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Classification & Detection of Melanoma Skin Cancer in Early Stages Using CNN

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Abstract: ***Melanoma, sometimes referred to as skin cancer, is one of the most severe forms of skin disease. Applying UV radiation to the skin effects or modifies the melanocytes, leading to uncontrolled cell growth and skin burning or shading. Some skin conditions, however less frequent than others, are still harmful because, if untreated, they will probably worsen and spread. Early on, it might not get the proper care. A biopsy is the standard procedure for finding skin cancer and it entails scraping out the patient's skin lesion and sending it for laboratory testing. This strategy is uncomfortable, difficult, and tiresome. A dermatologist must put a lot of work into treating skin cancer from melanoma. In this study, a novel approach is used to detect skin cancer using machine learning. Dermoscopy images of melanoma cancer make it easier and less tedious to detect skin cancer.***

Keywords: Image Pre-Processing, Segmentation, Feature Extraction, Classification, CNN.

I. INTRODUCTION

Once the melanomas begin to proliferate, the deadly skin disorder known as melanoma becomes uncontrollable. Melanoma can develop anywhere on the skin. A rare type of malignant skin tumor is melanoma. It certainly will spread to numerous places of the body and kill tissues nearby, unlike many other kinds of skin cancer. finding melanoma A biopsy is performed, including the removal of the irregular tissue as well as some of the nearby healthy tissue. A pathologist analyses the tissue under a microscope to look for malignant growth cells and then makes the difficult difference between a colored mole on the skin and an early melanoma harm. Patients might need to have another specialist analyze the tissue sample. Skin cancerous development is dangerous. A skin cancerous growth results from the melanocytic cells having abnormally. due to the possibility of melanoma, a skin cancerous growth[1]. Melanoma provides information about the skin's health, including whether or not bright radiation and genetic causes are responsible for it. The color of a melanoma sore is dark or darker. Melanoma may be completely treatable if caught early. Using a biopsy may be a common method to detect skin cancerous growths. This approach is harmful and painful [2]. Skin cancer is the most commonly malignant growth in the fair-skinned humanity and usually comes on by being exposed to bright light. Skin disease is the uncontrolled development of abnormal skin cells [3].

Melanocytes are the origin of melanoma. Melanoma can develop on any area of the skin. Melanoma is typical in those who have brown skin pigmentation. The top of the body, the neck, the area behind the shoulders, the lower legs, the palms of the hands, the bottoms of the feet, or the skin below the fingernails will each have it.

Basal cell skin cancer is a condition that begins in the basal cell layer of the skin. Usually, it occurs in areas that are exposed to the sun. The most frequently identified type of malignant development in people in good health is basal cell skin disease.

Squamous cells are where squamous cell skin cancer begins. The most common kind of skin cancer in dark people is squamous cell skin malignant growth, which is typically found on parts of the body that aren't exposed to sunlight, like the legs or feet [4].

Numerous exploratory concerns are made in an effort to develop automated skin disease diagnosis that also increases assurance accuracy. The composed attempts at these efforts are evaluated in the method. In similar ways, the right information that is immediately given is essential for understanding a reliable skin threat area system.

The ABCDEs of melanoma: The majority of moles, dark patches, and skin growths are benign. The first five letters A, B, C, D, and E can be used as a simple guide which will help you in detecting the symptoms of cancer.

1) *A is for Asymmetry:* Most melanomas have irregular borders. The two parts of the injury will not match properly if a line is drawn through the injury's center. The melanoma might appear different from a regular mole, an oval or even a round shape.

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Figure 1: Asymmetry

2) *B is for Border:* The border of a melanoma will typically be irregular and may have edges with curves or marks. Commonly, normal moles will have smoother, more even edges.

Figure 2: Border

3) *C is for Color:* The key cancer indication might be any dark, tan, or other sun-related color. The colors purple, white, or blue may appear when melanomas develop. The majority of harmless moles are one to two shades darker in color.

