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Skin Cancer Detection Using Region Based Segmentation

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Abstract :

When we think about the prominent organs that make up our bodies, we think of the heart, the lungs, the brain and perhaps the liver. Seldom would we think about our humble skin. However, our skin is actually the largest of our organs and plays as vital a role in maintaining our lives as those other more popular organs. Like any different organs within the body, the skin also subjects to cancer. Skin cancers are divided into two major forms: Non-melanomas and Melanomas. Melanoma is the most unpredictable. It will be helpful to cure it when the melanoma cancer is detected in the earlier stages. This paper is based on a computer aided method for the detection of Melanoma Skin Cancer using Image processing tools. The input to the system is the skin lesion image and then by processing itthe presence of skin cancer is analysed. In this paper proposing region based segmentation for separating the skin lesion from the normal skin. The Lesion Image analysis tools checks for the various Melanoma parameters like Asymmetry, Border, Colour, and Diameter (ABCD). Thedetection of skin cancer is done based on a parameter called TDS index which is calculated from ABCD parameters.

Index Terms- Skin disease, Melanoma, Segmentation, Region growing, ABCD parameters, TDS index.

I.INTRODUCTION

Skin cancer is the abnormal growth of skin cells. Skin cancer develops totally on the areas of sun-exposed skin as well as the scalp, face, lips, ears, neck, chest, arms and hands, and mostly on the legs in women. But this common form of cancer can also occur on areas of your skin not ordinarily exposed to sunlight such as your palms, beneath your fingernails or toenails. Carcinoma affects people of all skin tones, including those people with darker complexions. When melanoma occurs in people with dark skin tones, it's more likely to occur in areas not normally exposed to the sun, such as the palms of the hands and soles of the feet.

There are three major types of skin cancer: basal cell carcinoma, squamous cell carcinoma and melanoma, out of which Melanoma is the most hazardous type of skin cancer. Melanoma will develop anyplace on your body, in otherwise normal skin or in an existing mole that becomes cancerous. Malignant Melanoma most frequently appears on the face or the trunk of affected men. In females, this type of cancer mostly develops on the lower legs. In both male and female, melanoma can occur on skin that hasn't been exposed to the sun.Melanoma can affect people of any skin quality. In people with darker skin tones, melanoma tends to occur on the palms or soles, or under the fingernails or toenails. Melanoma signs include:

- A large brownish spot with darker speckles
- A mole that changes in colour, size or feel or that bleeds
- A small lesion with an asymmetrical border and portions that appear red, pink, white, blue or blue-black
- A painful lesion that itches or burns
- Dark lesions on your palms, soles, fingertips or toes, or on mucous membranes lining your mouth, nose.

The World Health Organization (WHO) estimates that around 60,000 early deaths occur each year worldwide because of excessive exposure to the sun's ultraviolet (UV) radiation. An estimated 49,000 of these deaths are from malignant melanoma. Avoiding exposure to the sun can significantly lower the risk of skin cancer. Tanning beds are also a source of damaging UV rays.

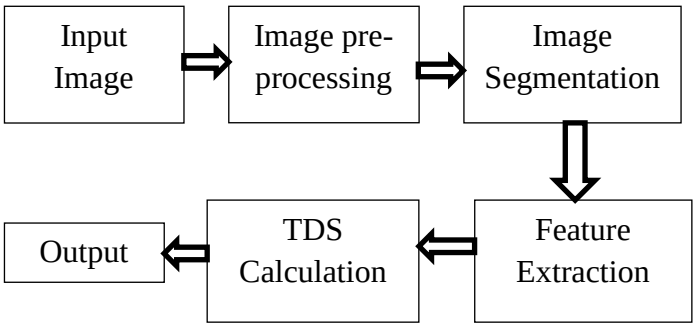
II. RELATED WORK

Many analysts have been working with the Computer based approach for Carcinoma detection. For sectioning of skin lesion in the input image; existing systems either use manual, semi-automatic or fully-automatic border detection methods. The characteristics to carry out skin lesion segmentation used in various papers are: shape, colour, texture, and luminance. Some of the border finding methods includes histogram thresholding, global thresholding on optimised colour channels followed by morphological operations, Hybrid thresholding. In this paper, we are applying region based segmentation method for separating the skin lesion in the input image.

