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A Study of Diagnosis of Skin Disease using Deep Learning Techniques

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Abstract: ***Dermatology is an early novel medical specialty in the world. Melanoma and Nevus (mole) cancer can be very dangerous in skin diseases because the growth rate of this type of cancer is quite high, requiring an evaluation for early diagnosis to dermatological care for the general public. More than 95% of skin cancers can be successfully treated if they are diagnosed early [1]. It is expensive for a variety of individuals in most developing countries. Nowadays machine learning and deep learning techniques are providing an important role in image classification, pattern recognition, texture analysis. These machine learning and deep learning techniques can be developed in mobile devices so that they can reach all individuals. In this study, we were analysing various types of machine learning and deep learning techniques for the diagnosis of skin diseases in patients.***

Keywords: Skin Disease, Deep Learning, Machine Learning, Diagnosis, Review, Image Processing.

I. INTRODUCTION

Many forms of human cancer exist, with skin cancer being the most common example of these cancers. There are two major skin cancer types, namely malignant melanoma and non-melanoma (basal cell, squamous cell, and Merkel cell carcinoma, etc.). Ultraviolet light (UV) exposure is the cause of most skin cancers. If we do not protect our skin, UV rays emanating from sunlight or a tanning bed can damage the DNA of your skin. It cannot properly control the growth of skin cells when DNA is altered. Melanoma is a form of melanocyte-forming skin cancer. It is rare and very aggressive. These are the cells that make up your so-called melanin pigment. These cancerous growths occur when unpublished DNA damage to the skin cells (often due to sunlight or ultraviolet radiation from the tanning bed) leads to mutations (genetic defects) that rapidly multiply the skin cells and malignant tumors. But most skin cancers are non-melanomas, meaning that melanocytes are not involved.

The two most common cancers are Basal cell and squamous cell skin cancers. When caught early, they can almost always be cured. Nevertheless, melanoma will easily become a problem, which is more difficult to treat, if you do not detect it and treat it early. According to the World Cancer Research Fund [2], melanoma accounted for about 22% of skin cancer diagnoses in 2018 and about 78% of non-melanoma tumors diagnosed with skin cancer. In 2018, there are approximately 300,000 new cases worldwide in which melanoma was the 19th most common cancer in men and women. Non-melanoma skin cancer is the 5th most frequent cancer in men and women, with more than 1 million diagnoses worldwide in 2018.