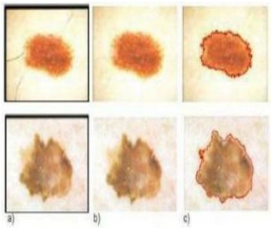


Figure 3: Colour

4) *D is for Diameter or Dark:* At their early stages, melanomas are often larger than a pencil eraser (about 6 mm, or 14 inch, in width). They might, however, also be smaller. When compared to regular moles, melanomas usually appear darker in shade. On the other hand, they can also be pink or lighter in color. Melanotic melanomas are uncommon and dark or colorless.

Figure 4: Diameter

5) *E is for Evolving:* Any change in a skin spot's size, shape, color, or height, as well as any new symptom like bleeding, tingling, or crusting, could be a warning sign of melanoma. If you detect any of these symptoms, consult a dermatologist right once.

Figure 5: Evolving

II. SYSTEM FLOW DIAGRAM

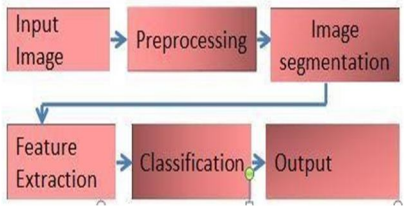


Fig.6. System flow diagram

III. COMPONENTS OF METHODOLOGY

In our study 3 steps are involved which are as follows:

1) *Dataset:* The images were collected from the Kaggle. The Skin Cancer MNIST: HAM10000 dataset provide the collection of images for skin cancer. This HAM10000 dataset contains approximately10,015 images , trained and tested over these images.

a) It involves collection of data. In this study the data used is Skin Cancer MNIST:HAM10000 dataset. Here the data is preprocessed which involves hair removal, glare removal and shading removal And then identify texture, color ,size and shape of the malignant cell. Image Pre-processing: The images are dimensions 600*450 and bit depth 24 bit. In this step input picture is converted into grey image. To convert color image into grey color image following formula is used: Gray Image = 0.2989*R+0.5870*G+0.1140*B the image may contain some noise and undesirable things, for example, hair and air bubbles. The Gaussian filter is utilized to eliminate the hairs from an image.

b) In this step image segmentation using Ostu's Segmentation and feature extraction is done for finding color, shape and size and texture. Image Segmentation: The second and important step is to detect and isolate the affected area. This process is called image segmentation and is done using one of the techniques. Skin image possess normal part and sore part. If you take these two parts together for further processing then it will lead to less accurate classification. As the affected part is only required for image examination, segmentation is performed with this goal. Different image segmentation techniques are used which will change the gray image into binary image. After segmentation, edges of the output picture become irregular, for smoothing the edges of an image different filters are applied. Feature Extraction: Feature extraction means to find the unique features of the segmented area of an image. The properties of the input image are represented by these features. This is another significant step. Melanoma possess the shading variety and general injury contains uniform shading. Another distinction is Benign (non-malignant) sore have round shape whereas melanoma has sporadic or irregular shape. From the skin image, using properties like abnormalities in shading, edges, region shape and texture, various features will be extracted.

c) This involves classification of melanoma or not. Here we used CNN. The dataset is trained and then tested and the results are obtained .

2) *Classification:* CNN (Convolution Neural Network) are a supervised learning method and are therefore trained using data labeled with the respective classes. Essentially, CNNs learn the relationship between the input objects and the class labels and comprise two components: the hidden layers in which the features are extracted and, at the end of the processing, the fully connected layers that are used for the actual classification task. Unlike regular neural networks, the hidden layers of a CNN have a specific architecture. In regular neural networks, each layer is formed by a set of neurons and one neuron of a layer is connected to each neuron of the preceding layer. The architecture of hidden layers in a CNN is slightly different. The neurons in a layer are not connected to all neurons of the preceding layer; rather, they are connected to only a small number of neurons. This restriction to local connections and additional pooling layers summarizing local neuron outputs into one value results in translation invariant features. This results in a simpler training procedure and a lower model complexity.

