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Analysis of Melanoma based on active contours method

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Abstract- Melanoma is a malignant tumor associated with skin cancer. It can appear anywhere on the body. Several visual features can be used for the detection of melanoma, texture being the most important one. The main objective of this paper is to classify a dermoscopic lesion as being either normal or abnormal (melanoma). This analysis consists of three stages which are segmentation, feature extraction and classification. Segmentation involves determining the border that separates the skin lesion from the surrounding healthy tissue. In this paper KL divergence method is used to maximize the distance between the distribution of the object and the background. After segmentation of the images the peripheral region is extracted which is followed by feature extraction using LBP. SVM classifier is applied to the selected features (periphery and texture).

Key Words*:melanoma, KL divergence, periphery region, Local Binary Pattern, SVM classifier*.

1.INTRODUCTION

Human skin is made up of two layers namely epidermis and dermis. Melanoma is often called cutaneous melanoma or malignant melanoma. It is a skin disease in which the cancer cells are found in the melanocytes of the epidermis. The rateof melanoma has been increasing over the past three decades and its mortality rate is very high if not diagnosed at an early stage. Early detection of melanoma is of significant importance. Assisted diagnostic tools can help significantly in early detection of cancer and thus an effective recovery of patients[13].

Dermoscopy is a non-invasive technique that is used for the detection of melanoma[14]. It involves visual inspection of the pigmented skin lesion by placing gel on the affected skin, followed by its observation with the help of a magnification instrument called a dermoscope that has the ability to amplify a skin image by up to 100 times. The dermoscope allows a detailed inspection of the subsurface structures of the skin followed by the application of diagnostic methods for a clinical assessment of the lesion[2]. There are four main diagnostic methods to detect melanoma: the ABCD rule, pattern analysis, Menzie's method and the seven-point check list. Several visual features can be used for the detection of melanoma, texture being the most important one.

The main objective of this paper is to classify a dermoscopic lesion as being either normal or cancerous (melanoma). To classify the skin lesions it is usually composed of three stages which are segmentation, feature extraction and classification.

In the existing work, the lesion segmentation of a dermoscopic image is done by using classic image segmentation methods such as histogram thresholding, adaptive thresholding, difference of Gaussian filter, morphological thresholding, wavelet transform, active contours, adaptive snake and random walker algorithm. Many of these previous works focused on only a certain aspect (e.g., lesion border localization), and they did not provide a complete solution that integrates all the steps[1]. These methods provide high computation, memory cost and time consuming.

In this paper KL divergence method is used to maximize the distance between the distribution of the object and the background. After the final segmented region, four feature categories are extracted which accurately characterize the lesion color, shape, border and texture[9]. To classify the skin lesion, SVM classifier is built for each feature category and then the final results is obtained by fusing their results.

2.METHODOLOGY

2.1. Pre-processing
The hair removal is applied as a pre-processing step for both the PH2 and ISIC datasets using the algorithm proposed. We applied the processing such as region filling (dark pixels completely surrounded by brighter pixels) and noise removal (isolated group of pixels).

2.2. Segmentation
In order to obtain a good segmentation result, the distance between the lesion and the skin should be maximized. For segmentation, Kullback-Leibler divergence method is used to segment the lesion and skin to fit a curve to the lesion boundaries[14]. After segmentation of the lesion, its periphery is extracted to detect melanoma using image features that are based on local binary patterns.

2.3. Feature Extraction
After segmentation of the images, extract the peripheral region of the lesion followed by feature extraction using local binary patterns.The periphery of the lesion is extracted to detect melanoma using image features which is based on LBP. Local binary patterns (LBP) is a texture feature extraction methodology that can extract local image characteristics such as blobs, spots, corners and edges based on a very local analysis of the images. The LBP is a gray scale invariant operator that was proposed .The method is based on generating a binary pattern at a pixel by calculating the

difference of the center pixel from its neighbours followed by binarizing the differences and concatenating the results in a clockwise way to form a decimal number representing the underlying pattern at a pixel.

