Skin Disease Classification Using Deep Learning Models and Machine Learning

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Abstract— Skin disorders can indeed have a significant impact on people's lives, and timely and accurate diagnosis is crucial for effective treatment. Dermatologists play a vital role in diagnosing and treating various skin conditions. As a result, a technique that is less expensive, faster, and more easily accessible is required. As a more efficient and dependable method, a machine learning skin disease identification model is given. In this paper, a deep learning-machine learning combined is designed to improve skin disease classification. Machine learning is used to classify and extract features from convolutional neural networks. The results show that by applying the classification approach, dermatologists can readily diagnose skin lesions and provide suitable treatment to patients in order to save their lives.

Keywords—Machine learning, skin diseases, Convolution neural network, Deep learning

I. INTRODUCTION

Skin is the biggest part in human beings and is essential for survival, various function like protection, temperature regulation, sensation. Skin disorders are fairly widespread in today's society [2]. Skin illnesses can be caused by a variety of factors, including an unbalanced and polluted food, various types of pollutants, and possibly family genetics. However, Abnormal growth of skin cells can indeed lead to skin cancer Early identification and treatment of skin tumours are critical for favorable results [4]. For quick and timely diagnosis using an effective approach is crucial in the treatment of skin cancer [3]. The delayed diagnosis resulted in the deaths of several people all across the world. Skin diseases are indeed common among human beings and can affect individuals of all cultural backgrounds and age groups. Cancer is caused by cancerous change of cells regularly developing malignant cells [4] of cancer, genetic characteristics such as fair hair, eyes, and pores, and skin colour patterns are all risk factors This disease causes 55,500 cancer cases each year, accounting for 0.7% on average of all deaths globally. Cancer occurrence and mortality rates vary by country due to religious and linguistic differences. UV rays, low-latitude lifestyles, excessive alcohol consumption, fatty diets, and basal cells or pre-cancerous moles present are all known cancer risk factors, a personal or family history.

The layer of skin that serves as the body's largest organ, is vulnerable to a wide range of disorders. It is made up of several layers, the two most important of which are the epidermis and the dermis. The epidermal tissue is the skin's outer layer, while the layer known as the dermis is below it. The epidermis is the skin's uppermost layer, whereas the dermis is beneath it. The outermost layer of skin is composed of three distinct layers different kinds of cell squamous cells, basal cells, and melanocytes [5]. Facial skin diseases are common and often have identical symptoms, making diagnosis challenging [2]. AI algorithms can be trained on large datasets of facial skin disease images, which enables them to learn patterns, features, and characteristics associated

with different conditions, Because the input of an CNN neural network is an image, the neurons within it have been organized in three dimensions, which are breadth, length, and depth [2]. A CNN network is made up of layers that change one after the other a distinct function connects the volume of activations to another. Its design layers are divided into three categories c completely connected layers, convolutional layers, and Maximum pooling layers [6]. These pictures are loaded into deep learning models like VGG16. After the features have been extracted, the photos are sent to machine learning classifiers like the SoftMax classifier.

II. RELATED WORK

A thorough exploration of the existing body of knowledge and previous studies is presented in this section to establish the context for the current research. skin is the external integument of the body of a human being. Individual skin colour differs from individual to individual, and there are three varieties that comprise human skin oily, wet, and combined. Bacteria and other organisms thrive in the diversified habitat provided by human skin. Melanocytes are in the body's skin produce melanin, which may absorb UV radiation from the sun and cause harm to the skin and skin cancer. [1]. In 2019 author an introduced a face skin condition that is computerized approach that employs a pre-trained convolutional neural network with deep training (CNN) in this research. [2]. In 2018, they proposed the method of some learning methods identify skin disease using colour pictures without the guidance of a specialist, this structure consists of two stages, the affected area of skin is identified using colour methods for image processing in the first stage, and engaged counter-segmentation is used subsequently utilized for classification to classify the type of skin disease in the second stage using various machine techniques for learning, such as neural networks with artificial intelligence, provide support for machines vectors, algorithms for decision trees, and so on. forth [3]. The approach was tested in artificial neural networks for five skin disease types, with first phase accuracy of 95.98% and second phase accuracy of 94.02%. 2016 suggested melanoma picture segmentation based on the French artist connectivity [10]. The technique used was automated melanoma detection. They investigated the approach based on freely accessible dermoscopic pictures. In 2018 they suggested a technique for detecting skin cancer by looking for morphological features [9]. The technique resulted in a computerized skin cancer detection system. In this paper author propose the usage of mobile devices and technology for cameras, as well as image processing technology, for skin diagnosis. S. Kolkur et.al to create a goal, then divide the challenge into two phases. The initial stage includes image processing for skin disease identification, while the next phase includes a machine learning algorithm. Because of changes in skin characteristics such as colour and texture, Skin illness can be tough for identification. in its early stages and later stages. This difficulty can be solved by employing machine learning approaches to discover the best features to use in the analysis of skin disease samples [5].