IV. RESULT AND DISCUSSION

1) *Input:* An example images from the dataset chosen is as shown in fig.6 below. The sample image represented cancerous part of the skin infected.

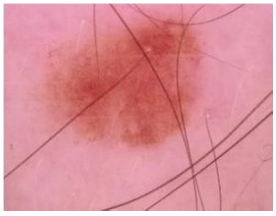
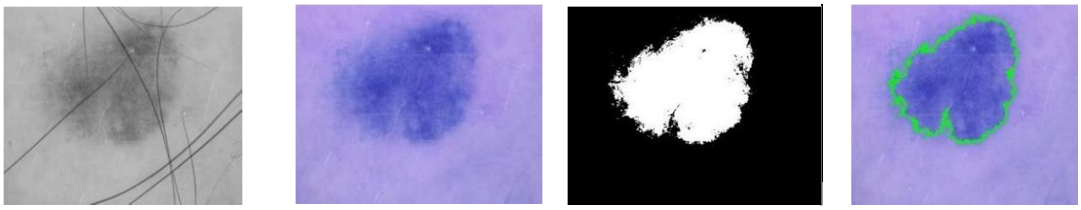


Fig.6. Input image(ISIC_0029321.jpg)

2) *Pre-Processing stage:* Firstly, for the input image, dull razor method is applied, then its is converted into grey scale, followed by application of Gaussion filter and Black hat filter. The pre-processing result are shown in fig.7 (a), (b).



(a) (b) (c) (d)

Fig.7. Pre-processing stage results, (a) Grey scale image (b) Clean image (c) Segmentation image (d) Detected image

3) *Segmentation:* The image is segmented using color based OTSU thresholding and result are show in fig.7(c).

4) *Feature Extraction:* Extracted feature for the input image using ABCD and GLCM methods are listed in the Table 1 given below:

Table 1

Extracted features and their values

Features	Values		
Standard vector	20.8532		
Diameter	2.1480		
Asymmetry index	1		
Color values of r, g, b	37.0471, 23.2337, 27.0009	Auto correlation	2.520931623931624e + 01
Contrast	1.228632478632479e-01		
Correlation	9.894224944536026e-01	Energy	1.669194389655928e-01
Entropy	2.156049329513495e + 00		
Homogeneity	9.411574074074074e-01		

5) *Classification:* CNN is used for classification. Since the HAM10000 dataset consist of about 10,015 images which involves complexity, total of 800 images are considered by following 200 images for each class. The training to testing ratio 70:30. The Segmentation result is show in below in fig.8. The accuracy is 96.25%.

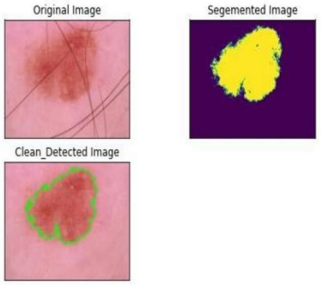


Fig.8. Segmentation result

In the experimental work, the CNN classifier apply to the skin cancer HAM10015 dataset the CNN model for training and testing with 60 epochs intervals then we got the following results.

Validation Accuracy = 0.773067 with Loss_V = 0.656232 and

Test Accuracy = 0.763355 with Loss_T = 0.757164

The classifier's loss vs. epochs, accuracy vs. epochs, confusion matrix, and ROC-AUC curve were all plotted. The plots are displayed.

