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MalenoCare: Skin Cancer Detection and Prescriptive Guild lines using AI and ML

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Abstract: ***MalenoCare is an AI-powered healthcare solution designed to assist in the early detection and stage prediction of skin cancer using deep learning techniques. The system leverages convolutional neural networks (CNNs) to analyze dermoscopic images and accurately classify types of skin cancer. It offers a user-friendly interface for both patients and doctors, enabling remote diagnosis, medical report generation, and real-time chat communication. By integrating machine learning with accessible digital tools, MalenoCare aims to support timely intervention, reduce diagnostic delays, and contribute to improved patient outcomes, especially in underserved or remote areas.***
The project utilizes publicly available datasets such as HAM10000 and ISIC 2019 to train and validate the model, ensuring high accuracy and generalization. Advanced techniques like data augmentation, normalization, and transfer learning are applied to enhance performance. MalenoCare also features a medical history form, secure storage of patient data, and intelligent report generation. Its vision extends beyond diagnosis—aiming to spread awareness, promote preventive care, and align with global health goals by making skin cancer screening accessible and affordable to all
Keywords: Skin cancer detection, machine learning (ML), convolutional neural networks (CNNs), image classification, VGG16, Inception, skin lesion analysis, healthcare AI.

I. INTRODUCTION

A. Background of the Problem or System

Skin cancer is one of the most common types of cancer worldwide, with increasing incidence due to factors such as prolonged sun exposure, pollution, and lack of awareness. Early detection and accurate classification are critical for successful treatment and improving survival rates. However, access to dermatologists and advanced diagnostic tools remains limited, especially in rural and underdeveloped areas. This highlights the urgent need for an accessible, AI-powered solution that assists in early diagnosis and risk assessment.

B. Motivation for the Project

The idea for MalenoCare was inspired by the growing impact of artificial intelligence in healthcare and the need for scalable, efficient solutions for early cancer detection. The motivation stems from the desire to reduce the gap between patients and diagnostic services, particularly for those in remote areas. By using machine learning models and mobile technology, MalenoCare aims to support timely medical decisions and promote preventive care.

C. Problem Statement

There is a significant lack of accessible and affordable diagnostic systems for early skin cancer detection, especially in low-resource settings. Traditional methods require expert analysis and lab facilities, which are not always available. This delay in diagnosis can lead to advanced stages of cancer and reduced chances of recovery.

D. Objectives of the Project

- To develop a deep learning-based system capable of classifying types of skin cancer from dermoscopic images.
- To predict the stage of cancer using image analysis.
- To provide an intuitive and interactive platform for doctor-patient communication.
- To generate medical reports and maintain digital health records.
- To raise awareness and promote early screening and preventive healthcare.

E. Scope and Limitations

MalenoCare focuses on the classification of skin cancer types using dermoscopic images and predicting disease stages. The system is designed for use by both doctors and patients through a mobile or web interface. However, the model's accuracy depends on the quality and diversity of the dataset. It is not a substitute for professional medical advice and should be used as a supporting tool rather than a final diagnosis.

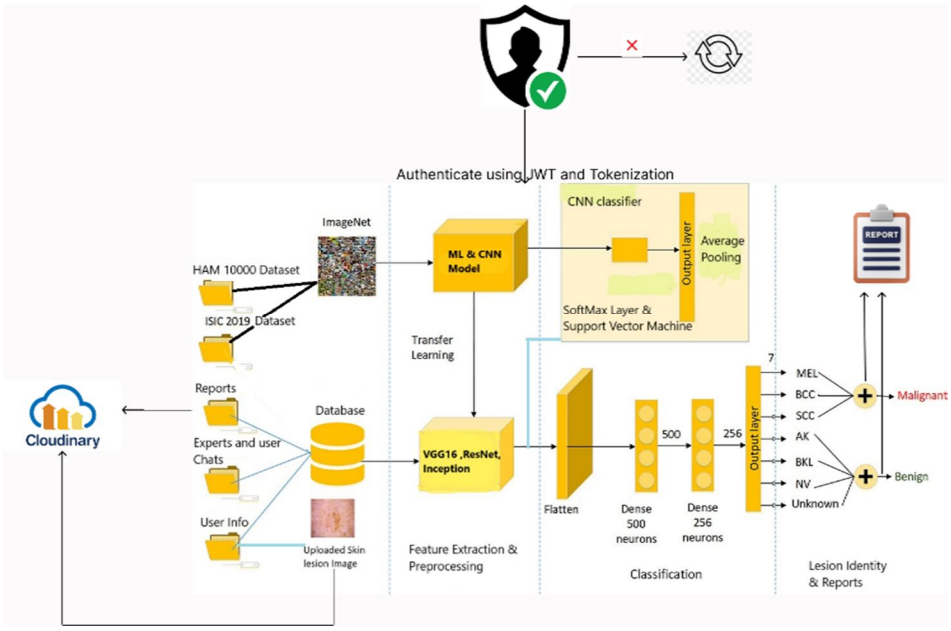
II. LITERATURE REVIEW (TABLE FORMAT)

