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A NONINVASIVE REAL-TIME AUTOMATED SKIN LASIONANALYSIS SYSTEM FOR MELANOMA EARLY DETECTION AND PREVENTION

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ABSTRACT

Melanoma spreads through metastasis, and therefore it has been proved to be very fatal. A system to prevent this type of skin cancer is being awaited and is highly in-demand. It is important to highlight that excess exposure to radiations from the sun gradually erode melanin in the skin. Moreover, such radiations penetrate into the skin thereby destroying the melanocyte cells. Melanomas are asymmetrical and have irregular borders, notched edges, and color variations, so analyzing the shape, color, and texture of the skin lesion is important for melanoma early detection and prevention. In this work, the components of a portable real-time noninvasive skin lesion analysis system to assist in the melanoma prevention and early detection are proposed. The first component is a real-time alert to help users to prevent skin burn caused by sunlight; a novel equation to compute the time for skin to burn is thereby introduced. The second component is an automated image analysis including image acquisition, hair detection and exclusion, lesion segmentation, feature extraction, and classification. The framework has been developed in a smart-phone application. The experimental results show that the proposed system is efficient, achieving high classification accuracies.

I. INTRODUCTION

Melanoma is the most frequent type of skin cancer and its incidence has been rapidly increasing over the last few decades. Nevertheless, it is also the most treatable kind of skin cancer, if diagnosed at an early stage. The clinical diagnosis of melanoma is commonly based on the ABCD rule, an analysis of four parameters (asymmetry, border irregularity, color, and dimension), or the 7-points checklist which is a scoring method for a set of different characteristics depending on color, shape, and texture.

Melanoma, a type of skin cancer must be diagnosed at an early stage. Early diagnosis makes treatment effective and life of patient can be saved. Dermoscopy has become important technique in early diagnosis of melanoma. In this technique, oil is applied on skin surface where lesion is present and polarized light is made incident on skin.

The hair which is present on skin can be segmented as lesion because of dark pixels being classified as lesion against lighter pixels which will be categorized as skin. So it is necessary to remove these hair pixels from

acquired image. In some of the cases, dermatoscope is provided with ruler markings for measurement of diameter of lesion. So these markings will be there in acquired image. The air bubbles and black frame in image can affect the accuracy of segmentation process and further diagnosis of skin cancer. So these artifacts must be removed from dermoscopic image. In some of the cases, contrast between skin and lesion can be very poor. It is needed to increase the contrast between skin and lesion. Histogram equalization based technique can be used for contrast enhancement. Histogram equalization gives good results for dermoscopic images. This involves remapping in gray levels to produce uniform distribution in input image. Improved contrast between the lesion and skin improves the accuracy of further diagnosis steps.

II. EXISTING SYSTEM

In existing system, the system approached a real time image analysis system to aid in the malignant melanoma prevention and early detection. The existing system presented an image recognition technique, where the user will be able to capture skin images of different mole types. The system will analyze and process the images and alert the user at real-time to seek medical help urgently.

The existing work introduced convenient steps for automating the process of melanoma prevention and detection. Experimental results on a PH2 dermoscopy research database images confirms the efficiency of our system.However the novelty of our system lies in the fact that we further improved the efficiency of the system by implementing an advanced image-processing framework to detect suspicious areas and help with skin cancer prevention. The existing system's goal was to demonstrate how smart phones could turn into powerful and intelligent machines and help large populations without expertise in low-resource settings.

Several algorithms have been proposed. They can be broadly classified as thresholding, edge based or region-based methods. An example of thresholding can be found, where a fusion of global thresholding, adaptive thresholding, and clustering is used. Thresholding methods achieve good results when there is good contrast between the lesion and the skin, thus the corresponding image histogram is bimodal, but usually fails when the modes from the two regions overlap. Edge-based approaches were used where the segmentation is based on the zero-crossings of the Laplacian-ofGaussian and in several active contour methods like the gradient vector flow (GVF) used and the geodesic active contour model (GAC) and the geodesic edge tracing described. Edge-based approaches perform poorly when the boundaries are not well defined, for instance when the transition between skin and lesion is smooth. In these situations, the edges have gaps and the contour may leak through them. Another difficulty is the presence of spurious edge points that do not belong to the lesion boundary. They are the result of artifacts such as hair, specular reflections or even irregularities in the skin texture and they may stop the contour preventing it to converge to the lesion boundary. Region-based approaches have also been used. Some examples include the multiscale region growing described the modified fuzzy c-means algorithm which is orientation sensitive proposed, the morphological flooding used, a multi resolution Markov random field algorithm and statistical region merging.

