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Derm-NN: Skin Diseases Detection Using Convolutional Neural Network

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***Abstract*—Skin is the most powerful protection of important organs in the human body. It acts as a shield to protect our internal body to get damaged. But this important part of the human body can be affected by so serious infections caused by some fungus or viruses or even dust too. Around the world, millions of people suffer from various skin diseases. From acne problems to eczema people suffer a lot. Sometimes a small boil on the skin can turn into a severe issue or even an infection that will cause a major health issue. Some skin issues are so contagious that one can be affected by another just with a handshake or using a handkerchief. A proper diagnosis can result in proper medication that can reduce the miseries of the people suffering create awareness. In this research, we have tried to develop a prototype to detect skin diseases using neural networks. In the choice of neural networks, we have chosen CNN which abbreviates as a convolutional neural network. Earlier detection works have been done using DNN which is a deep neural network. Right now have classes to identify a typical skin malady called dermatitis hand, eczema hand, eczema subcute, lichen simplex,statis dermatitis and ulcers. This paper is a sandwich between picture handling strategies and machine learning. Where picture preparation has produced the picture which is being utilized by CNN to arrange the classes. The preparation information comprises five classes of the skin gives that have been talked about above. We have 73% precision by actualizing our framework on the dermnet dataset of 500 pictures of various diseases. This will end up being an incredible achievement if the further enhancements are finished utilizing a bigger measure of the dataset.**

***Index Terms*—Skin disease, CNN, image processing, DNN.**

I. INTRODUCTION

Skin is a part of our body that is not separable. It protects our kidney, heart, liver, and other sensitive organs from the outside environment. This part of the body is a shield that needs to be protected to ensure a healthy lifestyle. Skin produces various vitamins the vital one is vitamin-D. If this part of our skin gets infected then that became the worst. Around the world, we have various types of weather, environment different type of weather conditions, humidity, food habit they can directly or indirectly affect our skin. To solve any problem that could be mathematical, science, economics we need to detect the problem first. To treat our skin first we need to identify the disease first. Skin can be affected by fungus and cause different kinds of fungal infections. Suffering from skin issues is common in our day to day life as we have to spend a long time outside under the sun or into the pollution that causes sweat which is a house of bacteria that creates bad smell along with some skin problems. Maintaining proper hygiene is a punch in the face of the skin issue. But some issues turn out to be vital that need proper identification with medication. The identification tool is our production. We have topped CNN over image processing to introduce a development in the field of medicine which we have named Derm-NN. It is an application of a convolutional neural network to detect skin disease. In this research, we have made a classifier prototype that will give the class of skin disease by analyzing an image and matching the image from its previous training data to produce maximum accuracy. In this test, we have used the dermnet dataset some images are collected from the internet randomly. Our classifier can accurately classify 70% of skin diseases. We have specified five classes of skin disease. We have used a part of our dataset for the training phase and also for the testing phase. The disease is an odd state of body where the natural functionalities of the body get to be stopped due to some imbalance on the body organs. Eczema is a skin condition where the skin became irritated due to the attack of some bacteria that inflame the skin and cause redness, itchiness some blisters too [1]. The convolutional neural network has proven its niche in the sector of computer vision and machine learning. It belongs to a class of neural networks. It has a great hold on the field of image processing. Visual imaginary classification is done with it. In this paper, we have created a classifier that will take input of an image that contains the contaminated skin image with its prior knowledge or could be referred to as the training data the classifier will determine its class. All the class information their accuracy and their result analysis have been given in the other parts of the paper. Skin disease has not been astounding until now. We motivate to do this study to create the cognizance about the issue. Their upshot on the skin can be dangerous over time [2]. In this digital era where the doctors are even digitally exploring patients through google glass technology, digitization should touch the fields of skin issues also. Here right now propose a mechanized framework that is incorporated with PC vision procedures that will help the patient to get exact data about their skin utilizing their cell phone or PC program. Our inspiration for this paper is to give patients access to assistance from anyplace which will distinguish the ailment promptly for serving their requirements

on compelling administration of ailment. First, they will snap a photo of the contaminated region of their skin and transfer it in our framework The transferred pictures of illness will be handled in the focal server and it will answer with the sickness name skin has on the off chance that it matches with five infections it was prepared on [3]. Convolutional neural network (CNN) have been applied in this study for the identification of five skin diseases named: eczema hand eczema nummular, eczema subcute, lichen simplex, Stasis dermatitis, and ulcers. It is possible to make this an autonomous system for disease identification and providing suggestions based on the image analysis report, that takes this step for solving problems.