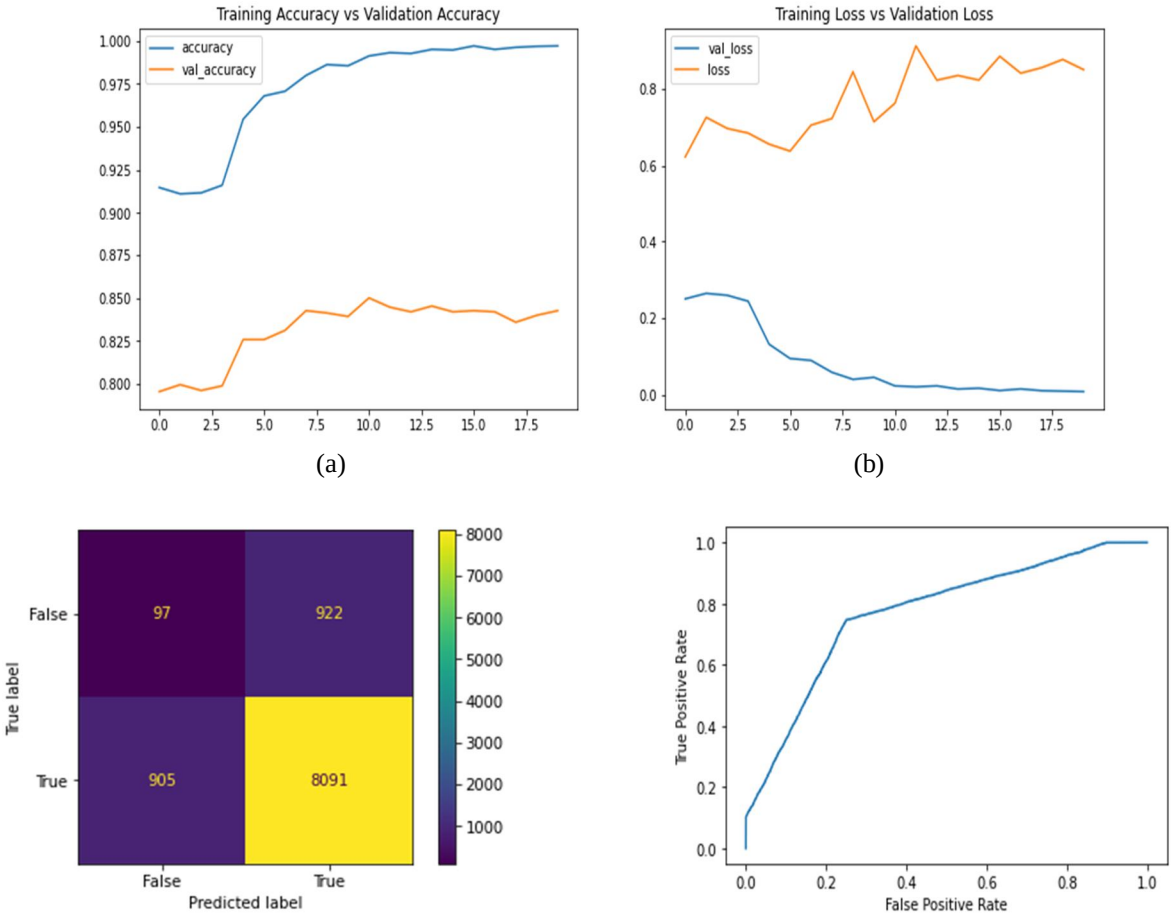


Figure 7: a) training acc. Vs. Validation acc. b) Training acc. Vs. Validation acc. c) Confusion Matrix d) ROC curve graph

V. CONCLUSION

In this work it has been concluded that Melanoma skin cancer detection is the technique to detect malignant melanoma disease from the skin. The Melanoma skin cancer detection technique consist of Image Preprocessing, Segmentation, Feature Extraction and Classification steps. In this paper we have presented feature extraction techniques with their accuracy, from which Convolutional Neural Network method gives the more accurate results in minimum amount of time. The accuracy achieved is about 96.25%. The proposed system uses seven types of skin cancer for classification and obtain high accuracy and precision.

