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Hybrid Approach To Investigate The Probability Of Skin Cancer By ABCD And PCA Method

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ABSTRACT

Image processing plays an important role in diagnostic. This feature of image analysis can be used in medical application for early diagnosis of any type of disease. Skin cancer is a common disease now days. Early detection of skin cancer is very important. This can be achieved by combination of feature extraction and segmentation methods. Proposed technique is cost effective as it does not require any costly instruments. Automatic image analysis method is used to provide quantitative information about a lesion, which is relevant for the clinical for early warning. Early finding of skin cancer can reduce the death of patients. The features should provide unique quantitative measures to routinely diagnose the cancer. Proposed work provides the steps required to automatically diagnose skin cancer by using various images of different risks. In this we have used ABCD feature extraction, Otsu segmentation and PCA method. We have provided the understanding of otsu segmentation method by adding some of the intermediary steps like preprocessing, creating and saving mask. So it is a better approach to detect the cancer at an early stage.

Keywords

Introduction to Skin Cancer, The American Cancer Society (ACS) recommendations, Genetics of Cancer

I. INTRODUCTION

1.1INTRODUCTION TO SKIN CANCER

Skin cancer - a malignant tumor that grows in skin cells isone of the most common of all human cancer and in thepresent-days, accounts for more than 50% of all types ofcancers around the world. Skin cancer (also known as "skinneoplasm") is skin's unwanted growth with differing causesand varying degrees of malignancies. It can spread very fast toall organs/parts of human body through lymphatic system orblood. The incidences of "melanoma - the deadliest form ofskin cancer has been on rise at an alarming rate of 3% per year[1]. In spite of a very intensive researcheffort there is still no concrete evidence of the root cause,preventive methods and the cure for cancer. In reality,some of the cancerous tissue appears to be veryaggressive. The only way to reduce the mortality rateamong cancer patients is through early detection and witha proper treatment the risk for the cancerous tissue tospread to other organ can be minimized. Usual traditionmethod is time-consuming and incurs unnecessary burdento radiologist. By the time it is detected, it may be atcritical stage[2]. Melanoma can appear anywhereon the skin surface depending on the part of the body and thegender, see the table 1.Nowadays one out of three cancer patients aresuffering from skin cancer and according to the National Cancerof Institute one out of five American will develop skin cancer intheir life time[3].

Melanoma – a lesion in the pigment-bearing basal layersof the skin – is nowadays one of the leading cancer causesamong many white-skinned populations. Indeed the earlierthe diagnosis, the lower the metastatic risk: investigationshave shown that the cure rate is nearly 100%, if the skincancer is recognized early enough and treated surgically.Such a progress was also allowed by the advances in skinimaging technology. In particular Epiluminescencemicroscopy (ELM or dermoscopy) is a non-invasivetechnique that adopts both optical magnification and liquidimmersion and with angle-of-incidence lighting or crosspolarizedlighting to make the contact area translucent andconsequently subsurface structures of the skin more visible tothe operator's eye (see Fig.1)[4].

S.NO	BODY PARTS	GENTS	LADIES
1	NECK	23	14
2	TRUNK	35	13
3	ARM	17	17
4	LEG	25	56

Table 1.1: Melanoma incidence by part of the body and gender

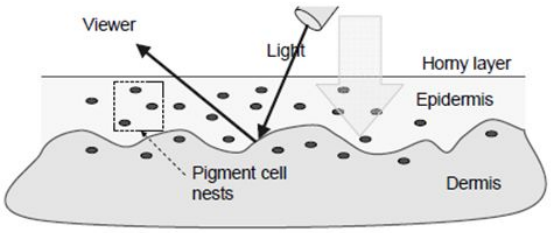

Figure 1: Epiluminescence dermoscopy

1.2 The American Cancer Society (ACS) recommendations: regular visual self-examination as well as examination byhealth professionals . The society also recommends theuse of the so-called "ABCD rule" for distinguishing betweena normal mole and a potential melanoma as follows:

- A – Asymmetry: One half of the lesion does notmatch the other.
- B – Border: The edges of the lesion are irregular,ragged, notched or blurred
- C – Color: The color is not uniform. May includeshades of brown or black. Or patches of pink, red,white or blue (variegated).
- D – Diameter: the spot is greater than quarter of aninch