II. Associated Literature

Several studies published in Skin disease since the last decade.Dermatologist-level grouping of skin malignancy with profound neural systems by Andre Esteva And Brett Kuprel in studied clinical screening and histopathological examination. At first, they demonstrated classification of skin disease using a single CNN and then they prepared to start to finish from pictures with two critical binary classification directly, inputs are labels as the disease which is only the pixel [4]. Dr. Bhindhu V has researched on the classification of biomedical images with segmentation [5].Dr. T. Vijayakumar has also some significant works in the field, he has some works on computer vision [6]Universal skin disease classification has been done applying deep learning by Haofu Liao is studied about the feasibility for the construction of skin disease diagnosis system. They have done this using a deep learning algorithm [7]. Anabik Pal and Akshay Chaturvedi have shown a study on psoriatic plaques. This technique is based on CNN. It is multitask learning [8]. They worked on three different single-task learning (STL) problems. Then they present new multi-task learning (MTL) based on three classification tasks using a deep learning algorithm. They use the dataset consist of seven hundred and seven (707) images [9]. Skin disease recognition using deep saliency features and multimodal learning of dermoscopy and clinical images by Zongyuan Ge and Sergey Demyanov dependent on the exploration of skin cancer. They said that there is similitude in various skin infections, with the goal that makes the determination extremely hard for clinical treatment and any order models. They partitioned the clinician's procedure into two sections. One is introductory screening and the other is dermoscopy imaging. All things considered that two procedure can be characterized by utilizing CNN [10].

III. Proposed Methodologies

Image Processing is a system that can be partitioned into various classes: one of these is image compression another picture upgrade and the latter is the reclamation and measurement extraction. It assists with diminishing the measure of memory which is expected to store an advanced picture [11]. The picture can be absconded. By the digitization process and by shortcomings, the pictures can be abandoned. An abandoned picture can be remedied utilizing Image Enhancement methods. And afterward, by testing and approving information, we have done an informational collection assortment, information resizes, information planning, expansion lastly applied the preparation strategy of this model. In this research, we have used the image processing feature accompanied with our own developed CNN architecture. The architecture is given later below in the sections. We have computed the confusion matrix for the given 500 pictures from which we have denoted the training and testing data. The precision and recall have been calculated from the true positive, true negative, false positive, and false negative values. The total value of the F1 score has been also determined. We have collected the images of certain skin diseases test and train the data. The dataset is independent. We have used different data for the training testing phase. Our two confusion matrix shows the result of the precision-recall values is absolute. The F1 score is also specified in the performance evaluation section.

A. Background of CNN

Convolutional Network is a sort of profound neural systems. It is a Deep learning calculation. The method of this calculation is, from the outset the model can take input picture at that point mark significance to different viewpoints/protests in that picture thus that machine can have the option to separate one class from the other [12]. Prepossessing is the primary necessity of this model. The design of CNN has the network examples of neurons in the human brain. Additionally, there is some preferred position for 2D structures of information pictures. Slope based enhancement is utilized here. This model has a few layers, for example, convolutional and subsampling layers.

B. Dataset Collection

We have considered skin ailment of the various regions of the world as trial pictures. We have taken the pictures from Dermnet. We have considered skin infection pictures with the natural parts. It has been seen that the proposed framework yield exactness differs as for skin illnesses. We have additionally gathered pictures from the web. More than 500 pictures have been downloaded on five unique infections which are eczema hand, eczema nummular, eczema subcute, lichen simplex chronicus, and stasis dermatitis and ulcers [13]. Right now are two stages – preparing and testing. In the underlying preparing stage, trademark properties of ordinary picture highlights are confined, and, in light of these, a one of a kind portrayal of every characterization classification is made for five distinct classes. The classes are skin inflammation hand skin inflammation nummular, dermatitis subcute, lichen simplex, Stasis dermatitis, and ulcers [14]. In the testing stage, these component space allotments are utilized to group picture highlights.

