Approach towards the Automated System for Understanding Facial Skin Diseases

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Now a days the facial skin problems can be identified and treated with the significant methods of computer-based technology and artificial intelligence. These skin diseases not only depress the infected person and cause psychological depression, but they may also lead to cause skin cancer. As the visual resolution is not so effective in skin disease images, medical experts with latest technical instruments are required for diagnosis of various types of diseases. These skin disease problems can be diagnosed automatically with the help of these computer aided system. In this paper, we suggested a Deep Convolutional Neural Network (CNN) which is an automated method for facial skin disease classification. In biomedical imaging-based decision making the importance of computer assisted diagnosis in deep learning is identified. ResNETs can be utilized for eliminating deep networks vanishing gradient problems. Various kinds of results may be obtained by the ResNET architectures having various activation functions, batch sizes, tested images and training stages. The activation functions ReLU and SELUare analyzed with the implementation of four network models are observed and by using same data sets image classification is done by residual learning. Highest accuracy is obtained by using ResNET with SELU instead of using residual block may lead to best accuracy rate of 97.01% for classification of various disease images.

Keywords: Convolutional Neural Network (CNN), ResNET, ReLU, SELU, Image classification, Deep networks.

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1 Introduction

Currently In today's life skin diseases have become the most common issue for many people all over the world for various reasons. As the skin is exposed to Ultraviolet radiations by using various wireless equipments for long time which radiates high frequency may be the reason for causing of skin cancer. As there is rapid advancement and increasing demand for usage of artificial intelligence in various sectors like health care is the main reason for development of computer based facial skin disease diagnosis. Skin diseases of face are very sensitive and it can spread easily and many patients show similar symptoms for different types of diseases which makes diagnosis a difficult task but by making use of computer aided technology the treatment becomes simpler by preventing errors in it. The advanced technologies like artificial intelligence using machine learning techniques and automated methods are used for treating these skin diseases. An automated deep learning method is achieved for treating the facial skin diseases. Deep convolutional neural network (CNN) can predict the disease in early stages. This CNN can classify the images of faces into 8 disease classes such as a "normal skin class", "no face class" and so on.

For identification of lesion skin spots skin imaging techniques such as dermoscopy is used widely for enhancement of diagnostic performance in treating various skin diseases. We have few complicated reasons in identification of melanoma skin disease by using dermoscopy in the form of images. The reasons are as follows:

1. As the contrast is least among normal skin regions and skin lesions becomes complex for identifying the lesion segment areas accurately.

2. A high degree of visual similarity is observed between the melanoma and non-melanoma lesions.

3. Skin disease appearance may be different for different persons due to the variations in skin color, hairs or veins present in skin may vary from person to person, hence we can observe difference in terms of color and texture of skin etc,.

Melanomas and non-melanoma skin lesions can be distinguished by application of some low-level hand- crafted features. To achieve high performance rate by advancement of discrimination capacity in present technology there is improvement in the performance of facial skin disease diagnosis by using latest technology such as convolutional Neural Networks (CNNs).

2 Related Work

2.1 Image Classification by Deep Learning

Image classification and object recognition can be performed by using advanced techniques of CNN. Hierarchical feature learning capacity is performed by CNN hence they can be largely applicable in classification of natural images and recognition of objects. In recent days challenges like ImageNet are significantly performed by the CNN based techniques over conventional techniques. Huge inter class variations are present in skin lesions. By using traditional vision-based approach it is difficult to fully capture the distinguishable features. Two advanced image classification CNNs architectures are developed namely ResNet50 and VGG for encoding the features in images. By excluding the bottom FC, adding 128 kernels to the FC layer and FC layer with 7 classes classification task of skin lesions are modified for fully connected (FC) layers in both the networks.

2.2 Deep Learning Feature Interpretation

In network classification basing on the way CNNs react to a particular input image which is corrupted our interpretation method is adopted. The classifier is contributed with localized features in this method. The corrupted image can be predicted with the probability of correct class can be analyzed for estimation of feature importance by application of appropriate methods. In other words, the region of interest (ROI) is covered by corrupting the pixels in sliding window and then difference in expected outcome is analyzed.