III. PROPOSED METHODOLOGY

A. Data collection and Preprocessing

The database is obtainable to everyone on Kaggle but the pictures are non-uniform, hence they must be transformed into a single format in order to be used for categorization. All of the images are converted to the same format using a variety of Picture procedures for pre-processing such as decreasing and resizing Additionally, occasionally the skin's hairs get in the way of the detection of skin cancer.1) The greyscale morphological operation is used applied to detect the arrangement of hairs in the skin. 2) Once the position is determined, the framework and shape of the hair are checked, and the hair pixel changes using the bi-linear approximation approach. 3) Finally, there is an adaptable the median filtering system is applied to smooth the substituted hair pixel.

- Grayscale conversion: A grayscale image is an image that contains only gray shades ranging fr with the colour black (representing no light) to white (representing the maximum amount of

light). Each pixel in a grayscale image represents the brightness or intensity of light at that particular point.

- Noise Removal: Noise removal algorithms are used to remove or eliminate undesirable noise from an image, enhancing its quality and visual attractiveness. These algorithms operate by analyzing the image and employing a variety of ways to suppress or smooth out noise while keeping crucial details and edges.
- Image enhancement: Image enhancement is the process of processing the original image to increase the data set, which can improve the model's performance to some extent.

B. Feature Extraction

The method of extracting feature labels from an acquired database set and using them to train images is known as feature extraction. Following that, the trained images are utilized to analyze the remaining images. Many models, specifically linear and logistic regression algorithms, can suffer from irrelevant inputs in the dataset. The following are the three advantages of extracting features for machine learning algorithms: (a)Minimize excess fitting, (b) improves reliability (c) decreases the amount of time for training.

C. Classification

The step of pre-processing is used to increase the image's clarity. The Gaussian filter is a technique that is used to improve the photographs and remove unnecessary pixels. CNN is a Deep Neural Network component because to its great structure extent and various uses in picture data. The CNN is the deep neural net mostly used in image classification (analysis) tasks. Another method is featuring extraction, which decreases the number of features needed to convey a large set of information. In this work, SoftMax classification is applied, and SoftMax applies to multiclass problems. Another classifier, Sigmoid, is included for binary classification methods with only two classes.

Machine learning is necessary because it can perform activities that are too complicated for a person to carry out directly. The structure of the block is shown in Fig. 4. using machine learning, we built a library of face skin photos from 2000 different people to study the disorders of the facial skin. Acne, Actinic Keratosis, Basal Cell Carcinoma, Rosacea, Eczema, regular skin type and no-face type are the five classes of facial skin diseases. 200 photos from various online sources are included in each class. The cost function can be utilized to assess how well the machine learning algorithm performs in relation to the volume of data. Using machine learning may help us saving time as well as money.

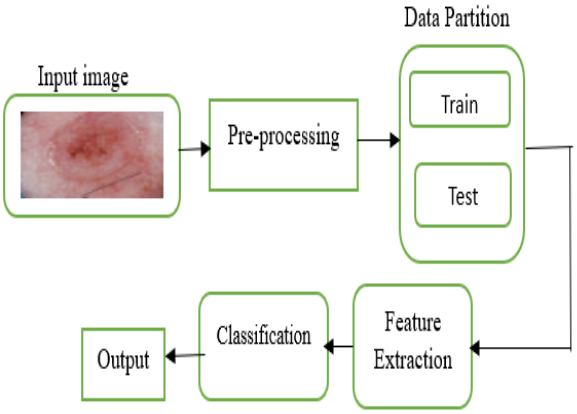


Fig 1: Block diagram of skin disease image Recognition based on machine learning

VGG-16 is used in our method. The VGG-16 allows 224x224 images as input. A set of convolutional layers are used to process an image. where the filters utilized have a limited receptive field of 3x3 size reduction is handled by using max pooling in a 2x2 frame.

