EFFECTIVE PREPROCESSING TECHNIQUE FOR BETTER BORDER DETECTION

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ABSTRACT

The skin cancer was analyzed for more medical application. The classification of melanoma and carcinoma such as basal cell, squamous cell, and merkel cell carcinomas cancer can be increased the sensitivity and specificity. Effective preprocessing of digital image is important and necessary for better skin lesion border detection. The artifacts such as, dermoscopy-gel, specular reflection and outline (skin lines, blood vessels, and hair or ruler markings), and Hair and lines were also contained in the dermoscopic images. So, specular reflection reduction and hair and lines reduction are necessary for preprocessing.

I.INTRODUCTION

The most common cancer in the world is Skin cancer [1]. There are two major types of skin cancer , namely malignantmelanoma and non-melanoma (basal cell, squamous cell, and merkel cell carcinomas, etc.) [9]. Most dangerous skin cancer is Melanoma and it can be fatal if untreated. These tumors develop changes in the skin texture and color, but they can be cured in morethan 90% of cases, if they are detected and treated in theearly stages. Some cutaneous tumors remain an enigma. It is well known that early finding and treatment of skincancer can reduce the mortality and morbidity of patients. An preprocessing for dermoscopy image analysis system has usually three stages: (1). specular reflection reduction, and (2). Hair and line reduction[10-11]. The preprocessing step is one of the most important, since it affects the precision of the subsequentsteps. Preprocessing is a difficult task due to the great variety of lesion shapes, sizes, and colors alongwith diverse skin types and textures. In addition to this, artifacts such as dermoscopy-gel, specular reflection and outline (markers), skin lines, hair might decrease the accuracy of border detection both in clinical and dermoscopy images. So, here concentration is necessary for specular reflection reduction, and Hair and line reduction.

Aim and our approach

Although the significant research efforts have gone into developing computerized algorithms to reduce artifacts, and categorization remains a technical challenge. Because segmentation step is highly dependent upon noise likes illumination, dermoscopic-gel or air bubbles andoutlines such as line markers, skin and hair, etc. It has been also observed that there are three major problems present inprevious studies in particular. First problem is that none of the study efforts have been fully devoted to develop an efficientroutine for every type of artifact attenuation. Second, veryfew studies dealt with the automatic segmentation of multiplelesions. Third problem is that in some cases for basal cell carcinoma (*BCC*), squamous cell carcinoma (*SCC*), and merkel cell carcinoma. (*MCC*) cancer, the skin lesion borders are not well clear, which reduces the accuracy of border detection.

II.RELATED WORK

Materials and methods
Image dataset

A Medical Digital database of 320-color dermoscopic and clinical view lesion images were obtained from varies sources but most images came from online. In addition, most of these skincancer images were captured from Nikon 995 with the digital acquisition system and very high quality. The images have been stored in the RGB color format with dimension but mostly 250 * 250. We have left images, which having non-lesions objects to show significance of ourproposed method for tumor delineation. We selected the blue channel because thenoise part in this channel is typically clearer than other channelsof *RGB* color space. This image gradient information isrelevant to design the local cost function.

Image rescaling

In this subsection, it is an initial and necessary step for preprocessing and segmentation results comparisons with other methods. In this step, all images were rescaled to a standard size of 250 × 250 pixels in Fig.1.

Fig.1. Rescaled image.

Preprocessing

In this step, it is possible to accurate preprocessing of image. It has been observed that a dermoscopic image often contains artifacts. Most recently, many studies suggested their works but none of them have discussed about all cases of artifacts. For this rationale, we have developed an effective preprocessing method which can be divided into following three steps namely, (1) specular reflection reduction, and (3) hair and lines reduction.

a). Specular reflection reduction

When using such imaging devices, non-uniform illumination can result in unsatisfactory border detection results. To address this issue, the homomorphic, *FFT* and high pass filter used to compensate for uneven illumination or specular reflection variations in order to obtain the high contrast lesion images.

Homomorphic filtering is a general technique for nonlinear image enhancement and correction. It simultaneously normalizes the brightness across an image and increases contrast. Let a skin image $s(x, y)$ can be decomposed as the product of illumination $I(x,y)$ and reflectance $R(x,y)$.

Butterworth function for Digital Image preprocessing. Butterworth function is very for reduction illumintion and specular and line reduction. The function makes use of the simple principle that a bandpass filter can be obtained by multiplying a lowpass filter with a highpass filter where the lowpass filter has a higher cut off frquency than the high pass filter. function butterworthbpf(I,d0,d1,n).

I = The input grey scale image,
d0 = Lower cut off frequency,
d1 = Higher cut off frequency, and
n = order of the filter.

Using this butterworth function showing the image in Fourier Domain, filter image, Filter image of the images in red, green, and blue.

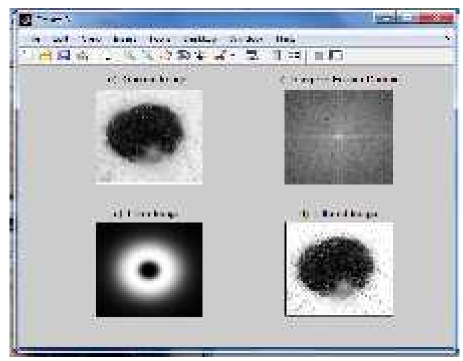

Fig.2. a). orginal image in red, b). image of Fourier Domain in red, c). filter image in red, d). Filter image of the images in red.