Many automated facial skin disease methods are explained in this literature. All these methods majorly focus on classification of normal and abnormal symptoms observed in skin and various techniques are analyzed for diagnosis of these diseases by various automated facial skin diagnosis methods basing on various techniques. Facial skin defects can also be detected with the help of support vector machine (SVM) and classify these skin defects as spots, rashes, acne or normal skin which are explained by Chang, this method achieved high accuracy. UV fluorescence is used in detection of acne. Even though this method is effective it may cause damage to the skin as it is exposed to UV light for long time. As there is a drawback in UV fluorescence method later on, we developed a pixel-based method for detecting acne. These techniques store the input details in the form of pixels. Acne and lightning conditions are detected accurately by utilizing these methods. Basing on speeded up Robust Features and K-Nearest Neighbors are two types of algorithms for classification of facial skin diseases and CNN is also a best approach for diagnosis of the skin diseases. Likewise various techniques are determined in various research papers.

3 Deep Convolutional Neural Network

3.1 Presence of neurons in convolutional neural networks [1]

Neurons consisting of learnable weights and biases are present in convolutional neural networks. The three-dimensional layers neurons image is taken as input in CNN network. The three dimensions present in each layer are the height, width and depth of the image. Succession layers are present in a CNN network where each layer modifies one activation volume to another through distinguishable functions. This architecture is composed of three kinds of layers: fully connected layer (FC), convolutional layer and pooling layer. The extraction of features is performed on input images which pass through convolution layers series in which a non-linear function is applied for activation. Here we have a widely used function called Rectified Linear Unit (ReLU) as it performs the training phase quickly. After this process the feature maps obtained is passed on to the next phase i.e., pooling layer for reducing the dimension size and over fitting is minimized. During this phase max or average pooling is performed. The result obtained from this pooling layer is flattened

and then it is further processed in fully connected layer (FC). Finally, the output images obtained are categorized by using a Softmax activation function. Apart from this we hvae many CNN architectures like GoogLeNet, AlexNet, ResNet, VGGNet.

3.2 Rectified Linear Unit (ReLU) and Scaled Exponential Linear Unit (SELU) [2]

In order to overcome the issues faced by CNNs network, recent technology like Residual NETwork (ResNET) is applied to resolve in order to overcome the drawbacks. Parallel to normal convolutional layers the ResNET also has some shortcut connections. The gradients can easily flow back with the help of these shortcuts. Fast training and convergence are the biggest advantage of ResNETs. The major reason for success of training of NNs is choosing of activation functions and residual blocks. Anyways, image classification is not clear by the effect of deep NNs. Hence, four network models are implemented in this work for analyzing the residual blocks effect and the activation functions. These two functions are Scaled Exponential Linear Unit (SELU) and Rectified Linear Unit (ReLU). Let us understand this with the help of following Figure.1.

Fig.1. Acne detection by using ReLU and SELU methods

3.3 VGG-16 Networking Model [3]

VGG-16 networking model [10] is a method which is used for identifying and categorizing various kinds of facial skin diseases. Simonyan and Zisserman invented this method of treatment. The network having number of weight layers is denoted the number "16". An image of size 224x224 is accepted as input by VGG-16. The series of convolutional layers are used for processing the images having low receptive field size of 3x3. Max pooling is performed in 2x2 windows as it handles reduction in size. Here 4096 nodes are present in each layer of three fully connected layers (FC) in softmax classifier in VGG-16 architecture for facial skin disease recognition and classification as represented in below figure 2.