III. PROPOSED WORK

In proposed system, This paper proposes the components of a novel portable (smart phone-based) noninvasive, real-time system to assist in the skin cancer prevention and early detection. A system to prevent this type of skin

cancer is being awaited and is highly in-demand. The proposed system has two major components. The first component is a real-time alert to help users to prevent skin burn caused by sunlight; a novel equation to compute the time for skin to burn is thereby introduced. The second component is an automated image analysis which contains image acquisition, hair detection and exclusion, lesion segmentation, feature extraction, and classification, where the user will be able to capture the images of skin moles and our image processing module will classify under which category the moles fall into; benign, a typical, or melanoma. An alert will be provided to the user to seek medical help if the mole belongs to the atypical or melanoma category. The proposed system uses PH2 Dermoscopy image database from Pedro Hispano Hospital for the development and testing purposes. The image database contains a total of 200 dermoscopy images of lesions, including benign, atypical, and melanoma cases.

To help the users avoid skin burn caused by sun exposure, and hence, to prevent skin cancer, our system would calculate the time for skin to burn and the system will deliver a real time alert to the user to avoid the sunlight and seek shade to prevent developing skin cancer. The system created a model by deriving an equation to calculate the time for skin to burn namely, ‘‘Time to Skin Burn’’ (*TTSB*). This model is derived based on the information of burn frequency level and UV index level. The proposed TTSB model can be validated by crosschecking the calculated TTSB values 2 with the information provided by the National Weather Service Forecast, where the TTSB values are calculated using our model based on the UV index, skin type, environment variable and SPF level. The calculated TTSB fall in the range of the data provided by the National Weather Service. To the best of our knowledge, this is the first model proposed that calculates the time-to-skin-burn based on the given UV index, skin type, environmental parameters and SPF, only take into account only UV index and skin type.

The system is important in the sense that it allows the users to detect melanoma at early stages which in turn increases the chance of cure significantly. The system introduces an image processing technique to detect and exclude hair from the dermoscopy images as an essential. The result is a clean hair mask which can be used to segment and remove the hair in the image, preparing it for further segmentation and analysis.

Advantages:

This novel framework is able to classify the dermoscopy images into benign, atypical and melanoma with high accuracy.

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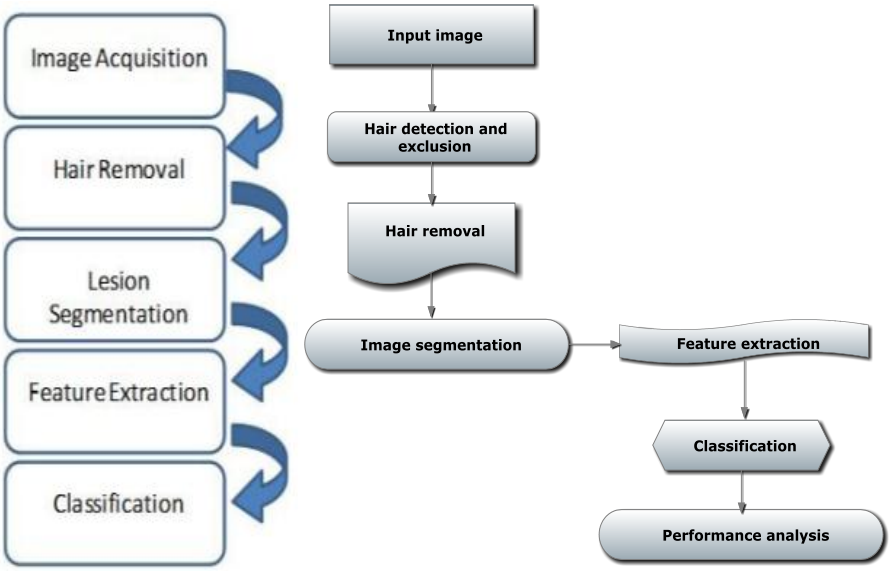