Machine learning part of implementation first we can collect the dataset form authentic source, in this project data has been collected from Kaggle analyze the data, draw conclusion read the dataset from csv file into pandas object, panads is the predefined module helps to work on dataset with various predefined functions we can split data into test and train data by calling predefined function and build the model check the accuracy of the model, using confusion matrix to train we will use fit function on our model with following parameters and save the classification model into

convolutional neural network using respective function. The CNN structure is made up of the layers, and each layer uses a distinct function to shift a particular amount of events to another. To extract the features, the input picture is passed through a sequence of layers of convolution with filters. Then an activation function that is nonlinear is applied.. Rectified Linear Unit (ReLU) is the most commonly utilized function since it shortens the training process. The resulting feature maps are sent via pooling layers to minimize their dimensionality and thus control overfitting. Max or average pooling might be used.

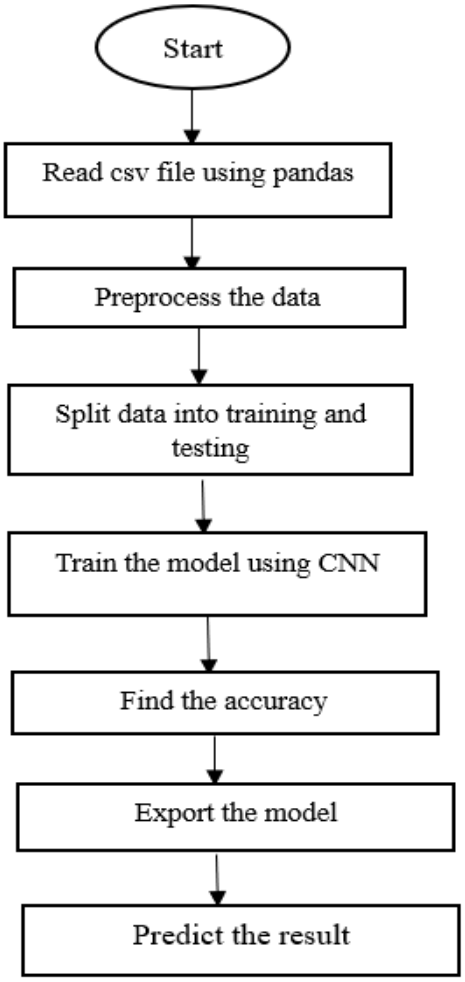


Fig 2: Flowchart of skin disease classification using CNN.

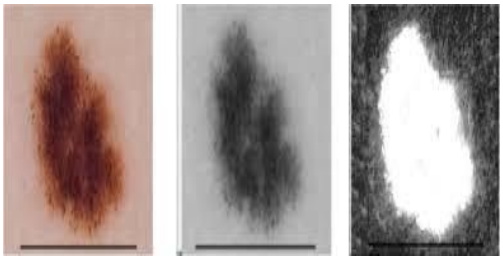


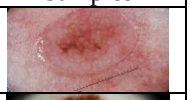
Fig3:(a) Input image(b)grayscale image(c)segmented image

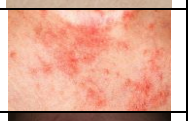
SoftMax classifier: A SoftMax classifier, further referred to as multinomial logistic regression techniques is an algorithm for classification based on artificial intelligence is utilized. tasks. It is particularly effective for problems where the number of classes is greater than two. The SoftMax classifier calculates the probabilities of an input belonging to each class and assigns the input to the class with the highest probability.

IV. RESULTS AND DISCUSSION

For training and testing, the seven classes are considered: benign, malignant, acne, actinic keratosis, basal cell carcinoma, rosacea, and eczema. The initial convolutional layer applies an intake with a picture size of 224 × 224 and 32 filtering of size 3 x 3 before applying a rectified linear operator (ReLU), a maximum pooling structure that uses the maximum result in regions with two-pixel steps, and a localised reaction normalization layer. Our pretrained VGG16 is trained and verified using our dataset; these photos are randomly divided into training and validation. The techniques are implemented using the language Python, and Python OPEN CV is used for pre-processing.