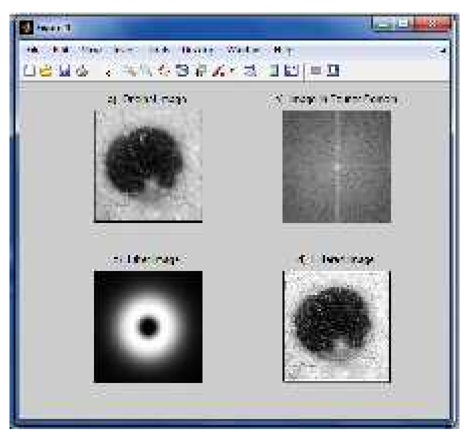

Fig.3. a). orginal image in blue, b). image of Fourier Domain in blue, c). filter image in blue, d). Filter image of the images in blue.

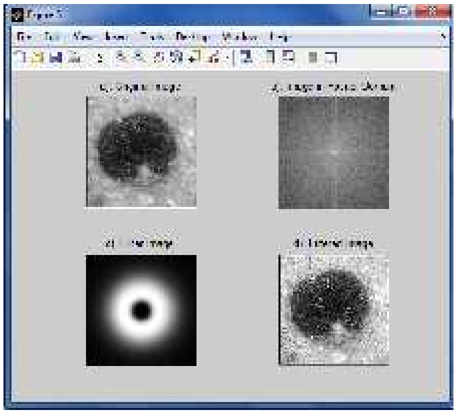

Fig.5. a). orginal image in blue, b). image of Fourier Domain in blue, c). filter image in blue, d). Filter image of the images in blue.

b). Hair and lines reduction

The detection and removal of hair pixels, blood vessels, and skin lines with ruler markings is an important early step in a dermoscopy image analysis system. As it was pointed out before, many skin lesion artifact removal algorithms have been proposed in the literature [3–6] just to remove hair pixels in dermoscopy images. But, these techniques often leave behind undesirable blurring; disturb the texture of the tumor; and result in color bleeding. Due to these problems, it is very difficult to use the color diffuse image for further skin tumor differentiation. In contrast, a new artifact removal algorithm that focuses on accurate detection of curvilinear artifacts and pays special attention to lesion structure during the removal stage has been introduced by Zhou et al. [2]. They confirmed that lines can be accurately detected by using explicit curve modeling [8] and then removed by exemplar-based inpainting.

This approach effectively removes artifacts such as ruler markings and hair, but it has high computational requirements. To address these issues, we developed a novel method for the removal of hair, blood vessels, and ruler markings using line detection and exampler-based inpainting [7]. Some properties of these lines' structures and these structures can be accurately identified using the line detection scheme are observed. These properties can be defined as thickness, magnitude, and length other than just direction. The lesion features, on the other hand, can be distinguished because they do not have these properties. Instead of repeatedly using the local Neighborhood average, we utilize an exampler-based inpainting technique, which actively searches for image regions that have the similar characteristics to the patch of pixels we are going to replace. In order to detect lines, we propose a line detection procedure based on the 2-D derivatives of Gaussian (*DOG*).

Fig.6. After hair removal and reconstruction using inpainting.

III. KEY OBSERVATIONS AND APPROACH OVERVIEW

Evaluation results

This preprocessing was applied to all set of images with type of pigmented and non-pigmented lesions. These were 24-bit *RGB* color images were converted into 250×250 pixels. The whole process of preprocessing was implemented in Matlab R2010. All computations were performed on a 3 GHz dual-core 32-bit core2duo processor with 3 GB *DDR2 RAM*, running MySQL server 2010 edition. As discussed before, quantitative evaluationswere also performed on segmentation by using four statistical metrics. These preprocessing results were compared with the reference images.

Experimental setup

In order to find out the efficiency of preprocessing of digital image by reduction the illumination of image, specular reflection, and hair and line reduction. The accuracy of preprocessing is important for better border detection.

Discussion and Conclusion

In this paper, presentation of various techniques for preprocessing for numerous cancers and it is also very useful for the elimination of artifacts. The various methods are used for better preprocessing. There are Butterworth function, acw median filter, inpainting, and derivatives of Gaussian (*DOG*). We have tested to this method not only melanomas but also in pigmentedand non-pigmented (basal cell, squamous cell, and merkel cell carcinomas) lesions. The method is robust, efficient and intuitive. This type of border detection techniquewith artifact reduction steps has not been proposed in the past. This segmentation algorithm delivers good results for thebig majority of the tested images; there are two groups' oflesions that are not almost correctly border detected..The best results were obtained by the presented method with achievements. These novel ideas related to skin cancer analysis for dermatologists includes: (1) a new and efficient method for analyzing skin images with multiple lesions(2) to reducethe artifact noises and recommended a solution for betterreduction of camera flash, bubbles and lines such as skin linesor ruler markings, hair, and blood vessels

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