ADVANCED MELANOMA DETECTION USING ABCD RULE

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Abstract
Melanoma is the most dangerous form of skin cancer that develops from the pigment producing cells known as melanocytes. Melanoma skin cancer has been increasingly identified as the major cause of deaths. Melanoma is a condition or a disorder that develops from the melanocytes, which produce a pigment known as melanin. So melanoma regions appear as black or brown in colour. But some of them doesn't produce melanin, they appear as pink, tan or white colour.So an effective melanoma detection technique is needed. In this paper,a more accurate melanoma detection technique is provided based on ABCD(Asymetry,Border,Color,Diameter) Parameters . Through this , a more userfriendly technique is obtained for the detection of melanoma. Experimental results on a PH2 dermoscopy research database images confirms the efficiency of our system.
Keywords: Skin cancer, Melanoma, SVM Classifier, Thresholding, Segmentation

I . INTRODUCTION

A. Background and Motivation

Skin cancers are cancers that arise from the skin. They are due to the development of abnormal cells that have the ability to invade or spread to other parts of the body. There are three main types of skin cancers: basal-cell skin cancer (BCC), squamous cell skin cancer (SCC) and melanoma. The first two, along with a number of less common skin cancers, are known as non melanoma skin cancer (NMSC).Basal-cell cancer grows slowly and can damage the tissue around it but is unlikely to spread to distant areas or result in death.It often appears as a painless raised area of skin, that may be shiny with small blood vessel running over it or may present as a raised area with an ulcer. Squamous-cell skin cancer is more likely to spread.It usually presents as a hard lump with a scaly top but may also form an ulcer. Melanomas are the most aggressive. Signs include a mole that has changed in size, shape, color, has irregular edges, has more than one color, is itchy or bleeds.. A skin that has inadequate melanin is exposed to the risk of sunburn as well as harmful ultraviolet rays from the sun[1].Clinical analysis and biopsy tests are commonly used.

Clinical analysis is done using a dermatoscope by trained dermatologists. A dermatoscope is an optical device used by the dermatologists to get a magnified and enhanced view of skin structure using skin surface reflection.Proper melanoma detection method is needed to detect and diagnose melanoma in the initial stage itself.Concerned scholars have put up into research in order to establish the biology behind early diagnosis melanoma .Research evidences have shown that it is easy to diagnose and control or rather prevent melanoma at its early stages than during its later stages .Researchers have established that there are numerous methods that are used to diagnose melanoma[2].Some of the remarkable methods include Seven Point Checklist, CASH (color, architecture, symmetry, and homogeneity) and ABCDE (Asymmetry, Border, Color, Diameter, Evolving) etc[6].Melanoma rates have been increasing steadily for 30 years. For white people it is 20 times more common than in African Americans.Overall, during the lifetime, the risk of getting melanoma is approximately 2% (1 in 50) for whites, 0.1% (1 in 1,000) for blacks, and 0.5% (1 in 200) for Hispanics.

II. RELATED WORK

Malignant Melanoma is one of the deadly skin cancer that is more prevalent to people between the age of 15 years and above [3].Research shows that failure to detect and diagnose the disease at its initial stages lead to development of lethal advanced melanoma [7]. Upon a careful review of literature, some of the notable clinical algorithms include,

A. Segmentation Methods For Computer Aided Melanoma Detection

An important step in the automated system of melanoma detection is the segmentation process which locates the border of skin lesion in order to separate the lesion part from background skin for further feature extraction. This paper gives a study on various segmentation techniques that can be applied for melanoma detection using image processing.Statistical region merging, iterative stochastic region merging,adaptive thresholding, color enhancement and iterative segmentation, multilevel thresholding are discussed in this paper. A comparative study of these segmentation methods is also performed based on the parameters accuracy, sensitivity and specificity. Multilevel thresholding has the highest accuracy and specificity and maximum sensitivity is obtained for iterative stochastic region merging.[11]

B. Noninvasive Real-Time Automated Skin Lesion Analysis System

Malignant melanomas are asymmetrical, have irregular borders, notched edges,and color variations, so analyzing the shape, color, and texture of the skin lesion is important for the early detection and prevention of melanoma. This paper proposes the two major components of a noninvasive real-time automated skin lesion analysis system for the early detection and prevention of melanoma. The first component is a real-time alert to help users prevent skinburn 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 module,which contains image acquisition, hair detection and exclusion, lesion segmentation, feature extraction, and classification.[9]

C. Melanoma Detection Using Fuzzy C-Means Clustering

Fuzzy C-Means (FCM) based approach designed for melanoma diagnosis. The methodology comprises the traditional data processing architecture, including pre-processing (contrast stretching),main processing (FCM) and post-processing (morphological erosion). The contrast stretching phase has the purpose of stretching the range of pixel intensities of the input image to occupy a larger dynamic range in the output image. This is followed by the FCM algorithm, which automatically divides the data provided by the contrast stretching phase into two clusters: lesion and skin. This process ends with the morphological erosion of the segmented image, where the structuring element istranslated over each pixel of the object, so as to overcome typical irregularities between lesion and skin.[5]

D. SVM-based Texture Classification and Application to Early Melanoma Detection

Goal is to improve the overall decision support capability of the DSS. The objective is to use texture information ONLY to classify the benign and malignancy of the skin lesion. A three layer mechanism that inherent to the support vector machine (SVM) methodology is employed to improve the generalization error rate and the computational efficiency. The performance of the algorithm is validated with a series of benchmark texture images and then tested on 22 pairs of real clinical skin lesion images[4]