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ACS recommends that lesions matching any of the abovecharacteristics be examined by a health professional. Ifsuspected of being a melanoma, a skin biopsy is done toconfirm. Some examples are shown in Fig. 2. The increased availability of smart mobile devices andthe ease of access to mobile applications via existing onlinemarkets (e.g. Google Android Market and Apple App Store)has resulted in users being willing to adopt and use suchapplications. The convenience of a lesion classificationmobile application may increase the likelihood of earlydetection of melanomas by persons who may not havedermatological training [5].

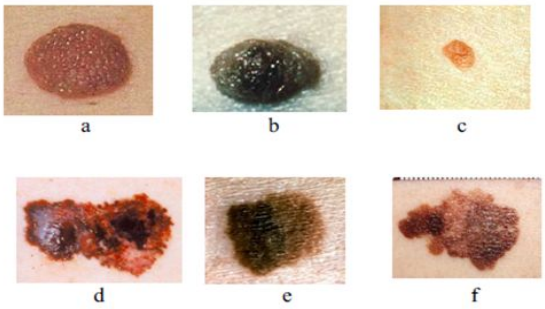


Figure 2: Examples of (a)-(c) Benign and (d)-(f) Malignant Lesions.

1.3 GENETICS OF CANCER: DNA, which is the geneticblueprint of the structure and function of every cell, is made up of a sequence ofnucleotide bases that collectively code for the production of a myriad of proteins. Each of these groups of proteinsis coded for by a *gene complex*, which is a group of genes, controlled by a genetic switchknown as an *operon* (Figures 2 and 3). There are different kinds of operons, but ingeneral, the presence or absence of a certain substance within the cell causes a repressorprotein to bind to the operator region of the complex, preventing the transcription of thegenes that are found downstream in the sequence [6].

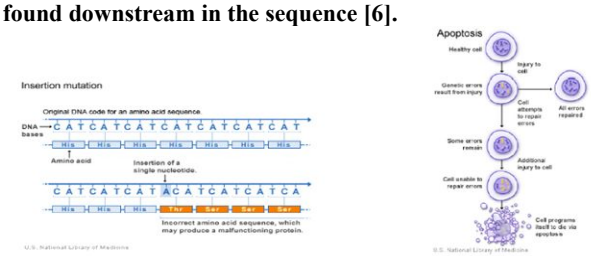


Figure 3:Transcription process in DNA

II. RELATED WORK

The research work performed in this field by different researchers is presented as follows:

Nilkamal S. Ramteke et al. [1] .This paper first reviews the past and present technologies for skin cancer detections along with their relevant tools. Then it goes on discussing briefly about features, advantages or drawbacks of each of them. Then author discuss the mathematics preliminary required to process the image of skin cancer lesion using our proposed scheme. This paper presents a new approach for Skin Cancer detection and analysis from given photograph of patient's cancer affected area, which can be used to automate the diagnosis and the ruptic treatment of skin cancer. The proposed scheme is using Wavelet Transformation for image improvement, de noising and Histogram Analysis whereas ABCD rule with good diagnostic accuracy worldwide is used in diagnostic system as a base and finally Fuzzy Inference System for Final decision of skin type based on the pixel color severity for final decision of Benign or Malignant Skin Cancer..

Fadzil Ahmad et al. [2]This paper reviews that Artificial Neural Network (ANN) is one of the most promising biological inspired computational intelligence techniques. However designing an ANN is a difficult task as it requires setting of ANN structure and tuning of some complex parameter. On the other hand, Genetic Algorithm (GA) as a global search technique is useful for complex optimization problem where the numbers of parameters are large and difficult to obtain. In this paper GA has been used to simultaneously select significant features as input to ANN and automatically determine the optimal number of hidden node. Meanwhile the ANN training is done by Levenberg Marquardt (LM) algorithm. A new procedure in obtaining optimal ANN architecture is also described which based on feature importance determine by Genetic Algorithm. Simulation results on cancer data set proved that the proposed method has achieved the highest97% average percentage of correct classification with the absent of 2nd and 5th feature.