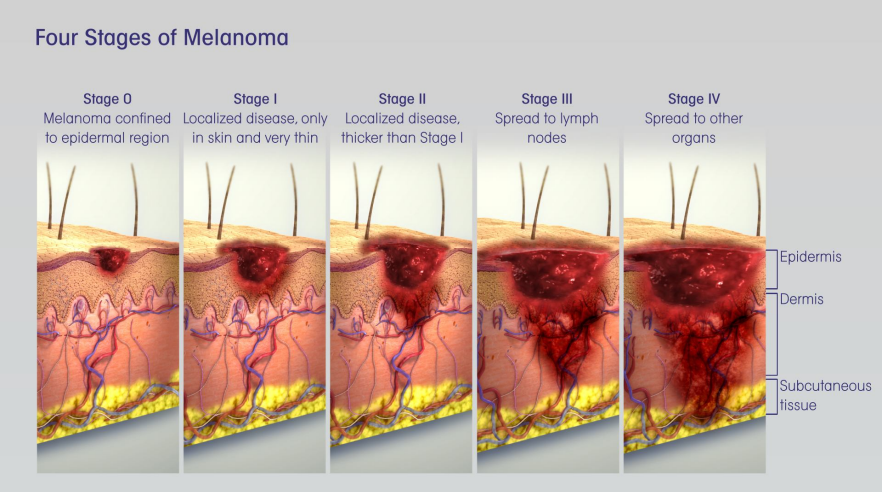

Fig. 1 Different Stages of Melanoma Skin Cancer

Common Risk Factors for skin cancer are [3] : -

1) Ultraviolet light (UV) exposure, either from the sun or from tanning beds. Fair-skinned individuals, those with hazel or blue eyes, and blond or red-haired are particularly vulnerable. The problem worsens in areas of high altitude or near the equator, where sunlight is more intense.
2) Chronic suppressed immune system (immunosuppression) from underlying diseases such as HIV / AIDS infection or cancer, or certain drugs such as prednisone or chemotherapy.
3) Exposure to ionizing radiation or chemicals such as arsenic to predict cancers.
4) Certain types of sexually acquired wart virus infection.
5) People who have a history of one skin cancer have a 20% chance of developing another skin cancer in the next two years.
6) Skin cancer is more common in elderly patients.

II. PROBLEM FORMULATION

Melanoma is a dangerous skin growth that occurs at a point when melanocytes begin to become uncontrollable. Melanoma can occur at any place on the skin. Melanoma is an uncommon type of malignant growth of the skin. It is bound to attack near tissues and spread to different parts of the body, causing various types of skin malignancy.

There is a clinical method biopsy which is usually used for diagnosing skin disease (skin cancer). It is a method of emptying the odd tissue and a limited amount of ordinary tissue around it. A pathologist takes a gander into the tissue under the magnifying lens to examine malignant growth cells. It becomes difficult to distinguish between a difficult mole and an early melanoma injury. Also, this method expensive and takes time to diagnose skin disease.

III.OBJECTIVE

Artificial intelligence (AI) and image recognition have the potential to revolutionize medical diagnosis. One of the most promising areas of health innovation is the application of artificial intelligence (AI) in medical imaging, including but not limited to classification and interpretation. Deep learning (branch of AI) is famous for image processing, image classification tasks and provides promising results in visual tasks. In addition to enabling the possibility of early disease detection and even prevention, it can enhance the workflow of medical diagnosis by accelerating reading time and automatically prioritizing urgent cases.

IV.LITERATURE REVIEW

Looking at the current things of computerized skin disease diagnosis systems, the field unit is achievable with some solutions that the field unit is still under development for analysis. The bounded limits and disadvantages area unit knew in them, therefore, this answer tries to beat the prevailing issues with a completely different approach. Many researchers have highlighted the potential of predictive classification to provide decision support for doctors and medical professionals. Over the last few years, a great deal of research has been conducted on different data set to predict skin disease. Following is some of the researches which have been reviewed for the proposed system:--

TABLE I
Comparison Various Research Algorithm

Authors	Methodology	Dataset	Accuracy
K. Polat, K.Onur Koc [5]	CNN & OVA	HAM10000 []	92.90 %
T.C. Pham et al.[6]	EfficientNetB4	HAM10000	89.97 %
K. Mahajan et al.[7]	Meta-DermDiagnosis network	ISIC 2018 [8], Derm7pt [9], SD-198 [10]	83.70 %
T. Majtner et al. [11]	Ensemble of VGG16 & GoogLeNet	ISIC 2018	81.50 %
Nils Gessert et al. [12]	Ensembling	HAM10000, ISIC 2018	85.10 %
P. Tschandl et al. [13]	ResNet34, LinkNet34 and LinkNet152	HAM10000, ISIC 2017	81.7 %
Y. C. Lee et al [14]	Ensemble of DenseNet and U-net	HAM10000	78.50 %

A. For Detection of Skin Disease automatically, Kemal Polat and Kaan Onur Koc [5] have been proposed two different methods; i) Alone Convolutional Neural Network model, and ii) the combination of Convolutional Neural Network and one-versus-all. In the first proposed method, they used raw dermatology images taken from the dataset that has been given to the input of the Convolutional Neural Network. In the second proposed method, seven different models with two classes are constructed and then combined with a one-versus-all approach. While the first method, Convolutional Neural Network obtained 77% classification accuracy and the one-versus-all approach achieved 92.90% accuracy.

