Multiple Detection and Diagnosis of Skin Diseases using CNN

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***Abstract*—One of the most sophisticated deep learning techniques, convolutional neural networks (CNNs), has revolutionised the field of medical image analysis by enabling previously unheard-of levels of efficiency and accuracy in the identification of illnesses. Using a heterogeneous dataset containing images of common skin conditions, including acne, actinic keratosis, basal cell carcinoma, and melanoma, we examine how well different CNN models detect and distinguish between these conditions.**

The study covers preprocessing techniques like data augmentation and normalisation to increase the resilience of the models. Furthermore, we investigate the effects of various CNN architectures (e.g., VGG, ResNet, DenseNet) on classification performance considering computational efficiency and model complexity. Through extensive testing and evaluation, we quantify each model's classification accuracy, sensitivity, specificity, and computational overhead, providing insightful data on how well-suited it is for real-world clinical applications. We use CNN models to demonstrate the interpretability of the learned features, assisting dermatologists in understanding the discriminative patterns utilised in disease diagnosis. The proposed framework not only improves the accuracy and efficacy of diagnosis, but it also serves as a helpful educational tool that helps physicians better understand the wide range of skin conditions they treat. When combined, these results provide credence to the ongoing efforts to incorporate deep learning into automated health systems, which could lead to improved patient care and dermatological diagnostics. To tackle this, deep learning algorithms for accurate disease classification become crucial. Several machine learning algorithms were tested, and we found that the Deep CNN model with contrast stretching yields the best results. The dataset was divided into two categories: test and train image datasets for the four diseases mentioned above, and a validation dataset. Subsequently, we trained our model on this data, yielding an accuracy of 92.7%.

***Index Terms*—Deep-CNN Model, HTML, Javascript, CSS, Python**

I. Introduction

Millions of people worldwide suffer from skin diseases, which are a common and occasionally ignored public health concern. Not only do these dermatological disorders cause physical discomfort, but they also carry significant hidden risks. These hazards include diminished self-worth, emotional distress, and a higher chance of life-threatening side effects like skin cancer. The World Health Organisation (WHO) has observed that even though skin disorders are incredibly prevalent, a sizable fraction of those affected are unaware of the precise nature and classification of their condition. This ignorance not only increases the difficulty of timely intervention and treatment but also increases the burden on global healthcare systems.

To close this huge gap in healthcare availability, we have developed a revolutionary system called the Skin Disease Prediction System Using Convolutional Neural Networks (CNNs). This method's main goal is to increase people's knowledge of their skin conditions so they can take proactive measures to maintain their health. Our method makes use of CNNs, a powerful class of deep learning algorithms that are widely recognised for their capacity to identify and categorise images, to produce accurate and readable predictions about various skin conditions.The goal of this project is to ensure that everyone has access to vital health information, regardless of background or level of knowledge, in line with the fundamental principle of healthcare equity. Our system gives everyone the ability to diagnose skin diseases, which not only gives the average person more control over their health but also gives medical professionals useful information for quicker and more accurate diagnosis. Our prediction system aims to mitigate the negative effects of untreated skin diseases, including the progression to more severe complications like cancer, by facilitating early detection and intervention. With the help of our method, anyone can now diagnose skin conditions, giving the general public more control over their health and providing medical professionals with important information for a quicker and more accurate diagnosis. By promoting early detection and care, our prediction method seeks to mitigate the harmful effects of untreated skin conditions, including the development

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of more serious problems like cancer.

II. Literature Survey

Srujan S A et al. [1] examines the architecture of CNN systems as well as the different approaches used for disease detection in order to make clear the part these systems play in helping with the accurate diagnosis of skin conditions. It also outlines the intended investigation, which aims to assess the diagnostic accuracy of a CNN-based skin disease detection system for various dermatological disorders. To boost accuracy, the CNN model is trained on the enhanced dataset. Its diagnostic performance is then evaluated by subjecting it to a battery of tests on a separate dataset of skin lesion photos. T. Shanthi et al. [10] divided the work into distinct sections and included a thorough literature review, a thorough justification of the recommended methodology, an examination of the properties of the dataset, a thorough discussion of the findings, and more. By performing a thorough validation and comparison with existing approaches, they highlight the potential impact of their proposed method on the field of dermatology and offer recommendations for future research directions.

