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SKIN CANCER DETECTION USING MATLAB AND IMAGE PROCESSING TOOLSBOX

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Abstract
Skin cancer is one of the most popular types of cancer, which inspires the life of millions of people every year in the entire world. Melanoma is one of the forms of cancer that initiates in melanocytes and it can influence the skin only. It's more serious as compare with other types of skin cancer. The Melanoma can be of benign or malignant. The paper focused on detection system has been designed for diagnosing melanoma in early stages by using digital image processing techniques. The paper has many steps like preprocessing, segmentation, feature extraction and detection process which give the acceptable results for skin cancer detection problems

Keywords: *skin cancer, preprocessing, segmentation; feature extraction; diagnosis.*

I. INTRODUCTION

Human Skin the outermost tissue of the human body. As a result, people are very aware of, and very sensitive to, the appearance of their skin. Consequently, skin appearance has been a subject of great interest in several fields of science and technology. Human skin is the largest and fastest growing organ of the body. The skin weight in the human body is near about between 6 and 9 pounds and the surface area of skin is about 2 square yards. Human skin separates the inside of body from the outer environment. The skin protects to human from bacteria, Viruses, microbes and the elements, helps regulate body temperature, and permits the sensations of touch, heat, and cold[1]. Human skin can cause symptoms such as redness, swelling, burning, and itching. Allergies, irritants, genetic makeup, and certain diseases and immune system problems can cause dermatitis, hives, and other skin conditions. Signs of skin diseases, such as a bump, a rash or a dry patch, can be perplexing. There are many skin problems, such as acne, also affect your appearance. Human skin can also develop several kinds of cancers [1]. Human Skin is constructed of two major layers; the epidermis (or surface layer), the outermost layer of skin, provides a waterproof barrier and creates our skin tone. And the dermis (or interior layer), beneath the epidermis, contains tough connective tissue, hair follicles, and sweat glands. The thin epidermis layer is composed of constantly renewing layers of cells called keratinocytes which rise in layers from the interior of the epidermis only to get sloughed off at the surface, and other supporting cell types including melanocytes (pigmented cells responsible for skin color or freckles), dendritic cells (involved in skin immune function), and basal cells. The thicker, deeper dermis layer is composed of connective tissues and embedded blood vessels, nerve and sensory fiber endings, oil and sweat glands, body hair follicles and a variety of other structures [2]. These cancer subtypes are largely differentiated based on where in the skin layers they form.

Skin Cancer—Skin cancer is the very common form of cancer in the United States. The skin cancers are divided into two major forms: Nonmelanomas and Melanomas[3]. The Nonmelanomas usually form on the head, face, neck, hands, and arms. Another type of skin cancer is melanoma. It is more dangerous but less common. Melanoma occurs in the melanocytes, which are cells in the outer layer of human skin. The role of melanocytes produce the skin coluring calls as melanin, which gives skin its tan or brown color and helps protect the deeper layers of the skin from the harmful effects of the sun. Melanoma develops when melanocytes undergo malignant transformation [2]. Melanoma may be cured if caught and treated early, but, if left untreated, the majority of melanomas eventually spread to other parts of the body. Early detection and surgery to remove the melanoma are successful in curing most cases of melanoma.

The paper is Organized as follows: In section 2, Methodology system of skin cancer, in section 3, the results are presented, in section 4, conclusion remarks are given.

II.   METHODOLOGY SYSTEM

The methodology system was covered different step which shows a general step of diagnosis melanoma skin cancer. The block diagram shows the structure of the methodology system of this work as show in fig.1.
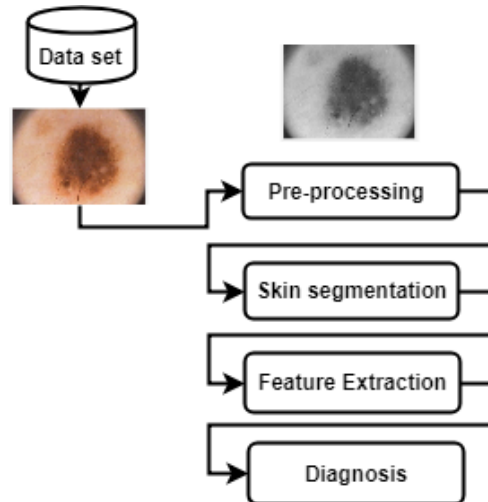

Fig.1 Block diagram of methodology system

The first phase of the methodology was start with read the digital images and send it to the preprocessing stage in the skin cancer detection system.

A.   Detecting Melanoma Lesions

In the paper, identifying melanoma injuries includes four stages: pre-processing, injury division (separate sore from skin), highlight extraction (shading, surface and shape highlights), and finding to distinguish if the sore is considerate or harmful melanoma. The pictures databases of melanoma skin malignancy that have been received in this paper are gotten from the Lloyd Dermatology and Laser Center [4]. The database contains around 200 shading pictures for melanoma skin malignant growth, pictures are caught in the JPEG arrange, with most extreme goals measure 481x734 pixels, which were later resized to 256 x 512 pixels.