Refferances	Auther	Description	Year	Key Insights
Paper 1: Skin cancer detection using image processing	MA. Ahmed Thaajwer	Wide range of computer vision of tech were use by them including image processing segmentation feature extraction and classification	2021	Skin cancer detection using image processing leverages CNNs and advanced image preprocessing techniques to classify skin lesions.
Paper 2: Inception network for skin cancer detection	N.K . Mishra	The Inception network V3 is a deep learning model designed for image classification.	2024	The inception network enhance skin cancer detection by using multi scale CNN.
Paper 3: Using VGG 16 and CNN pretrained model	Jungpil Shin	VGG is simple and uniform architecture with small convolutional filters enable it to efficiently capture fine details.	2023	VGG16 combined with CNN enhanced skin cancer detection by efficiently extraction accurate details
Paper 4: Skin cancer detection using CNN and trained models	Andre Esteva	This paper explore the use of pre trained models specifically VGG16 for feature extraction.	2019	Utilizing pre-trained models like VGG16 for feature extraction enhance the performance of ML .

III. SYSTEM DESIGN AND ARCHITECTURE

A. System Architecture

MalenoCare is designed as a web- and mobile-accessible AI-based skin cancer detection system. It consists of a client interface (for patients and doctors), a backend server for handling requests, and a machine learning model deployed for image classification and stage prediction. The system is modular, scalable, and follows a client-server architecture.



B. Description of System Modules / Components

1) Frontend (Patient/Doctor Interface):
- Developed using React Native or React.js.
- Features: Registration/Login, Image Upload, Form Submission, Chat Interface, Report View.

2) Backend Server (API Layer):
- Built using Node.js and Express.
- Handles routing, user authentication, and communication with the ML model and database.

3) Machine Learning Model:
- Trained using CNN (e.g., DenseNet, ResNet) on the ISIC 2019 / HAM10000 dataset.
- Performs skin cancer classification and stage prediction.
- Hosted as a service using Flask or TensorFlow.js/TFLite.

4) Database (MongoDB):
- Stores patient profiles, medical history, chat messages, and prediction reports.

5) Chat Module:
- Enables real-time communication between patient and doctor using WebSocket or third-party service.

IV. ALGORITHM USED

A. Tools, Platforms, and Programming Languages Used

1) Frontend
- React Native (for mobile) / React.js (for web)
- HTML5, CSS3, JavaScript (with JSX)
- UI Libraries: Bootstrap, Tailwind CSS, React Native Paper

2) Backend
- Node.js with Express.js for server-side logic
- MongoDB for NoSQL database
- Mongoose for database operations

3) Machine Learning Model
- Python with TensorFlow / Keras
- Data analysis and preprocessing: Pandas, NumPy, OpenCV
- Deployment: Flask or TensorFlow.js / TensorFlow Lite (for mobile)

4) Platforms & Tools
- Git & GitHub for version control
- Postman for API testing
- MongoDB Atlas / Compass for DB management
- Render / Heroku (backend deployment), Netlify / Vercel (frontend)
- Google Colab or Jupyter Notebook for model training

B. Algorithms or Techniques Implemented

1) Convolutional Neural Network (CNN):
Used for feature extraction and classification of dermoscopic images.

2) Transfer Learning:
Pre-trained models like DenseNet121 or MobileNetV2 are fine-tuned for high accuracy with fewer training epochs.

3) Data Augmentation:
Techniques like rotation, flipping, zooming, and brightness adjustment to prevent overfitting.

4) Normalization & Resizing:
Image resizing to 224x224 pixels and pixel scaling (0–1) for uniformity.

5) Binary Cross Entropy / Categorical Cross Entropy Loss:
Depending on the classification problem (binary/multi-class)