C. Data Augmentation

We enlarged our informational collection so we can stay away from overfitting. So that our important dataset in expanded and it encourages us to group our model. We extended our genuine informational collection utilizing 5 unique

techniques. 1. Rotate +90 degree 2. Rotate -90 degree 3. Shading 4. Adding salt and pepper noise 5. Flip Horizontal

D. Data Preparation

At the point when we gathered our pictures, all the pictures are in an alternate measurement. Our informational index are diverse for their tallness, width, and size. In any case, our profound neural classifier needs a comparable informational index for preparing and testing the informational index. So we set the pixels into 100 X 100. At that point, we have changed over into the picture grayscale to prepare our model. Weutilize the lower GPU in our PC. Our all-out picture number after growth is 3000. We utilized 2400 pictures for preparing and 600 for testing [15].

IV. PROPOSED MODEL

Our idea is to build up a new CNN model, In our model, we have 13 layers. We also have 4 convolutional layers:

- The first layer has 32-3 × 3 filters and 'linear' as an activation function.
- The second layer has 64-3 × 3 filters and 'linear' as an activation function.
- The third layer has 128-3 × 3 filters and 'linear' as an activation function.
- The fourth layer has 256-3 × 3 filters and 'linear' as an activation function.

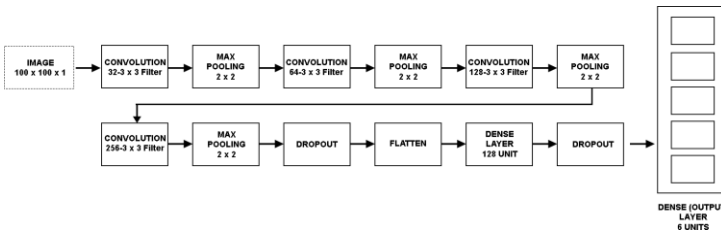

Fig. 1. Proposed CNN Model.

Furthermore, we can say that 4 max-pooling layers have a size of 2 X 2. Likewise, we have two dropouts layer having parameters 0.3 and 0.4. There is a leveled layer in our model . And finally, there are two thick layer capacities called 'straight' and 'softmax'. Both the capacity is utilized as initiation work. Yet, 'softmax' is utilized to get the likelihood of our five classes [16].

A. TRAINING THE MODEL

Adam optimizer is used for the compilation of our model. For training purposes, we use 80% of our training dataset, and then the rest of the 20% dataset is used for validation purposes. Our training dataset consists of 2400 images. So we can say that the number of training sets consists of 1920 images and validating set consist of 480 images. Our classifier's batch size 64. 40 epochs were used by us to train the model.

V. PERFORMANCE EVALUATION

Preparing precision is considered as the exactness of the model which is applied to our preparation information. The exactness of the model which is applied to a couple of chosen information from arbitrary class is considered as approval precision. The figure shows a diagram that contains the preparation and approval of exactness.

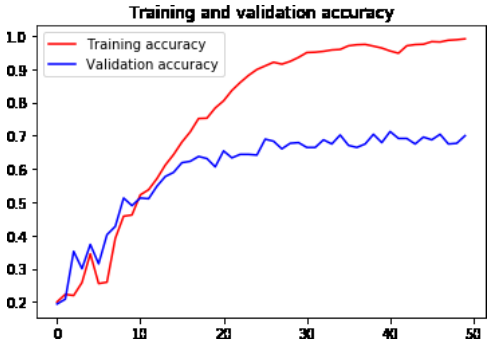

Fig. 2. Training Validation Accuracy.

The mistake which happens on the preparation informational index is called preparing loss. Validation misfortune is considered as the blunders which happen in the wake of running the approval informational collection through the prepared system.

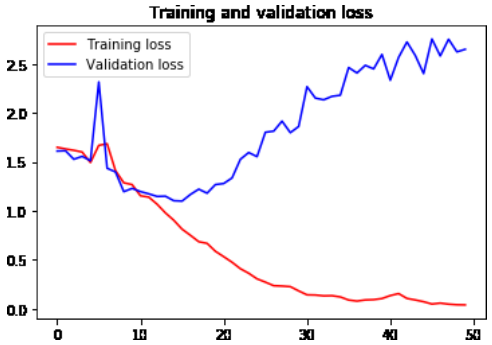

Fig. 3. Training Validation Loss.

