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A Review Of Skin Cancer Detection

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ABSTRACT

It can be said that the most common or common health disease is a skin disease. skin diseases are often determined by doctors' experience and sample results (skin biopsy), and it is certainly a time-consuming process. Therefore, there has become an urgent need for an automated system (computer) to identify and discover skin diseases through images with very high accuracy, with fewer doctors or experts in this purview. Identification and classification of the skin disease through the feature/s and characteristics that were taken from these images. Since skin diseases have very similar optical properties And therefore add a lot more challenges to choosing the useful feature/s of the image. This means that the accurate analysis of these skin diseases through images will have a good prognosis, short diagnostic time, and speed in diagnosis, and thus it will facilitate and cost-effective treatment. This paper provides an overview or study on the different methods and techniques for identifying and classifying skin diseases, which are traditional technology and technology based on deep learning.

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1-Introduction

The skin in the human body represents the largest part and its weight is estimated at (6-8) kilograms and its area is estimated at (1.5-2) square meters. The skin protects the body from extreme temperatures, harmful ultraviolet rays (UV), and harmful chemicals. It protects the tissues from the harmful rays of the sun and also acts as a waterproof shield [1]. around(13) million skin cancers occur in the world each year. This is what the World Health Organization stated [2]. This means that skin diseases are increasing rapidly and greatly. Among the factors responsible for the occurrence of skin diseases such as pollution, ultraviolet rays (UV), weak immunity, and the unhealthy nature of life. Skin diseases can be classified into two main categories: benign and malignant skin lesions. Skin diseases or lesions are mostly benign and not dangerous. While lesions of malignant diseases are represented by skin cancer.

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There are several problems in diagnosing skin diseases through images. Some of those problems that we face during the identification and classification of skin disease:

1-The disease can have many types.

2-The disease or diseases may have visually similar characteristics, and this is a problem and confusing for the doctor himself.

3-The difference in skin color and type, as well as age, leads to more complexity in diagnosing through (computer).

To properly identify diseases by computer, consideration must be given to choosing the feature/s and related to these diseases. The success of the automated system (computer) depends on the accuracy of the system's performance and the high accuracy of image processing. Today, as is well known, the technology of medical sciences are widely available, especially skin diseases. There is no doubt that automatic or computer-based diagnosis of diseases (skin diseases) is faster, more useful, and makes medical decisions more accurate. When an automatic system for (skin diseases) is designed and constructed and this system is distributed in health care centers, And therefore it will reduce the burden on patients if they are not available or experts in this purview. Also, this process or method, i.e. the method of diagnosis, is not painful and is not surgical as well. About 1,210,000,000 people in India and there are approximately 6,000 specialists (dermatologists), according to the statistics provided for the year 2015 in India. That is, for every 100,000 people they have 0.49 dermatologists.

There are large amounts of medical data, and this data contains valuable information in this regard, and all this is due to the great and continuous development of technologies and techniques. Yes, artificial intelligence at this time has become more common and widespread. Most skin diseases are diagnosed based on images. Accuracy in diagnosing diseases with the automated system is usually dependent on the following matters: choosing the relevant feature/s, how to classify, and providing a group or a large amount of data (images) that have been trained. And the Convolution Neural Networks (CNN) became widely used in this regard. To understand the topic more, we will conduct a study on the different methods used in dermatology.

This article was divided into several sections:

Types of images and how to use the traditional approach and the deep learning approach to diagnose and classify skin diseases. This is called basic knowledge. The survey of traditional or feature-based technology for feature extraction, in addition to technology-based on convolutional neural networks (CNN) for classifying skin diseases.

2-General steps for skin detection

skin diseases (types), classification and identification of skin diseases using technology Traditional and the use of deep learning.

a-Type of skin cancer images

can be divided into two:

Clinical images:- Regarding the clinical image, it is taken with a digital or regular camera of the affected part of the patient's body. The clinical image may have different lightness, resolution, and angle, and this difference depends on the type of camera used and the image was taken.

image (Dermoscopic), Dermoscopic:- is a device or tool used by a dermatologist.

The image using (Dermoscopic) is more useful because this Dermoscopic device has a uniform, [3] good and clear lighting and gives a lot of difference or contrast to the image and thus the image processing will be easy because the noise is little.

