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Melanoma Skin Cancer Detection Using Image Processing

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ABSTRACT

Image processing is having very important role in medical domain. Melanoma skin cancer is critical and dangerous for human beings. Early detection of Melanoma skin cancer is very much necessary for the patient because this Melanoma skin cancer directly lead to the death of a person. If it is detected at early stage then Melanoma skin cancer is completely curable. In this paper early detection and classification of Melanoma skin cancer is done using different classifiers as Neural Network and Support Vector Machine.

Keywords: Neural Network, Support Vector Machine, Medical Images, Wavelet and Lesions.

1. INTRODUCTION

Melanoma skin cancer develops in melanocytes skin cells those are responsible to produce melanin. Already research has been done on detection of Melanoma skin cancer but still issue exists for higher accuracy for the detection and classification of Melanoma skin cancer. In this paper both supervised and unsupervised classification is done using supervised learning based classifiers as Neural Network, Support Vector Machine and unsupervised learning based classification as K-means clustering algorithm. The resultant accuracy is compared with these different classifiers. The highest accuracy is obtained by Support Vector Machine. The accuracy received by K-means clustering algorithm is less than that of Neural Network and Support Vector Machine. In this paper the flow will be programmers design section in that mathematical model for the system is elaborated which describes input and output state of the system. The classification algorithm has discussed along with its accuracy. At last the results in terms of percentage accuracy for different types of classifier are discussed.

2. LITERATURE REVIEW

Sarrafzade,O.; Baygi,M.H.M.; Ghassemi,P, "Skin Lesion Detection in Dermoscopy Images using wavelet transform and morphology operations" Biomedical Engineering(TCBME),201O Iranian Conference , IEEE Nov.20l0.

Dermoscopy is one of the major imaging modalities used in the diagnosis of skin lesions such as melanoma and other pigmented lesions. Due to the difficulty and subjectivity of human interpretation, computerized analysis of dermoscopy images has become an important research area. One of the most important steps in dermoscopy image analysis is the automated detection of lesion borders. In this paper we propose a novel approach for border detection of lesions in dermoscopy images. First, the color input image is converted into a gray-level image. Then,

the wavelet coefficients of gray-level image are calculated. The wavelet coefficients are modified using gradient of each wavelet band and a nonlinear function. The enhanced image is obtained from the inverse wavelet transform of modified coefficients. Morphology operators are used to segment the image, and finally the lesion is detected by an automated algorithm. The results show that the proposed method has a low percentage border error in a vast majority of skin lesions compared recent methods.

Sookpotharom,S, "Border Detection of Skin Lesion Images Based on Fuzzy C-Means Thresholding" Genetic Computing,2009. WGEC '09. 3,International conference IEEE Oct.2009

The accurate location of the border of skin lesions is an important first step in the automatic diagnosis of malignant melanoma. In this paper, we propose a new method of segmentation to locate the skin lesion. The method consists of two stages; image pre-processing and image segmentation. As the first step of image analysis, pre-processing techniques are implemented to remove noise and undesired structures for the images using median filtering. In the second step, the fuzzy c-means (FCM) thresholding technique is used to segment and localize the lesion. The border detection results are visually examined by an expert dermatologist and are found to be highly accurate

F. Samopa, A. Asano.,"Hybrid Image Thresholding Method using Edge Detection", TJCSNS Inter-national Journal of Computer Science and Network Security, Vo1.9 No.4, PP.292- 299, April 2009

An automatically skin cancer classification system is developed and the relationship of skin cancer image across different type of neural network are studied with different types of pre-processing. The collected images are feed into the system, and across different image processing procedure to enhance the image properties. Then the normal skin is removed from the skin affected area and the cancer cell is left in the image. Useful information can be extracted from these images and pass to the classification system for training and testing. Recognition accuracy of the 3-layers back-propagation neural network classifier is 89.9% and auto-associative neural network is 80.8% in the image database that include dermoscopy photo and digital photo.

