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Melanoma Detection using Deep Learning

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Abstract: ***There is a lot of scope for automation in health care and health management. Let us consider the dermatology sector, which deals with different types of skin diseases .In which cancer is most difficult for diagnosis different types of cancer like melanoma can be cured if found in the early stages. In this paper we introduce a method to digitize and automate the process of diagnosis of melanoma using deep learning techniques. Deep learning techniques have achieved high accuracy rates in classifying images in various fields. Deep learning is a technique that attempt to teach a computer to gain knowledge through example. Use of deep learning to automatically detect melanomas in dermoscopy images. The system first preprocesses the images by removing unwanted artifacts and it then classifies the images using Convolution Neural Network (CNN). Then the classifier has been tested on preprocessed and unprocessed dermoscopy images to evaluate its effectiveness.***
Keywords: Melanoma, dermoscopy images, deep learning, CNN.

I. INTRODUCTION

Computers have made the life of humans easier. Its the most used tool in almost every fields. They made research very easier. This has evolved an Era of maintaining huge records for data storage. Modern medical devices has been offered by biomedical for diagnostic and preventive measures. These include diagnostic test kits, vaccines, antibodies and radio labeled biological therapeutics used for imaging and investigation purpose. With the evolution of technology many types of cancers are detected and it has become a common disease.

In modern era, cancer is becoming a common disease with the increased use of cosmetics, pollution and radiations. The images are captured with the help of derma scope and are fed as input to the algorithm. The main aim of this strategy is to develop an algorithm which require minimal intervention of doctors. Many patients are suffering from skin cancer i.e melanoma due to late detection of cancer. They might understand that they are affected only after a long stage. So in order to make people aware about their health and to do a checkup online this is a great choice by just uploading the images of the skin and check whether these matches for the images in the data set. After discovering the type of disease, next step is to identify which stage the cancer is. This can be done using various factors such as thickness, depth of penetration, and the extend to which melanoma has spread. After detecting the stage of patient further treatment is done. The early stages of melanoma are insular. Stage 0 tumors are noninvasive and have not entered the external layer of skin. Stage 1 has attacked the skin's next layer. Stage II tumors are bigger and additionally they might have different characteristics. Deep learning is growing rapidly and is not bond to only one field it consists of many other things. The reason why we use machine learning is to program, so as to make the device perform several tasks continuously without explicitly programming each time[7].

A computer improves from its past inputs given by user and records the patterns applied by the user for various diseases. Deep learning means that when a data is being recognized by the computer with the help of an algorithm. Training is referred to as the process by which machine learns and model is the output processed. The main objective of a learner is to generalize from the past experiences actually means the ability of a system to perform the operations on any new data which is unseen earlier. Deep learning in the past has decade has invented automated cars, practical speech recognition, effective web search and so on. Actually in the resent world we are using it many times in our daily life without knowing it.

The main objective of the project for melanoma detection using Deep learning is to analyze and access the risk of melanoma using dermatological photographs. It reduces the amount of patients which suffer from lack of treatment. Here we introduce a new model for every user to check whether they are undergoing any diseases related to skin cancer and in which stage of cancer .So as a precaution before consulting the doctor it will be helpful for users to check by themselves. A data set which contains the images of each stages of melanoma are recorded and trained with the algorithm. This data set is used to identify a new image when a user gives as input and predict the result whether it is melanoma or any other disease. There is only 95 percent of chance to be predicted correctly although the machine gets trained with huge amount of data set.

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II. RELATED WORKS

Cancer is one of the leading causes of loss of life in young person. It can strike at any age. skin cancer is of three types: Basal Cell Carcinoma, Squamous Cell Carcinoma, and Melanoma. Among all its types, melanoma is considered to be an deadliest of skin cancer. Melanoma in almost all cases starts in pigment cells. The incidence of melanoma continues to increase worldwide. Early detection of melanoma is really a challenging task. Therefore, various systems were developed to automate the process of melanoma detection. Dermoscopy is a microscopy-based tool to improve noninvasive diagnostic discrimination of skin lesions based on color and structure analysis. It allows detailed examination of skin lesions and provides inner view of many dermoscopic structures. It also helps dermatologist in diagnosis of malignant melanoma. Color features play a very important role in the melanoma skin cancer diagnosis. The accuracy of the system is affected by the features used. A lot number of research in the
field of melanoma detection have been made over the last decade, which covers a wide range of computer vision and pattern recognition techniques. Segmentation and classification of images are the
most used techniques, found in the literature.

