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DETECTION OF MELANOMA USING ASYMMETRIC FEATURES

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Abstract:

In this research work, Efficient identification of Melanoma with its asymmetric properties is considered and efficiently detect it with the help of preprocessing algorithm and border analysis. Two parameters out of four is chosen in this work. Asymmetric feature and Border feature defined, is calculated efficiently and according to it graphical user interface gives result about Skin Cancer Patches is Malignant or not combine image processing techniques with machine learning or pattern recognition algorithms to assist in the early detection of melanoma. By focusing on specific features known to be associated with melanoma, the method aims to improve the accuracy and efficiency of diagnosis.

Keywords— Skin Cancer; Melanoma; Preprocessing algorithm;

1.Introduction

Melanoma – A Big cause of Death According to the survey of American Cancer Society in United State in 2010, Over 2.8 million patient of cancer is diagnosed. The death ration in this population was very high. In last few years this problem arises very rapidly and death rate also increased. In this research work, five types of skin cancer are discussed. These five types of cancer are the enhancement of one another. Most

1. **Melanoma and Skin Cancer**: Melanoma is highlighted as one of the most dangerous and deadly forms of skin cancer. It arises from unrepaired DNA damage to skin cells, leading to mutations and uncontrolled cell growth.
2. **Impact of Skin Cancer**: The text mentions that skin cancer, including melanoma, contributes significantly to the overall cancer burden, with millions of diagnoses and a high death rate. It suggests that the problem is rapidly growing, indicating a need for effective detection and treatment strategies.
3. **Types of Skin Cancer**: The text mentions five types of skin cancer, suggesting that they can enhance each other's effects. Actinic keratosis is highlighted as a common form, which can progress to squamous cell carcinoma if left untreated.
4. **Early Detection**: Early detection is emphasized as crucial for improving outcomes for skin cancer patients. The ABCD rule is mentioned as a method for detecting melanoma in its early stages. This rule involves assessing asymmetry, border irregularity, color variation, and diameter of skin lesions.
5. **ABCD Color Detection**: The research discussed appears to focus on detecting melanoma based on its color characteristics. Melanomas can exhibit various colors, including red, black, white, blue-gray, light

brown, and dark brown. The combination or mixture of these colors can indicate the presence of melanoma.

Overall, the text underscores the importance of awareness, early detection, and effective treatment strategies for combating skin cancer, particularly melanoma, which poses significant risks to health and life if left untreated.

This research work gives an efficient algorithm to calculate the asymmetric features which are define. Few asymmetric features calculated in many work but in this research work, try to identify maximum parameters and according to these feature and efficient graphical user interface gives result for the malignant patches.

Different Research on Melanoma related to Computer Imaging

Image Processing

ELM (Epiluminescence microscopy) is the method which proved the early detection of Malignant skin lesion [1], [2].ELM is described as a technique where halogen light is projected onto the skin lesion, rendering the surface translucent. This allows for the visualization of subsurface structures. ELM is used as a method for early detection of malignant skin lesions. ELM aided by high-quality image acquisition techniques such as CCD cameras or scanners, plays a significant role in the early detection of malignant skin lesions, including melanoma. This underscores the importance of technology in improving diagnostic accuracy and patient outcomes in dermatology.

Different Image Segmentation Techniques

OTSU's method [7], [8] which include a thresholding method for analysis of images of Malignant region and Non Malignant lesion. Basically this method helps to separate out background skin region and the Malignant region from the image. Color based segmentation method is also very popular and K – Mean Clustering method of Color based image segmentation method is more popular. K – Mean Clustering [9] technique segment the color in different cluster. If N number of colors available in the image, then this method reduces the number of colors smaller than N and equal to K. The optimal K value for the image is estimated separately using five commonly used cluster validity criteria The passage discusses the complexity of skin lesions, particularly pigmented lesions, and the challenges in accurately identifying them due to their similarity in color to surrounding skin. To address this issue, region-based image segmentation techniques are employed, with thresholding operations being a commonly used method. the importance of employing sophisticated image processing techniques, such as region-based segmentation with thresholding operations, to improve the accuracy of skin lesion detection and differentiation. These techniques play a crucial role in early detection and diagnosis of potentially malignant lesions, enhancing patient outcomes in dermatology.