TABLE 1. SKIN DISEASES

Diseases	Samples
Benign	
malignant	

Acne	
Actinic Keratosis	
Basal cell carcinoma	
Eczemaa	
Rosacea	

The training vs validation accuracy curves are displayed to examine our model's efficiency. Each splitting situation is taken into into consideration. The training loss is a statistic that measures how effectively a deep learning model matches its training data Validation loss is a statistic utilised to evaluate a deep learning model's efficiency on the validation data set. Training accuracy indicates the usage of identical pictures for both training and testing, whereas test accuracy indicates the trained model identifying unique pictures that were not utilised in training.

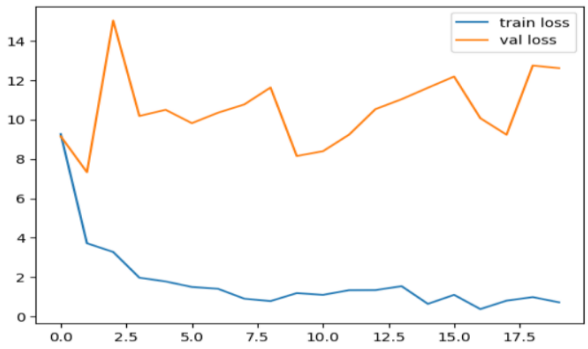


Fig 4: Training and Validation loss

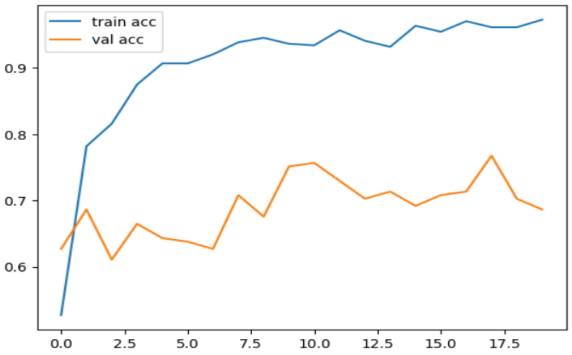


Fig 5: Training and validation accuaracy

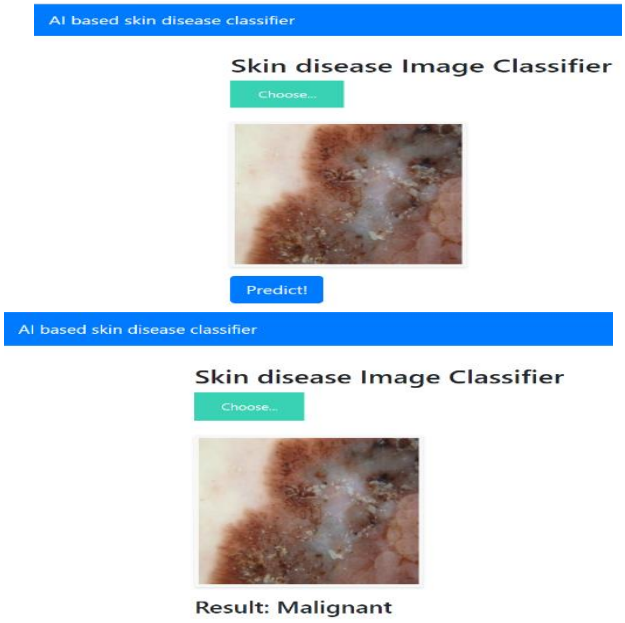


Fig 5: Snapshot of live examples results

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V. CONCLUSION

In machine learning techniques are employed, the present work to detect various skin disorders. Skin disease identification is critical for lowering mortality rates. Dermatological procedure to quite expensive to detect skin disease type. the prediction of disease is achieved by pre-trained CNN we used VGG-16 models. It can be concluded that the proposed system of skin diseases detection can be implemented using SoftMax and sigmoid to classify easily cancer and non-cancerous this technique made use of a combination of ML and DL models. In the suggested method,

one deep learning model for feature extraction from training data was combined with well-known machine learning classifiers. Following a thorough comparison, it was shown that the Convolutional Neural Network model CNN with softmax classifiers delivers the best accurate predictions, with an accuracy rate of 91.04%.

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