated during image acquisition and due to excessive staining. Image preprocessing involves the correction of distortion, degradation and noise introduced during the imaging process.The test images were subjected to median filtering [4] followed by unsharp masking [5] to remove the noise. An image can be represented with the help of three color components. Images generated by the digital microscopes are usually in RGB color space which is visually difficult to segment. This can be caused by multiple reasons such as camera settings, varying illumination, and aging stain. Hence the RGB images obtained by digital microscopic images are converted into CIELAB color images (CIEL*a*b color space). This L□a□b color space with dimension *L* represents the lightness of the color, dimension *a*□ represents its position between red/magenta and green, and dimension *b*□ represents its position between yellow and blue.

2. SEGMENTATION

Segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify and change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics [1].Cluster analysis is the formal study of methods and algorithms for grouping, or clustering, objects according to measured or perceived intrinsic characteristics or similarity.

Cluster analysis does not use category labels that tag objects with prior identifiers, i.e., class labels. *k*-means, which is one of the most popular unsupervised learning algorithm and is also a simple clustering algorithm [8].K-means algorithm does not work well with clusters (in the original data) of Different size and Different density. Hence, we go for Lloyd's clustering algorithm.al uniformity, L□a□b produces a proportional change visually for a change of the same amount in color value.closely related k-means clustering algorithm, it repeatedly finds the centroid of each set in the partition, and then re-partitions the input according to which of these centroids is closest.

However, Lloyd's algorithm differs from k-means clustering in that its input is a continuous geometric region rather than a discrete set of points. Thus, when re-partitioning the input, it uses Voronoi diagrams rather than simply determining the nearest center to each of a finite set of points as the k-means algorithm does. The figure 2 illustrate about the Lloyd's clustering that finds evenly-spaced sets of points in subsets of Euclidean spaces, and partitions of these subsets into well-spaced and uniformly sized convex cells.



It then repeatedly executes the following relaxation step:

1) The Voronoi diagram of the k sites is computed.
2) Each cell of the Voronoi diagram is integrated and the centroid is computed.
3) Each site is then moved to the centroid of the Voronoi cell.

The Lloyd's clustering is preferred for segmentation which has high robustness and low complexity compared to other cluster analysis.

Texture Features:

Nucleus texture measurements were performed on gray scale version of the nucleus images. These features were computed from the co-occurrence matrices for each nucleus image [1]. This includes

- *Homogeneity:* It is a measure of degree of variation.
- *Energy:* Is used to measure uniformity.
- *Correlation:* This represents correlation between pixel values and its neighbourhood.
- *Entropy:* Usually used to measure the randomness.

III. PROPOSED SYSTEM

Feature extraction in image processing is a technique of redefining a large set of redundant data into a set of features (or feature vector) of reduced dimension. This transformation of the input data into the set of features is called feature extraction.

In this paper, LDP is proposed (Local Directional Pattern) which is a gray-scale texture pattern which characterizes the spatial structure of a local image texture. A LDP operator computes the edge response values in all eight directions at each pixel position and generates a code from the relative strength magnitude. Since the edge responses are more illumination and noise insensitive than intensity values, the resultant LDP feature describes the local primitives including different types of curves, corners, and junctions, more stably and retains more information.

The LDP assigns an 8 bit binary code to each pixel of an input image. This pattern is then calculated by comparing the relative edge response values of a pixel by using Kirsch edge detector. Given a central pixel in the image, the eight-directional edge response values are computed by Kirsch masks as shown in Figure 3. Since the presence of a corner or an edge shows high response values in some particular directions, thus, most prominent directions of number with high response values are selected to generate the LDP code. In other words, directional bit responses are set to 1, and the remaining bits are set to 0.

Shape Features:

According to hematologist the shape of the nucleus is an essential feature for discrimination of blasts. Region and boundary based shape features are extracted for shape analysis of the nucleus. All the features are extracted from the binary equivalent image of the nucleus with non-zero pixels representing the nucleus region

Area: The area was determined by counting the total number of none zero pixels within the image region approaches very close to examples of one or both classes. The SVM in particular defines the criterion to be looking for a decision surface that is maximally far away from any data point. The figure 4 illustrate about the Support Vector Machine (SVM) for classification of the blood image as normal or abnormal.

The proposed system has been tested using sample-images extracted from an image. It has been applied on 40 high-quality 184 × 138 size images obtained from the American Society of Haematology. The system not only gives classification of whole images but also gives a better performance for sub image.

IV. CONCULSION

This paper has reported the design,development and evaluation of an automated screening system for AML in blood microscopic images.It uses 80 high quality 184*138 size images obtained from the American society of haematology [32].The presented system performs automated processing,including color correlation, segmentation of the nucleated cells,and effective validation and classification. A feature set exploiting the shape,color,and texture parameters of a cell is constructed to obtain all the information required to perform efficient classification.The impact of the LBP operator on the HD proved to be a promising feature for this analysis,Furthermore ,a color feature called cell energy was introduced ,and results show that the this feature presents a good demarcation between cancer and noncancer cells

Further research will foscus on collection of more samples to yield better performance and building an overall systems for cancer classification.

V. References

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