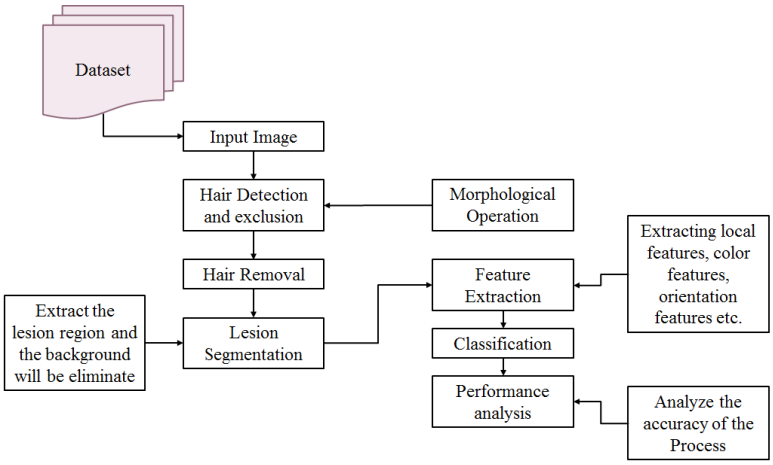

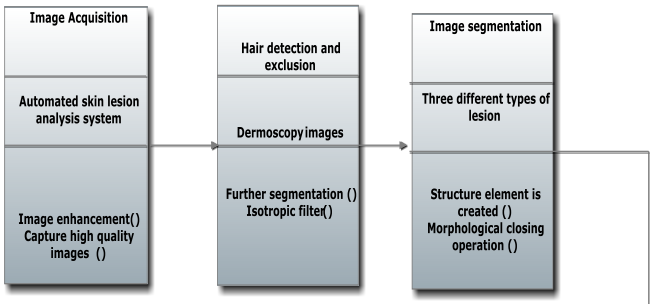

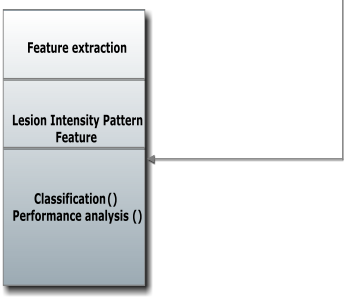

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IV. SIMULATION RESULTS AND DISCUSSION

