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International Journal for Modern Trends in Science and Technology
Volume 11, Issue 05, pages 398-402
ISSN: 2455-3778 online
Available online at: http://www.ijmtst.com/vol11issue05.html
DOI: https://doi.org/10.5281/zenodo.15288949

Skin Diseases Prediction Using Deep Learning Techniques

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To Cite this Article
K.Leelavathi, M.Pavithra, G.Anitha, Y.Deepthi & K.Susmitha (2025). Skin Diseases Prediction Using Deep Learning Techniques. International Journal for Modern Trends in Science and Technology, 11(05), 398-402. https://doi.org/10.5281/zenodo.15288949

Article Info
Received: 30 March 2025; Accepted: 20 April 2025.; Published: 26 April 2025.

KEYWORDS

DERMATOLOGICAL CONDITIONS, COMPUTER-AIDED DIAGNOSIS, CONVOLUTION NEURAL NETWORK, SKIN DISORDER DIAGNOSIS, DEEP LEARNING, NLP

ABSTRACT

In this paper, we present a novel method for predicting and classifying various skin diseases using convolutional neural networks (CNNs) and the HAM-10000 Dataset. Our approach demonstrates exceptional accuracy, achieving high accuracy in classifying skin conditions such as nevi, melanoma, benign keratosis, basal cell carcinoma, actinic keratoses, vascular lesions, and dermatofibroma. The versatility of our method allows for potential expansion to include a broader range of dermatological conditions. This research holds significant implications for dermatologists, offering a more efficient diagnostic process and enabling faster and more accurate treatments for patients. By leveraging our approach, dermatologists can benefit from improved decision-making support, leading to enhanced patient care. The combination of the HAM-10000 Dataset and our innovative methodology contributes to the originality and significance of this research in the field of skin disease classification.

1. INTRODUCTION

Skin diseases are prevalent worldwide, posing a significant risk to public health. However, accurately diagnosing these conditions can be challenging due to the complexities of skin tones, hair colors, and hairstyles. Dermatological diseases are becoming increasingly problematic, exacerbated by factors such as pollution and poor diet. Early signs of skin disease are often overlooked, and the current diagnostic approach relies on biopsies administered by physicians. To address these challenges, a hybrid technique incorporating deep learning methods shows promise in providing timely and accurate findings, reducing the need for human evaluation. The human body's main protective barrier is the skin, composed of the epidermis, dermis, and subcutaneous tissues. Skin serves as a sensory organ, shielding internal organs from harmful microorganisms, pollution, and sunlight. Environmental and internal factors, such as simulated skin damage, toxic exposure, infections, immune function, and genetics, contribute to the development of skin diseases.

These conditions significantly impact individuals' well-being, and attempting to treat them with home remedies may have adverse effects. Given the contagious nature of skin disorders, effective management becomes crucial. Unfortunately, skin diseases often receive inadequate attention in their early stages, leading to the development of severe conditions like skin cancer. Currently, detection and examination rely on manual biopsies, which are time-consuming and prone to human error. Deep learning-based methods offer a potential solution by efficiently analyzing microscopic images and providing quick results, aiding in the identification and treatment of skin disorders. Artificial intelligence is replacing automation in several domains, including the healthcare industry.These illnesses have caused alarm in recent years because they appear suddenly and are complex leading to greater risks to life. These dermatological illnesses are very contagious and need immediate treatment to avoid their spread. Unprotected exposure to high levels of ultraviolet (UV) radiation is a primary factor contributing to sickness. Benign skin lesions are less dangerous than malignantmelanoma and may be successfully treated with proper medical intervention. However, malignantmelanoma is the most severe kind of skin disease.The survey findings suggest that skin cancer is mostly seen on the trunk, lower limbs, and upper limbs. There is a significant population of patients between the ages of 30 and 60. In addition, those who are under the age of 20 seldom develop melanocytic nevi, malignancy, and dermatofibroma. The diagnosis of dermatological disorders is especially challenging due to the heterogeneity they display in various contexts. Dermatological diseases are the most prevalent among them, and they have a significant potential for transmission. If left untreated, these illnesses may develop into cutaneous cancers. Presently, the prevalence of skin cancer exceeds the combined frequency of new cases of lung and breast cancer. Studies suggest that around 20% of people may encounter the occurrence of skin cancer at some point in their lifetimes, therefore making the screening procedure more intricate. 1. Existing methodologies are limited to the examination of a singular kind of dermatological condition. 2. The evaluation and identification of several skin diseases need a higher level of computer-assisted proficiency.