Feature Estimation of Malignant Lesion

Feature estimation of skin malignant region or nonmalignant region is based on famous ABCD – rule of Dermatoscopy [1], [17]. ABCD rule define four major parameters of skin lesion which are Asymmetry, Border irregularity structure, Variegated color and Dermatoscopical structures. These parameters are defined by the dermatologist. Each parameter has their sub parameters like asymmetry has circularity index [18], [5], bulkiness score [19], fragmentation index [20],[21], asymmetry index [20], [22]. Border irregularity is evaluated in [5], [18]. Mean value, standard deviation [4], [21] and fractal dimensions [24] also helps to calculate the border irregularity and gives near to accurate result. Color estimation is a major challenge in the Malignant and Non-malignant skin lesion because sometime the malignant skin lesion very similar to skin color. To estimate this parameter, different channels of color extracted by the help of average mean value and standard deviation of the RGB [4], [5], [20], [21] matrix and HSV matrix [18]. On using and optical model of skin by [23], found that all the skin colors value lies in a two dimensional patch within three dimensional color space. Dermatoscopic parameters are difficult to find theoretically so we evaluate this feature by textural characteristics and four parameters chosen based on classification accuracy and computation and these are Energy, Homogeneity, Correlation and Contrast. They are part of most Commonly used Harlick features [25].

II. Calculation of Asymmetric Parameters

1. **Areas Covered by Malignant Lesion**:
   - **Area of Malignant Lesion (ASL)**: This refers to the total area covered by the malignant lesion.
   - **Area of Convex Hull (ACH)**: The convex hull is the smallest convex shape that encloses the entire malignant lesion. ACH refers to the area of this convex hull.
   - **Area of Bounding Box of Malignant Lesion (ABB)**: This represents the area of the smallest rectangle that completely encloses the malignant lesion.
2. **Major and Minor Axis**:
   - **Major Axis of Pigmented Area (ap)**: The major axis refers to the longest axis of the pigmented area within the lesion.
   - **Minor Axis of Pigmented Area (bp)**: The minor axis represents the shortest axis of the pigmented area within the lesion.
   - **Axis of Bounding Box (ab, bb)**: These parameters define the major and minor axes of the bounding box that encloses the entire lesion.
3. **Feature Extraction**:
   - Features are extracted from the binary form of the melanoma image, which is obtained after converting the RGB image into a binary image.
   - The features considered are related to the area of the malignant region.

Asymmetric Index along Major axis and Minor axis

The area of white pixels in the image is divided in to two parts along its major axis and both the part fold on one another than using xor() function it evaluate the symmetricity of the image. Circle has maximum symmetricity. The image evaluated in [28] is proving the symmetricity. But it shows symmetry about Major axis only. Here we find symmetricity about major axis and minor axis both. This feature gives two points in Melanoma Calculation

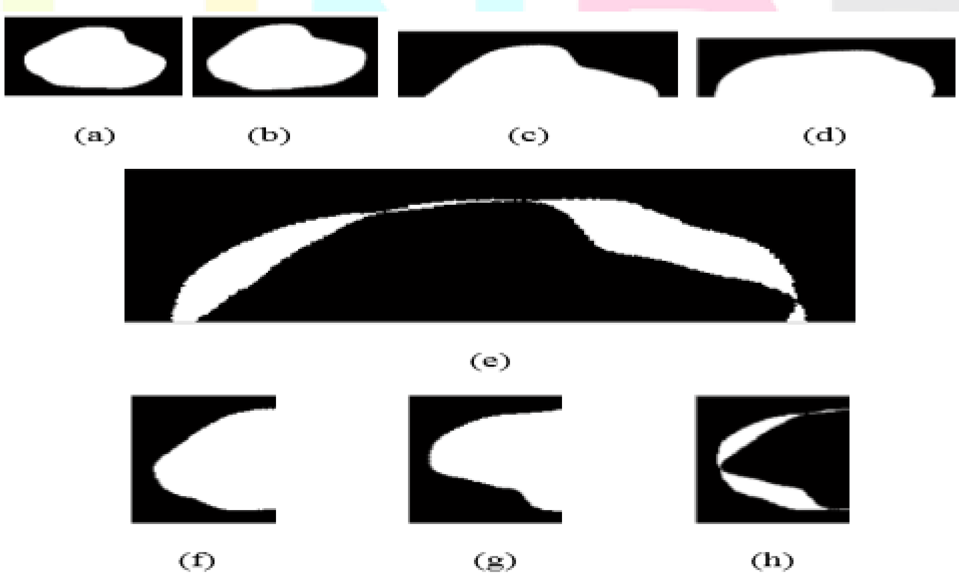


Fig.1. Symmetricity of the Image (a) Real skin lesion (b) Rotated image along major Axis (c) Upper half of the skin Legion (d) Lower half of the skin lesion (e) applying xor() for symmetricity along major axis (f) left half of skin lesion (g) right half of the image (h) applying xor() along minor axis.

