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A NOVEL TECHNIQUE FOR DETECTION OF SKIN DISEASE USING CNN

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ABSTRACT: Due to its intricacy, dermatology presents one of the most challenging and uncertain diagnostic environments. Skin conditions like melanoma and cancer are sometimes extremely difficult to identify in their early stages and are much more challenging to categorize. Different approaches for automated detection utilizing pattern recognition models have been investigated by a number of writers. This research describes a novel Deep Convolutional Neural Network (DCNN) for skin disease diagnosis. Skin photos are treated to improve the image quality and are filtered to remove unwanted noise. An image's pixel values will have a significant influence on how well it is classified. The picture is classified using the softmax classifier method by feature extraction utilizing DCCN, and an output including a diagnosis report is produced. Better accuracy, precision, recall, and reduced processing time would be obtained with this strategy, outperforming more conventional techniques like CNN and KNN (K-Nearest Neighbor). With a detection time of 10,000 ms, the DCNN achieved accuracy and detection time.

KEYWORDS: Image Processing, Deep Convolutional Neural Network, Skin images, Skin diseases, Melanoma and Carcinoma.

I. INTRODUCTION

The skin diseases prevalence in India is about 10 to 12% of overall population [1]. As the skin provides protection to the body and receives the sensory stimulus from outer factors of environment. The skin contains a seven layer ectodermic tissue and provides protection to the muscles, internal organs and muscles, making it as the largest organ in human body. The stimulating skin disease factors are increased population levels, harmful UV (Ultra-Violet) rays, poor hygiene and global warming. One of the most prevalent diseases across the world is dermatological diseases [2].

The dermatological diseases are the most difficult terrains for easy, quick and accurate to diagnose particularly in developed and developing countries with less healthcare budget because of their scarce expertise, complexity and variety [3]. In addition it is a basic knowledge that early detection reduces the serious outcomes chances in many of the cases. However recent environmental factors are only acted as a catalyst to these kinds of skin diseases. The diseases like melanoma, psoriasis, eczema and herpes are detected in early stages then the life of someone is saved from danger.

The infections of skin are rated as more basic of all the diseases and dangerous of all the cancers [4]. Various skin conditions are there that may affect the human and are identifiable and diagnosable with their symptoms and are treated appropriately by a skin expert. In traditional process, the skin infection screening involved the pathologist which performs a prognosis examination on the infected skin part for classification. The process is followed by biopsies that might involve the removing of affected portion of skin to the laboratory investigation for the

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establishment of cancer presence in the affected skin area. For infections further classification as appropriate types, another medical group experts who are specialized in autopsy can perform the histopathology over the sample of skin for grading the diseases for suitable medical administration.

An inconsistent schooling (normally inhibited) in the dermatology at the undergraduate level which indicates that trainees must reassess their current knowledge and skills in this specific area. At present almost 90% of skin diseases have exclusively managed through Primary Care. This would implicatively insinuate that many of the quandaries of skin disease might be solved when care is taken in early stages. The diseases of skin may significantly impact the quality of life of patients. As the skin disease rates have been increasing and the outcomes are depending on early stage diagnosis. The General Practitioners (GP) play a vital role in skin ailments early diagnosis [5]. Several endeavors are available for implementing the classical medicines across the globe particularly where the countries are not advanced technologically and the efforts are met the challenges like cost-effective medical equipments and tools and lack of medical expertises.

In digital imaging, the pixel is a smallest addressable element in the display device which addresses all the points, thus it is a smallest controllable element in an image of dermatological skin. Every pixel is a sample which indicates the actual image most accurately. The changes in a pixel value refer the representation of color intensity presence at a specific segment of the image. Scaling of image pixels may involve new image generation with no loss in image quality [6]. Scaling the image pixel information is essential for the removal of undesired pixels from the image as a result the image is prepared for preprocessing. An imperative measure considered in image pre-processing is data normalization. The main goal of image values normalization is changing the numeric column values in a dataset to the basic scale particularly if various ranges are available in data features.

II. LITERATURE SURVEY

Mustafa et. al. [7] presented color space utilization by conducting an experiment with luminance for enhancing the visualization for GrabCut segmentation accuracy. The melanoma skin cancer is globally on the rise because of the increasing UV (Ultra-Violet) radiation and also darker skin communities, new cases have been discovering. In Computer Aided Diagnosis systems application to detect melanoma, image segmentation, pre-processing and feature extraction are the vital stages for the accuracy in segmented skin lesions classification. Corner and geometric features are extracted and are utilized for training the SVM (Support Vector Machine) ML algorithm with better results.