3. METHOD

3.1 SKIN CANCER

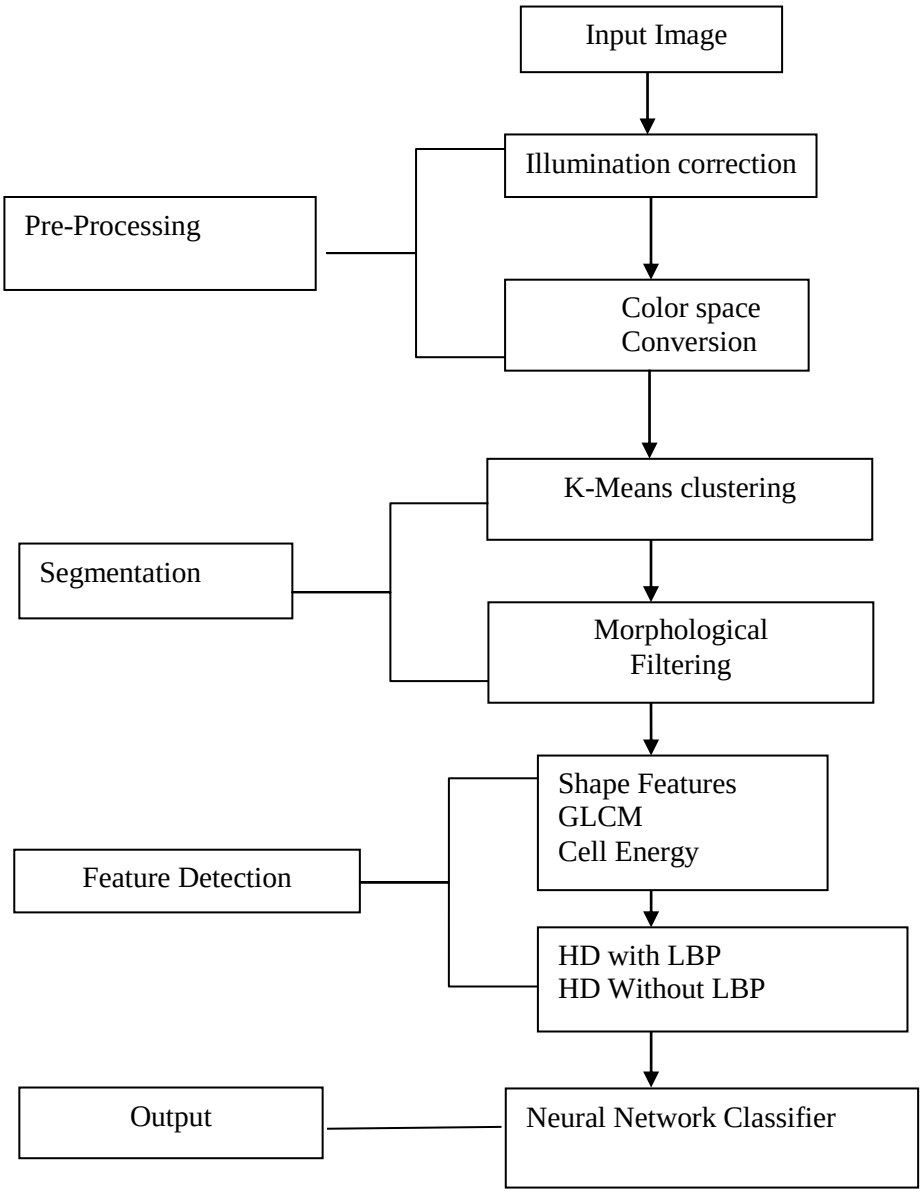
Skin cancer is divided into three types. They are as follows

1. BASAL CELL CANCER.
2. MELANOMA.
3. SQUAMOUS CELL CANCER

Basal cell cancer found in upper epidermis of the skin. Squamous cell found in the middle epidermis of the skin. Melanoma occur in the lower epidermis of the cell. Melanoma is the most destructive type of skin cancer found in human body. It is formed from melanocytes cells. In women, most common site of melanoma is the legs and in

men, it's the back. The majority of melanoma detection in earlier time is to analyze images using dermoscopy which is also called epiluminescence microscopy (ELM).

3.2 FLOW GRAPH



The proposed system consists of two stages; prevention stage and pain treatment stage. In the first stage, captured data from the environment (e.g. sun-light exposure, image of consuming foods) and plug it into the system to alert the user in real time for preventing the risks associated with developing skin cancer disease. In the second stage introduced different techniques to aid in the treatment of skin cancer pain. The outcome of this platform is intended to help users prevent developing skin cancer by triggering a real-time alert that informs the users to:

1) Avoid exposure to harmful UV radiation and
2) Avoid consuming risky foods and/or encourage eating beneficial foods.

Aswin.R.B. et al, Computer Aided Skin Cancer detection is proposed here. This methodology uses Digital Image processing and artificial intelligence for skin cancer detection. This methodology involves no direct contact with skin. Only the dermoscopic image is used here. The image after certain image processing techniques is subjected to segmentation. After segmentation, the unique features are extracted from the image using feature extraction techniques. The feature extraction technique used here is GLCM (Gray Level Co-occurrence Matrix) and RGB color feature. These features are used for classification. Artificial neural network classifier is used for classification. In order to improve the accuracy of classification, the ANN is optimized by Genetic Algorithm.