Zahra Waheed [1] proposed a method in which different type of color and texture features are extracted from varying intensifies of melanomic lesions and these extracted features are used to classify melanoma out of the dermoscopic images using a SVM classifier which returns a accuracy of 96%.Nikhil Cheerla et al.[3] proposed an algorithm using texture and local binary pattern for segmentation of melanoma effected images. After application of segmentation technique, images are classified which returns a sensitivity of 97%.Giotis [4] proposed a system that works on the non-dermoscopic digital images of skin for the melanoma skin cancer detection. This system works on the three type of information: lesion color, lesion texture and visual diagnostic attributes of the patients. Color and texture features are automatically extracted from the digital images whereas the presence and absence of a set of visual attributes are determined by the examining physician. The final classification decision for a test case is made by using a voting method from the three sources.Aman Kamboj[2]proposed a system thats uses segmentation and classification using three different methods: Naive Bayes, Decision Tree K-Nearest Neighbor(KNN).

The images after the removal of artifacts are then use to extract the region of interest and finally they are classified by each of the methods. The accuracy rate of 75.88% returned by using Naive Bayes, accuracy rate of 82.35% returned by decision tree and a accuracy rate of 75.88% by using KNN.

In this paper we aim to take advantage of deep learning methods to form an automatic diagnosis system for melanoma detection. For this purpose the input digital images, usually subjected to noise and illumination effects, are preprocessed. This preprocessing effectively helps CNN extract discriminative features from the images. Afterward, the images are fed to a CNN architecture to classify the input as melanoma or not melanoma.

Deep learning mechanisms can learn set of high level features from low level ones and gain high accuracy for classification applications without the need for extracting handcrafted features Convolution neural network (CNN) is a type of deep learning method where trainable filters and pooling operations are applied on the raw input images, extracting set of complex high level features automatically

III. PROPOSED METHOD

In this section, the proposed method is explained in detail. The method includes two main steps preprocessing and architecture model creation using CNN. The goal of the preprocessing is to covert the image into machine understandable array format. Preprocessed images are fed into second stage which is a CNN.

A. Preprocessing

Data Preprocessing or simply preprocessing is a process of preparing available data and making the data suitable for a machine learning model. It is the primary and crucial step while creating a machine learning model. The deep learning system which is already implemented on a Computer server which is also equipped with graphic server for melanoma detection. By using deep learning scheme we will upload a series of images to the system for the system to study the pattern appearing in Melanoma disease.

The more data or images given to the system will emphasize the whole system and will give a more precise outcome. After the training process, i.e, when the system reaches at the stage of the melanoma detection at a primary stage, there is a need of the enhancement of the image should be used. Which includes, removal of noise, affected area are highlighting, etc.

In this stage the background image is coverted to
grayscale form and a mask generation is taken. The next step is image resizing. The user may not upload the image of only affected part.

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The user may also includes the image of non affected part. It may results in undesired results or it may affect the precision of system. So the image should be resized. It includes Cropping, grading, etc.The avoiding of the non affected area is important
At the first stage, we should get the image, for extracting all its features like colour of skin, the pattern of skin, the non affected area, the highlighted part, the noises, the depth of affected area, etc. it will be the primary scene of the process. The feature extraction are included in this part.

B. Architecture creation

In this section, details of the proposed CNN are discussed. The most challenging task is extracting an effective and discriminative feature set from various classification groups. The CNN algorithm is an algorithm which can take an image as input, and understands its importance by its various aspects and find the difference between any other images. The architecture of this CNN algorithm is similar to that of Neurons in Human Brain. i.e individual neurons respond to stimuli only in restricted region of visual field. The CNN algorithm is used for feature extraction of the image. It includes the details like colour of skin, the pattern of skin, the non affected area, the highlighted part, the noises, the depth of affected area, etc. They can examine various structures in input images. Hence, in utilization of CNN, the input is the image itself and the network automatically extracts appropriate aspects of the image.
The other process used in the system is Max Pooling. Max Pooling is a Sample based discretization process. The input image needs to be down-sampled. i.e, the image should be converted to a somewhat simpler form by reducing its dimensionality, size of data, number of parameters, amount of computation needed, etc and allow to made assumptions about features reside in the sub regions. 2D max pooling block represents a max pooling operation. After processing the input layer, the output layer will only consist of smaller tensors in term refers to a mathematical object which is represented by an array.