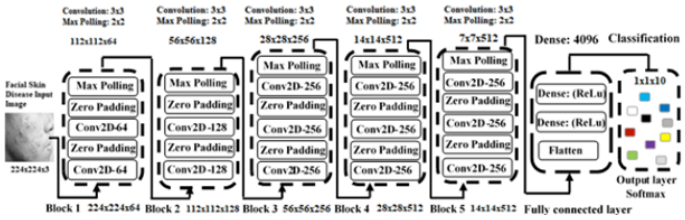

Fig.2. Acne detection by using ReLU and SELU methods

3.4 Acne detection using UV fluorescence [4]

One of the most popularly known techniques for acne detection is UV fluorescence. Acne can be detected by utilizing UV fluorescence. This method is efficient one and effective but there may be a chance of damaging the facial skin as the skin is exposed to UV light for long time. Due to this drawback UV fluorescence introduced a pixel-based acne detection method. The image is taken as in put and the number of pixels is stored in data and one of the methods detecting the acne shape in the suggested technique. Acne and lightening are affected in this method as it maintains accuracy standards. Some other methods are also suggested for detection of acne and many other skin diseases treatment methods such as K-Nearest Neighbors classification algorithm (KNN), Speeded Up Robust Features and CNN network.

3.5 Deep learning: Deep Neural Networks and Auto encoders [5]

Machine learning is a widely used technology in present days and Deep Learning is a subset of Machine Learning concept it is in a format of "representative learning". The major aim of this method is extraction of high-level features from the raw data. Successive layers make use of deep learning, as each layer is represented meaningfully. Natural language processing, Computer vision, Biomedicine and various other fields used Deep learning techniques in recent years as it is a successful methodology. Convolutional neural networks and recurrent neural networks are two kinds of techniques in deep learning architecture. Deep Neural Networks (DNNs) and Auto encoders is the main focused region in this paper. Artificial neural network (ANNs) is current used effective technique where deep neural network (DNNs) is the subset of ANNs. Many hidden layers is known as DNNs is the hidden layer method of ANNs. The similar input and output are provided to Auto encoder and one of the types of deep learning methods. Two functionalities of an Auto encoder are as follows.

(a) Encoder function: The raw input data is transformed into representations.

(b) Decoder function: the task here is that representation resulted from encoder layer are decoded into original input data. The main object of auto encoder is to store large amount of information.

3.6 Erythemato-Squamous disease identification by using Derm2Vec [6]

A novel hybrid deep learning approach and its development is the main objective of this paper i.e. Derm2Vec. This Derm2Vec method is used for the diagnosis of the Erythemato Squamous Disease

(ESD). Deep Neural Networks and Autoencoders form a hybrid deep learning approach that results in Derm2Vec technology. Artificial neural networks, Random forests, K-nearest neighbors, Extreme Gradient Boosting, Support Vector Machines (SVM), decision trees and various other methods of conventional machine learning techniques for the ESD diagnosis. Derm2Vec and DNN are two methods applied in this paper along with different kinds of conventional machine learning methods on dermatology dataset in real world. This Derm2Vec method is identified as the best application as it has best accuracy standards. In this paper, we propose A novel hybrid deep learning method is approached which is a two-step modeling approach consisting of DNN and auto encoders for classification of ESD. This is not reported in literature of dermatology information. Our classified method "Derm2Vec" is designed for facial skin disease classification as represented in Figure 3 as it exhibits modus-operandi functionality of the Derm2Vec method.