Notice:- **Figure No. (1)** image (Dermoscopic)(a), the device (Dermoscopic)(b).

the clinical image(c).

(a) (b) (c)

b-Classification using Traditional Approach (Machine learning)

The identification and classification of skin diseases according to traditional techniques or methods, as shown in the following Scheme. Figure No. (2)

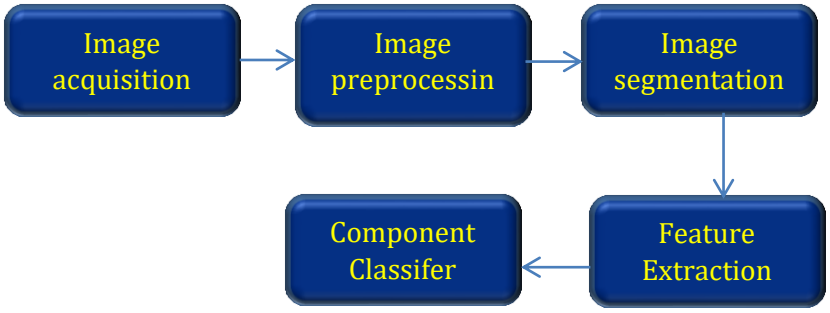

Figure No. (2). It represents approach steps traditional

1-Image Acquisitions

Although (dermatoscopy) images are better than (clinical) images, which are often used instead of others to enhance visual perception of the skin lesion, automatic identification of melanoma is a difficult task, and we will face many of the difficulties mentioned. Advance discovery of dermatologist.

With advances in image processing, new classification algorithms in computer vision, and deep learning algorithms, we can now import images directly into these algorithms and allow them to automatically extract features from the images themselves. This is known as the main difference between deep learning and machine learning. In machine learning, algorithms learn all of the pre-defined (most often human-made) traits that are associated with outcomes. However, machine learning cannot affect the way features are defined. While in deep learning, a good set of features is captured algorithmically (it learns the features themselves).

skin diseases databases are the image of many skin diseases, and these images that make up the databases are usually available either free of charge or commercially. And the images entered are either of clinical type or (dermoscopic) images according to the databases Used. This table contains important information and details, which is a set of data that includes pictures (clinical or dermoscopic), the number of images, and so on[4],[5],[6],[7].

2- Preprocessing

Images processing (preprocessing) The processing of images is a very important step and is very necessary because the images may contain noise or the injured skin has hairs or is not clear. This processing is very necessary for the clinical image because the clinical images, as mentioned previously, are usually noisy and imprecise compared to the dermoscopic image. We must take into account the lighting, the angle of the image, and other things when taking the image, otherwise, we may run into several problems. Various filters are used according to the problem present. Some of the problems we have with hair removal are because it is considered noise. The average filter [15], for example, specializes in a type of noise that is called (salt and pepper). There is also a Gaussian filter and a medium filter, and there is also a morphological process, the binary thresholding, and others. These filters and operations can contribute to reducing the noise [16].

3-Segmentation

Image segmentation can be performed in the following ways

1-Segmentation according to pixels, 2-Segmentation by edges, 3-Segmentation by region. The identification and detection of skin diseases by image segmentation or images is very important

The Segmentation according to pixels:- At this stage, every pixel in the image is expressed as being part of an object, through a second threshold procedure or other operations

The Segmentation by edges:- It is the most common method and edges and pixels are identified and then linked to the surrounding shape of the skin disease (Robert, Prewitt, Sobel, and Canny)

The Segmentation by region:- (watershed algorithm) is a prime example [17],[18],[19].

4-Feature extraction

Color, as well as texture, are among the most important feature/s that are used in describing and identifying skin diseases Because color plays a very important role in distinguishing between one disease and another. Many different feature/s extraction strategies, including (color histograms, color correlograms, color descriptors). To obtain good information from skin lesions, we need this scale-invariant feature transform(SIFT) because it can recognize objects. The viewpoint is also partially unrelated to Photogrammetry Transformations such as Contrast or Brightness [20]. We also need a Grey level co-occurrence matrix (GLCM) for its capacity at the expense of two features of difference and interdependence. Moreover, the skin lesions have different shapes and sizes according to the type and severity of the disease.