Cho-I Moon et al. [2] address the urgent need for precise skin diagnosis in dermatology by introducing a novel technique for segmenting skin microstructure and classifying ageing using CNN-based models. Their method increases diagnostic accuracy by capturing details that are invisible to the human eye by extracting complex skin microstructures using a fusion U-Net model. While the mobile CNN models exhibit promise in ageing classification, the fusion UNet model performs well in microstructure segmentation. Despite these advancements, further research is still needed to determine the efficacy of the recommended strategy and whether it can enhance patient care and dermatological diagnostic precision.

Pravin R. Kshirsagar et al. [3] explores the use of deep learning methods in the diagnosis and prognosis of skin conditions, highlighting the critical role that early identification and accurate diagnosis play in improving patient outcomes. In order to develop a deep learning model specifically suited for the diagnosis and prediction of skin diseases, they outlines a methodical approach that includes stages for feature extraction, classification, and preprocessing. Preprocessing includes segmentation techniques for image enhancement, reconstruction, and lesion isolation. High performance in experimental trials confirms the effectiveness of the proposed system, as measured by evaluation metrics like accuracy, sensitivity, and specificity.

Weihua Wang et al. [7] provides a neural network analysis model for urticaria, a common skin disease that millions of people experience globally. Medical records were consulted in order to ascertain the patients' susceptibility to these skin conditions. Simultaneously, variations in air quality indicators over the same time period were also examined. The artificial neural network approach was used to create a prediction model. Several parameters, such as the initial weight, learning rate, and number of hidden layer nodes, needed to be calibrated.

Natasha Nigar et al. [9] presents a novel approach that increases the accuracy of skin lesion classification by utilizing an explainable artificial intelligence (XAI) model. It attains excellent F1 score, recall, accuracy, and precision. The suggested XAI model may increase the accuracy of skin lesion classification, allowing dermatologists to make more informed decisions and, ultimately, expedite the diagnosis and treatment of skin cancer. Additionally, they assess how well dermatologists' decision-making processes are supported by the LIME framework through visual explanations, contributing to the broader discussion about the use of AI in healthcare and the importance of explainability in AI models.

Muhammad Attique Khan et al. [10] presents a novel framework for Multi-Class Skin Lesion Detection and Classification via Teledermatology. They Offer a promising solution for skin lesion detection and classification, the proposed framework has proven to be highly accurate and performs better than existing methods on benchmark datasets. The study plans to enlist participants from rural areas with limited resources to evaluate the efficacy of the proposed framework in detecting and classifying skin lesions. These metrics would offer important insights into how the framework might improve skin cancer diagnosis and treatment in unreserved areas.

III. Proposed Methodology

The core component of the Twacha Skin Disease Prediction system is a Convolutional Neural Network (CNN). As a deep learning algorithm created especially for image identification applications, CNN is ideally suited to identify skin conditions from uploaded photos. We employed the Deep CNN model as our CNN model.

The system consists of two main modules: the User module and the Admin module.

User Module: Users must register with the module in order to access the system. Users can upload an image of the skin lesion they wish to diagnose after registering and logging in. The trained CNN model is then used by the system to process the image and determine the class of skin condition. Users can also see a list of qualified physicians for additional diagnosis and treatment alternatives. They can also offer input on how well the system works and is easy to use.

Admin Module: Administrators are able to control the system through the Admin module. Administrators can access user input to enhance the functionality of the system and manage user accounts (adding, updating, deleting, and viewing users); they can also manage doctors (adding, updating, deleting, and viewing doctor profiles).

A. Data Collection

We acquired a dataset of photos of skin conditions from Kaggle in order to collect data. These pictures of acne, actinic keratosis, basal cell carcinoma, and melanoma skin cancer were gathered from a variety of sources, including digital cameras and medical imaging equipment.