III. PROPOSED WORK

In order to achieve an efficient way to identify skin cancer atan early stage without performing any avoidable skin Biopsies, digital images of melanoma skin lesions have been investigated. The proposed method consists of the following steps for melanoma skin cancer detection: image pre processing, image segmentation, feature extraction, and TDS index calculation.

BLOCK DIAGRAM:



Input image- The input RGB image is a skin lesion which is to be detected either as a cancerous or non cancerous skin.

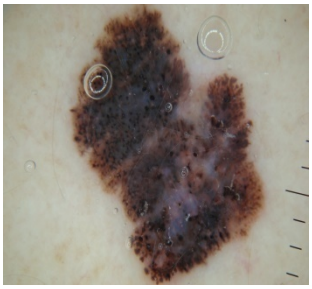
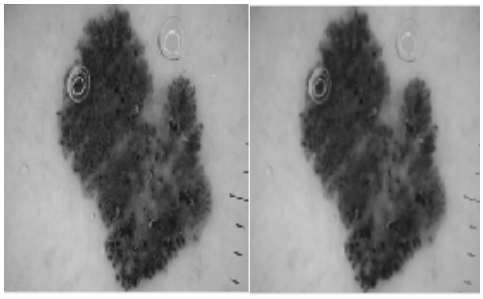


Fig: RGB Image

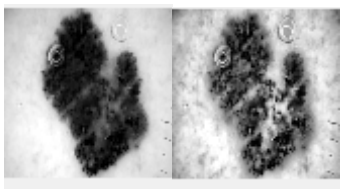
IV. IMAGE PREPROCESSING

Image pre processing: The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing.Pre-processing is a common name for operations with images at the lowest level of abstraction -- both input and output are intensity images. These iconic images are

of the same kind as the original data captured by the sensor, with an intensity image usually represented by a matrix of image function values (brightness). The image pre-processing steps involve resizing the image, RGB to gray level conversion, noise removal and image enhancement. The noise can be removed by applying median filtering technique. Contrast Stretching and Histogram equalization can be used for image enhancement.



(a) **(b)**



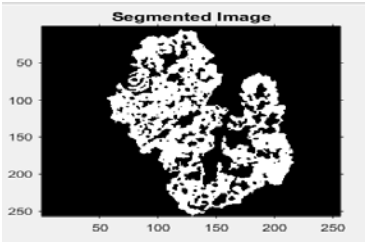
(c) **(d)**

Fig: Image pre-processing-(a) gray level image (b) median filter (c) contrast stretching (d) Histogram equalization

V. IMAGE SEGMENTATION

Image Segmentation- Image segmentation is one of the most significant steps leading to the examination of processed image data. Its main goal is to partition an image into parts that have a strong correlation with objects or areas of the real world contained in the image. Medical Image Segmentation is the process of automatic or semi-automatic detection of boundaries within a 2D or 3D image. Major difficulty of medical image segmentation is the high inconsistency in medical images. The result of the segmentation can then be used to obtain advance diagnostic insights. In this paper the proposed segmentation method is region growing method.

In region growing segmentation the region is repeatedly developed by contrasting all unallocated neighbouring pixels with the region. The dissimilarity between a pixel's intensity value and the region's mean is utilized as a measure of likeness. The pixel With least dissimilarity measured along these lines is allotted to the individual region. This handle stops when the intensity difference between region mean and new pixel wind up noticeably bigger than a specific threshold, t.