T Y Satheeshsa et al. [3] .This paper reviews the differentiation of melanoma dysplastic nevus, and non dysplastic nevus is not so easy task for even for the experienced dermatologists. But still it is curable suppose if it is diagnosed at the early stages. In this paper we are focusing to identify the distortion parameter, symmetry of the data according to the axis and the color spread factor.

G. Di Leo et al. [4] this paper reviews the early detection of melanoma is a very critical issue into day's dermatologic practice. Different diagnostic methods have been proposed which define multiple criteria for the evaluation of the malignancy of a lesion. The paper is devoted to the detection of an important dermatologic structure: the atypical pigmented network. A proposal is described for the application of decision-tree classification techniques to the results of specific image processing algorithms for the estimation of chromatic and structural parameters.

Kiran Ramlakhan et al. [5] .This paper reviews that Melanoma skin cancer accounts for less than 5% of skin cancer cases but causes the most deaths due to skin cancer. Convenient automated diagnosis of skin lesions and melanoma recognition can greatly improve early detection of melanomas. This paper presents a prototype of an image-based automated melanoma recognition system on Android smart phones. The system consists of three major components: image segmentation, feature calculation, and classification. It is designed to run on a mobile device with a camera, such as a smart phone or a tablet PC. A skin lesion image is converted to a monochrome image for outline contour detection. Color and shape features of the lesion are extracted and used as input to akNN classifier. Initial experimental result shows that the system is efficient and works well on well-lighted test images, achieving an average accuracy of 66.7%, with average malignant class recall/sensitivity of 60.7% and specificity of80.5%.

G. Ali Mansoori et al. [6] .This paper is an overview of advances and prospects in applications of nanotechnology for cancer prevention, detection and treatment. Author begins with a brief description of the underlying causes of cancer. Then address preventive treatment, disease-time treatment, and diagnosis in the context of some of the most recent advances in nanotechnology. Nano particle science is also briefly addressed as the foundation upon which most nano technology cancer therapy is based. It is demonstrated how nanotechnology can help clarify one of the most challenging and longstanding problems in medicine, which is how to eliminate cancer without harming normal body tissue.

GurkiratKaur et al. [7] melanoma is a cancerous lesion in the pigment-bearing basal layers of the epidermis and is the most deadly form of skin cancer, yet it is also the most treatable, with a cure rate for early-stage melanoma of almost 100%. Therefore, there is a requirement to develop computer-aided diagnostic systems to facilitate the early detection of melanoma. The first step in these systems is skin lesion segmentation. The next essential stair is feature extraction and pattern analysis procedures to make a diagnosis. Author decided to work on this automatic melanoma detection system. In this paper, a beginning is given about dissimilar distinctiveness of the melanoma cancer images and a brief review

has been present in which dissimilar features of melanoma have been discussed. Finally a survey has been given which carry out the analysis of melanoma images by different methods.

Mahmoud Elgamal et al. [8] this paper presents two hybrid techniques for the classification of the skin images to predict it if exists. The proposed hybrid techniques consist of three stages, namely, feature extraction, dimensionality reduction, and classification. In the first stage, author have obtained the features related with images using discrete wavelet transformation. In the second stage, the features of skin images have been reduced using principle component analysis to the more essential features. In the classification phase, two classifiers based on supervised machine learning have been developed. The first classifier based on feed forward back-propagation artificial neural network and the second classifier based on k-nearest neighbor. The classifiers have been used to order subjects as normal or abnormal skin cancer images. A classification with a success of 95%and 97.5% has been obtained by the two proposed classifiers and respectively. This outcome shows that the proposed hybrid techniques are robust and effective.