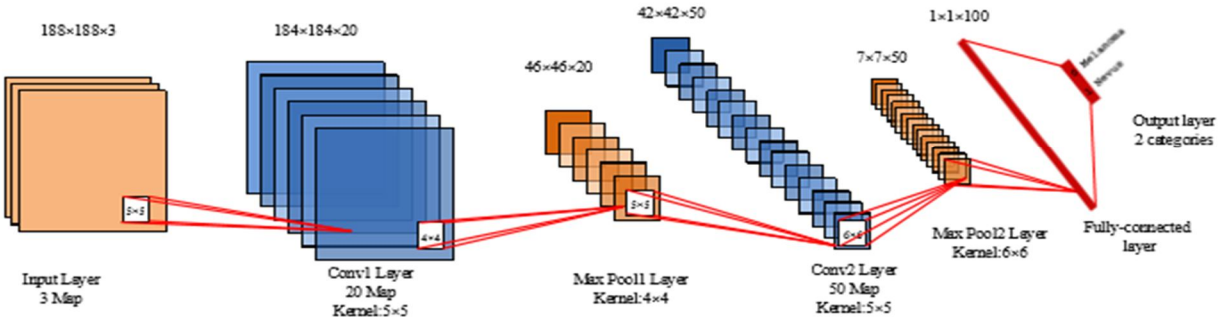


Figure 2. Architecture of proposed CNN

The used CNNs in this paper consist of two convolving layers with a 5×5 kernel. There are 20 feature maps in the first convolution layer and 50 feature maps in the second convolution layer. There is one pooling layer after each convolution layer. Outputs of these four layers are fed to a 2layer fully connected stage respectively having 100 and 2 neurons. This 2-layer network forms the final diagnosis results with a linear transfer function. The proposed configuration can be seen in Fig. 2.

IV. EXPERIMENTAL RESULTS

In this section, we summarize our evaluation results for the previously proposed method. The dataset were taken from HAM10000 and ISIC 2016. The dataset is divided into two one or training and other for testing.
To perform training and testing the dataset is split into two randomly selected groups. A 70% - 30% ratio is used where 70% of the dataset images are randomly selected for training and the rest is used for test while there is no overlap between the test and train samples. The training data is fed to a network with a batch size of 64.
The network is trained through 20,000 iterations. Firstly we compare the effectiveness of classification results with regard to dataset used for training and testing. Our thorough evaluation obtains best accuracy values of 80%on HAM10000 and ISIC 2016. After the detection of melanoma the option for consulting a doctor is also included in the proposed method.
For comparing the proposed method with other existing methods, two works that have reported their results on the same dataset are studied [5] and [6].Work of [6] is an example of existing commercial applications and method of [5] makes its final diagnosis in a semi supervised framework, where the opinion of a physician who has examined the lesion is involved. e. The evaluation results are shown in Table 1. As can be seen, the proposed method has the highest accuracy compared to other methods.

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Methods	Sensitivity	Accuracy
MED-NODE texture descriptor [5]	0.67	0.76
MED-NODE colour descriptor [5]	0.74	0.73
Spotmole [6]	0.82	0.67
Proposed model	0.80	0.80