VI. FEATURE EXTRACTION

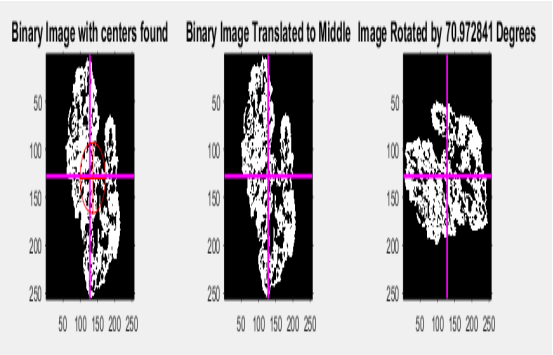
Feature Extraction- Feature extraction is the crucial part in classifying the images as cancerous and non cancerous. After segmentation the images are classified based on ABCD dermatoscopic rule. Various features like Asymmetry, Border, Colour, and Diameter of the image are extracted.

Asymmetry: According to dermatologists, melanomas develop in an anarchic fashion (i.e. they are asymmetrical), while benign tumours are symmetrical.Asymmetry Index is computed with the following equation:

$$AI= (A1+A2)/2Ar$$

Where, A1= Area of non-overlapped region along minor axis of the lesion A2= Area of non-overlapped region along major axis of the lesion Ar= Area of lesion

Implementation: Area of lesion (Ar) can be calculated using "bwarea" over the binary image of the segmented region. For calculating non overlapped area over axis. The segmented region is separated along the lines passing through centroid of the region Two separate areas are generated which are then adjusted so that the areas will be overlapped by flipping one area. Using XOR over the area will generate the non-overlapped region whose area is calculated using "bwarea" function. To generate area along x axis the bisection will be generated using first Gx pixels and the next Gx pixels along x axis and bisecting line on y axis. To generate area along y axis the bisection will be generated using first Gy pixels and the next Gy pixels along x axis and bisecting line on y axis. After calculating area of the regions Asymmetry index is calculated using the specified formula.



BORDER IRREGULARITY (B): Benign lesions are usually defined by clear borders; while melanomas are defined by much contrasted borders irregularly. The parameter B can be calculated from compactness index where

$$CI = (P*P)/(4*AR)$$

COLOUR (C): Melanomas are represented by several colours. The pigmentation of a lesion can be characterized by several colours ,five to six colours may be present in a malignant lesion. The colours to be verified are: Black, white, red, light brown, dark brown and blue gray. If a particular colour presence is above 5 percent it's score is given 1. The maximum colour score is 6 because here 6 colours are being tested.

DIAMETER (D): Melanomas usually start with a diameter of more than 6–7 mm.The diameter is assigned to be 5 if the diameter of lesion is greater than 6mm. For other values the diameter is one less than its actual rounded value. To calculate Diameter the "regionprops" function is used to get the major axis length of the lesion region. Resultant value is converted into mm value and the value is assigned to diameter.

```
asymmetry:
    0.9490


borderirregularity =

   52.0371


A =

  6×3 table

                 Color_Count    Percentage    Score
                 ___________    __________    _____

    Black            610         3.8708        0
    White              0             0         0
    Red                0             0         0
    Light Brown      114         0.7234        0
    Dark Brown     13940         88.457        1
    Blue Gray          0             0         0

color:
     1


diam =

    0.0961
```

Fig: ABCD parameters output

VII. TDS INDEX CALCULATION

TDS Index Calculation- Following formula is used

$$TDS = 1.3A + 0.1B + 0.5C + 0.5D$$

If the TDS Index is less than 4.75, it is benign (noncancerous) skin lesion. If TDS Index is greater than 4.75 and less than 5.45, it is suspicious case of skin lesion. If

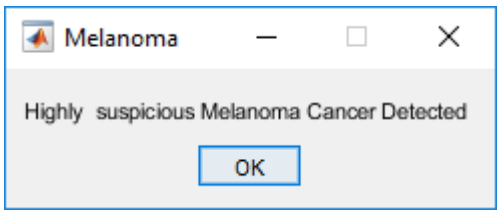
TDS Index is greater than 5.45, it is malignant melanoma (cancerous) skin lesion.

```
TDS =

    6.9855
```

Fig: TDS index for given input

RESULT:



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