DERMACARE: AI-DRIVEN SKIN DISEASE DETECTION AND SKIN CARE RECOMMENDATION SYSTEM

Project Reference No.: *49S_BE_5384*

College : Don Bosco Institute of Technology, Bengaluru
Branch : Department of Computer Science and Engineering
Guide : Dr. Usha Kirana S P
Student(s) : Ms. Ebbali Pavithra
Mr. Gowrav K M

Keywords:

Artificial Intelligence, Convolutional Neural Networks (CNN), Deep Learning, EfficientNet-B0 Algorithm, Image Classification, skin diseases.

Introduction:

Millions of individuals globally suffer from skin disorders, yet accurate and trustworthy diagnoses are often inaccessible, particularly in underserved regions where specialized medical resources are limited. A severe shortage of dermatologists leads to prolonged waiting periods, forcing patients to rely on self-assessment or informal online tools, which frequently results in misdiagnosis and postponed clinical care. The visual similarities between conditions like psoriasis, eczema, and fungal infections further complicated by variations in skin tone make precise identification incredibly challenging without professional expertise. While deep learning technologies, specifically Convolutional Neural Networks (CNNs), have demonstrated high efficacy in analyzing skin imagery, most current solutions merely output a disease label without offering any actionable next steps. To address this critical gap, DermaCare introduces a comprehensive, AI-powered dermatology assistant designed to classify common skin disorders through robust image analysis while simultaneously providing practical, rule-based care recommendations, thereby bridging the divide between initial detection and early intervention.

Objectives:

1. The primary objective is to develop a highly accurate, AI-powered dermatological diagnostic tool that bridges the gap between disease detection and actionable patient care.
2. The project aims to utilize a transfer-learning-based deep learning model, specifically EfficientNet-B0, to identify five widespread skin conditions from standard clinical images.
3. Additionally, the system seeks to implement a rigorous image preprocessing pipeline to guarantee model reliability across varied lighting and hardware conditions.
4. Finally, the project aims to integrate a rule-based recommendation module that pairs the multi-class diagnostic output with general, condition-specific treatment and skincare guidance for the end-user.

Methodology:

The Figure 1, proposed system features a scalable AI architecture built using Python 3.10, TensorFlow 2.x, Keras, and OpenCV. The operational pipeline begins with user image input via a graphical interface or API, accommodating photos taken from everyday devices like smartphones. To ensure consistency, these raw images undergo a strict preprocessing layer: they are resized to 224x224 pixels to fit the EfficientNet-B0 input requirements, pixel values are normalized, and augmentation techniques (flipping, zooming, rotating) are applied to simulate real-world diversity. Additionally, Gaussian blur noise filtering is implemented to remove background artifacts and isolate the affected skin regions. The core analytical stage utilizes an EfficientNet-B0 convolutional neural network to extract distinct visual features (shapes, colors, textures). The system then classifies the extracted features into one of five categories: Acne Rosacea, Fungal infections, Eczema, Psoriasis, or Urticaria (Hives), assigning a transparent confidence score to the prediction. Following classification, a rule-based engine triggers, mapping the diagnosed condition to basic, clinically rooted care recommendations, offering the user an immediate, safe starting point for symptom management.

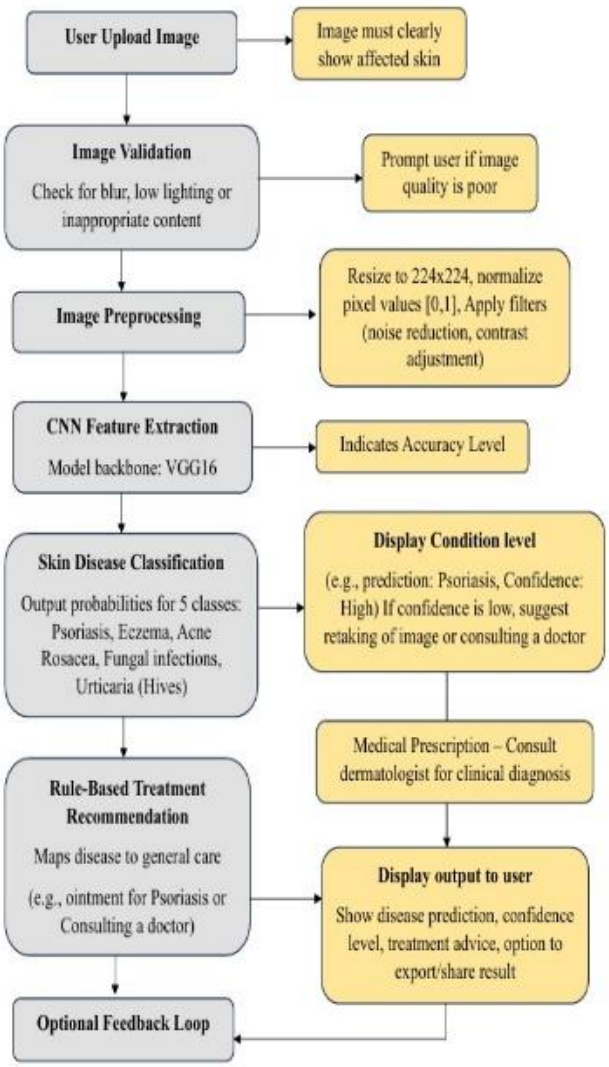

Figure 1: Proposed System Framework

Result and Conclusion:

The CNN-based model achieved highly competitive results, reaching a peak training accuracy of 95.21%, which demonstrates exceptional capacity shown in learning discriminative dermatological features in figure 2. During validation testing, the model maintained an accuracy of 85.38% with a robust F1-score of 0.847 in figure 3, confirming balanced precision and recall metrics across all five disease classes with minimal overfitting. In figure 4 Confusion matrix analysis verified strong discriminatory power, highlighted by high true positive rates and very low off-diagonal misclassifications. Furthermore, comparative evaluation showed that DermaCare demonstrated significantly faster convergence and higher average accuracy than previous baseline implementations. In conclusion, the integration of deep learning with a rule-based guidance engine successfully yielded a reliable, fast, and accessible diagnostic triage tool capable of supporting both clinical environments and individual patients.

