USE OF DEEP LEARNING ALGORITHMS FOR THE SKIN DISEASE DETECTION AND CLASSIFICATION

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Abstract:

Human health is more important than the prevention of sickness. Infections with fungi, bacteria, allergies, viruses, etc., are common triggers for skin disorders. Accurate and rapid skin disease detection is made possible by advances in laser technology and photonics-based medical technologies. This kind of diagnosis requires specialized and very costly medical equipment. Therefore, Deep learning methods aid in the early diagnosis of skin diseases. Feature extraction is crucial in skin disease categorization. Human effort in areas like feature extraction and data reconstruction for categorization is no longer necessary thanks to Deep Learning algorithms. For the purpose of Skin Disease Classification, a dataset of 938 pictures was collected. Melanoma, nevi, and seborrhea Kerasotes are only a few examples. The categorization of skin diseases is improved by 70% using CNN algorithms. Additionally, we have tested Alex Net, which achieves 80% accuracy.

INTRODUCTION

Skin is one of the largest and fastest growing tissues in the human body. Skin diseases are thecommon health problems in the worldwide. The burden of skin disease is viewed as amultidimensional concept that comprehends psychological, social and financial importance of the skin disease on the patients and their families and also on society. It is the infections that occurring inpeople among all the ages. Skin is frequently damaged because it is very sensitive part of the body.There is 3000 and more unknown skin

Diseases. A cosmetically appearance spoiler disorder can havea significant impact, and can cause considerable pain and permanent injury. Most of the chronic skinconditions, such as atopic eczema, psoriasis, vitiligo and leg ulcers, are not immediately lethal, theyare recognized as a considerable trouble on health status including physical, emotional and financialoutcome. On the other hand, skin cancers, like malignant melanoma, are potentially lethal and theirtrouble is associated with the temporality that they carry. People of almost 73% are affected with skindisorder do not seek medical advice. Chronic and several other incurable skin diseases, like psoriasisand eczema, are associated with significant sickness in the form of physical discomfort andimpairment of patient's life; whereas malignant diseases like malignant melanoma carry substantialtemporality. With the wide range of health status and quality-of-life measures, the effects of most skindiseases on patients lives can be measured efficiently. Along with some of the deep learningalgorithms are used for detecting skin diseases in whole body. The convolutional neural network(CNN) is a category of deep learning neural networks. CNN represents a huge advance in imagerecognition. They are used to analyze the visual images and image classification. A convolutionalneural network (CNN) is used to extract features from images. This eliminates the need of manualfeature work extraction. The features from the set of images are not trained they are learned while thenetwork trains on a set of images. It makes extreme accuracy for the deep learning models.CNNlearnsthefeaturedetectionthroughtensorhundredsofthehiddenlayers.Each layer increases the in all the

Documents in the training set involvement of the learned features. A particular amount dataset will beprovided to detecting the skin diseases