5-Classification

The Classification of the characteristics and linking them to the pattern to which they belong and identifying patterns, in clear terms, is a technique of machine learning after what has been taught and supervised. We need a set of data to be able to define or classify those categories. Forward neural network feeding, background neural network feeding, decision trees, support vectors, and others are all of the algorithms that are relied upon in the classification of dermatological images [21].

6-Classification of dermatological diseases using deep learning

Deep learning:- Machine learning includes deep learning in which many algorithms are inspired by the structure and function of the human brain, including Convolutional Neural Network (CNN), Recurrent Neural Network (RNN). The machine learns from big data using different designs for deep learning networks, including Recurrent Neural Network (RNN), which are frequently used with texts and continuous data, and Convolutional Neural Network (CNN), which are commonly used in visual analysis such as videos and images, and also draw their inspiration from biological processes in the visual lobe. And dermatologist examination and other designs.

There is a clear and significant improvement in solving many problems in identifying, classifying, and analyzing medical images. With the development of CNN, a significant improvement was observed in solving many classification-based problems in medical image analysis. Figure (3) illustrates this process

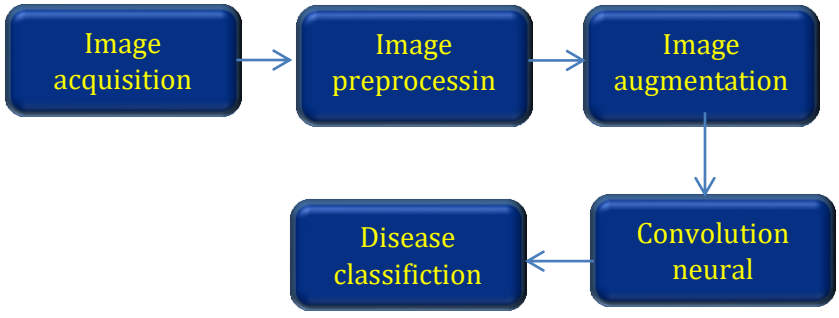

Figure No. (3). It represents approach steps based on deep learning

As it is in the diagram or figure No. (3), it begins with obtaining the data represented by images and then to image processing (or pre-processing) and then increasing the data (images), and then this data inputs in Convolutional Neural Network (CNN) that extracts the features and classifies them automatically.

A bypass neural network performs the following operations:

The input layer (input is an image). The second process, called the layer (learning feature), consists of several stages, and each stage includes a layer (Convolutional, pooling). Finally, the (classification) layer also consists of counted stages, and each stage is a layer (flatten, fully connected, softmax). Several researchers have used CNN to classify diseases and especially dermatological diseases by learning to transmit or fine-tune pre-trained models such as Inception v3 [22],[23],[24], Residual neural network [25] Visual Geometry Group architecture, among others. The weights of the original model remain the same, and some optimization classes can be added. Also, we are required to follow the work of the neural network, otherwise, we will face many problems in adding these layers [26],[27].

7-Literature of survey

This part introduces us to the strategy in which diseases are identified and classified according to the traditional approach and the deep learning approach. approach Both the second and third tables analyze the traditional method and the deep learning method for skin diseases.

a- traditional strategy(Machine learning) of classifying skin diseases

Amaratunga and others have come up with a smart system proposal that is limited to classifying three diseases. This smart system consists of; Data processing and image processing unit. The data processing unit is responsible for image acquisition and image processing to remove noise, hashing, and extracting features from the images while the data processing unit is responsible for extracting or classifying the data. Among the five algorithms, MLP was chosen because it gave good results compared to (AdaBoost), (J48), (BayesNet), and (NaiveBayes). Also, a hybrid model was proposed by (Chakraborty et al.) Using the NSGA-II and ANN algorithms to diagnose a skin lesion that is either benign or malignant. This bag of- features is also proposed for classifying skin lesions generated using SIFT. SIFT is an algorithm that identifies key and distinct points in the input image

The use of the k-mean clustering algorithm is important in handling the base points and in large numbers and these features are then fed into the hybrid classifier where the NSGA-II is located and the NSGA-II AD is present in an artificial neural network (ANN).

Also (Chakraborty et al.) Compared the model's accuracy with ANN-PSO (ANN was trained using particle swarm optimization) and ANN-CS (ANN was trained using cuckoo's research).