B. Data Processing

Before being entered into the CNN model, the gathered images were preprocessed. Resizing the photos to a uniform size—typically 256 by 256 pixels—and normalising the data to make sure the pixel values were scaled to an acceptable range for the model were two preprocessing processes.

C. Model Selection

We selected a Convolutional Neural Network (CNN) as our model because of its performance in image categorization applications. CNNs are frequently utilised in computer vision applications because they are excellent at analysing the spatial structures found in images.

D. Model Compilation

The Adam optimizer, an adaptive learning rate optimisation technique that works well for training deep neural networks, was used to assemble the chosen CNN model. Additionally, a suitable loss function (categorical cross-entropy, for example) was specified for multi-class classification problems.

E. Data Splitting

Divide the dataset into three subsets: test, validation, and training sets in order to train and assess the model. The model was trained on the training set, adjusted hyperparameters and checked for overfitting on the validation set, and the final model performance was assessed on the test set.

F. Model Training

The training set was used to train the CNN model. The model acquired the ability to identify pertinent characteristics from the input photos and categorise them into one of the four groups of skin diseases during training.

G. Model Evaluation

The test set was used to evaluate the model's performance following training. Evaluation criteria like accuracy, precision, recall, and F1-score were employed to assess the model's performance in accurately classifying skin disease photos.

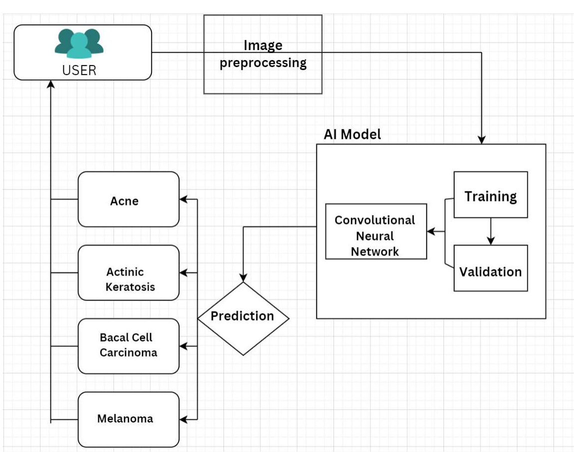

Fig. 1. Proposed System Architecture

IV. Result

A. Dataset Test Results

Based on supplied photos, the Twacha Skin Disease Prediction System seeks to forecast the presence of several skin conditions, including acne, actinic keratosis, basal cell carcinoma, melanoma, cataract, and non-cataract. Thirty-one photos from the training set were used for testing. For every test image, the final predictions produced accurate results.

Fig. 2. Test Image 3165

Fig. 3. Acne Predicted

B. Labeled Image Test Results

Using samples that we acquired from the Roboflow Universe website—a collection of various image datasets—we further evaluated the system. For every sample pertaining to melanoma, basal cell carcinoma, acne, or actinic keratosis, our results show excellent accuracy. This demonstrates how well the system understands and forecasts skin conditions using CNN. In our CNN environment, microscopic images now yield the greatest results. In subsequent stages, we want to increase the system's adaptability by utilising technological developments to support a greater variety of image formats during testing.

V. Conclusion

Although the Twacha Skin Disease Detection System's potential benefits are highlighted in the information provided, there are a number of issues with the system's lack of objectivity and important details. First off, the description is devoid of any citations to academic research or clinical studies that attest to its precision in identifying a range of skin conditions. Furthermore, it is yet unclear what precise CNN

Fig. 4. Robflow Universe Sample(Melanoma)

Fig. 5. Melanoma Predicted

technique is employed and how limited it is, which makes it more difficult to assess the dependability and any biases of the system. Moreover, the omission of any reference of Twacha's regulatory licences for medical use raises concerns about the product's compliance with accepted safety and efficacy guidelines. Additionally, the system's advantages are the only things highlighted in the advertising language, which ignores any potential drawbacks or hazards. It's critical to offer a fair analysis that takes into account all viewpoints. Furthermore, it's possible that the assertion that Twacha lowers the risk of skin cancer is misinterpreted as unapproved medical advice. It is important to stress that the system does not replace a trained healthcare provider's professional diagnosis and treatment.

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