III. IMAGE DESCRIPTION

All the images for this project is taken from American Cancer society website only for the research work and analysis for social work. All type of skin cancer image's is given on the website of the cancer society and started the first research work and diagnose the Skin cancer
lesion. Firstly, the work is started on the five types of skin cancer explain in the above article. The data which is taken from the website is shown in the table given below. Few images are shown in the table II given below. The first stage of skin cancer is converted into the second stage of skin cancer if it is not treated well. The category of these kind of the skin cancer lesion is explained very well in [29], [30], [31].

Table-1 Melanoma Images from American Cancer Society

Sr. No.	Type of Cancer	Sub Type	Images
1	Melanoma	Superfacial Spreading Melanoma Leingo Maligna Acral Lentiginous Melanoma Nodular Melanoma	

All the images in table II is Cancerous images and for comparison of our parameters it is necessary to compare these cancerous images with non-cancerous image. So in Table III few non-cancerous images are taken in to account. The non-cancerous images are simple mole, which can be further converted into dangerous skin cancer. The data which is taken in this research work is limited and the algorithm and parameter analysis is done on few images.

Table-2 Non-Cancerous Mole

Sr. No.	Simple Moles	Images
1	Simple Moles	

Table-3 Benign Stage of Cancer Cell

Sr. No.	Benign Stage	Images
1	Initial Stage of Cancer	

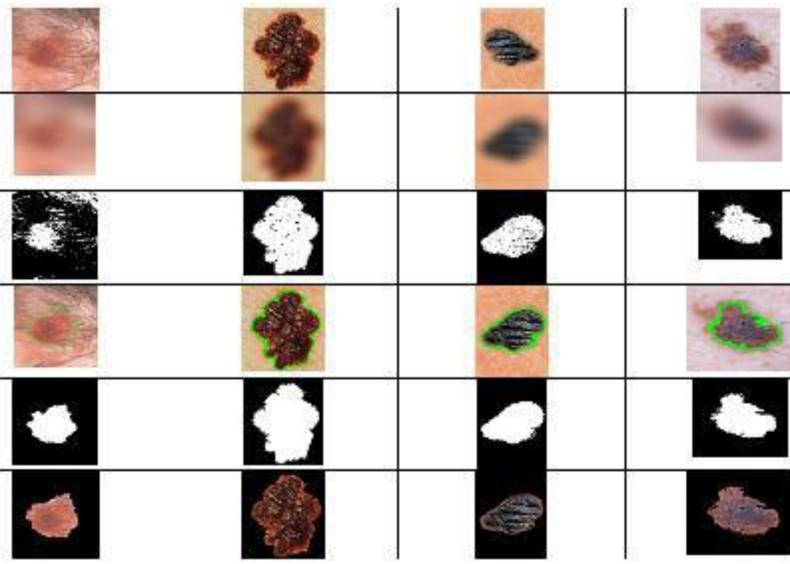
IV. IMAGE SEGMENTATION PROCESS

Image segmentation process is the root of the complete project. So many algorithms are available to segment the image but first select different types of images to test the segmentation steps or to develop the segmentation steps.

Fig 2 shown the four selected images on which initial test of segmentation will be start. Fig.1(a) is the image which is little bit hairy and it gives challenges in the edge detection process. If we treat it as noise in the images and apply some thresholding process and Gaussian filters, then it can be easily removed. In fig.2(b) and fig2(c), the edge detection is easy and the lesion can be traced easily. The image is clear and it has no any noise but in fig.2(b), the border is not so much clear so during the border detection process it need more accurate algorithm. In fig.2(d), the middle patches are very dark and it can be easily detecting but the edge of the lesion is mixed with skin color and it can be traced with few difficulties. Gray scale morphology used to segment this type of noisy image. With the help of this process hairy image can be removed and the exact lesion will appear. Every segmentation steps have some disadvantages and it need exact value to tune up. In [32], Lots of sample images test with different parameters and through this test it is possible to derive appropriate segmentation technique for every images of the skin cancer lesion.

Implementation of preprocessing algorithm

Sr. No.	Operation on Images	Images
1	Real Image	
2	Filtered Image	
3	Binary Image with Extracted Patch	
4	Border Detection	
5	Binary Border Representation	
6	Centroid of Patches	



V. RESULT

we evaluate each image in Table I, Table II and Table III for the Asymmetric features by applying the developed method. Basically it is a training of the images and from this training we found the values of features by which we can identify the case of Melanoma.. The values change according to image but our GUI (Graphical User Interface) is able to identify the Melanoma case very efficiently.

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