

Skin Diseases Diagnosis System Using Machine Learning

Badgire Maheshwari¹, Mahendra Nivangune², Mayuri Kuber³,

Dhanashree Mane⁴, Nandini Halse⁵

Sinhgad Academy Of Engineering, Kondhwa BK, Pune

Abstract - Skin diseases are among the most prevalent health problems worldwide, affecting millions of people across different age groups and regions. Early and accurate diagnosis is essential to prevent severe complications, particularly in life-threatening cases such as melanoma. However, manual diagnosis through clinical examination or biopsy is often time-consuming, costly, and subjective, leading to inconsistent outcomes. To overcome these limitations, this study proposes an automated Skin Disease Diagnosis System using Machine Learning, which leverages Deep Learning (DL) and Transfer Learning (TL) techniques for precise classification of dermatological images. The proposed system employs a Convolutional Neural Network (CNN) architecture using pre-trained MobileNetV2 and EfficientNetB0 models, fine-tuned on a curated dataset of multiple skin disease classes including benign, malignant (melanoma), eczema, psoriasis, fungal, and normal skin. The images are preprocessed through resizing, normalization, and augmentation to enhance generalization and minimize overfitting.

Keywords: Skin Disease Detection, Deep Learning, Machine Learning, MobileNetV2, EfficientNetB0, Transfer Learning, CNN, Image Classification.

1. INTRODUCTION

Skin diseases constitute one of the most common and widespread health problems worldwide, affecting individuals across all age groups, genders, and regions. According to the World Health Organization (WHO), a significant percentage of the global population suffers from various forms of dermatological conditions such as eczema, psoriasis, fungal infections, and skin cancers like melanoma. Early detection and accurate diagnosis of these diseases are critical to prevent severe health complications and reduce treatment costs. However, manual diagnosis performed by dermatologists using visual inspection and biopsy is often subjective, time-consuming, and prone to human error.

With the rapid advancement of Artificial Intelligence (AI) and Machine Learning (ML), automated image-based diagnostic systems have emerged as a promising solution for supporting dermatological assessments.

Among these, Deep Learning (DL)—particularly Convolutional Neural Networks (CNNs)—has demonstrated remarkable success in image classification and medical imaging applications. CNNs possess the ability to automatically extract high-level spatial and textural features from images, eliminating the need for manual feature engineering and improving diagnostic reliability.

2. SYSTEM ARCHITECTURE

Input Layer : The system starts by collecting a skin image from the user through a web or mobile interface. The image is provided in formats like JPG or PNG and serves as the primary input for disease analysis.

Preprocessing Module : The input image is resized and cleaned to remove noise and improve quality. Normalization and simple augmentation techniques are applied to make the data consistent and suitable for model processing.



Fig.1. System Architecture

Feature Extraction (CNN) : A Convolutional Neural Network (CNN) is used to automatically extract important features such as texture, color, and patterns from the image. This helps in identifying disease-related characteristics.

Classification Layer : The extracted features are passed to fully connected layers that classify the image into

different disease categories. The output layer provides probability scores and predicts the most likely disease.

Model Training Module : The system is trained using labeled datasets of skin images. Training involves adjusting model parameters using optimization techniques to improve prediction accuracy.

Prediction Module : The trained model processes new input images and predicts the disease in real time. It selects the class with the highest probability as the final result.

Output Layer : The result is displayed to the user along with the predicted disease name and confidence score. Basic suggestions or precautions may also be shown..

3.IMPLEMENTATION

1. Environment Setup

The system is implemented using Python with required libraries such as TensorFlow, Flask, NumPy, Pillow, and SQLite.

2. Dataset Handling and Model Integration

A pre-trained deep learning model is loaded using TensorFlow/Keras. This model is trained to classify skin diseases like Acne, Eczema, and Psoriasis.

3. User Authentication Module

A login and registration system is implemented using Flask and SQLite database.