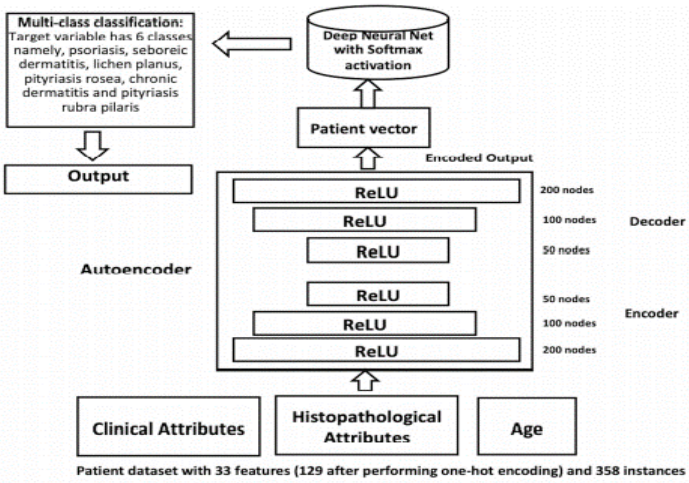

Fig.3. Derm2Vec Method Representation

3.7 Identification of Melonoma disease with Deep Learning Image Classifier [7]

Natural image classification and object recognition procedures are not so effective by using CNNs. As CNNs have capacity of performing hierarchical feature learning as it process classification of natural images and recognition of objects. In this method, we can observe performance discrimination and hierarchical feature learning. For example, at present the challenges faced by ImageNet are significantly performed by the CNN based traditional techniques. Inter class variations are presented at large in skin lesions. By making use of conventional computer-based approach it is difficult to capture the image completely and key differentiating features can't identify the skin lesions. Here two fine-tuned CNNs architectures are classified which are well known as successful image classifiers they are: ResNet50 and VGG which helps in encoding the features of an image. The last FC layer is eliminated by adding a FC layer with 128 kernels and a FC layer with 7 classes for classification of 7 kinds of skin lesions task are done in both the networks of fully connected (FC) layers. Various model features of CNN can be combined by using LightGBM, whereas LightGBM is an algorithm that boosts tree-based learning. This algorithm offers hyper-parameters for obtaining high accuracy. As represented with the help of following Figure 4.

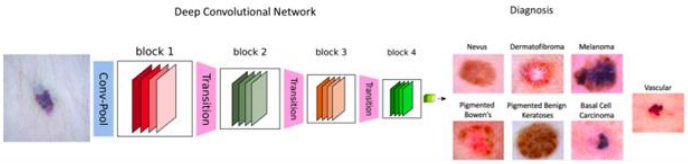

Fig. 4. The skin lesions classification by deep learning flowchart

3.8 Dermatology Data [8]

For determination of ESD facial skin disease these dermatological datasets are analyzed in this paper. The repository UCI machine consists of these datasets publicly. In these dermatological datasets we can observe 33 attribute variables out of which 12 are clinical attributes such as:

(a) Itching.

(b) Erythema.

(c) Scaling.

(d) Definite borders.

(e) Follicular papules.

(f) Polygonal papules.

(g) Koebner phenomenon.

(h) Scalp involvement.

(i) Elbow and knee involvement,

(j) Oral mucosal involvement.

(k) Family history

(l) Age.

3.9 TRIPLET Selection Method for Skin Disease Classification [9]

Due to some reasons like interacting capacity of performance management with extreme labels at present Triplet Loss is acquiring high consideration which is a deep metric learning approach. In this approach a high standard of multi-label classification is observed. The number of parameters is relatively increased in traditional methods such as multi label classification. With high level standards of labels an N-way softmax classifier is developed. For compact embedding which can effectively handle the classification problems is learnt by triplet loss function as it is a convolutional neural network

3.10 Dataset and Evaluation Methods for Skin Disease Classification [10]

The facial skin diseases can be classified by using datasets and various evaluation methods as explained in this paper. By searching the keywords in web browsers we can observe the images that depict different kinds of skin diseases. The dermatologists from various countries categorize all the skin disease and divided the images of 14 classes into five major skin issues such as: Acne, Spots, Blackheads, Dark circles and clear facial skin, which is classified basing on characteristics observed as diseases in the images. Skin with Acne, Blackheads, dark circles and spots are taken into n consideration as positive samples whereas clean faces are taken as negative samples.

4 Conclusion

By using machine learning techniques such as deep convolutional neural networks are identified as diagnosis methods for treatment of different kinds of facial skin diseases as presented in this paper. By

using pertained convolutional Neural Network the skin disease can be predicted such as VGG-16 model, Rectified Linear Unit (ReLU) and Scaled Exponential Linear Unit (SELU) as these models are trained and authenticated by a database. Four network models have been investigated to observe the effects of active functions such as ReLU and SELU along with residual blocks for classification of images. Depending on the results obtained and its performance from the scanned images the comparative analyses is held on these models for choosing the optimized technique. From the experiments that are conducted the output exhibits automated classification of five skin diseases that are executed by using deep networks which shows high accuracy.

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