3. PROPOSED WORK

3.1Problem Formulation

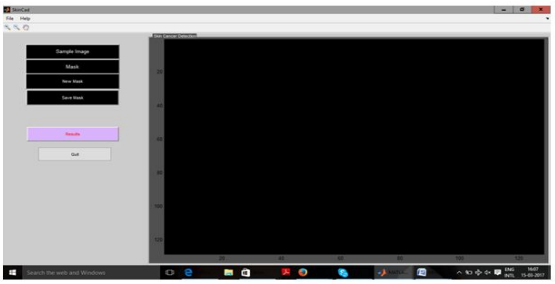
In order to achieve an efficient way to identify skin cancer at an early stage without performing any unnecessary skin biopsies, digital images of melanoma skin lesions have been investigated. To complete this goal, feature extraction is considered as an essential-weapon to analyze an image appropriately. Segmentation is the most important stage for analyzing image properly since it affects the accuracy of the subsequent steps. Though correct segmentation is not easy because of the great verities of the lesion shapes, sizes, and colors along with different skin types and textures.

3.2 Proposed Work

Proposed work contains implementation of three main steps on the skin lesion i.e. preprocessing, features extraction and classification PCA. Preprocessing involves noise removal and segmentation by Otsu's method .Feature extraction is carried out by ABCD method.

4. RESULTS AND ANALYSIS

Many images are tabulated for suspicious by extracting the features of ABCD. Classification uses Principal component Analysis method. In that A, B, C, D values are given for training, and testing is done. By using MATLAB tool the result of PCA was compared. If the PCA value is >0.4 then lesion malignancy probability is high, if p>0.3 and <=0.4 then lesion malignancy probability is medium and if p <=0.3 then lesion malignancy probability is low.



Main GUI

The above shown Figure 4.1 shows the Main GUI.

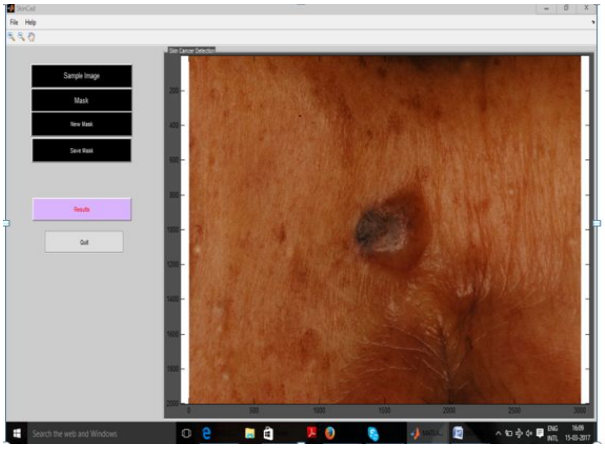


Figure 4.2: Loading Sample Image

With Sample Image option user can load the image to be tested. So we will select the sample image to be tested for skin cancer by loading the image through sample image button

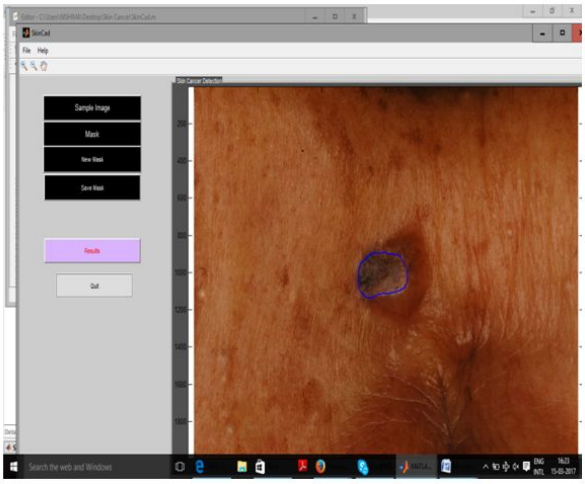


Figure 4.3: Selecting Mask

We can select Mask or New Mask option to apply the masking for image. New mask option will create new mask which can be saved for later use.

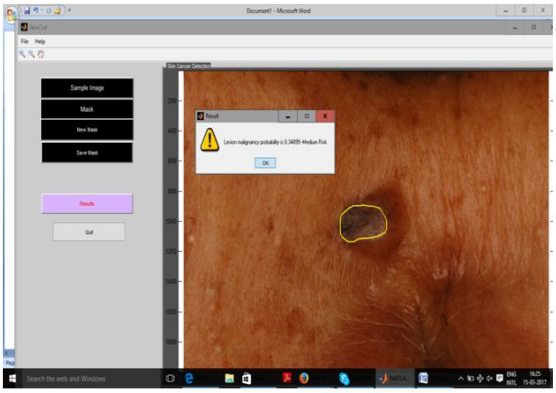


Figure 4.4: Result showing Medium Risk

Lesion malignancy probability can be calculated by using Result option from GUI. By clicking the result options button, we will get the probability of cancer.