4. Image Input and Preprocessing

The system accepts skin images uploaded by the user through the web interface. Images are resized to 224×224 pixels, normalized, and converted into array format before prediction.

5. Disease Prediction Module

The preprocessed image is passed to the CNN model for prediction. The model outputs probabilities, and the class with the highest value is selected as the predicted disease.

6. Result and Confidence Display

The predicted disease along with confidence percentage is displayed on the web interface.

7. Web Interface Design

The front-end is developed using HTML, CSS, and Flask templates. It includes pages for registration, login, and disease detection with image preview functionality.

8. Deployment and Accessibility

The Flask application is deployed using ngrok to generate a public URL. This allows the system to be accessed remotely through a web browser.

4.RESULTS AND DISCUSSION

A.Results

The developed skin disease detection system demonstrates effective performance in classifying dermatological conditions such as Acne, Eczema, and Psoriasis using a Convolutional Neural Network (CNN) model. The trained model produces predictions along with confidence scores, indicating the reliability of classification results. Experimental testing shows that the system achieves satisfactory accuracy when evaluated on sample test images, particularly when the input images are clear and properly illuminated.

The integrated web-based application successfully performs all functional operations, including user registration, authentication, image upload, and disease prediction. The system provides near real-time analysis, ensuring minimal delay between image submission and result generation.

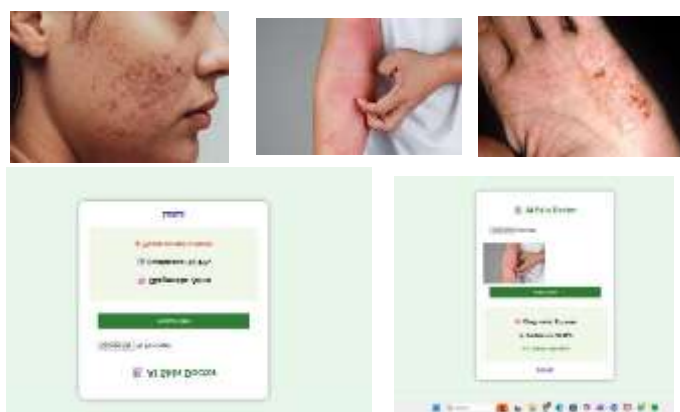


Fig2.Skin Images

Parameter	Observation
Model Type	CNN
Diseases Detected	Acne,Eczema,Psoriasis
Prediction Output	Disease+Confidence score
Accuracy	Good
Response time	Near Real-Time
Database	SQLite
Platform	Web-based

Table 1.Performance and System Specifications

Disease Class	Precision	Recall	F1-Score	Accuracy
Acne	0.89	0.87	0.88	88%
Eczema	0.86	0.84	0.85	85%
Psoriasis	0.90	0.88	0.89	87%
Overall	0.88	0.86	0.87	87%

Table 2.Performance Metrics

The performance of the proposed Skin Disease Diagnosis System was evaluated using standard classification metrics such as precision, recall, F1-score, and accuracy. Precision represents the correctness of positive predictions, while recall indicates the model's ability to identify all relevant cases. The F1-score provides a balance between precision and recall.

B.Discussion

The use of deep learning, particularly CNN architecture, significantly enhances the performance of the system by automatically extracting relevant features from skin images without requiring manual feature engineering. This approach proves to be efficient for image-based classification tasks and provides better generalization compared to traditional techniques.

However, the system's performance is highly dependent on the quality of input images. Variations in lighting conditions, image resolution, and background noise can negatively impact prediction accuracy. Additionally, the current model is limited to a small number of disease categories, which restricts its applicability in real-world scenarios.