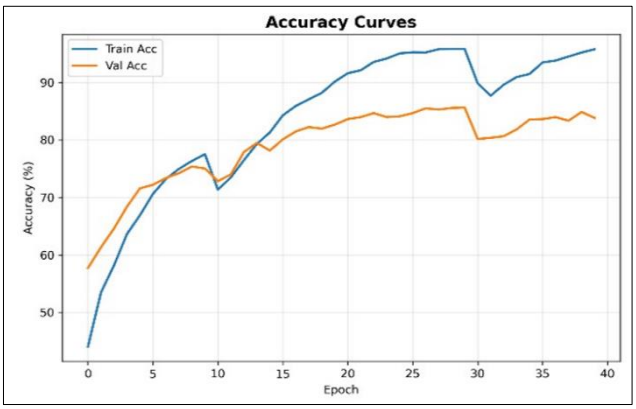

Figure 2: Accuracy Curves

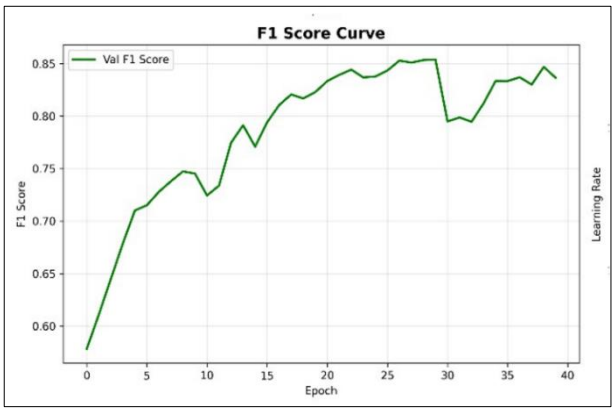

Figure 3: F1-Score

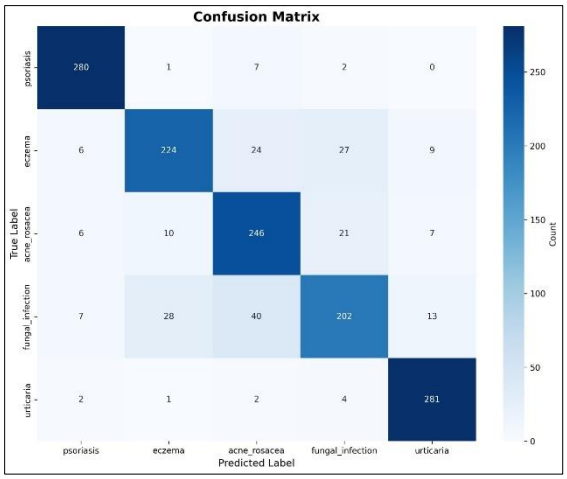

Figure 4: Confusion Matrix

References:

[1] A.Rashmi, N. R. T., and A. A. S., “AI-Powered Dermatological Diagnosis for Diverse Skin Diseases,” Proceedings of the International Conference on Innovative Systems for Cybersecurity(ISCS),pp.1–5,2024. DOI: 10.1109/ISCS61804.2024.10581357.

[2] J. P. Pandian, R. Jegan, R. Jerlinkasmir, P. S. H. Jose, and P. A. Christu Raj, “Early Detection and Treatment of Skin Diseases Using Advanced Image Preprocessing and Machine Learning Techniques,” Proceedings of the 4th International Conference.on Ubiquitous Computing and Intelligent Information Systems (ICUIS), pp. 1031–1037, 2024.
DOI: 10.1109/ICUIS64676.2024.10866949.

[3] E. Priya, N. Vishnu V, L. Kamal T. M, and A. Aakash, “Optimizing Convolutional Neural Networks for Dermatological Disease Detection Using Ensemble Learning on Edge AI Platforms,” Proceedings of the International Conference Power, Energy, Control and Transmission Systems (ICPECTS),pp.1–6,2024.
DOI: 210.2024.10780196.

[4] S. Juneja, P. Tiwari, R. Devi, and S. Atwal, “DERM-AI: A Convolutional Neural Network Based Approach for Skin Disease Detection,” Proceedings of the International Conference on Intelligent Systems for Cybersecurity (ISCS), pp. 1–6, 2024.
DOI: 10.1109/ISCS61804.2024.10581357.

Future Scope:

The future scope of this project includes:

1. Future enhancements will focus on broadening the model's diagnostic capabilities by expanding the disease list to include conditions like atopic dermatitis and incorporating severity staging, such as grading acne.
2. To prioritize inclusivity and fairness in AI, subsequent iterations will require training on a vastly expanded dataset featuring diverse demographics to optimize accuracy across all skin tones.
3. The rule-based recommendation module will be upgraded to a dynamic, learning based advisor capable of tailoring care strategies based on patient age, comorbidities, and regional treatments.
4. Long-term objectives also include clinical validation within tele-dermatology settings and deep integration with Electronic Health Records (EHR) to track disease progression securely.