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Classification of Melanoma Using Segmentation Based Fractal Texture Analysis

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Abstract: Melanoma is a dangerous form of skin cancer. This cancerous growth develops when an unrepaired DNA damages the skin cell which causes the cell to multiply rapidly and form a malignant tumor. Atypical nevus, are more likely to develop into a type of skin cancer called melanoma. The thickness of the melanoma is an important factor associated with survival of patients with melanoma. The measurement of depth is given in millimeters and computed by means of pathological examination after a biopsy of the suspected lesion. The proposed method gives an advanced earlier detection of melanoma by classifying the stages in dermoscopic images using Segmentation Based Fractal Texture Analysis (SFTA).The classification stages consist of Common Mole (pigment cell grows in clusters), Atypical Mole (feature between a normal mole and melanoma), Melanoma (cancer in melanocyte). The feature extraction is based on the clinical findings that correlate certain characteristics present in dermoscopic images. The Markov Random Field model (MRF) provides adequate representation of the intensity distribution of a given image for classifying the stage. Texture plays an important role in image analysis. SFTA is used to form the texture pattern for the classification of melanoma.Naive Baye's classifier is used to detect the abnormal skin cells with SFTA feature vectors.

***Index Term:* Skin Cancer,Melanoma,Atypical nevus,SFTA,MRF, Naive Baye's classifier**

I. INTRODUCTION

Skin is the largest organ of the human body.It protects against heat, sunlight, injury and infection. It helps to control body temperature, store water, fat, and vitamin D.The most important layers of skin are epidermis (upper or outer layer)and dermis (lower or inner layer).Skin cancer is developed on the epidermis, have an ability to invade and spread to other parts of the body. Skin cancers are three types: basal cell skin cancer (BCC), squamous cell skin cancer (SCC) and melanoma [1].

Melanoma[2] is a dangerous form of skin cancer.This cancerous growth develops when an unrepaired DNA damages the skin cell which causes the cell to multiply rapidly and form a malignant tumor.These tumors are originated in the melanocyte (basal layer of epidermis) cell that produces pigment melanin which gives color to skin, hair, and eye.If melanoma is recognized and treated earlier it is almost curable, if not, the cancer can spread to other parts of the body and hard to treat.

The proposed system provides the possibility of early detection of melanoma by classifying the stages using segmentation based fractal texture analysis (SFTA). Stage I: Common Mole (pigment cell grows in clusters) which is usually smaller than 5mm wide and color varies from pink, brown or black.It is round or oval in shape and begins as a flat, smooth spot on the skin. Stage II: Atypical Mole or Dysplastic Nevus [3] is a type of mole looks different from a common mole,it is usually more than 5mm wide.Atypical Mole has a mixture of several colors which varies from pink to dark brown. The surface texture of atypical mole is flat, smooth pebbly surface with irregular and indistinct border. According to the National Cancer Institute, atypical moles are more likely to develop into a type of skin cancer called melanoma.So it is a feature between a normal mole and melanoma.These moles are not malignant but

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their presence is a warning of an inherited tendency to develop melanoma.Stage III: Melanoma is a skin cancer developed from a common mole or atypical mole, which is wider than 6mm and its color feature is uneven it may have shades of black, brown, tan, white grey, red, pink or blue.Surface texture looks scraped and becomes hard or lumpy or ooze or bleed with irregular and asymmetrical border.

II. PROPOSED METHOD

The main components of the proposed system are Image acquisition, Preprocessing, Markov Random field based Segmentation, Featureextraction using Segmentation Based fractal Texture Analysis, Naive Baye's classifier for classification. The block diagram for the proposed system is shown below:

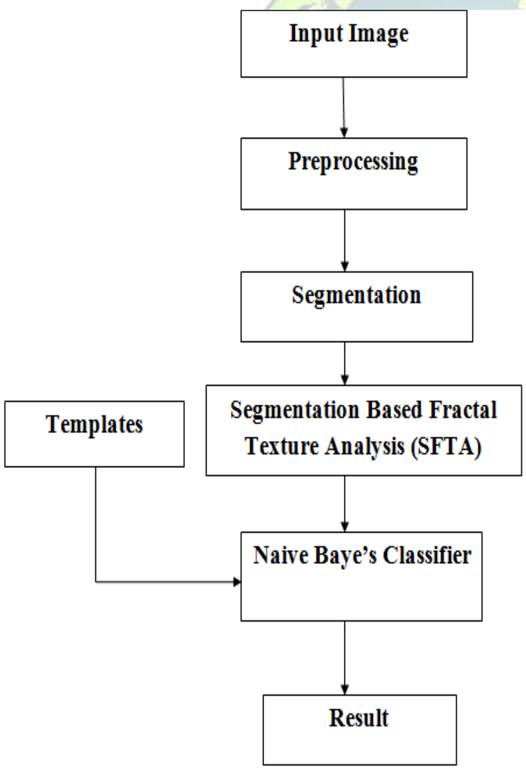

Figure 1: Block Diagram

A. Image Acquisition

Image Acquisition is the first stage of all image processing systems. In this proposed system the skin lesion analysis is done on dermoscopic images [4].Dermoscopic images are obtained by dermatoscope.It consists of a magnifier, a non-polarized light source, a transparent plate and a liquid medium between the instrument and the skin.Modern dermatoscopes use liquid medium and a polarized light to cancel out skin surface reflection.Figure.2 shows a sample image captured using dermoscope.