B.   Preprocessing

The aim of pre-processing step is to enhance the digital image and remove unwanted data(Noise) to make the image very clear for the next stages. This stage contains different steps like remove the hair; remove the noise, contrasting the images. In the case of Hair Removal the Dull Razor filter algorithm was derived and used from [7],[8] which summaries as the replace the pixel of the hair by their neighbor pixels. The second case which was called remove the noise from the skin images which conducted by using median filter as mention in [9]. Finally, the last stage of pre-processing was contrasting the skin image and makes the image very clear for achieved good performance. The image adjustment methods was used and implemented for improve the image clarity.

C.   Skin Lesion Segmentation

This stage conducted after preprocessing to detecting and extracts the region of interest (ROI) which represents the lesion region. To perform the segmentation there are many steps like Image thresholding, morphological operation, border extraction and detection, image filling, lesion extraction then converting extracted region to gray level, and then performing histogram equalization to the extracted gray level image.[11,12]

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D. Feature Extraction

after the pre-processing stage and segmentation which the result was the Region of Interest (ROI), the part which have the many types of feature which is unique and determine the melanoma from benign melanoma. In this work the different type of feature were used like color feature, shape feature and texture feature which discuss in details in the next section.

1.   Colour Features

At the first stage of the instantly signs of melanoma is the skin color variations. They are constantly colorful from one end to the other brown, or black, tentative the concept of the melanin pigment at diverse depth in the skin. The extract the color features are mainly statistical calculation of different parameter which related to color like color space channels, variance and standard deviation of Read ,Green and Blue (RGB) or Hue, Saturation, and Value (HSV) [8]. The work was done by calculated   color variance of RGB image with help of HSV channel and the algorithm was sequentially as below:

Algorithm1: color features extraction
Input: color images of skin disease.
Output: features vector.
Begin
Step1: preprocessing whichconvert the RGB color map into an HSV color map.
Step2: calculate the variance and standard derivation for each channel of H, S, and V.
Step 3: store the feature fromeach channel of H, S, and V as feature vector in database for next steps
End

2.   *Shape Features*

the second feature was shape feature which contain asymmetry, irregularity, and diameter which was calculated from lesion in binary image.

A. Asymmetry

The concept of Asymmetry is an important to understanding the shape, which is very helpful for analysis in pattern recognition and detection. The idea behind a symmetric pattern was one need only one half of the pattern with the axis of symmetry. The condition is if the missing part from the pattern or noisy, with the help of symmetry one can full the pattern or get rid the pattern of noisy. Malignant skin lesions resort to have symmetric shape, but in the case of benign lesions resort to have an asymmetric shape. However, we can say that the ratio becomes 1 if the shape is completely symmetrical. While in the case of asymmetry increases, the ratio closer or nearly to 0 [8]. Asymmetry equation as shows the Eq.(1).

$$AI = \frac{\Delta A}{A} \times 100 \qquad (1)$$

Where, A is whole Image area, ΔA is the difference between whole image and lesion area.

B. Irregularity

The Irregularity feature can be compute and detect with help of shape and area. In the case of Malignant skin lesions resort to have irregular borders with sharp edges and notches. While in the case of Benign lesions resort to have smooth borders. As similar to previous the condition with the help of ratios, If the shape is whole symmetrical, the ratio is 1, otherwise the ratio nearly or closer to 0 [8]. The calculation of Irregularity index with help of Eq.(2).

$$IR = \frac{4\pi A}{P^2} \qquad (2)$$

 Where A is the area and P is the perimeter. For a typical circle, the irregularity is 1. While the border becomes more irregular, the index values may reach to 0.

C. Diameter

Malignant melanoma was resort to expand big than benign melanoma, and essentially the diameter of 6 mm, the way to find the diameter was by calculates the distance between each pair of points. The diameter computes with help of maximum distance of these pair of points[8]. The shape feature extraction algorithm was shows as below:

Algorithm2 : shape features.
Input: Binary image.
Output: shape features vector.
Begin
Step1: Calculate the whole Area of the Image.
Step2: Calculate the area of lesion.
Step3: subtract the whole image and lesion area.
Step4: Calculate asymmetry as shows in Eq.(1).
Step5: Compute border irregularity as show in Eq.(2).
Step6: Calculate the distance between each pair of points.
Step7: The maximum of these distances is the diameter.
Step8: store the value of asymmetry, regularity and diameter as feature point in feature vector of each image in database for next stage.
End

D. Diagnosis

In this stage the proposed system is diagnosis, the malignant melanoma types, with the help of features vector and store it in database for diagnosis step

III.   RESULTS

The experiments was perform on A set of images were acquired from different web [4] and by using MATLAB platform and Image Processing tools box. The images are processed and their features evaluated using the Image Processing Toolbox and classify the images into malignant and benign categories.

Since, the acquired images are captured using general purpose digital cameras; they suffer from noise and face inconsistencies in background illumination. Apart from these issues, some lesions also have hair over them, which make their identification difficult.Early melanoma skin cancer diagnostic system by using computer vision and pattern analysis techniques is more effective than the traditional Biopsy methods. The benefits of that were major in two parameter cost and time which the more efficiency and with low cost and less time taken for detection and evaluation of the system as compare with traditional methods. The figure 2 Show different sample of skin cancer.