LITERATURE SURVEY

Many studies have applied deep learning algorithms in classification of skin diseases. Daily softdrink consumption significantly increases the risk of moderate-to-severe acne in adolescents,especially when the sugar intake from any type of soft drink exceeds 100 g per day [2]. Rosacea isone of the common chronic facial disorders that affect the patient's health. The adjusted Chinese versionRosholt was easy to complete, well received by patients, and demonstrated acceptable validityand reliability [3]. The results indicate that lepton plays a critical role in the development ofautoimmune disorders and demonstrate that the transgenic lepton pigs will be act as a valuable modelof SLE. Certain results argue strongly to include skin disease prevention and treatment in futureglobal health strategies as a matter of urgency [1]. The results in ''Symptoms of systemic lupuserythematosus are diagnosed in lepton transgenic pigs,'' indicate that lepton plays a critical role in thedevelopment of autoimmune disorders and demonstrate that our transgenic lepton pigs can act as avaluable model of SLE [4]. Samples from nine normal skin analyzed by IHC in expression of ATP5Band K10 such as, six chronic dermatitis, five purringnodular is, seven kurtosisseborrhea, nineverruca vulgarism, 25 psoriasis, five keratoacanthoma, and nine SCC in "Possible involvement of F1F0-ATP syntheses and intracellular ATP in Keratinocyte differentiation in normal skin and skin lesions"[5]. Similarly several skin diseases are associated with long-term disfigurement, disability and stigma.A treatment and care activities for skin-related diseases to maximize the use of limited resources andexpand the treatment coverage [6]. In order to explore the association between polymorphisms andcitrating efficacy, the specialists enrolled 46 and 105 Chinese Han psoriasis vulgarism patients fordiscovery and validation phases [7]. This study indicates ''Frizzled-related proteins 4 (SFRP4)rs1802073G allele predicts the exalted serum lipid levels during citrating treatment in psoriaticpatients from Hunan, to investigate the relation between the Frizzled-related proteins 4 (SFRP4)rs1802073 polymorphism and what are the changes of serum lipids in Chinese psoriatic patientsduring the treatment with citrating [8]. The illustration in the usefulness of Image Net through threesimple applications in object recognition, image classification and automatic object clustering is donein "Image Net: A large-scale hierarchical image database" [9]. For example, the task of classifyingskin tumors using the Inception-v3 network has reached the classification level of professionaldermatologists. For certain nine classes of tumors, a computer achieved an accuracy rate of 55.4%, andtwo dermatologists achieved accuracies of 53.3% and 55.0% [10]. With the same network structure,[11] it has been achieved an accuracy of 87.25, 2.24% on the dermoscopic images for four mostcommon skin diseases, such as SK, BCC, psoriasis and melanocytic nevus. These studies show thatcurrent deep learning algorithms have the potential to be applied to skin related diseases.At the same time, deep learning application to face- related diseases is also promising. Reference[13] designed a deep learning algorithm called Deep Gestalt and it trained the model on more than17,000 facial images of genetic syndromes, and this model identified more than 200geneticsyndromes using skin images with very high precision. Reference [14] used CNNs for classificationof acne into different severity grades ranging from clear to severe, and their results show that theaccuracy obtained by their method outperformed expert physicians.Initially, investigation of the proportion of skin images in the most commonly used public datasets forskin disease, which include AtlasDerm [15], DermlS

[16], the ISIC Archive[17], Derm101 [18] andDement [19]. Most of these datasets [15]–[18] did not provide information about body parts. In [19],which provides body parts information, there were only 195 facial images

IMAGE DATASET:

Skin Disease classification Dataset contains 938 images of Three Classes of Skin diseases. Datasetconsists of three categories, which includes training, test and validation. Each category containsimages of three diseases such as Melanoma, Nevus and Seborrheakurtosis. In the Dataset,Melanoma contains 439 Images. Nevus contains 551 Images. SeborrheaKurtosis contains 413Images. Training data is used for training the system and finally the images are detected and classified into above mentioned three categories. Fig 1, Fig 2, Fig 3 represent melanoma, Nevus and Seborrheakurtosis respectively.

Fig 1 Melanoma   Fig. 2 Nevus

Fig.3 Sebborheic keratosis

CNN and Alex Net FOR SKIN DISEASEDETECTION

Neural networks and deep learning are currently providing the best solutions for many problems inimage recognition, speech recognition, and natural language processing. A neural network is a type ofmachine learning algorithm allows the computer to learn by incorporating new data. CNNs are veryuseful in image recognition in order to analyze visual imagery and are frequently used in classifyingthe images. It takes the given three classes of skin disease images as input and it gives the output ofa probability that the input belongs to a particular class.CNN is now the go-to model on every imagerelated problem. The main advantage of CNN compared to its predecessors is