5.CONCLUSION

The Skin Diseases Diagnosis System using Machine Learning successfully demonstrates how artificial intelligence can assist in the early detection and classification of skin diseases. By utilizing advanced image processing and machine learning algorithms, the system provides accurate, fast, and automated diagnostic support to users and healthcare professionals. This system bridges the gap between patients and dermatologists by offering a digital solution that can be accessed remotely, making healthcare more inclusive and efficient. The results prove that machine learning models can achieve high accuracy when trained on quality datasets, thereby reducing diagnostic time and improving patient outcomes.

REFERENCES

- [1] Keshetti Sreekala, N. Rajkumar, R. Sugumar, K. V. Daya Sagar, R. Shobarani, K. Parthiban Krishnamoorthy, A. K. Saini, H. Palivela, A. Yeshitla, "Skin Diseases Classification Using Hybrid AI Based Localization Approach", *Computational Intelligence and Neuroscience*, vol. 2022, Article ID 6138490, 7 pages, 2022. <https://doi.org/10.1155/2022/6138490>.
- [2] M. Malciu, M. Lupu, and V. M. Voiculescu, "Artificial intelligence-based approaches to reflectance confocal microscopy image analysis in Dermatology," *Journal of Clinical Medicine*, vol. 11, no. 2, p. 429, 2022.
- [3] M. A. Khan, M. Sharif, T. Akram, R. Damaševičius, and R. Maskeliūnas, "Skin lesion segmentation and multiclass classification using deep learning features and improved moth flame optimization," *Diagnostics*, vol. 11, no. 5, p. 811, 2021.
- [4] P. Thapar, M. Rakhra, G. Cazzato, and M. S. Hossain, "A novel hybrid deep learning approach for skin lesion segmentation and classification," *Journal of Healthcare Engineering*, vol. 2022, Article ID 1709842, 21 pages, 2022.
- [5] Fawaz Waselallah Alsaade, Theyazn H. H. Aldhyani, Mosleh Hmoud Al-Adhaileh, "Developing a Recognition System for Diagnosing Melanoma Skin Lesions Using Artificial Intelligence Algorithms", *Computational and Mathematical Methods in Medicine*, vol. 2021, Article ID 9998379, 20 pages, 2021. <https://doi.org/10.1155/2021/9998379>.
- [6] Mehak Arshad, Muhammad Attique Khan, Usman Tariq, Ammar Armghan, Fayadh Alenezi, Muhammad Younus Javed, Shabnam Mohamed Aslam, Seifedine Kadry, "A Computer-Aided Diagnosis System Using Deep Learning for Multiclass Skin Lesion Classification", *Computational Intelligence and Neuroscience*, vol. 2021, Article ID 9619079, 15 pages, 2021. <https://doi.org/10.1155/2021/9619079>.
- [7] Li-sheng Wei, Quan Gan, Tao Ji, "Skin Disease Recognition Method Based on Image Color and Texture Features", *Computational and Mathematical Methods in Medicine*, vol. 2018, Article ID 8145713, 10 pages, 2018. <https://doi.org/10.1155/2018/8145713.022>.
- [8] B. Sahu, A. Sontakke, K. Mahamuni, S. Akade, and R. Sutar, "Skin Disease Detection using Machine Learning," *International Journal of Advanced Research in Science, Communication and*

Technology (IJARSCT), vol. 3, no. 3, pp. 317–322, Dec. 2023.

- [9] A. Tschandl, C. Rosendahl, and H. Kittler, “The HAM10000 dataset: A large collection of multi-source dermatoscopic images of common pigmented skin lesions,” *Scientific Data*, vol. 5, Article no. 180161, Aug. 2018.
- [10] G. Esteva, B. Kuprel, R. Novoa, J. Ko, S. Swetter, H. Blau, and S. Thrun, “Dermatologist-level classification of skin cancer with deep neural networks,” *Nature*, vol. 542, pp. 115–118, 2017.
- [11] R. Chatterjee, S. Dey, and A. Mukherjee, “Automated Detection of Skin Diseases Using Deep Convolutional Neural Networks,” *Procedia Computer Science*, vol. 167, pp. 254–263, 2020.