L. Platisa et.al. [8] has explored the requirement for defining the clinical task in digital pathology image quality valuation. In this work, three different experimental cases are performed with the same pathology samples and are observed by 6 pathologists. These experiments are developed for functioning with various protocols. But the results of experiments 2 and 3 won't agree with the set of questions. Whereas the experiment results indicated that pathologist does not noticed JPG (Joint Photographic Group) artifacts similarity with higher similarity Mega-none and Mega-JPG. The experiment 3 results indicated that the observers are failed for observing which has been observed previously in experiment 1. The authors utilized the samples of animal skin and do not utilized any pre-processing

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method for ensuring the full control on image alteration as well as the experiment is not algorithmic.

Nikhil Cheerla et al. [9] presented an automatic technique for the segmentation of lesion. Ostu and LBP (Local Binary Pattern) are utilized to segment the texture. Neural network classifier is used to classify and it achieved 93% of specificity and 97% of sensitivity. In this work, they do not considered other types of lesions like Non-Melanocytic Skin Lesions (NoMSLs). Khaled Abu et al.[10] demonstrated an classification system for skin cancer for the detection of melanoma that is malignant or benign. Here other types of lesion are not employed i.e. they do not considered the Nonmelanocytic skin lesion.

Catarina Barata et al. [11] demonstrated local and global techniques to detect melanoma in dermoscopy images. First system is utilized for skin lesion classification, while the second system is utilized for bag-of-features extraction. In this work the features of color are performed and are compared with the features of texture if it is only utilized and the global technique achieved 96% of sensitivity and the local techniques achieved 80% of specificity. This is only concerned the melanoma but not other types of lesion types like NoMSLs. M. Shamsul Arifin et.al. [12] have very acutely used the color of skin as major classification pattern to determine the benign and malignant lesions. In every disease the skin color appeared differently and it might follow same pattern in every disease. The task of classification is made effective and simpler when this pattern is identified.

K. MD. Thomas et. al., [13] performed an investigation on Joint Photographic Experts Group (JPEG) 2000 lossless compression effect on the diagnostic virtual microscopy. Evaluation is performed over virtual 3-dimensional microscopy with JPEG2000 entire gastric biopsy specimens slide images. From the pathologists results, it is observed that a significant variation is appeared from a observation through Consultant B whereas grading the H pylori (Helicobater pylori gastritis) density but in H pylori direction no considerable variance is appeared. This work only indicated the human diagnosis relative ability performance by the statistical analysis. C.Y. Chang et. al. [14] presents an automatic detection method for facial skin defects detection. Analysis of skin is the most vital process before the medical cosmetology. Firstly the system may detect the face of human from the facial image. Facial features might be extracted based on detected face for locating the Region of Interest (ROI). So a pattern recognition model is used for facial skin defects detection like wrinkles and spots in ROI. To a special type of detect the classifier is developed for providing high performance in recognition. With the certain features extracted from the ROI, this model successfully detected the defects of skin. Obtained results indicated that it has great effectiveness.

Z. Wu, et.al [15] Skin problems not only injure physical health but also induce psychological problems, especially for patients whose faces have been damaged or even disfigured. Using smart devices, most of the people are able to obtain convenient clinical images of their face skin condition. On the other hand, the convolutional neural networks (CNNs) have achieved near or even better performance than human beings in the imaging field. Therefore, this paper studied different CNN algorithms for face skin disease classification based on the clinical images.

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III. DCNN FOR DIAGNOSIS OF SKIN DISEASE

The block diagram of Deep Convolutional Neural Network (DCNN) for Diagnosis of Skin Disease is represented in below Fig. 1.

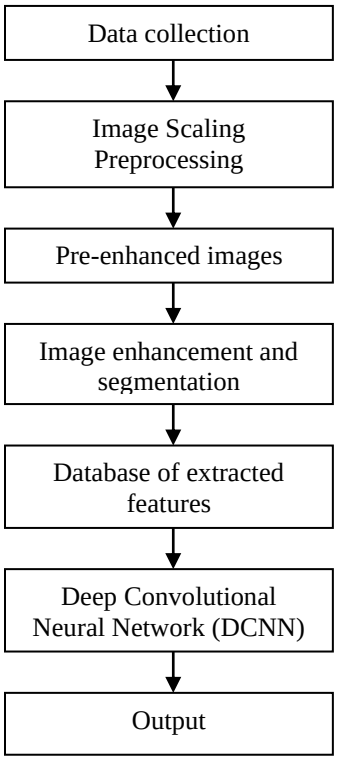

Fig. 1: BLOCK DIAGRAM OF SKIN DISEASE DIAGNOSIS

Dermatological HAM10000 (Human Against Machine) dataset is used in this work. It is an image dataset which is published by Medical University of Vienna, Harvard and it would be adopted for dermatological skin disease classification as seven different types of classes. This dataset consists of about 10,015 skin image samples which are collected from various backgrounds of population. Manually these images would be cropped with the lesion centered to 800 x 600px at 720 Projected Digital Image (PDI). The manual histogram corrections are applied for the enhancement of visual contrast and reproduction of color. The 80% of test dataset is used for training the set and 20% of data is used for testing the set.