that it automaticallydetects the important features without any human superintendence. For example, given many picturesof cats and dogs it learns distinctive features for each class by itself. CNN is also computationallyefficient. A CNN has Convolutional layers, Rely layers, Pooling layers and fully connected layer.Here it takes input as the skin disease dataset. Convolutional layers apply a convolution operation tothe input. It uses different filters to create a feature map and passes the information to the next layer. Ituses convolution and pooling operations and performs parameter sharing. This enables CNN modelsto run on any device, making them universally attractive. The main building block of CNN is theconvolutional layer. Convolution of an image with different filters can perform operations such asedge detection, blur and sharpen by applying different filters. Rely function is used to increase thenon-linearity that is; it is an element wise operation and replaces all negative pixel values in thefeature map by zero. Since, the real world data would want our Convent to learn non-negative linearvalues. There are other non linear functions such as tan and sigmoid that can also be used instead ofusing Rely layer. Rely is used since performance wise Rely is better than the other two layers.Pooling layer is used for combining the outputs of clusters of neurons into a single neuron in the nextlayer. Spatial pooling which reduces the dimensionality of each map but retains importantinformation. It is of three different types such as Max Pooling, Average Pooling and Sum Pooling.Max pooling takes the largest element from the feature map. Average pooling takes the average forthe feature. Sum of all elements in the feature map is called as sum pooling. With the fully connectedlayers, combining the features together to create a model. Flattening layer flattens the pooled images

Into one long vector and inputs the vector into a fully connected artificial neural network .The finalfully connected layer provides the "voting" for the three classes of dataset that we're after. Forwardpropagation and backpropagation are also used to train and it repeats until we have a well-definedneural network with trained weights and feature detectors.

RESULTS AND DISCUSSION

First of all, the CNN algorithm is used for training and classifying all kind of clinical images. Wehave taken three types of skin diseases. They are Melanoma (439 Images)**,** Nevus (551 Images)Seborrheakurtosis (413 Images).We train the system using the set of data and use the parametersfrom the pre-trained set as the initial parameters for the new input, which is also called as transferlearning. The performance of sets retrained using the images are generally superior to the sets thatwere trained using the next set of inputs. According to us, there were so many differences between theimages in different parts of the body. However, for most of the diseases, the difference in symptomson different body parts is not same. Therefore, while training the model for skin diseases, a betterstrategy could be used to train the model with datasets of the skin diseases in different parts of thebody and then retrain model on images of particular body parts. Then, the particular model can beused to diagnose the disease at any specific body part. We obtain the overall accuracy 71%. Theresults shows that, generally, the predictions were made by CNN by using features and characteristicslearned from lesion areas with abnormalities, rather than from the textures or other features of normalskin. The training set is used for training the model, while the validation set is only used for evaluatingit. For example, if the model has an accuracy of 86% on the training set and 84% accuracy on thevalidation set, then it means that model can perform with 84% accuracy on new data. Percentages ofthe results which are relevant are referred as precision. Percentage of total relevant results correctlyclassified by the algorithm

is referred as recall. Fig 4 represents the training and validation accuracyobtained by using CNN algorithm in skin disease classification. Fig 5 represents the training andvalidation loss. Table 1 represents Precision and Recall obtained for CNN network.
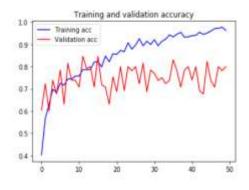

Fig. 4 Training and validation accuracy

Fig. 5 Training and validation loss

Table. 1 Precision and Recall

DISEASE	PRECISION	RECALL
Melanoma	0.29	0.29
Nevus	0.37	0.38
Sebborheic Keratosis	0.15	0.14

Apart from CNN, we have also tried with Alex Net. The classification accuracy of Alex Net is found to Be better than CNN. The results are shown in Table 2.

Table.2Accuracy for CNN and Alex Net

ARCHITECTURE	ACCURACY		
	10 Epochs	20 Epochs	30 Epochs
CNN	67.1%	69.2%	71.5%
Alexnet	69.8%	72.1%	76.1%

CONCLUSION AND FUTURE SCOPE

Experiments were conducted in this paper employing a convolutional neural network (CNN) structure for the identification of three prevalent skin illnesses using photographs of the affected skin. The findings prove that CNNs can identify and categorize skin disorders. Additionally, our research shows that an acceptable network topology may enhance the model's performance. Though it has been put to use for illness categorization with the existing network architecture, it still has room to grow in terms of its overall performance. Therefore, specialized changes should be made if individuals wish to truly utilize this method to assess their skin health in their everyday lives. We predict that the performance of CNN-based skin disease diagnostic algorithms will continue to improve as more and better picture data of different skin disorders becomes available and as the network structure is continuously improved. Classification accuracy may be enhanced by using architectures other than convolutional neural networks.

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