II. LITERATURE REVIEW

Viswanatha Reddy Allugunti, 2020[1] has proposed a paper A machine learning model for skin disease classification using convolution neural network. In this research paper, a Convolutional Neural Network model for the diagnosis of skin cancer was. constructed, and evaluated using a well-known melanoma dataset. as demonstrated by its overall accuracy of 88.83 percent. Tanzina Afroz Rimi, Nishat Sultana, Md. Ferdouse Ahmed Foysa,2020[2] has proposed a paper Derm-NN:Skin Diseases Detection Using Convolutional Neural Network. In this research paper, The convolutional neural network model is used with 4 convolutional layers and the dataset consists of 2400 images and the accuracy gained is 73%. T.Shanthi ,R.S.Sabeenian, R.Anand, 2021[3] Elsevier B.V.,2019[4] has proposed a paper A Method Of Skin Disease Detection Using Image Processing And Machine Learning – ScienceDirect. In this research paper the method of detection was designed by using pretrained convolutional neural network (AlexNet) and SVM for classification. The database has 80 images of every disease (20 Normal images, 20 Melanoma images, 20 Eczema images and 20 Psoriasis images).

III.PROBLEM STATEMENTS

The process of diagnosing and forecasting skin disorders is a time-consuming one, including the investigation of the patient's medical records, doing a physical assessment, and conducting appropriate laboratory testing. The typical approach to conducting an examination and subsequent treatment requires a substantial quantity of clinical and histological features. The diagnosis and prediction of a disease get more challenging as the illness becomes more complicated and the number of symptoms grows. Thus, a sophisticated computer-assisted diagnosis and identification method is introduced. Due to the laborious nature of human study with the present technology, only certain types of skin diseases are currently being examined. As the complexity and abundance of the disease's features increase, the task of detecting and predicting the sickness becomes more challenging. Presently, the examination of such disorders in persons necessitates a substantial investment of time and exertion.

IV. METHODOLOGY

1)Dataset Selection:

The selection of an appropriate dataset is crucial for training and evaluating the performance of the proposed method. In this research, we chose the HAM-10000 Dataset as our benchmark dataset. The HAM-10000 Dataset is a widely recognized and publicly available dataset in dermatology research, consisting of 10,000 images of various skin conditions, including nevi, melanoma, benign keratosis, basal cell carcinoma, actinic keratoses, vascular lesions, and dermatofibroma. This dataset provides a diverse representation of skin diseases, enabling us to train a robust classification model.

2)Data Preprocessing:

Prior to training the convolutional neural network (CNN) model, we performed several preprocessing steps to ensure the dataset's quality and suitability for training. Firstly, we resized the images to a standard size, such as 224x224 pixels, to facilitate uniform input dimensions for the CNN. Next, we normalized the pixel values to bring them within a certain range, typically [0, 1] or [-1, 1]. Normalization helps in reducing the effect of lighting and contrast variations across the dataset. Additionally, to evaluate the performance of the model accurately, we split the dataset into training and validation sets in a stratified manner. This partitioning ensures an equal distribution of different skin conditions in both sets, allowing us to monitor the model's performance during training and tune hyper parameters effectively.

3)Architecture Design:

The design of the CNN architecture is crucial for achieving accurate classification results. In this research, we utilized a Sequential model, which is a linear stack of layers, to define our CNN architecture. The model consists of the following layers: a. First Convolutional Layer: This layer has 96 filters with an 11x11 kernel size and a stride of 4x4. The activation function used is ReLU, and batch normalization is applied. A MaxPooling layer with a pool size of 3x3 and a stride of 2x2 follows this layer. b. Second Convolutional Layer: This layer has 256 filters with a 5x5 kernel size and a stride of 1x1. It uses the ReLU activation function, applies padding, and is followed by batch normalization. A MaxPooling layer with a pool size of 3x3 and a stride of 2x2 is added after this layer. c. Third Convolutional Layer: This layer has 384 filters with a 3x3 kernel size and a stride of 1x1. It uses the ReLU activation function, applies padding, and is followed by batch normalization. d. Fourth Convolutional Layer: This layer has 384 filters with a 1x1 kernel size and a stride of 1x1. It uses the ReLU activation function, applies padding, and is followed by batch normalization. e. Fifth Convolutional Layer: This layer has 256 filters with a 1x1 kernel size and a stride of 1x1. It uses the ReLU activation function, applies padding, and is followed by batch normalization. A MaxPooling layer with a pool size of 3x3 and a stride of 2x2 is added after this layer. f. Flatten Layer: A Flatten layer is added to convert the 2D outputs from the previous convolutional layers into a 1D vector, preparing the data for the fully connected layers. g. Sixth Dense Layer: This fully connected Dense layer has 4096 neurons and uses the ReLU activation function. Dropout regularization with a rate of 0.5 is applied to prevent overfitting. h. Seventh Dense Layer: Another fully connected Dense layer with 4096 neurons and the ReLU activation function is added. Dropout regularization with a rate of 0.5 is applied again. i. Eighth Output Layer: The final output Dense layer is added with 7 neurons, corresponding to the 7 classes in the classification task. The activation function used is softmax, producing probability values for each class.

