

Scanova: AI-Powered Skin Cancer and Dermatological Disease Detection System

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Abstract -

Skin diseases and skin cancer are among the most common health problems worldwide, affecting millions of people and posing serious risks if not detected early. While traditional diagnostic methods such as clinical examination and biopsy are effective, they are often time-consuming, invasive, and dependent on expert availability.

This paper presents an AI-based skin disease detection system using deep learning techniques for accurate and automated diagnosis. The system utilizes Convolutional Neural Networks (CNNs) to classify skin diseases from image data. It incorporates preprocessing techniques such as image resizing, normalization, and augmentation to improve model performance. Public datasets such as ISIC and HAM10000 are used for training and evaluation.

Unlike traditional methods, the proposed system enables faster, non-invasive, and cost-effective detection of skin diseases. Experimental results from existing studies show that deep learning models achieve high accuracy, ranging from 78% to over 90%, depending on model architecture and dataset quality. The system contributes toward improving early diagnosis and supporting dermatologists in decision-making processes.

Key Words:

Skin Disease Detection, Deep Learning, Convolutional Neural Network (CNN), ISIC Dataset, HAM10000, Image Classification, Artificial Intelligence, Medical Imaging

1.INTRODUCTION

The skin is the largest organ of the human body and plays a vital role in protecting internal organs from external environmental factors. However, it is susceptible to various diseases such as acne, eczema, psoriasis, and skin cancer. Skin cancer, in particular, is one of the most dangerous conditions, with high mortality rates if not detected at an early stage

Traditional diagnostic methods rely on visual examination and biopsy, which can be invasive, expensive, and time-consuming. Moreover, access to dermatologists is limited in many regions, especially in rural and economically disadvantaged areas. These challenges highlight the need for automated and efficient diagnostic systems.

Recent advancements in artificial intelligence, particularly in deep learning and computer vision, have enabled the development of automated skin disease detection systems. CNN-based models can analyze large datasets of skin images and identify patterns with high accuracy. These systems assist dermatologists by providing faster and more consistent results.

However, existing AI-based systems still face limitations such as dataset imbalance, similarity between different skin diseases, and lack of real-world validation. To address these challenges, this paper proposes an AI-based approach that focuses on improving accuracy and usability for practical applications.

2. LITERATURE SURVEY

[1] This study presents a comprehensive review of AI-based techniques for skin disease detection, analyzing different models, datasets, and evaluation metrics. The authors highlight that CNN models outperform traditional machine learning techniques due to their ability to automatically extract features from images. The study also identifies challenges such as limited datasets, class imbalance, and similarity among skin diseases .

[2] This research proposes a CNN-based approach for skin cancer detection using the HAM10000 dataset. The methodology includes preprocessing steps such as image resizing and normalization followed by classification of multiple skin cancer types. The model achieved an accuracy of approximately 78%, demonstrating the effectiveness of deep learning for automated diagnosis .

[3] This study discusses the role of artificial intelligence in dermatology and highlights both its advantages and limitations. While AI shows strong potential in detecting skin cancer through image classification, it is not always superior to dermatologists due to issues such as biased datasets and lack of clinical validation. The study emphasizes the importance of using AI as an assistive tool rather than a replacement .

[4] This paper presents a deep learning-based system using CNN and transfer learning models such as ResNet50 and InceptionV3 for skin cancer detection. The system uses the ISIC dataset and applies preprocessing techniques like augmentation and normalization. The results show improved accuracy up to 85.8%, highlighting the effectiveness of transfer learning.

[5] This research introduces ensemble deep learning approaches that combine multiple CNN architectures such as VGG16, DenseNet, and Inception. The ensemble method improves classification performance and achieves higher accuracy compared to individual models, demonstrating robustness in skin disease detection.

3. PROPOSED SYSTEM

The proposed system is an AI-based skin disease detection platform designed to enable automated and accurate classification of skin diseases using deep learning techniques. The system focuses on analyzing skin images and predicting disease categories to assist dermatologists and improve early diagnosis.

The system consists of the following core functionalities:

Skin images are captured using a camera or uploaded by the user. These images are processed and analyzed using a trained deep learning model to detect and classify skin diseases.