Figure 4.5: Sample Image

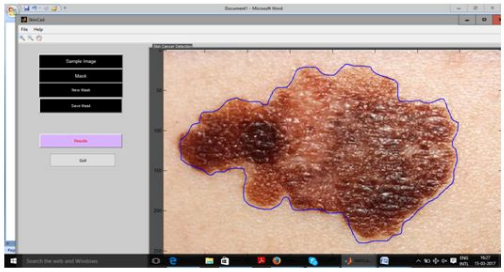


Figure 4.6: Selecting Mask

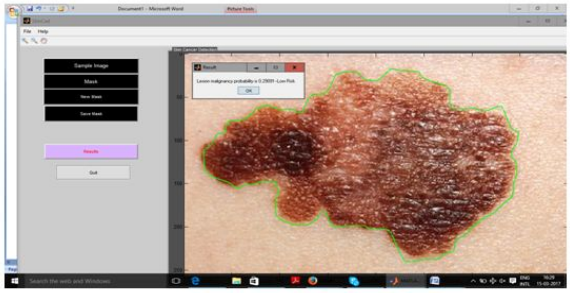


Figure 4.7: Lesion malignancy probability low risk

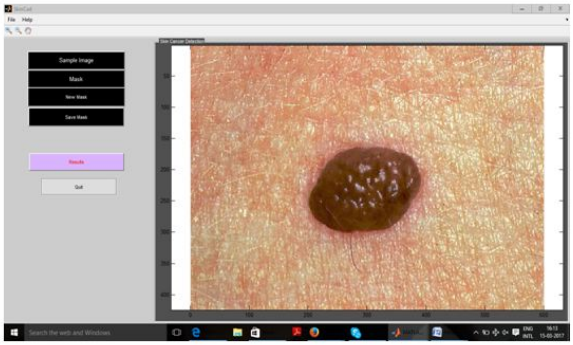


Figure 4.8: Selecting Sample Image

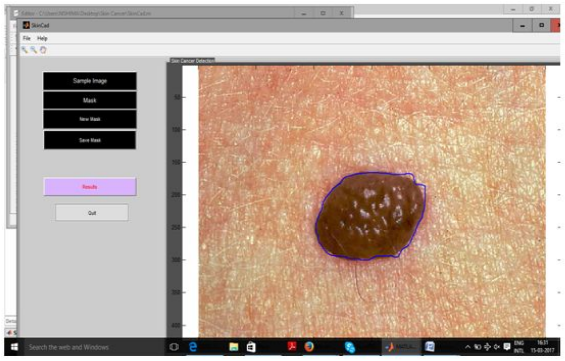


Figure 4.9: Creating new Mask

Skin probability for different skin lesions

Author	Segmentation	Edge detection	Classification	Accuracy(%)
Pauline J	Watershed Method	Canny Method	ABCD	90
	Watershed Method	Canny Method	PCA	92
Proposed	Otsu	Canny Method	ABCD+PCA	94

Table 4.1: Accuracy comparison of existing and proposed

5. CONCLUSION AND FUTURE SCOPE

In this dissertation skin cancer detection technique by using ABCD feature extraction and Otsu segmentation method is implemented. Different types of images with different risk probabilities (low, medium and high) are considered for evaluation. It proposes an improved method of image segmentation by using Otsu segmentation. ABCD rule with good diagnostic accuracy is used in diagnostic system as a base and finally the classification is done using principal component analysis. Classification is done by PCA (Principal Component Analysis) to analyze the values of ABCD. If the PCA value is >0.4 then lesion malignancy probability is high, if p>0.3 and <=0.4 then lesion malignancy probability is medium and if p <=0.3 then lesion malignancy probability is low. Existing work can be extended with the results of testing and training, PCA will find whether the given values are benign or malignant.

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