The proposed implementation is compared with the MATLAB only results for accuracy and speed-up. It is observed that the speed-up obtained for epidermis segmentation is roughly 3 times whereas the speed-up obtained by the nuclei segmentation technique is more than 15 times. Both the epidermis segmentation and nuclei segmentation implementations consist of hole-filling and image reconstruction modules respectively which involve iterative computations which have been implemented as pipelined modules. The proposed a new computer-aided method for the skin lesion classification applicable to both melanocytic skin lesions (MSLs) and non melanocytic skin lesions (NoMSLs).

*3.3 LOCAL BINARY PATTERN*T

The local binary pattern tests the relation between pixel and its neighbours, encoding this relation into a binary word. This allows detection of patterns/features. The LBP feature vector, in its simplest form, is created in the following manner:

1. Divide the examined window into cells (e.g. 16x16 pixels for each cell).
2. For each pixel in a cell, compare the pixel to each of its 8 neighbors (on its left-top, left-middle, left-bottom, right-top, etc.). Follow the pixels along a circle, i.e. clockwise or counter-clockwise.
3. Where the center pixel's value is greater than the neighbor's value, write "1". Otherwise, write "0". This gives an 8-digit binary number (which is usually converted to decimal for convenience).
4. Compute the histogram, over the cell, of the frequency of each "number" occurring (i.e., each combination of which pixels are smaller and which are greater than the center).
5. Optionally normalize the histogram.
6. Concatenate (normalized) histograms of all cells. This gives the feature vector for the window.

3.4 K-MEANS CLUSTERING ALGORITHM

It is an algorithm to classify or to group your objects based on attributes/features into K number of group. K is positive integer number. The grouping is done by minimizing the sum of squares of distances between data and the corresponding cluster centroid. Thus, the purpose of K-mean clustering is to classify the data k-means is one of the simplest unsupervised learning algorithms that solve the well-known clustering problem. The procedure follows a simple and easy way to classify a given data set through a certain number of clusters (assume k clusters) fixed. The main idea is to define k centers, one for each cluster. These centers should be placed in a cunning way because

of different location causes different result. So, the better choice is to place them as much as possible far away from each other. The next step is to take each point belonging to a given data set and associate it to the nearest center. When no point is pending, the first step is completed and an early group age is done. At this point we need to re-calculate k new centroids as barycenter of the clusters resulting from the previous step. After we have these k new centroids, a new binding has to be done between the same data set points and the nearest new center. A loop has been generated. As a result of this loop we may notice that the k centers change their location step by step until no more changes are done or in other words centers do not move any more. Finally, this algorithm aims at minimizing an objective function knows as squared error.

3.5 IMAGE PRE-PROCESSING

Goal of pre-processing is an improvement of image data that reduces unwanted distortions and enhances some image features important for further image processing. Image pre-processing involves three main things

1) Gray scale conversion
2) Noise removal
3) Image enhancement.

3.6 MORPHOLOGICAL FILTERING

Morphological operations are originally developed for bi-level images for shape and structural manipulations. Basic functions are dilation and erosion. Concatenation of dilation and erosion in different orders result in more high level operations, including closing and opening. Morphological operations can be used for smoothing or edge detection or extraction of other features. The fundamental instrument in mathematical morphology is the structuring element. A structuring element is simply defined as a configuration of pixels (a shape) on which an origin is defined (also called anchor point).

Applying a morphological filter consists of probing each pixel of the image using this structuring element. When the origin of the structuring element is aligned with a given pixel, its intersection with the image defines a set of pixels on which a particular morphological operation is applied. In principle, the structuring element can be of any shape, but most often, a simple shape such as a square, circle, or diamond with the origin at the center is used (mainly for efficiency reasons).

As morphological filters usually work on binary images, we will use a binary image produced through thresholding. However, since in morphology, the convention is to have foreground objects represented by high (white) pixel values and background by low (black) pixel values, we have negated the image. Morphological filters can also be used to detect specific features in an image. In this recipe, we will learn how to detect lines and corners in a gray-level image.