B. Tri-Cuong Pham et al. [6] proposes a hybrid method for handling class imbalance of skin-disease classification in the research of "Improving Skin-Disease Classification Based on Customized Loss Function". The training dataset contains 24,530 dermoscopic images of seven skin disease categories. They have proposed the EfficNetB4 model that achieves the highest accuracy of 89.97% and also the smallest recall, which is 86.13% with a standard deviation of the smallest recall of 7.60%.

C. Kushagra Mahajan, Monika Sharma, Lovekesh Vig [7] proposed the method Meta-DermDiagnosis. Meta-DermDiagnosis utilizes meta-learning-based few-shot learning techniques like distance-based metric-based Prototypical networks and gradient-based Reptile for the diagnose of disease. They evaluate the model on publicly available skin lesion datasets such as ISIC 2018, SD-198 datasets, and Derm7pt. Meta-DermDiagnosis obtained an accuracy of 83.70% with Reptile and 80.20% with Prototypical network.

D. T. Majtner et al. [11] in their research "Ensemble of Convolutional Neural Networks for Dermoscopic Images Classification" proposed the solution is based on deep learning, where they have applied a transfer learning strategy on the VGG16 and GoogLeNet architectures. The key feature of the solution is image augmentation and color normalization as preprocessing. In their research, ISIC 2018 Skin Lesion dataset is used and achieved an accuracy of 80.1% for VGG16 architecture, 79.70% for GoogLeNet architecture and 81.50% for their ensemble.

E. Nils Gessert et al.[12] present fine-tune pre-trained Densenet, SENet and ResNeXt state-of-the-art deep learning models and used multiple balancing approaches such as loss weighting and balanced batch sampling. Also implement a feature in their pipeline is the use of a vast amount of unscaled crops for evaluation and lastly, consider meta-learning techniques for the final predictions. Final ensemble contains 54 models with SENet154, ResNeXt101 32x4d, Densenet201, Densenet161, Densenet169, SE-Resnet101, PolyNet and achieved 5-fold accuracy of 85.10 %.

F. Philipp Tschandl et al [13] proposed a fully convolutional network where the ResNet34 layers are reused as the encoding layer of the UNET style architecture. They using random initialization then use pre-trained ImageNet weights and fine-tune ResNet34 for skin lesion classification. After transferring the layers to fully convolutional network architecture, train the network for a binary segmentation task using ISIC 2017 da*taset. For final classification* LinkNet34 and LinkNet152 were used which achieve 81.7% and 81.3% of accuracy respectively.

G. Y. C. Lee, S. Jung, and H. Won [14] designed the WonDerM Pipeline, which resamples images of pre-processed skin lesions. They build neural network architecture and fine-tuned with segmentation task data, also uses an ensemble method to classify skin diseases. The model achieved an accuracy of 89.9% in the validation set and 78.5% in the test set.

V. FUTURE SCOPE

Automatic detection of skin disease is a complex task. In this paper, we study different techniques to diagnose skin disease using the Convolution Neural Network (CNN) model using skin lesion images. There are many pre-processing steps such as feature extraction, segmentation, data sampling, class balancing, and image data augmentation. The system can be developed in many different ways with a wider scope of improvement in the system. It needs to improve the model to give better and efficient accuracy and reduce the loss percentage. Advanced architecture can be applied to achieve better accuracy and is applied to clinical trials to increase accuracy and reduce loss percentage. Also, a Graphical User Interface (GUI) application can be developed that will be user-friendly. It will also broaden the scope of learning more about neural networks.

VI. CONCLUSIONS

Detection of skin diseases is a very important step to reduce mortality, disease transmission, and the development of skin disease. Clinical diagnostic procedures to detect skin diseases are very expensive and time-consuming. Image processing techniques help to create an automated screening system for early-stage dermatology. The extraction of features plays an important role in helping classify skin diseases. From our in-depth analysis of a literature survey, we acknowledge that the data set is irregular and not as clear as is necessary. A new algorithm for pre-processing is required to train the model more accurately. Also, the prediction will be done with the help of the deep learning algorithm which gives better accuracy based on their performance factor.