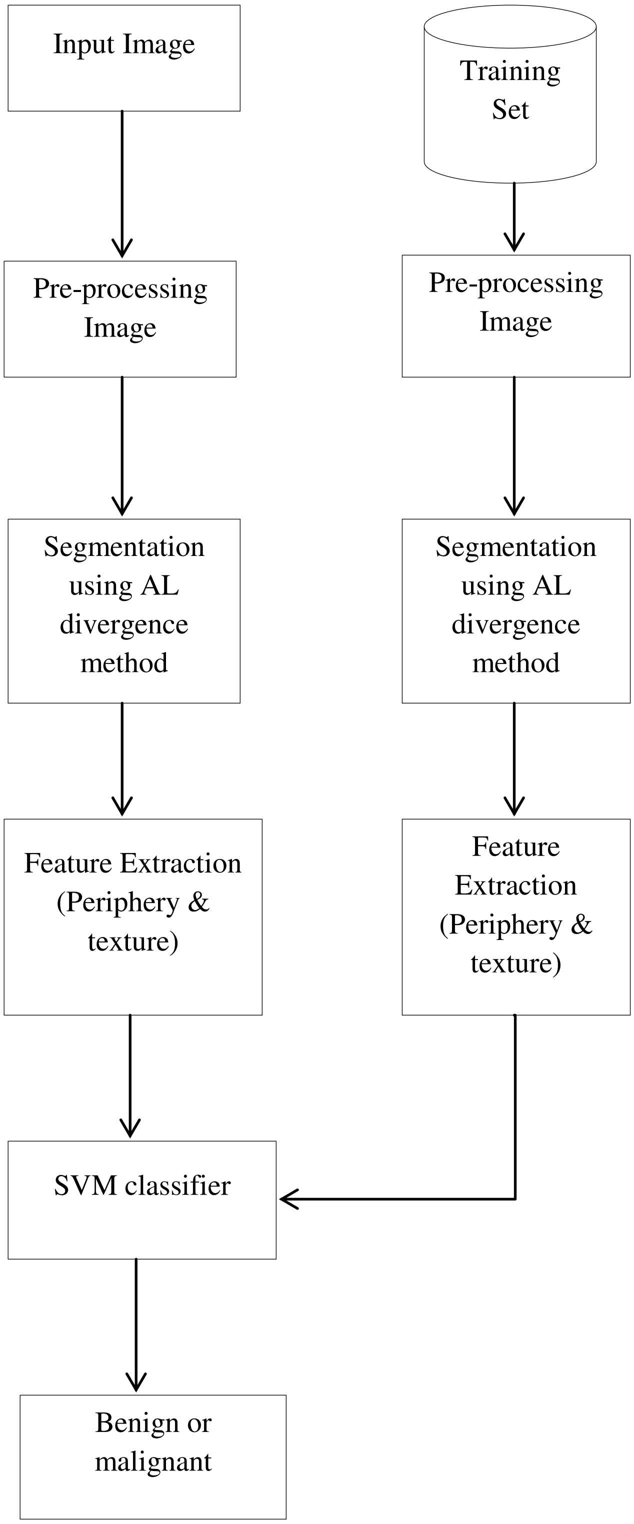

Fig -1. System Architecture

2.4. SVM classification

For a lesion image, system computes these selected features for each category and passes them into SVM classifiers. It trains fourdifferent SVM classifiers, each corresponding to a single feature category.LBP produces a high dimensional feature vector, we will require a large number of samples in order to project the LBP features to higher space where can use SVM. SVMs are applied to the selected features from two feature categories (Periphery and Texture).

3. RESULTS AND DISCUSSION

The proposed KL divergence method provides good segmentation result compared to existing methods and shows higher significance in the identification of melanoma. The SVM classification improves the classification results. The input image is taken from PH2 and ISIC datasets which is shown in fig-2.

