

Review of Skin Diseases Classification Using Machine Learning

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Abstract- Skin diseases are among the most common health problems worldwide. These diseases like acne, eczema, benign, or malignant melanoma have various dangerous effects on the skin and keep on spreading over time. Feature extraction using complex techniques such as SVM (Support Vector Machine) and Convolutional Neural Network (CNN). The work may in the future serve as a knowledge base for an expert system specializing in medical diagnosis, testing evaluation, treatment evaluation, and treatment effectiveness. AlexNET, a pre-trained CNN model will be used to extract the features. This system will give more accuracy and will generate results faster than the traditional method. Multiple skin lesions are classified using different image processing and machine learning techniques. The most used machine learning techniques used for skin lesion classification are SVM, trees, artificial neural network K-nearest neighbor, ensemble classifiers and convolution neural network (CNN).

Keywords- Skin diseases classification, convolutional neural network, image pre-processing, skin lesion detection, melanoma classification, eczema classification, acne classification, support vector machine.

I. INTRODUCTION

Skin diseases are one of diseases whose number has been largely increasing day by day. Only in India, about 200 million people suffer from one or the other forms of skin diseases. People often neglect skin diseases and do not take necessary treatment. This is especially seen in rural and economically backward areas due to many factors such as lack of awareness, poverty and lack of resources etc.[5]. Skin diseases are a major health problem in both high and low-income countries and are the fourth leading cause of non-fatal skin disease burden. Skin diseases may occur due to several factors like exposure to ultraviolet radiation, tanning, family history, environmental factors, alcohol etc [1].

Biggest organ of human is a skin, which mass of it is approximately around 4 kg to 5 kg. The skin have the surface area of about 1.2 m² – 2.2 m². It has many functions and especially it is one of the most essential organ for human being. The skin itself can be separated into three different layers which are epidermis, dermis and subcutaneous.

The two layers that make up the human skin is known as epidermis. Meanwhile, dermis is the thick layer of living tissues below the epidermis that forms the true skin and contains a lot of important structures such as blood capillaries, nerve endings, sweat glands, hair follicles and other structures [3].

Dermatological diseases are the most prevalent diseases worldwide. Despite being prevalent, its diagnosis is profoundly arduous and requires extensive experience in the domain. Around to a study, 24 percentage of the population consult their general practitioner (GP) with a skin quandary in a period of one year [4].

In the age of technologies, machine learning is finding its application in all fields and clinical diagnosis is the newest addition to it. Developing ML based diagnostic tools are quite challenging to develop and it is important to choose the right decision making algorithm to achieve a better diagnostic accuracy [6].

Skin is the largest organ present in the human body. Its functions include regulation of body temperature as well as indicating any malfunction within the body with the change in color or pigmentation. There are several image segmentation methods available to segment the skin lesions and neural network classifier used to distinguish the normal and abnormal skin disorders [7].

Its weight lies between six and nine pounds and surface area is about two square yards. Inner part of body is separated by skin from the outer environment. It provides protection against fungal infection, bacteria, allergy, viruses and controls temperature of body.

Situations that frustrate, change texture of the skin, or damage the skin can produce symptoms like swelling, burning, redness and itching [8].

Human skin is one of the most unpredictable and difficult terrains to automatically synthesize and analyze due to its complexity of jaggedness, tone, presence of hair and other mitigating features.

In a developing country like Bangladesh it is expensive for a large number of people to go to dermatologist for their skin disease problem. Every year a large number of populations in the developing countries like Bangladesh suffer due to different types of skin diseases. So, it is very necessary for both the patients and dermatologists to have an automated skin disease detection system especially in developing countries [9].

Expert system as a mean of conducting medical diagnosis and recommending successful treatments has been a highly active research field in the past few years. An intelligent computer program assisting medical diagnosis could provide easy access to a wealth of information from past patient data. Such a resource may help hospitals reduce excessive costs from unnecessary laboratory test and ineffective patient treatment, while maintaining high quality of medical care [10].

Acne is a skin disease that affect oil glands with inflammation or infection. acne, accurate evaluation of the severity of acne is important. Acne lesions can be classified into several skin types, including comedone, pustule, reddish papule, with or scarring without. However, in some cases, detecting acne from color image visually can be difficult for the proper evaluation of acne lesions. In this paper, we present several image segmentation methods to detect acne lesions and machine learning methods used to distinguish different acne lesions from each other [11].

The high increase of interest in artificial intelligence has caused a speedy development of all activities in all fields including healthcare, and especially facial skin diseases diagnosis. The most common technology used in these automated methods is based on artificial intelligence using machine learning.

In this paper, a new automated face skin diseases identification approach based on deep learning method is provided. These methods focused on diagnosis of acne and its classes and classification of the facial skin into normal and abnormal [12]. Deep learning is a major driver behind numerous technologies and innovations, from real-time text translation to unmanned driving.

Many major corporations are focused on advancing and benefiting from deep learning Many traditional machine learning methods have been developed using supervised and unsupervised algorithms that are able to tackle a range of problems such as data analytics problems [13].

1. Some Common Skin Diseases:



Fig 1. Skin Diseases.