4. RESULTS AND DISCUSSION

MATLABR2009a software version is used for this project **Digital Image Processing** technique. The MATLAB coding for melanoma skin cancer detection is given as below

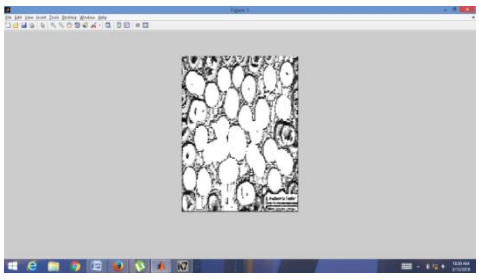


Fig 4.1 represents the illumination

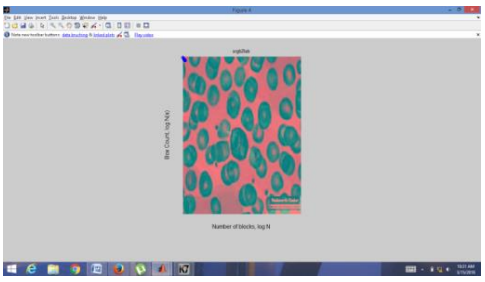


Fig 4.2 represents the srgp2lab

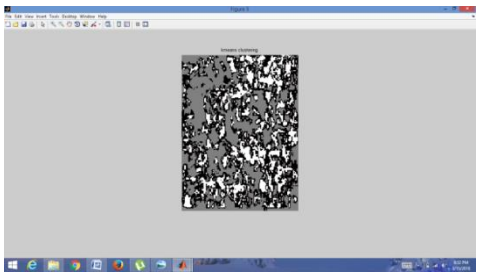


Fig 4.3 represents the K-Means clustering

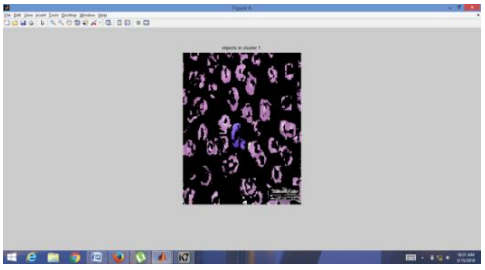


Fig 4.4 represents the object cluster form

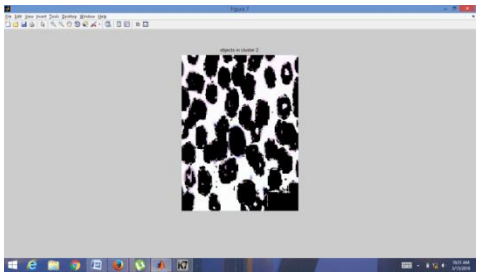


Fig 4.5 represents the object cluster form 2

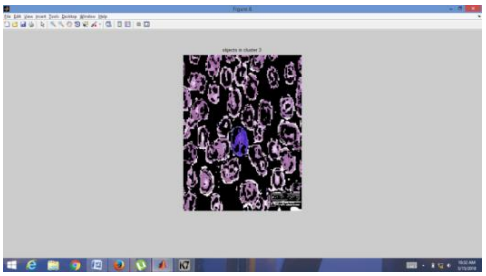


Fig 4.6 represents the object cluster form 3

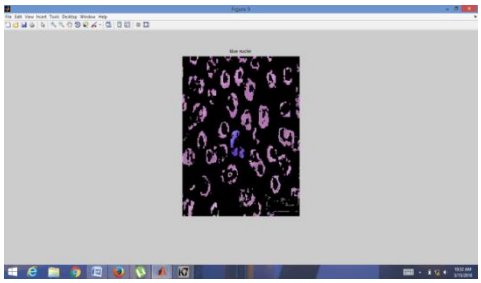


Fig 4.7 represents the blue nuclei

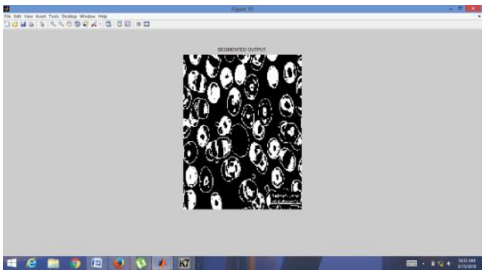


Fig 4.8 represents the segmented output

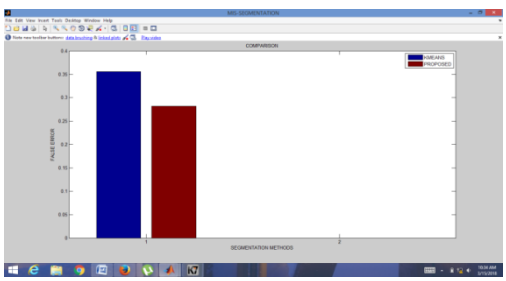


Fig 4.9 represents the MIS segmentation

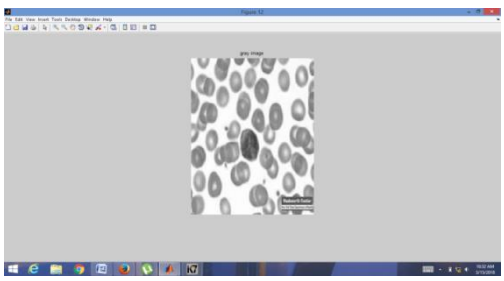


Fig 4.10 represents the grey image

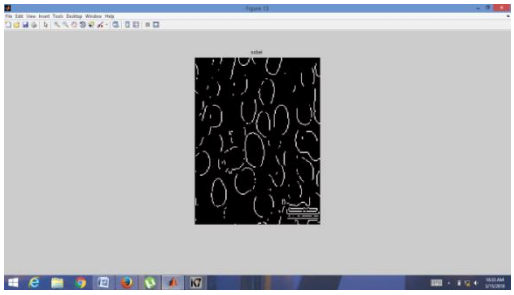


Fig 4.11 represents the sobel

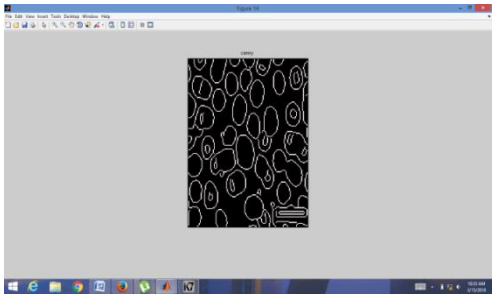


Fig 4.12 represents the canny

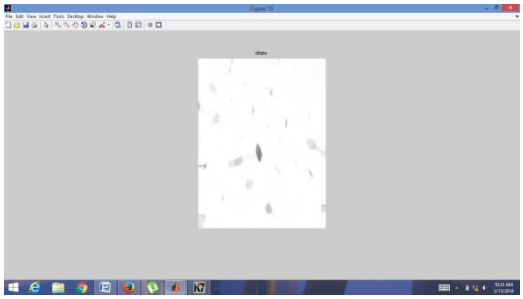


Fig 4.13 represents the dilate

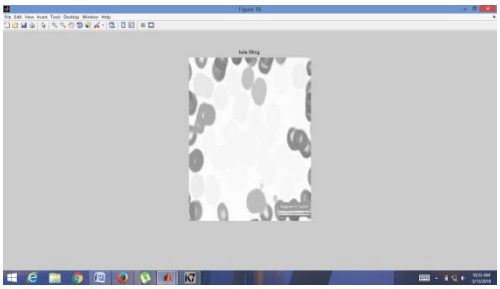


Fig 4.14 represents the hole filling

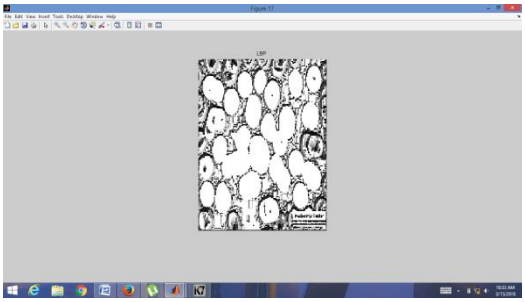


Fig 4.15 represents the LBP

5. CONCLUSION

The rate of patient with skin cancer will be increasing if pollution still damaging the ozone layer. The risk of ultra violet light is a hidden damage to our body skin. It is hard to prevent and the effect can be accumulated. Early detection is important to the patients of the skin cancer. Building an image classification system for early skin cancer detection include different stages, pre and post processing, feature extraction and classifier. The pre-processing resizes the image that improves the speed performance and removes the superfluous feature such as the noise and fine hair. Post-processing enhances the image quality and sharpens the outline of the cancer cell. Feature extraction decomposes the useful feature without prior clinical knowledge. The classifier uses neural network proved advance on predict new image. The paper presented a study which can be concluded that there are some possible factors of low classification result. The image database is not feasible and too small; the variation between dermoscopy and digital image is large. Since dermoscopy and digital image are used both in testing. The imaging processing methods are not unique and their variation is large. The result has shown clearly in the group A. Group A has a relatively low classification result to group B, C and D. A possible improvement and generalization is to deal with the effect of large variation and overcome of it by using larger database. However for our study with both

types of image and for two types of skin cancer, overall result is 89.9% for back- propagation neural network and 80.8% for auto-associative neural network.

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