4)Model Training and Evaluation:

After defining the architecture, we trained the model using the prepared dataset. The model was compiled with appropriate loss function, optimizer, and evaluation metrics. The training process involved iterating over the training data in batches, adjusting the model's weights based on the calculated gradients, and repeating this process for multiple epochs. During training, we monitored the model's performance on the validation set to prevent overfitting and make necessary adjustments to the hyperparameters. Once the model training was completed, we evaluated its performance on the test set. We calculated the overall accuracy, as well as class-wise accuracy, precision, recall, and F1 score to assess the model's performance on individual skin conditions

V. PROPOSED METHODOLOGY

A neural network is a machine learning technique that allows a computer to acquire knowledge by incorporating fresh data. Convolutional neural networks

(CNNs) are very advantageous in the domain of image recognition for the explicit task of assessing visual imagery and are often used in the categorization of images. The algorithm receives three categories of skin illness photographs as input and offers the probability that the input corresponds to a certain category as output.CNN has emerged as the favored framework for resolving any image-related problem. The main advantage of CNN, in contrast to earlier models, is its capacity to independently detect important features without any human intervention.

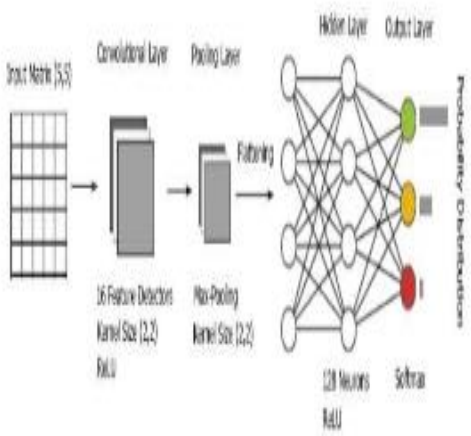

Figure .1 Proposed CNN Model

It provides a higher level of accuracy in comparison to other techniques. The goal is to optimize the process of detecting and treating skin disorders via automation, while also offering a cost-efficient method to treating skin diseases.In order to accelerate the process of identifying certain dermatological diseases.

VI. RESULTS

Depending on specific features. Successful image classification model AlexNet demonstrated the efficacy of this method . Using the input data and the learnt patterns and connections inside the network, the last layer of a neural network, called the output layer, is responsible for providing the ultimate predictions or outputs. In this layer, each node receives data from every node in the hidden layer and uses an activation function to produce the model's final output. One way to look at the supplied data is as a categorical issue with three labels, as it comprises three distinct variables. Therefore, the Softmax function is the best choice for the output layer. A categorical distribution, representing a probability distribution across numerous alternative outcomes, is generated using the softmax function. After determining the loss using the category cross entropy function, the training procedure continues by back propagating to adjust the link weights.

Figure.2 Home Page

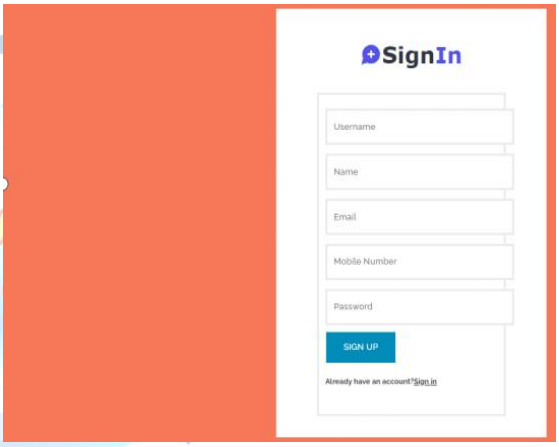

Figure.3 Registration Form

Figure.4 SignIn Form

Figure.5 Upload form

Figure.6 Result

VII. CONCLUSION

The proposed approach showcases the capacity to detect skin illnesses with positive results by combining computer vision and machine learning techniques. It has the capacity to aid persons worldwide and enable efficient jobs. The instruments used are readily available and may be utilized by the user, allowing for the installation of the system at no cost. The program has been intended to be lightweight and is compatible with PCs that have modest system specifications. Furthermore, it has a simple and intuitive user interface to optimize user convenience. The deployment of the deep learning algorithms was accomplished well.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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