1.1 Acne: Acne, also known as acne vulgaris, is a long-term skin condition that occurs when dead skin cells and oil from the skin clog hair follicles. Typical features of the condition include blackheads or whiteheads, pimples, oily skin, and possible scarring. It primarily affects skin with a relatively high number of oil glands, including the face, upper part of the chest, and back. In 2015, acne affected approximately 633 million people globally, making it the eighth-most common disease worldwide.

1.2 Benign: A benign tumor is a mass of cells (tumor) that lacks the ability to either invade neighboring tissue or metastasize (spread throughout the body). When removed, benign tumors usually do not grow back, whereas malignant tumors sometimes do. Unlike most benign tumors elsewhere in the body, benign brain tumors can be life-threatening. Benign tumors generally have a slower growth rate than malignant tumors and the tumor cells are usually more differentiated (cells have more normal features). They are typically surrounded by an outer surface (fibrous sheath of connective tissue) or stay contained within the epithelium. Common examples of benign tumors include moles and uterine fibroids.

1.3 Eczema: Eczema is a skin disease that makes your skin red and become irritated. Eczema can last for a most of a person's life. The person's skin may start to fall off. The person may get a rash, and skin may ooze fluids (liquid will come out from the area). If a person has eczema, the person's skin might itch and turn a lighter color in the area. Eczema is common on the backs of knees. It is also most common during the winter.

There are three different kinds of eczema: atopic, contact dermatitis, and neurodermatitis. No kind of Eczema is contagious. If a person's relatives have Eczema, that person is more likely to have it, too. Some foods or

medicines can start eczema. There are medicines that can help eczema hurt less. Eczema can be treated with lotions and ointments. Bathing with hot water will make Eczema rashes worse.

1.4 Malignant: Melanoma, also known as malignant melanoma, is a type of skin cancer that develops from the pigment-producing cells known as melanocytes. Melanomas typically occur in the skin but may rarely occur in the mouth, intestines or eye (uveal melanoma). In women, they most commonly occur on the legs, while in men they most commonly occur on the back. About 25% of melanomas develop from moles.

Changes in a mole that can indicate melanoma include an increase in size, irregular edges, change in color, itchiness or skin breakdown. The primary cause of melanoma is ultraviolet light (UV) exposure in those with low levels of the skin pigment melanin. The UV light may be from the sun or other sources, such as tanning devices. Those with many moles, a history of affected family members and poor immune function are at greater risk.

II. MACHINE LEARNING

Machine learning (ML) is the study of computer algorithms that improve automatically through experience. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so. There are a variety of ML algorithms commonly used in dermatology.

Most ML algorithms are examples of statistical learning; for example, some of the most common statistical learning methods are linear regression, logistic regression, k-nearest neighbor (k-NN), support vector machine (SVM), random forest (RF), and natural language processing (NLP). K-NN is used for data classification and regression based on the number of k neighbors.

In the age of technologies, machine learning is finding its application in all fields and clinical diagnosis is the newest addition to it. Developing ML based diagnostic tools are Quite challenging to develop and it is important to choose the right decision making algorithm to achieve a better diagnostic accuracy.

Hence, it is equally important to choose the right feature and machine learning algorithm to obtain the highest diagnostic accuracy [6].

1. (Support Vector Machine) SVM:

Support Vector Machine (SVM) is a supervised learning algorithm and mostly used for classification tasks but it is also suitable for regression tasks. SVM is the most used machine learning technique for skin lesion classification

that is why we are using SVM to perform classification. The proposed intelligent expert system is capable of classifying healthy, acne, eczema, benign and malignant skin lesions[1]. Besides SVM, another technique can also be used to classify among diseases. That is the classification using "Neural Networks". However, SVM is a better technique to classify than Neural Networks because they have a strong founding theory [5].

2. Artificial Neural Network (ANN):

An artificial neural network (ANN) is the piece of a computing system designed to simulate the way the human brain analyzes and processes information. ANN technique is an effective and efficient method for implementing diagnostic problems. The features of the ANN provided learning capability, which makes the system opened ended to new disease conditions or variation of a known skin disease due to the mutation of the causative organism [12]. The ANN can learn patterns of symptoms of particular diseases and provides faster diagnosis and recognition than a human physician. Thus, the patients can do the treatment for the skin disease faced immediately based on the symptoms detected [3].

3. Convolutional Neural Network CNN:

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The user gives input of the skin disease image, which then the system processes, does feature extraction using CNN algorithm and use softmax image classifier to diagnose diseases. If no disease is found, the system provides a negative result[4].

III. LITERATURE SURVEY

Hameed, et. al in [1], proposed hybrid approach i.e. using deep convolution neural network and support vector machine (SVM). The proposed scheme is designed, implemented and tested to classify skin lesion image into one of five categories, i.e. healthy, acne, eczema, benign, or malignant melanoma. Experiments were performed on 9,144 images obtained from different sources. AlexNET, a pre-trained CNN model was used to extract the features. the overall accuracy achieved is 86.21%.

