Detection and Classification of Leukemia using Image Segmentation and SVM Classifier

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Abstract— *Leukemia stands for blood cancer that begins in the bone marrow and results in the generation of abnormal cells. Leukemia is mainly classified as acute lymphoblastic Leukemia (ALL), acute myeloid Leukemia (AML), chronic lymphocytic Leukemia (CLL) and chronic myeloid Leukemia (CML).This thesis makes an effort to devise a methodology for the detection and classification of Leukemia. The images have been segmented using K means clustering algorithm. The morphological components of normal and Leukemic lymphocytes differ significantly; hence various features are extracted from the segmented lymphocyte images, for detection purpose. The Leukemia is classified using SVM classifier.*

Keywords— Image Segmentation, SVM Classifier, ALL, AML, CLL, CML

I. INTRODUCTION

Many Image processing algorithms have been developed for Leukemia detection. Image segmentation is a fundamental problem in automated haematological analysis and needs to be accurately carried out. In automated image segmentation the thresholding is done by Otsus method because in Otsus method the threshold value is automatically selected [14]. The watershed transform breaks the connected objects at their weakest point, and separates overlapped objects [29].Himali Vaghela carried out the segmentation of the white blood cells by using Watershed transform to separate the overlapping WBC, but noticed that the exact separation of cells was not possible [1]. Aimi Salihah proposed the use of three contrast enhancement techniques for colour images using RGB components [12]. The Colour images allow for more reliable image segmentation than greyscale images. Two of the basic models for colour images are the HSI (Hue, Intensity, and Saturation) Colour space and the RGB (Red, Green, and Blue) colour space [14]. The three Components of RGB colour model are highly correlated, so the chromatic information is not suitable for direct processing. Due to colour space, it is convenient to convert from RGB to HSV (Hue, Saturation and Value) colour space [11]. RGB images is difficult for segmentation, hence is converted into the HSV colour space to make segmentation easy[14].This reduces correlation between the colour channels (compared to RGB) and enables dealing with three H, S and V channels separately [24]. The feature extraction technique which is carried out after the segmentation process plays a vital role in differentiating the normal cells from the leukemic ones. The features are extracted from the nucleus of the wbc. The commonly extracted features are radius, roundness, standard Deviation, centroid, major axis and minor axis of the nucleus of WBC [30]. Subrajeet Mohapatra suggested that features such as fractal dimension, shape features including contour signature and texture could be extracted for detection of Leukemia [2, 7]. Once Leukemia is detected, it needs to be classified into its types (Acute or Chronic). Subrajeet Mohapatra suggested the use of SVM classifier and FLANN-Functional Link Artificial Neural Network for classification purpose [2, 7].The Support Vector Machine (SVM) classifier has been most commonly used for classification [27, 30]. If the patterns are very close in the feature space, support vector machine (SVM) is a suitable choice for classification. It is a powerful tool for data classification based on hyper plane [24].N. Z. Supardi proposed to use k-nearest neighbour to classify blasts in acute Leukemia into two types which are AML and ALL [9].

II. PROCESS OVERVIEW

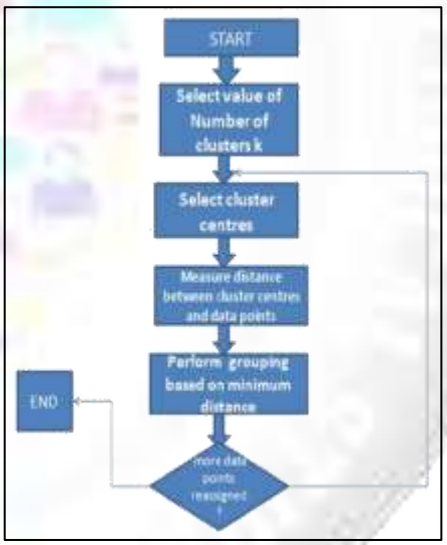

Fig. 1: Steps followed for k means clustering segmentation

A. Image Acquisition

Images of the blood smears of leukemic patients and images of the blood smears of non-leukemic patients; have been obtained from online databases.

B. Image Pre-Processing

Image pre-processing is a technique by means of which the signal to noise ratio and image quality can be improved, that will be helpful for further processing processes. The images that were obtained were in CMYK form, hence were pre-processed and converted to RGB form.

C. Image Segmentation Algorithm

The main aim of the segmentation process is to simplify and represent the image into something more meaningful and easier to analyze. The k means clustering algorithm has been used in this case.

D. Feature Extraction

While analysing data, the major problem arises due to the number of variables involved that require a large amount of memory and computation. This problem is overcome by feature extraction. The features that were extracted are shape based features and statistical features.

E. Classification

The classification model chosen for this phase is the Support Vector Machine, which is a machine learning technique. Since the patterns are very close in the feature space, support vector machine is a suitable choice for classification. It is a powerful tool for data classification based on hyper plane classifier.

III. CONCLUSION

The k means clustering algorithm has been used for the segmentation of the blood smear images. SVM classifier has been used for the detection of Leukemia and its classification.

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