Image scaling may involve new image generation with less or more number of pixels with no loss in image quality. Scaling the image pixel information is essential for the removal of undesired pixels from the image as a result the image is prepared for preprocessing. In images pre-processing, the features extraction is one of the vital task which helps for time reduction by the removal of unwanted images and helps for the improvement of model efficiency while increasing the dataset. Data extracted from the database of image would be verified as prone to a specific disease. The images database might be pre-enhanced i.e. they are undergoing methods like image centering, softening and hair removal.

These pre-enhanced images are transformed to RGB (Red, Green, Blue) format and all the image pixel values are transformed as 1-D (1-Dimensional) array. These recorded intensities of pixels are scaled between the range 0 and 1. A 64*64-pixel format is considered here, so about 12288 values are recorded for each image. The feature extraction is the main step in any kind of classification oriented issues. The features will be vital for training as well as testing purpose. This feature consists of vital about the image that is utilized for disease identification. All 1-D arrays would be arranged in a database form through appending all the pixel intensities of all images. With this, the database will be created along with all images pixel intensities. All the pixel intensities of images would be taken and formed as a database and further they utilized for training the DCNN.

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IV. RESULT ANALYSIS

Presented DCNN implementation is performed on any kind of platform. However, here python is preferred because it offers a wider range of neural networks and ML libraries to the developer.

Table 1: PERFORMANCE COMPARISON TABLE

Parameters	KNN	CNN	DCNN
Accuracy (%)	87.2	92.4	98.4
Detection time (ms)	14000	12000	10000

Fig. 2 Shows accuracy Comparison of KNN, CNN and DCNN algorithms with various Threshold. X-axis shows classification & Y-axis represents percentage (%). DCNN obtained most accurate prediction compared to KNN and CNN.

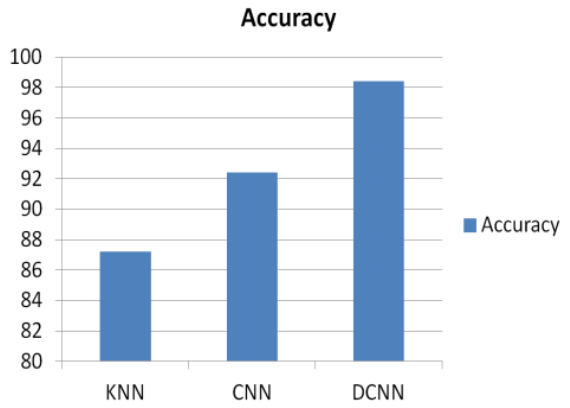

Fig. 2: Accuracy Comparison Graph

Fig. 3 illustrates the Time comparison between DCNN and KNN algorithms with various sizes. The Y-axis represents the time in ms (milli seconds) and X-axis represents the algorithms. The DCCN requires less time compared to KNN in order to classify the largest dataset.

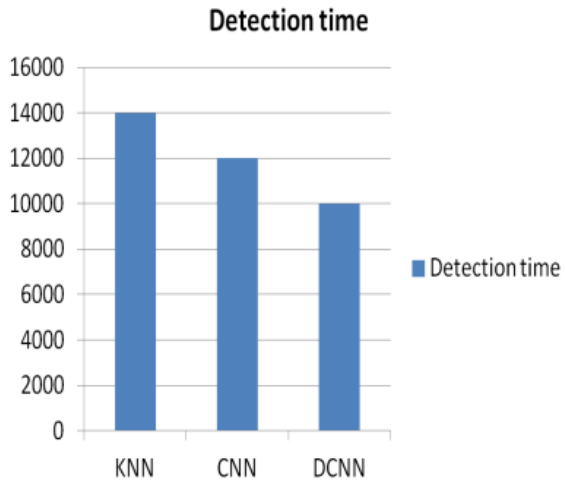

Fig. 3: DETECTION TIME COMPARISON GRAPH

Therefore, DCNN classification technique efficiently detects the skin diseases with high Accuracy as 98.4% and less detection time as 10000 ms.

V. CONCLUSION

This paper describes the use of Deep Convolutional Neural Networks (DCNNs) for skin disease diagnosis. The DCNN method of diagnosing skin disorders involves many phases. Skin pictures are extracted in the process of getting the data ready for processing. In this investigation, the Dermatological HAM10000 dataset is employed. 10,015 skin picture samples total from a population with varying backgrounds make up the collection. The previously upgraded pictures are converted to RGB format, and every RGB image pixel value is then converted to a 1-D array. Lastly, the detection times and accuracy of the DCNN, CNN, and KNN algorithms are compared. When compared to CNN and KNN classifications, DCNN classifications are more accurate and require less time to complete than KNN and CNN classifications. Accuracy and DCNN percentage obtained are 98.4% and 10000 ms, respectively. As a result, the DCNN

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classification approach diagnoses skin illnesses accurately.

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