2. Preprocessing Module

Input images are preprocessed to improve quality and consistency. This includes resizing, normalization, and removal of noise or artifacts such as hair and lighting variations.

3. Feature Extraction and Classification

The processed images are passed through a Convolutional Neural Network (CNN), which automatically extracts important features such as texture, color, and shape. The model then classifies the image into different skin disease categories such as melanoma, benign lesions, or other conditions.

4. METHODOLOGY

A. Data Collection: Skin image datasets are collected from publicly available sources such as ISIC and HAM10000, which contain labeled dermoscopic images of various skin diseases.

B. Preprocessing: Images are resized, normalized, and augmented to improve model performance and reduce overfitting. Techniques such as rotation, flipping, and scaling are applied to increase dataset diversity.

C. Feature Extraction: The CNN model automatically extracts relevant features from images, including color variation, texture patterns, and lesion shape. These features are essential for accurate classification.

D. Model Training: A Convolutional Neural Network (CNN) is trained using the processed dataset. Transfer learning models such as ResNet50 and InceptionV3 can

also be used to improve accuracy and reduce training time.

E. Classification (Inference): The trained model predicts the class of the input image, such as benign or malignant. Predictions are generated in real-time or during testing based on input data.

F. Evaluation Metrics:

Model performance is evaluated using metrics such as:

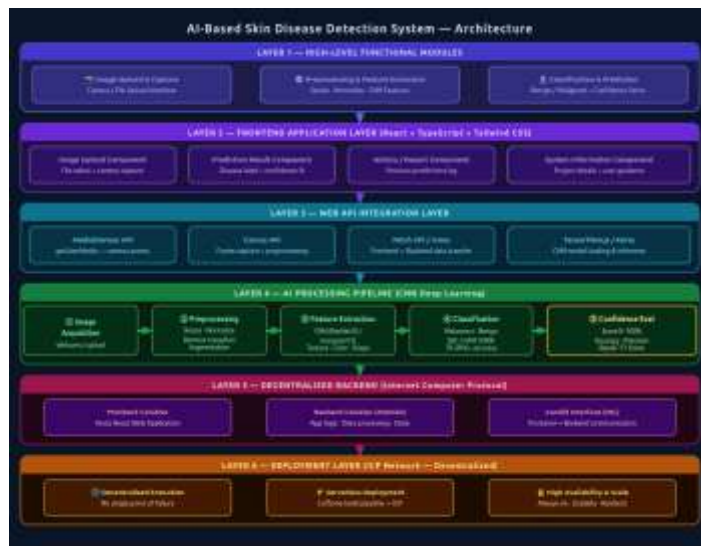
- Accuracy
- Precision
- Recall (Sensitivity)
- F1 Score

These metrics help in measuring the effectiveness and reliability of the model.

4.SYSTEM ARCHITECTURE

The proposed system follows a modular, layered, and decentralized architecture designed to support real-time multimodal communication using web technologies and AI-based gesture recognition.

1.1. Image-Based Skin Disease Detection Architecture



1. High-Level Functional Modules:

At the top layer, the system is divided into three core functionalities:

• **Image Upload & Capture:** Allows users to upload or capture skin images using a device camera or file upload interface for analysis.

• **Image Preprocessing & Feature Extraction:** Processes uploaded images through resizing, normalization, and feature extraction using Convolutional Neural Networks (CNNs) to prepare them for classification.

• **Skin Disease Classification & Prediction:** Detects and classifies skin diseases such as benign and malignant conditions and displays prediction results with confidence scores to the user. These modules ensure efficient and accurate early skin disease detection.

2. Frontend Application Layer

The frontend is implemented using a React-based architecture and is designed to provide a responsive and user-friendly interface for interacting with the system.

• **Image Upload Component:** Handles image selection and camera-based image capture.

• **Prediction Result Component:** Displays detected disease category and confidence level clearly to the user.

• **History/Report Component:** Stores and displays previous prediction results (optional feature).

• **System Information Component:** Provides project details, user guidance, and system workflow information.