Fig.2. different sample of skin cancer

The result of preprocessing was show the convert color image to grayscale image as show in fig.3 for different samples.
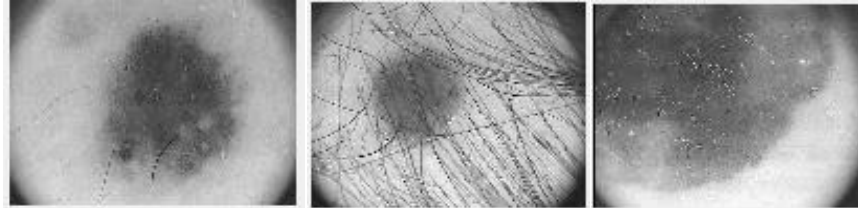
Fig.3. Convert color image to grayscale

The result of segmentation was determined and detected the exact part of skin cancer with help of morphological operators (open and close).The fig.4. Show visualization results of segmentation for three samples from skin cancer datasets.
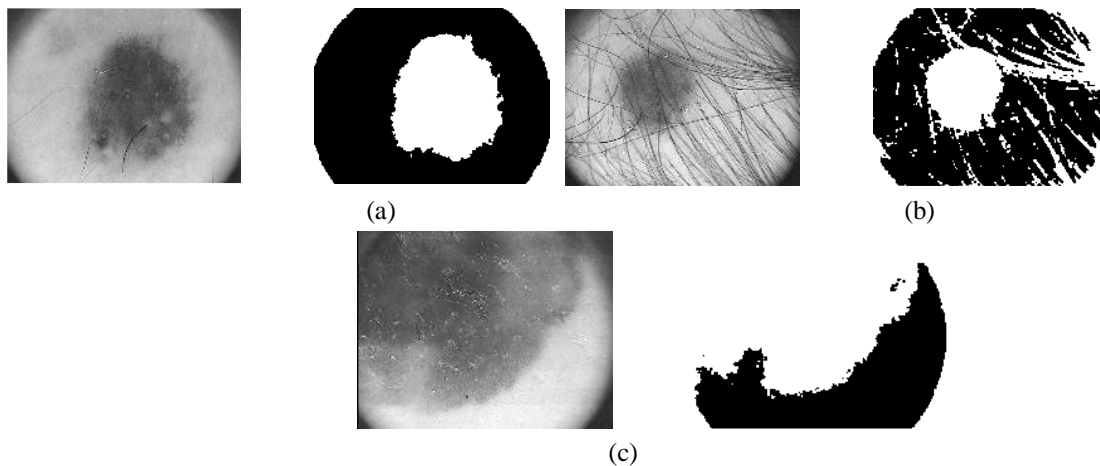

(a)   (b)

(c)

Fig.4. Segmentation (a) sample 1 (b) sample 2 (c) sample 3

ally, the feature vector was calculated and store in database to Diagnosis and classify. Table 1 shows the results of different types of images taken from datasets with help of feature we can classify the each image has cancer and which types either Melanoma or Benign

Table 1 the results of different types of images for performance

Image name	Asymmetry	Boarder Irregularities	Color Variation	Diameter	Result
Cancer 1.jpg	3.1221	0.5675	0.9985	0.8973	Melanoma
Cancer 2.jpg	1.8030	0.5149	1.2925	1.1027	Benign
Cancer 3.jpg	4.3867	0.6342	0.9278	0.9837	Melanoma
Cancer 4.jpg	2.1184	0.5719	1.3110	0.8737	Benign
Cancer 5.jpg	4.9400	0.6309	1.0720	0.9467	Melanoma
Cancer 6.jpg	3.0173	0.5802	1.0747	1.2500	Melanoma
Cancer 7.jpg	1.5559	0.5054	1.4478	1.0234	Benign
Cancer 8.jpg	2.3855	0.5858	1.1584	1.1513	Benign
Cancer 9.jpg	2.0076	0.6201	1.2288	1.2500	Benign
Cancer 10.jpg	4.9400	0.6353	0.9822	1.2500	Melanoma
Cancer 11.jpg	4.2909	0.6208	0.8773	1.2500	Melanoma
Cancer 12.jpg	4.9400	0.6353	1.2671	1.2500	Melanoma
Cancer 13.jpg	3.8651	0.6217	1.5000	1.2500	Melanoma
Cancer 14.jpg	3.3100	0.5969	0.7452	1.1787	Melanoma
Cancer 15.jpg	3.9589	0.6291	1.4502	1.0079	Melanoma

IV.   CONCLUSIONS

In this work, the process of detection the skin cancer was conducted and presented approach to classify the skin lesions into their respective category either Melanoma or Benign. In this study, we presented a powerful tool for detection, extraction of skin lesion. The work was done practically step by step by using the MATLAB software with the help of image processing tools. The result which we got was acceptable

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