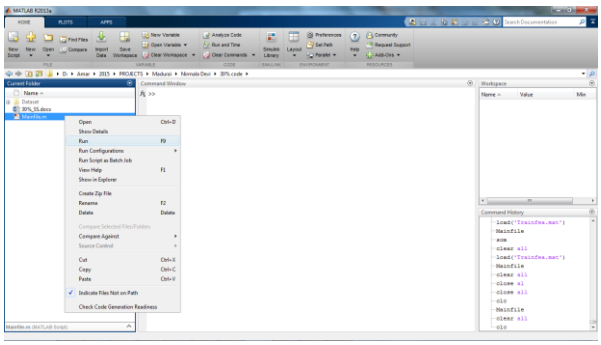

Fig 1 – Shows the simulation result to run the code

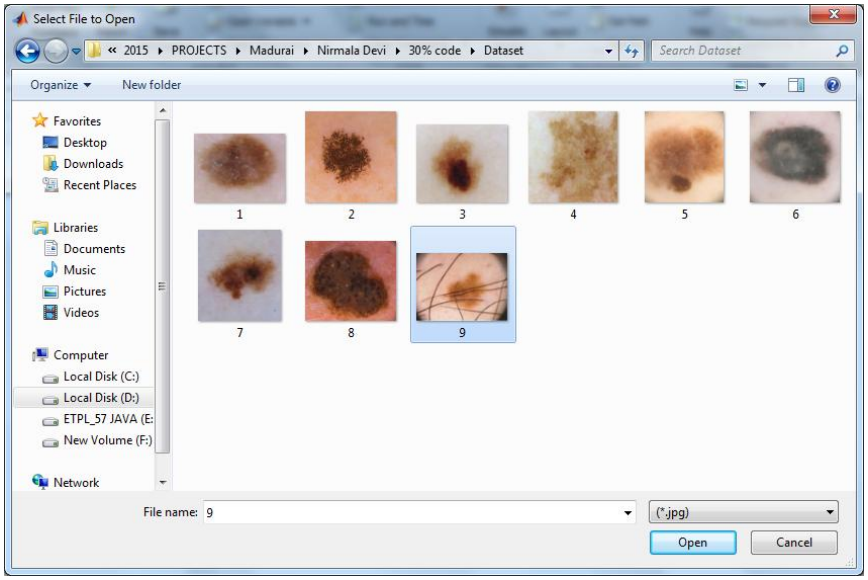

Fig 2 – Shows the Simulation Result of getting input image.

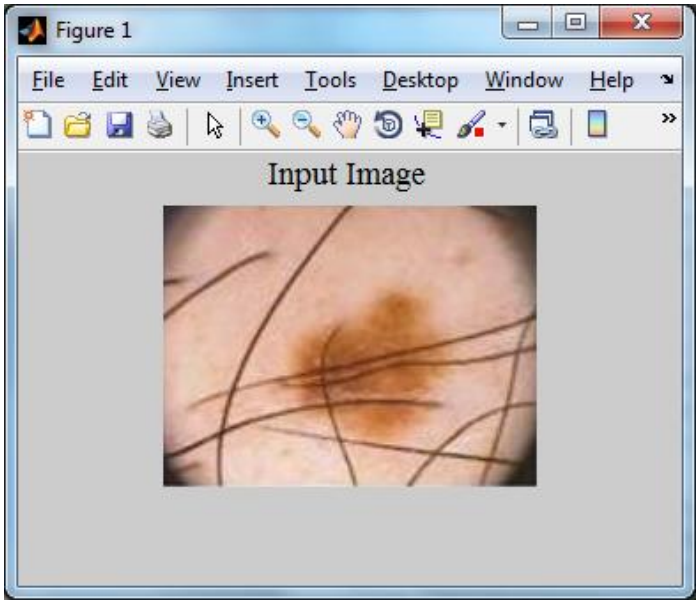

Fig 3 – Shows the simulation result of Input image.

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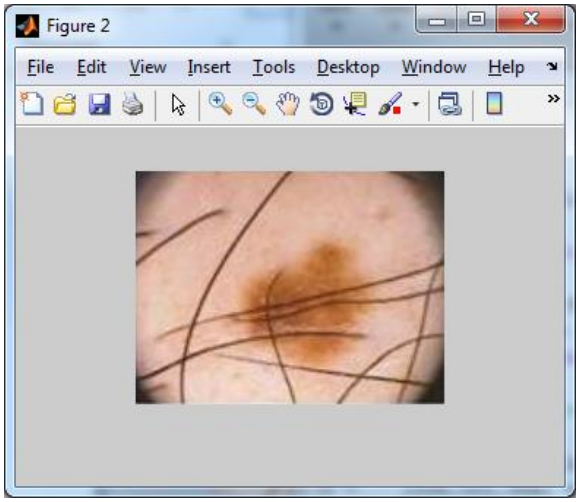

Fig 4 – shows the simulation result of Filtered image.