Figure 2: Dermoscopic image

This instrument is useful for a dermatologist for distinguishing benign from the malignant lesion for the diagnosis of melanoma.The accuracy of dermoscopy increased sensitivity up to 20% and specificity up to 10% when compared with a naked eye examination, so that it can reduce the frequency of unnecessary surgical excisions of a lesion.

B. Pre-Processing

Image pre-processing technique is mandatory for any image based application. In this stage, the image is enhanced for improving the resolution of the image and noise is reduced by using a median filter [5] [6]to improve the result of later processing. Allfiltering techniques are effectively at removing noise in smooth patches, but it affects edges of the images. By using this median filter it can preserve the edges because edges are important for the visual appearance of images.Figure 3 shows a denoiseddermoscopic image.

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Figure 3: Denoised Dermoscopic Image

C. Image Segmentation

Image segmentation is the process of separating lesion region from the background.Before separating the region edges are detected for finding the boundaries of a lesion within images, for that images are converted to grayscale.Edges are detected using a canny edge detector [8], which uses a multistage algorithm to accurately catch wide range of edges in images.Figure 4 shows a canny edge detected dermoscopic image.

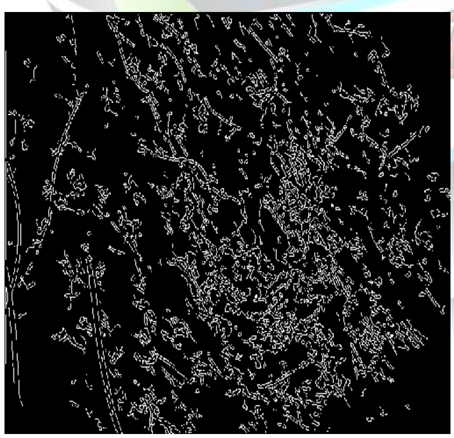

Figure 4: Edge Detected Image

Segmentation is done on the lesion region by creating the Region of Interest (ROI) to filter out the portion of the image for the further operation. The ROI is creating a binary mask, the pixels that represent ROI are set to 1 and all other pixels are set to 0. Figure 5 shows ROI and Segmented lesion region. [7] proposed a system, this system has concentrated on finding a fast and interactive segmentation method for liver and tumor segmentation. In the pre-processing stage, Mean shift filter is applied to CT image process and statistical thresholding method is applied for reducing processing area with improving detections rate. In the Second stage, the liver region has been segmented using the algorithm of the proposed method. Next, the tumor region has been segmented using Geodesic Graph cut method. Results show that the proposed method is less prone to shortcutting than typical graph cut methods while being less sensitive to seed placement and better at edge localization than geodesic methods. This leads to increased segmentation accuracy and reduced effort on the part of the user. Finally Segmented Liver and Tumor Regions were shown from the abdominal Computed Tomographic image.

(a) (b)

Figure 5: (a) Masked Image and (b) Segmented Lesion Region.

Markov Random Field (MRF) [9] [10] is also used in segmentation stage to find out the intensity distribution of a given images, same intensities are clustered that contain a local and physical structure of image which is sufficient to obtain a good and global image representation. Figure.6 shows clustered intensity distribution of image.

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Figure 6: Clustered Intensity Distribution of Image

D. Segmentation Based Fractal Texture Analysis

In this stage decomposing the input image to binary image for getting the fractal dimension of the region border to describe the segmented texture pattern [11] [12]. The feature vector obtained through this stage is given to classifier for comparing with the training data.

E. Naive Baye's Classifier

Naive Baye's Classifier [13] is a probabilistic classifier based on Bayes Theorem, it assumes that the value of a particular feature is independent of the value of other feature given in the templates. Feature vector obtained in SFTA is classified in this stage.

III. CONCLUSION

In this proposed system, PH_2 dermoscopic image database from Pedro Hispano Hospital is used for the experiment. The database contains 200RGB colour image. Early diagnosis of melanoma is almost curable so that the detection of atypical nevus is important for the survival of patient (the stage before the melanoma).The goal of this paper is to classify the melanoma, for that a new feature extraction algorithm, the Segmentation based Fractal Texture Analysis (SFTA) were proposed.

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