This modular UI design ensures smooth navigation, scalability, and improved user accessibility.

3. Web API Integration Layer

• **MediaDevices API (getUserMedia):** Used to access the device camera for capturing skin images in real time.

• **Canvas API:** Captures and processes image frames before sending them to the AI model for prediction.

• **Fetch API / Axios:** Handles communication between frontend and backend services for transferring image data and receiving prediction results.

• **TensorFlow/Keras Integration:** Used for loading and executing+

- the trained CNN model for disease classification

4. Decentralized Backend Architecture (ICP)

- The system is deployed on the Internet Computer Protocol (ICP) using canister-based architecture:
- Frontend Canister:
- Always-On Hosting
- Secure HTTPS Endpoints
- Distributed Network Availability
- Hosts and serves the React web application.
- Backend Canister (MotokoLogic):
- Handles application logic, data processing, and coordination.
- Candid Interface (IDL):
- Defines communication between frontend and backend. This architecture provides:
- Decentralized execution
- Serverless deployment
- High availability and scalability

5. Deployment Layer

At the lowest layer, the system operates on a decentralized infrastructure offering:

1.2. Image-Based Skin Disease Detection : Deployment



5. SYSTEM DESIGN

1.3. Image-Based Skin Disease Detection : System Design

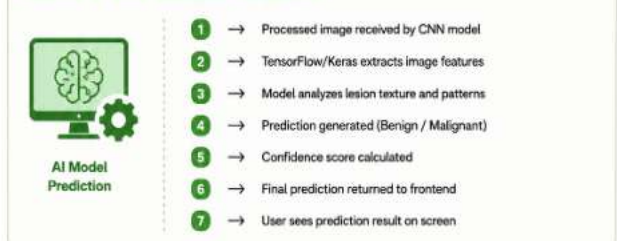


Data Flow

Feature 1: Image Upload & Capture



Feature 2: Skin Disease Prediction



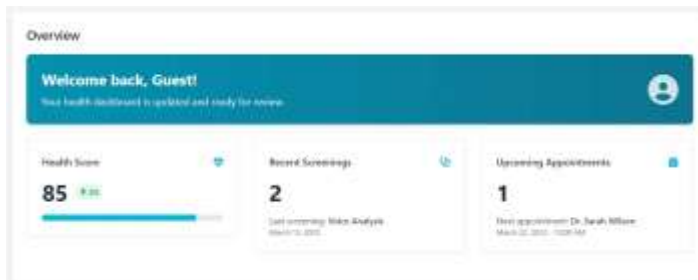
Feature 3: Result Display & Analysis



1.4. Image-Based Skin Disease Detection : Data flow

6.IMPLEMENTATION RESULTS

1.5. Image-Based Skin Disease Detection : Result Screen1



1.6. Image-Based Skin Disease Detection : Result Screen 2



1.7. Image-Based Skin Disease Detection : Result Screen 3



1.8. Image-Based Skin Disease Detection : Result Screen 4



1.9. Image-Based Skin Disease Detection : Result Screen 5



7.CONCLUSION AND FUTURE SCOPE

This study shows that Artificial Intelligence, especially deep learning models like CNN, is highly effective for skin disease and skin cancer detection. Compared to traditional methods, AI-based systems provide faster, non-invasive, and cost-efficient diagnosis. Research results indicate that CNN and transfer learning models can achieve high accuracy (around 80%–98%) depending on dataset quality and model design .

However, several limitations still exist. Many models suffer from imbalanced datasets, lack of diversity in skin tones, and difficulty in distinguishing visually similar diseases. In addition, most systems are tested in controlled environments and lack proper clinical validation, making them less reliable for real-world use . Therefore, AI should be used as a support tool for dermatologists rather than a complete replacement.

In future, the performance of these systems can be improved by using larger and more diverse datasets, applying better preprocessing and data balancing techniques, and integrating transfer learning and hybrid models. Development of mobile-based applications, explainable AI systems, and real-world clinical validation will further enhance usability and trust. Combining AI with medical expertise (Augmented Intelligence) will be the most effective approach for accurate and reliable skin disease detection.

8. REFERENCES

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