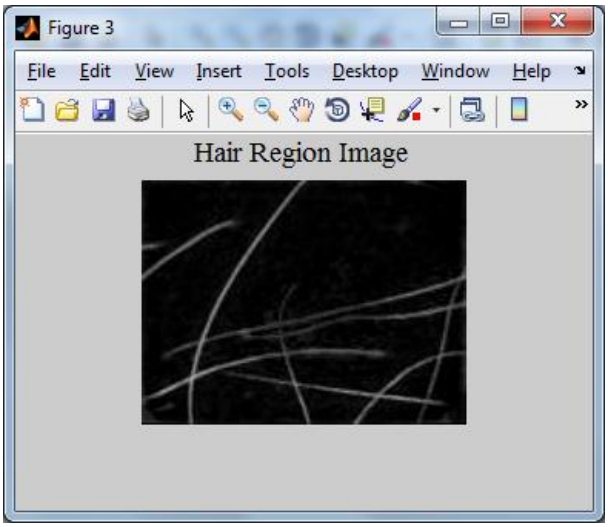

Fig 5 – shows the simulation result of Hair Region image.

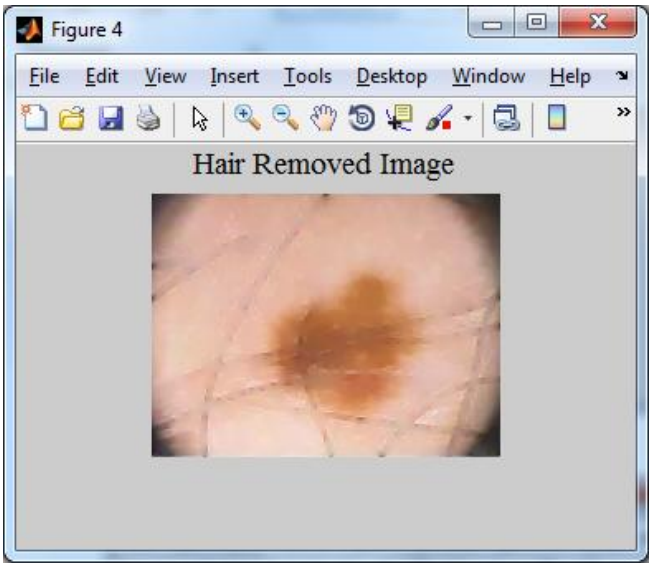

Fig 6 – shows the simulation result of Hair Removed image.

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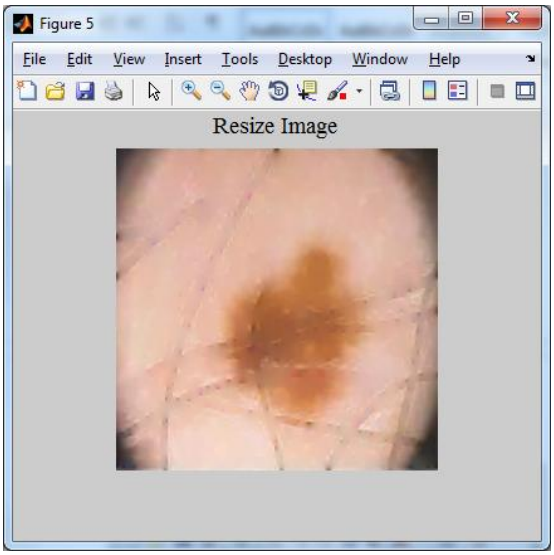

Fig 7 – shows the simulation result of Resized image.

V.CONCLUSION

In this paper, the proposed system has two components. The first component is a real-time alert to help the users to prevent skin burn caused by sunlight. a novel equation to compute the time-to-skin-burn was introduced in this component. The second component is an automated image analysis module where the user will be able to capture the images of skin moles and this image processing module classifies under which category the moles fall into; benign, atypical, or melanoma. An alert will be provided to the user to seek medical help if the mole belongs to the atypical or melanoma category. The proposed automated image analysis process included image acquisition, hair detection and exclusion, lesion segmentation, feature extraction, and classification. The proposed system used a state of the art for the dermoscopy image acquisition, which ensures capturing sharp dermoscopy images with a fixed distance to the skin and consistent picture quality. The image processing technique is introduced to detect and exclude the hair from the dermoscopy images, preparing it for further segmentation and analysis, resulting in satisfactory classification results. This system proposes an automated segmentation algorithm and novel features. It is able to classify the dermoscopy images into benign, atypical and melanoma with high accuracy.

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