Chatterjee and others used the technique based on spatial domain and frequency to identify skin lesions that are either benign or malignant. And they used the correlation technique to extract regional features that are constant on light intensity and lighting changes. Also, a cross-spectrum based frequency domain analysis has been used to restore more detailed features of the skin lesions. For classification, the SVM classifier was used[2].

Table(1): A survey of traditional techniques for classifying dermatological diseases Survey.

reference	type images	disease identification	Number images	Segmentation	Feature extraction	Classifier	preprocessing	Performance Measurement
[15]	Clinical	1-melanoma 2-Impetigo 3-Eczema	-	Thresholding	-	MLP	Yes	Accuracy 90%
[20]	Clinical	1-Warts 2-Benign Skin cancer 3-Malignant Skin cancer	45	watershed algorithm K-means Clustering	IQA and GLCM	SVM	Yes	Accuracy 96-98%
[19]	Clinical	1-vitiligo 2-scabies 3-Acne 4-eczema 5-psoriasis	704	Thresholding	GLCM	feedforward backpropagation ANN	Yes	Accuracy 94.04%
[17]	Dermoscopic	1-Basal Cell Carcinoma 2- Skin Angioma	-	Thresholding	SIFT	NN-NSGA-II	Yes	Accuracy 90.56%
[28]	Dermoscopic	1-Melanoma 2-Basal Cell Carcinoma 3-Seborrheic keratoses	6838	-	SVM	Cross correlation, cross spectrum	Yes	Accuracy 98.79% Sensitivity 99.01% Specificity 95.35%
[30]	Dermoscopic	1- Basal Cell Carcinoma 2-Skin Angioma	-	GMM	GLCM	NSGA-II-PNN	Yes	-

Note:- GMM- Gradient Mixture Model, GLCM- Grey level co- occurance matrix, IQA- Image Quality Assessment, NSGA-II - Nondominated Sorting Genetic Algorithm

One of the most important problems that artificial intelligence (machine learning or traditional methodology) has encountered is that the number of data is limited or few compared to deep learning.

b- deep learning strategy of classifying skin diseases

Esteva and others were the first to report on how a Convolutional Neural Network (CNN), could classify images. Consequently, In this, areas performance became parallel or similar to the performance of 20 specialized dermatologists In this area. An algorithm was designed that divides or classifies the skin disease into three categories, malignant, benign, non-neoplastic. InceptionV3 CNN's recent architecture for classifying skin lesions gave Convolutional Neural Network (CNN) that it could outpace human experts if it were carefully trained and data-tuned.

InceptionV3 has also been used by Zhang and others [37]. Also, Zhang and those who followed him in this technique were those wrong classifications can occur due to the presence of multiple diseases in one picture. By training the model designed by Zhang on two nearly identical data sets from dermatoscopy images. Sun and others [18] proposed a technique based on the Convolutional Neural Network (CNN) to classify the clinical image. They trained those CNN technologies that have been designed (Caffeine, VGG, and VGGNet) and among these technologies (VGGNet) have proven their success with very high accuracy. The accuracy of VGGNet technology is very good and was established by the following methods, Local binary patterns (LBP), Scale-invariant feature transform(SIFT), As well as a classifier (SVM).

(Gessert) and others have introduced a correction method to obtain accurate differences between different skin diseases through images. The high-resolution image is divided into counted spots and these spots input into Convolutional Neural Network (CNN) [31].

Three strategies were used by the designers (DenseNet) (Inception v3) (SE-Resnet50) to predict diseases through images .

Rahman and others [32] suggested a CNN strategy by designating 16 different 7 * 7 core-size filters with sampling layers. The proposed model is trained on the benign and malignant diseases of melanoma. The outputs of this matrix (7*7) are inputs to the Convolutional Neural Network (CNN)for extraction. Characteristics Moreover, ANN consists of a 3-layer well-connected layer that classifies the skin lesion as toxic or malignant .

(Kulhalli) and others suggested a hierarchical strategy consisting of 5 phases, 3 phases, and 2 phases to identify and classify diseases with InceptionV3 CNN. To solve the problem of balance between categories, they used the image enlargement technique the classifier consisting of 5 stages certainly had better results than the 3 and 2 hierarchy.