Vinayshekhar, et. al [2] Dermatological diseases are the most prevalent diseases worldwide .we use a dual stage approach which effectively combines Computer Vision and Machine Learning on clinically evaluated histo pathological attributes to accurately identify the disease. In the first stage, the image of the skin disease is subject to various kinds of pre-processing techniques followed by feature extraction. The second stage involves the use of Machine learning algorithms to identify diseases based on

the histopathological attributes observed on analysing of the skin. Upon training and testing for the six diseases, the system produced an accuracy of up to 95 percent.

Md. Nazrul Islam et.al [3] research describes skin disease recognition by using neural network which based on the texture analysis. the performance of the ANN classifier is analyzed in terms of accuracy, sensitivity and specificity. The overall performance of the system is calculated in terms of 80% accuracy, 71.4% of sensitivity and 87.5% of specificity.

Jainesh Rathod et. al [4] This system will utilize computational technique to analyze, process, and relegate the image data predicated on various features of the images. Skin images are filtered to remove unwanted noise and also process it for enhancement of the image.

Feature extraction using complex techniques such as Convolutional Neural Network (CNN), classify the image based on the algorithm of softmax classifier and obtain the diagnosis report as an output. An initial training gives the output accuracy of 70% approximately.

N Vikranth Kumar, et. al [5] Skin diseases such as Melanoma and Carcinoma are often quite hard to detect at an early stage and it is even harder to classify them separately. Skin diseases such as Melanoma and Carcinoma are often quite hard to detect at an early stage and it is even harder to classify them separately. The results show that the achieved accuracy of classification is about 90%.

Parameshwar et. al [6] Machine learning algorithms are being used widely in biomedical fields for segmentation and diagnosis. To address this problem, we have collected Chronic Eczema, Lichen planus and Plaque psoriasis images using a digital camera and extracted Red, Green and Blue (RGB) color features and Gray Level Co-occurrence Matrix (GLCM) texture features. In the database; 232 images were Plaque Psoriasis and 78 images were Non-psoriasis. Support vector machine gave the highest accuracy when the same classifiers were compared with texture features. Later when we combined both the features and tested LDA obtained the highest accuracy rate of 82.26%.

Mugdha S Manerkar, et. al [7] The classification of different diseased state was done using multi-class SVM classifier. Feature extraction is performed using GLCM and IQA methods for examining texture which gave the statistical parameters of each algorithm respectively. C-means algorithm produced better segmentation results with an accuracy of 98% compared to watershed algorithm (92% accuracy) in segmenting the skin cancer images.

Nisha Yadav et. al [8] These diseases like alopecia, ringworm, yeast infection, brown spot, allergies, eczema

etc. These diseases are identified by using many technologies such as image processing, data mining, artificial neural network (ANN) etc. The proposed system is successfully implemented to detect 6 different skin diseases with an accuracy of 90%.

Rahat Yasir et. al [9] In this article we proposed a method that uses computer vision based techniques to detect various kinds of dermatological skin diseases. The system works on two phases- first pre-process the colour skin images to extract significant features and later identifies the diseases. The system successfully detects 9 different types of dermatological skin diseases with an accuracy rate of 90%.

L. G. Kabari et. al [10] This paper deals with the construction and training of an artificial neural network for Skin Disease Diagnosis (SDD) based on patients' symptoms and causative organisms. The artificial neural network constructed using a feed-forward architectural design is shown to be capable of successfully diagnosing selected skin diseases in the tropical areas such as Nigeria with 90 percent accuracy.

Alamdari, Nasim, et. al [11] In this study, images of various dermatology resources were used. Detection and Classification of Acne Lesions in Acne Patients: A Mobile Application Techniques used Hue, Saturation and Value (HSV) for segmentation and Kmeans for classification . Classification produces more accuracy than segmentation method. The two level k-means increases the accuracy and can be used to detect other skin diseases. the rate of accuracy 80%.

Table 1. Image categories with their sources

Category	Source
Acne	1) DermIS [15]
	2) DermNZ [14]
Eczema	1) DermIS [15]
	2) DermNZ [14]
Benign	1) DermNZ [14]
Malignant	1) DermNZ [14]

EL SALEH, et. al [12] The use of computer based technologies or Artificial intelligence in facial skin problems identification has evolved significantly over the years. In this paper, we propose an automated facial skin disease method using a pre-trained deep convolutional neural network (CNN).

Method/ Techniques used Convolutional Neural Network (CNN), VGG-16 model . The accuracy of the system can be improved by increasing the size of dataset and new deep neural network models can also be considered. The rate of Accuracy 88% .

Gao, Min, et. al [13] 2017 A Mobile Application for Plant Recognition through Deep Learning . In this Techniques used Deep Learning using Convolutional Neural Network (CNN) and the rate of accuracy 76.2%. This work uses deep learning to classify different types of plants and flowers using CNN. The images are from different sources. Images from DermIS and DermNZ are free to use for educational purpose .

IV. CONCLUSION

On the basis of study to reach in soon that several machine learning techniques have been successful applied in Skin diseases Classification and still there chance to improve performance. we have also collected and built a large-scale skin lesion dataset using images from DermNZ and DermIS.

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