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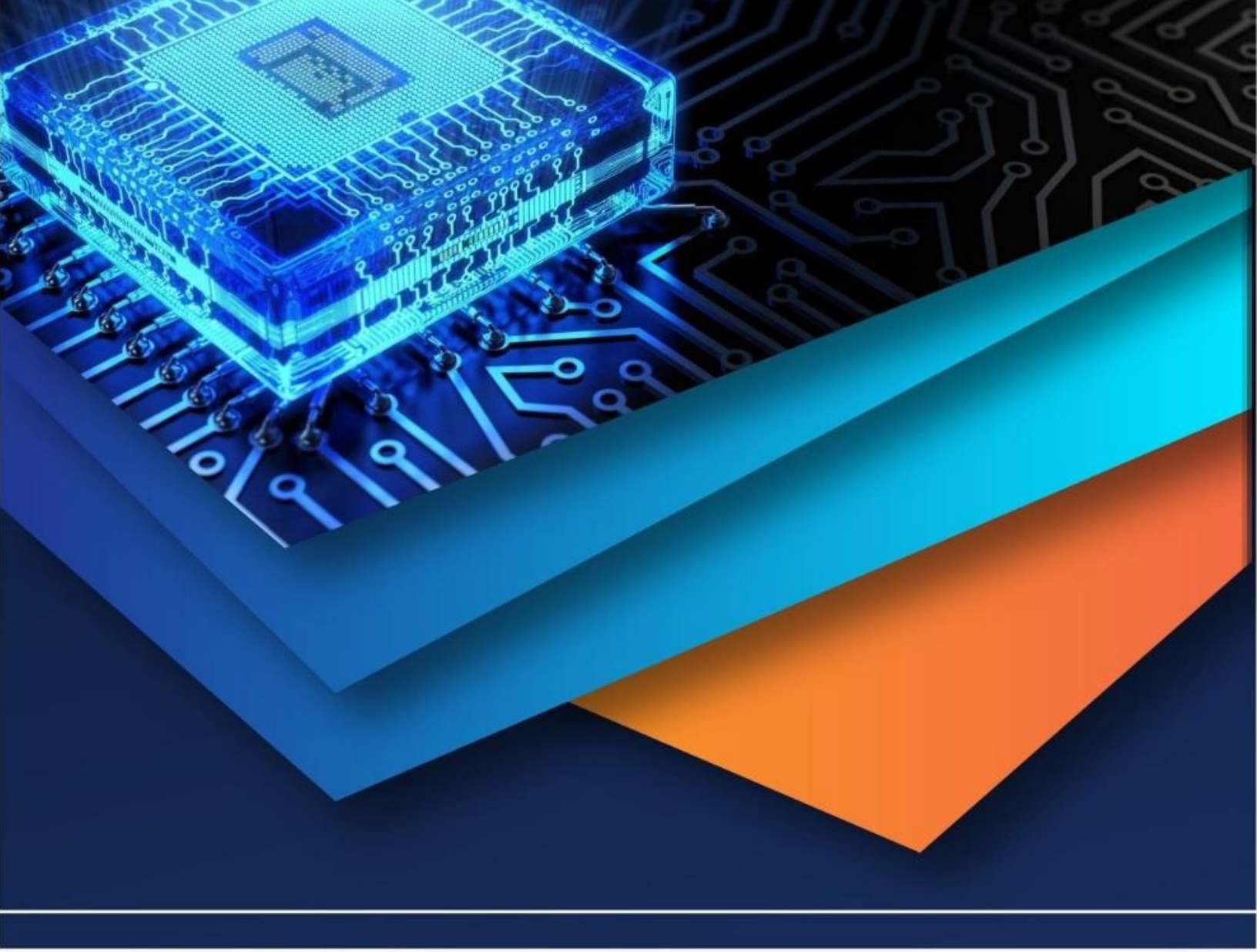

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