Table(2): Deep Learning-Based Skin Disease Classification Survey

reference	Type image	Number images	dataset	Architecture CNN	Performance Measurement
[4]	Clinical	6584	SD-198[8]	Fine-tuned VGG19	Accuracy 50.27%
		5619	SD-128[18]		
[33]	Dermoscopic	1067	Dataset[37]A	Inception v3	Dataset A: Accuracy: 87.25%
		522	Dataset[37]B		Dataset B: Accuracy :86.63%
[35]	Dermoscopic	379	ASIC-2016[15]	(CNN) With Conv : 16 filters of 7*7, pooling layer:16 FC: 100*50*5	Accuracy: 98.32% Sensitivity: 98.15% Specificity: 98.41%
[36]	Dermoscopic	10015	HAM10000[15]	Inception v3	Normalized F1 Score : 0.93
[32]	Dermoscopic	1279	ISBI-16[15]	1-ResNet50	Accuracy ISBI 2016 : 90.20%
		2790	ISBI-17[15]	2- ResNet101	Accuracy ISBI 2017 : 95.60%
		10000	HAM10000[15]		Accuracy HAM10000: 89.8%
	Clinical	129450	[15],[9],[38]	ResNet50	Accuracy

[17]	Dermoscopic	3374			: 72.1 %
	Dermoscopic	12378	HAM10000[15]	Inception v3	Sensitivity: 89.4%
[37]					Specificity: 64.4%

8-Comparison & Discussion

The traditional strategy and strategy based on Convolutional Neural Network (CNN) is very important in identifying and classifying skin diseases. The extraction of distinct and appropriate feature/s is a requirement of the traditional strategy, followed by the segmentation method for skin diseases. There is no doubt that identifying and classifying the relevant distinguishing feature/s is very important and ignoring the unrelated Properties. Therefore, the classification is often based on specific feature/s. Irrelevant identification causes misclassification problems Thus, it does not require a large data set, in contrast to the traditional Convolutional Neural Network (CNN) approach.

For the Convolutional Neural Network (CNN), which can distinguish skin diseases automatically, the Convolutional Neural Network (CNN) selects the appropriate filters, accurately and intelligently as well, compared to the traditional strategy that relies on manually selecting filters to extract the feature/s on which the classification is made. Thus, there is no real way to extract the desired advantage in a strategy based on the Convolutional Neural Network (CNN .(

The previous models can be used to train and classify skin diseases even though these models are bulky and heavy in terms:

1-Parameters and their number, 2-The number of layers, 3-Choose the right model that has been trained and tuned, 4-Training the model on images of all skin diseases.

Note: It is also possible to specifically design and develop a Convolutional Neural Network (CNN) within the criteria for classifying skin diseases.

1-Data: A large dataset that is (images) must be provided for CNN to be well educated, and the more this network is trained on sufficient and large data, its performance becomes better. Data (clinical images) in, (dermoscopic) data.

2-Hyperparameters of Convolutional Neural Network (CNN): Different model training algorithms require different hyperparameters and are constructed by hyperparameters. Certainly, these parameters must be set and defined before training the Convolutional Neural Network (CNN), and the parameters have a role in determining the network structure such as the number of hidden layers, leakage, core size, number of cores, activation function, learning rate, etc.

3-Computing power: A new design was developed in evaluating image processing algorithms on GPUs that are largely parallel to CNN implementation and thus CNN GPUs were provided for the training process.

9-Conclusion

This paper introduces dermatological classification techniques. In general, the automatic process is important in identifying, classifying, and diagnosing skin diseases and it takes a very short time. This paper focuses on two approaches, the traditional approach, and the deep learning approach.

In terms of traditional strategy, there is no doubt that the process of selecting the relevant features takes a long time compared to deep learning.

While in deep learning strategy (CNN), the feature selection process is fast and efficient and automatically learns the features. In addition to the selection of filters by CNN intelligently, pre-trained models such as (Inceptionv3), VGG16, VGG19, (Alexnet), and others are also trained on a very large set of data that contains millions of images and can be used with transfer learning or fine-tuning. However, a pre-trained model must be trained from scratch if it has not been trained in dermatology images before.

Also, CNN needs a very large data set for training to be able to learn effectively compared to the traditional method of classifying skin diseases.

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