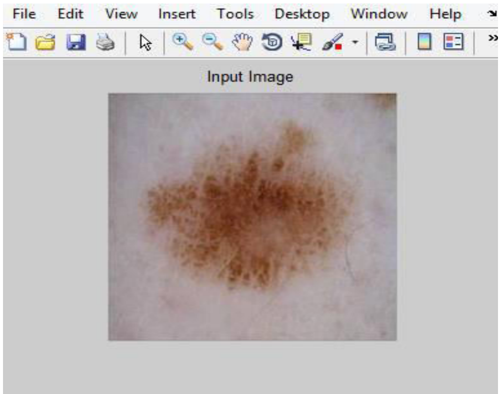

Fig -2. Input Image

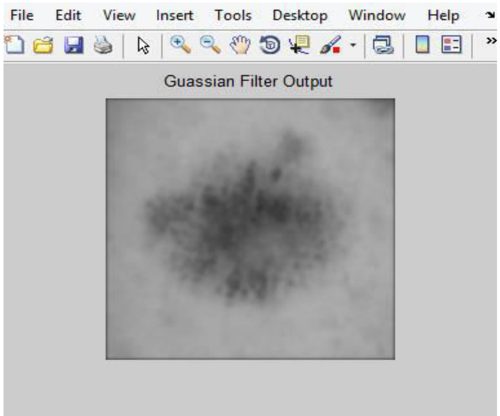

Fig -3. Filtered output

Under pre-processing step the image is converted into grey scale image and removes the noise. Here we use Gaussian filter to remove the noise. The filtered output is shown in Fig -3. The segmentation is done using KL divergence method. The segmented lesion boundaries and segmented lesion are shown in Fig -4.

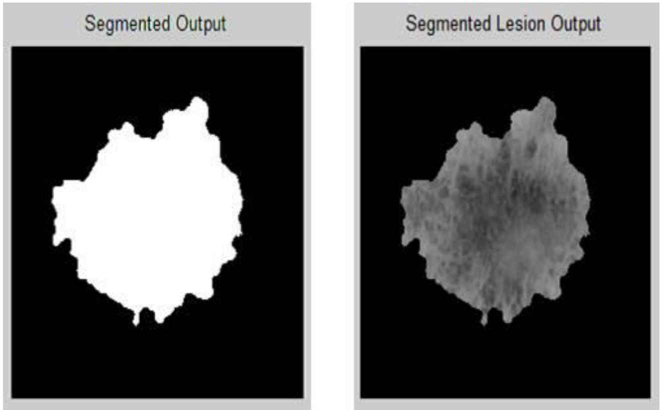

Fig -4 Segmented Output

The feature extraction is done using Local Binary Pattern and the output is shown in Fig-5.

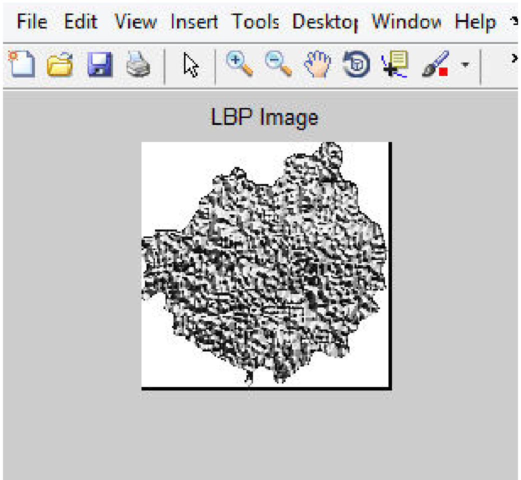

Fig -5. LBP output

The SVM classifier is used for classification of an image which is melanoma or benign. The fig -6.shows the output as the given input image is benign type (non-cancerous).

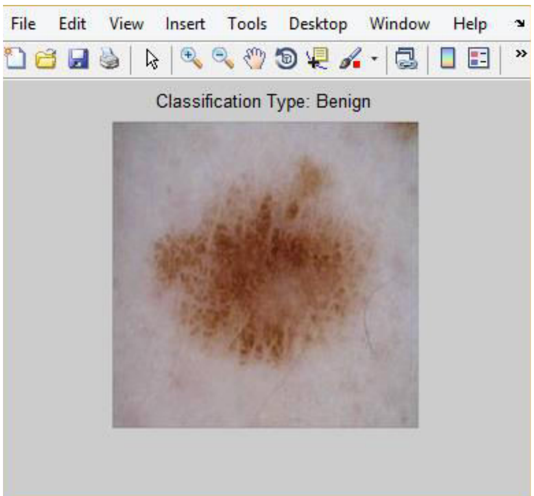

Fig-6.Classified output

4. CONCLUSION

Nowadays detecting Melanoma is a significant one. To improve the accuracy of detection the distance between skin lesion and its boundaries should be maximized. For this purpose KL divergence method is proposed for segmentation and LBP is used for feature extraction. With two feature categories such as periphery and texture feature the skin is classified as melanoma or Benign by using SVM classifier. Compared to existing methods our proposed method produces higher accuracy as 95%.

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