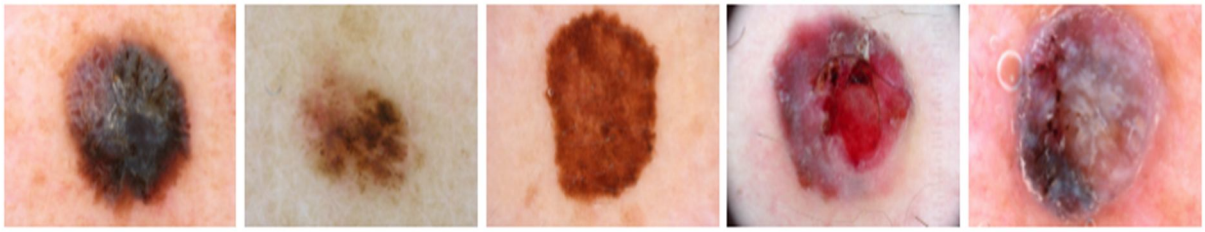


Fig 2. Example of melanoma cases

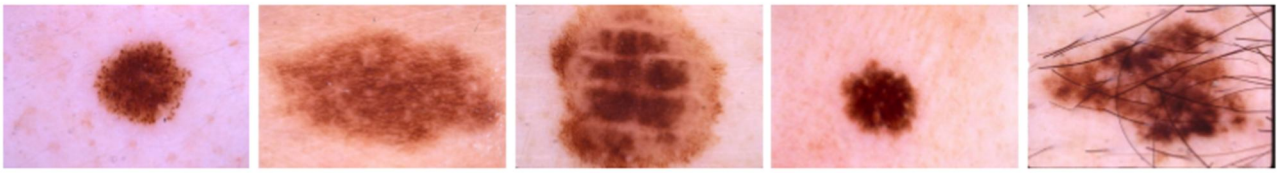


Fig 3. Example of non-melanoma cases

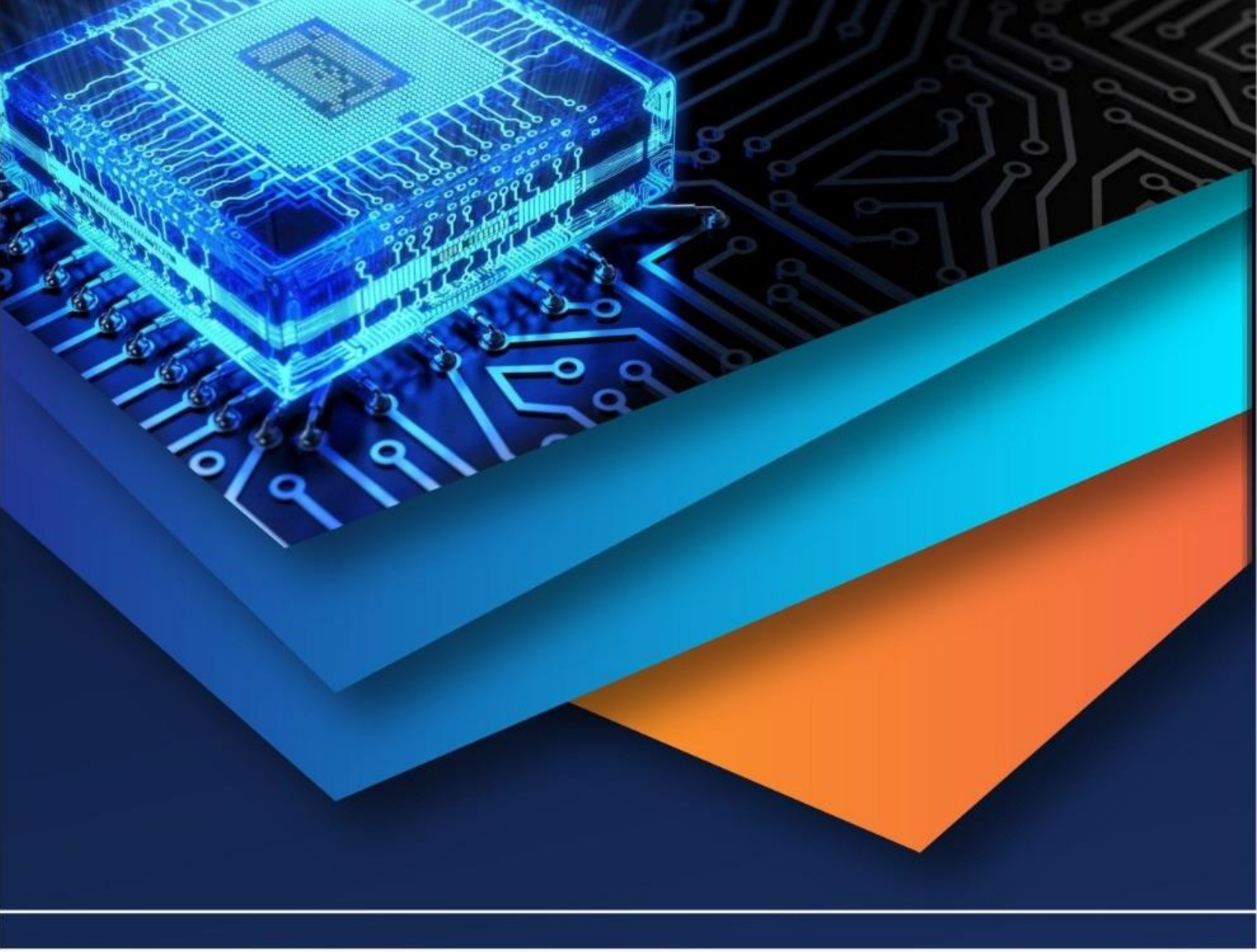
V. CONCLUSION

In this paper a computational complex method based on deep learning was implemented that used clinical images. This system was capable of detecting melanoma cases from benign ones. We were able to increase the accuracy of the system by sending images through illumination correction that increased the discrimination capability of the system. For training, we used an available small dataset. By cropping, scaling, and rotating of images the number of images was increased. Our proposed method left the process of feature extraction to CNN while traditional learning approaches try to extract features from data. Experimental results showed our better accuracy, as compared to other detection algorithms.

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