III . METHODOLOGY

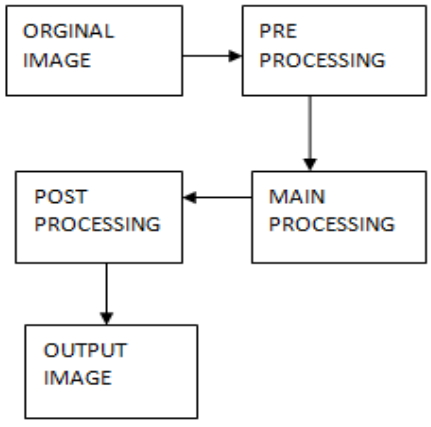

Fig:1 Block Diagram

Fig 1,comprises the traditional data processing architecture, including preprocessing , main processing and post processing .

A.Preprocessing

Artefacts such as bubbles and hair represent noise.It is necessary to remove Hair and bubbles before any feature extraction for an accurate diagnosis of disease.Median filter is used to reduce the effect of bubbles, that may appear on the lesion affect the measure of colour and luminosity asymmetry.Hair detection is done with the help of Gabor filters.[10]

B.Main Processing

Melanomas have a propensity to grow chaotically and incoherently. The feature extraction is based on the ABCDE rule of dermatoscopy. ABCD stands for Asymmetry, Border structure, Color variation, diameterand evolving[13]and[10].

- Asymmetry

One half doesn't match the appearance of the other half . Degree of symmetry can be checked using the Asymmetry Index. It is calculated using below formula.

$$AI = \frac{1}{2}\sum_{k=1}^{2} \frac{\Delta Ak}{A_L},$$

Symmetrical Benign (non-cancerous and non-malignant) moles are typically round. And Asymmetrical Melanoma (cancerous and malignant) lesions are typically irregular in shape.

- Border irregularity

The edges are ragged, notched, or blurred. Border structure can be analyzed by using Compact Index, Fractal Dimension and edge Abruptness.Border even benign moles have smooth, even borders.Ragged or notched edges melanoma lesions often have uneven borders.

- Color

The color (pigmentation) is not uniform. Shades of tan, brown, and black are present. Dashes of red, white, and blue add to a mottled appearance.Color single shade benign moles are usually a single shade of brown.Many shades melanoma lesions often contain many shades of brown or black. lesions with one of the six suspicious colours (white, black, red, light-brown, dark-brown and blue-grey) are likely to be melanomas. These six colours are represented in red, green, blue (RGB). These values are obtained from a manually segmented lesion .

Colour	RGB Values
White	[197 188 217]
Black	[41 31 30]
Red	[118 21 17]
Light-brown	[163 82 16]
Dark-brown	[135 44 05]
Blue-gray	[113 108 139]

Fig:2 Six melanoma colors

- Diameter

The size of the mole is greater than 1/4 inch (6 mm), about the size of a pencil eraser. Any growth of a mole should be evaluated.Diameter <6mm or 1/4” benign moles are usually less than 6 millimeters in diameter.Diameter>6mm or 1/4”melanoma lesions are often more than 6 millimeters in diameter.

C.Post Processing

(a) Support Vector Machine

Classification procedure is a well known machine learning technique, k-Nearest Neighbors, where the attributes are geometric extracted features. Support Vector Machines are based on the concept of decision planes that define decision boundaries. A decision plane is one that separates between a set of objects having different class memberships.

IV .RESULT

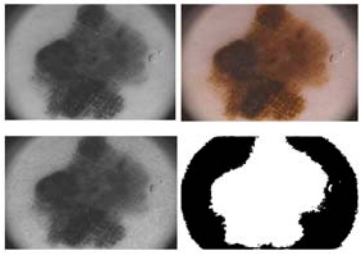

Fig:3 (a).Original Image,(b).Gray Image,(c).Median Filter,(d).Segmentation

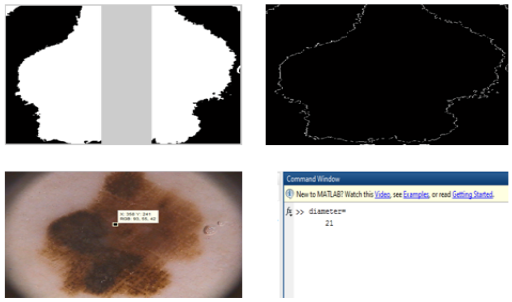

Fig:4(a).Asymmetry,(b).Border,(c).Color,(d).Diameter

V.CONCLUSION

The incidence of skin cancers has reached a large number of individuals within a given population, especially among whites, and the trend is still rising. Early detection is important,especially concerning melanoma, because surgical excision currently is the only life saving method for skin cancer. This paper presented the components of a system to aid in the malignant melanoma prevention and early detection.Pre processing is done using median filter.Feature extraction is done using the ABCD rule of dermatoscopy, where ABCD stands for Asymmetry, Border structure, Color variation and Diameter of lesion.Compared with the existing automatic implementations ,ABCD rule achieve the highest accuracy[10].But bad contour detection and the inability to detect structures.Future work could allow further improvement, primarily in the artifact removal steps and in structures detection.

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