VI. ACKNOWLEDGMENT

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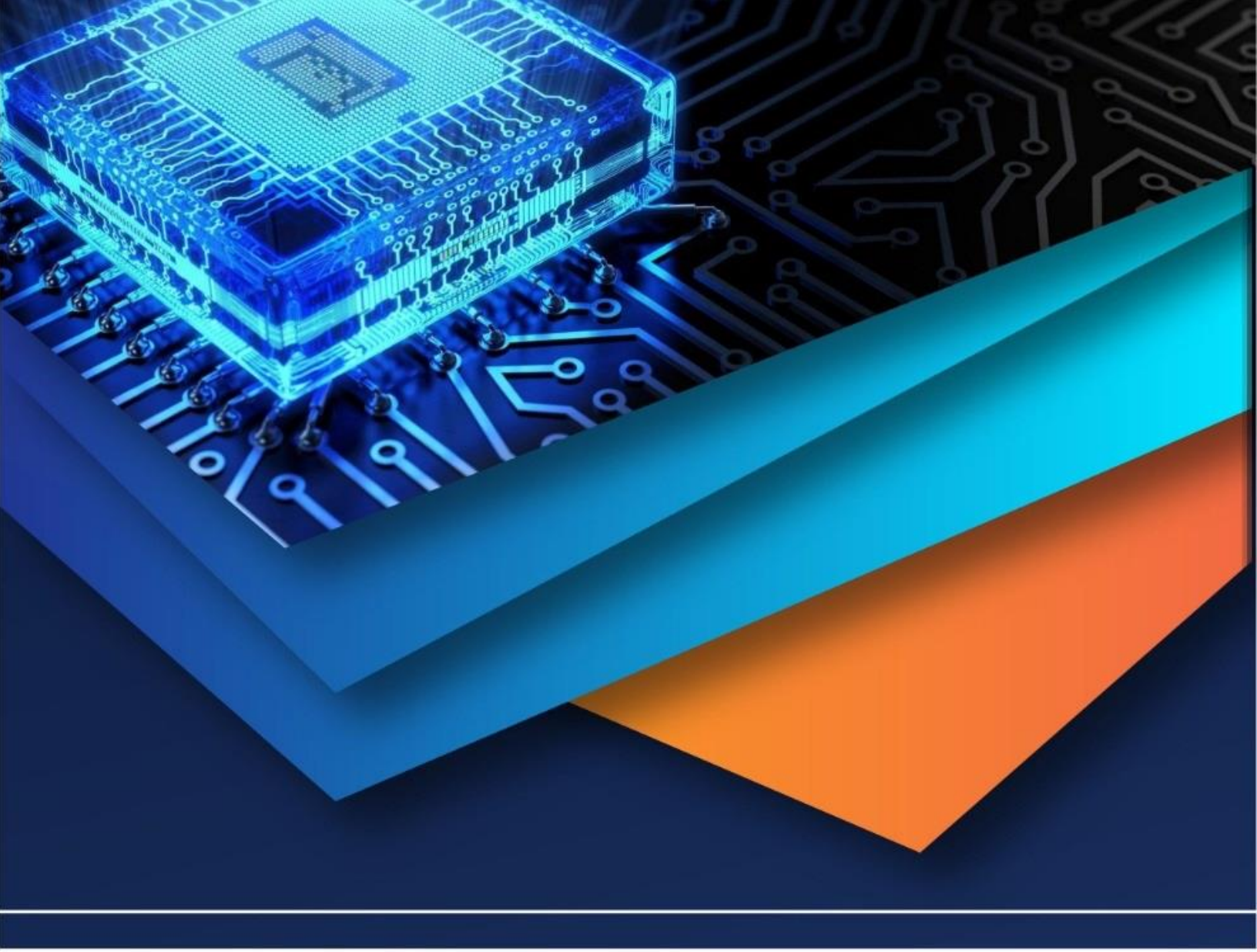

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