Accuracy, Recall, and F1-score have been determined from our test dataset which contains 600 pictures. So we can say that out Precession normal is 0.70, Recall normal is .70 and F1-score normally us 0.69. Finally, we can say that our classifier is quite acceptable. Characterization table is given underneath: From the table of classification report, we can see that the classifier accomplished a tolerable precision, which is 70%. We got total precision of about 0.93. The total recall value is 0.88. The total accuracy we got 0.73 where the F1-score was 2.45. The result we got is for the five classes we have determined. The recall

width=.5

Class	Precision	Recall	F1-score
Class-0	0.75	0.78	0.77
Class-1	0.68	0.74	0.71
Class-2	0.70	0.58	0.64
Class-3	0.64	0.68	0.66
Class-4	0.71	0.68	0.69
Avg	0.70	0.70	0.69

TABLE I
CNN CLASSIFICATION RESULT

value for the classes ranges to 0.56 to 0.9. We portray the presentation of our model by hardly any figures, Fig. 5(a) Shows the disarray grid without standardization and Fig. 5(b) Show the standardized disarray framework.

Here,
Class 0- Eczema Hand
Class 1-Eczema Nummular
Class 2-Eczema Subcute
Class 3-Lichen Simplex Chronicus
Class 4-Stasis Dermatitis and Ulcers

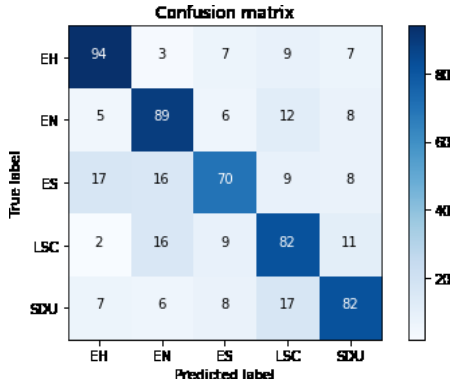

Fig. 4. Normalized Confusion Matrix.

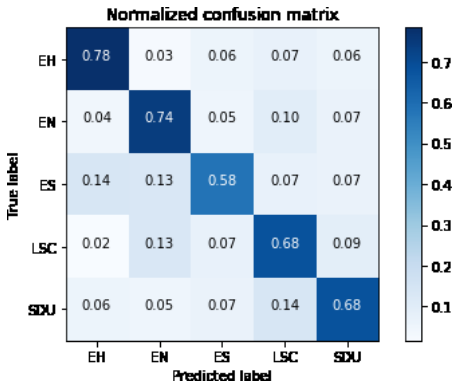

Fig. 5. Normalized Confusion Matrix.

A. Performance Comparison

There are various models have been working on this field of skin disease detection for the past recent years. From In the literature review, we can get an idea about the authors and their significant works. In this paper, we have used the deep neural networks accompanied by some noble feature from the image processing family. Rathod, J., Wazhmode, V., Sodha, A., Bhavathankar, P has developed a system using the tensor flow medium by taking the image of the skin issue and converting it into some standard size according to their system demand and they have retained about 70% accuracy from their system [17]. They also have tested on five diseases initially and they have used some core libraries like OpenCV, keras, tensorflow, pandas,numPy, etc [17]. Here we have gained our accuracy over the dataset of about 73% which makes it reliable to use this source of classification to use for the skin disease prediction. The research paper that we are comparing has dealt with the different disease classes then ours. Wu, Z., Zhao, S., Peng, and others have worked on the various diseases on the facial skin. They have dealt with six various classes of diseases. They have used 344 different images one of the class precision valued as 70.8% [18]. The other classes of their calculation derive pretty impressive results [18].

VI. CONCLUSION

The computerized skin ailment pictures were caught by the camera and preparing strategies were applied to these information pictures. Picture handling is a strategy that can be partitioned into various classes: one of these is Image Compression another picture upgrade and the latter is the reclamation, and estimation extraction. We trust that this model will be created as a genuine application for our clinical science for the government assistance of patients. It will be so encouraging for created nations to identify their sicknesses so they can concern prior and can make legitimate strides for their sound skin.

VII. FUTURE WORK

We have intended to refresh this framework for the usage of the task, all things considered. We have an arrangement that after overhauling this framework the individuals particularly the individuals who are poor and living in a remote territory of the nation will get help effectively and can take care of their concern with less exertion. The essential focal point of our undertaking is to conquer the restrictions of the current created framework. Our Background wiping out calculations should be applied for the picture handling to take a shot at the picture. Notwithstanding that, we likewise need to overhaul this framework utilizing better calculation to show signs of improvement exactness so they can identify any skin issues utilizing just cell phones camera and web.

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