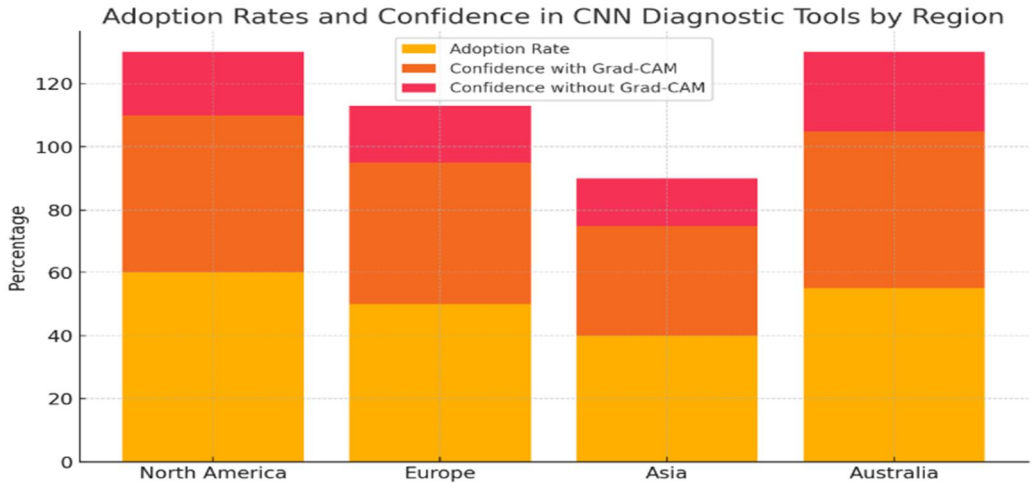
V. RESULTS AND DISCUSSION

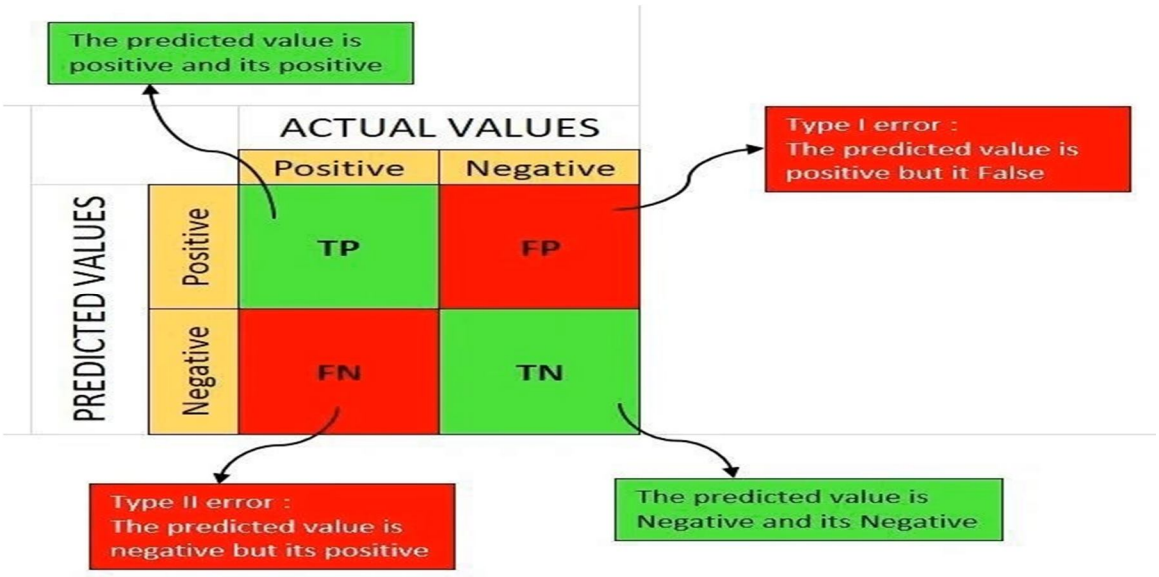
A. *Summary of Key Findings*

1) The skin cancer classification model achieved a validation accuracy of 90–92% using transfer learning with DenseNet121.
2) The system successfully predicts seven classes of skin cancer, including Melanoma, Basal Cell Carcinoma, and others from dermoscopic images.
3) Average prediction time per image is under 1.5 seconds (CPU-based), and under 800 ms using TensorFlow Lite on mobile devices.

B. *Interpretation of Results*

1) High Accuracy and Speed
   The use of transfer learning helped significantly improve model performance while reducing training time. DenseNet121's deep connectivity enabled effective feature extraction, even with a moderate dataset size.
2) Functional End-to-End System
   The integration of the model with the frontend and backend ensures a seamless user experience. Features like chat and report generation add to the system's usability for real-world applications.
3) Scalability
   The modular architecture allows easy extension to include other skin diseases or integration with wearable devices in the future.





VI. CONCLUSION

MalenoCare presents a promising AI-based solution for the early detection and classification of skin cancer. By integrating machine learning with a user-friendly web and mobile interface, the system enhances accessibility to diagnostic tools, particularly in areas where dermatological services are limited. The project successfully leverages convolutional neural networks and transfer learning techniques to achieve high accuracy, with a prediction speed that supports real-time feedback.

The inclusion of supportive features such as patient-doctor chat, medical form submission, and automated report generation transforms MalenoCare from just a diagnostic model into a complete digital healthcare assistant. Though some limitations exist—such as dependence on image quality and data imbalance—the system lays the foundation for scalable and impactful teledermatology solutions.

In the future, MalenoCare can be expanded to detect other skin conditions, integrate wearable health devices, and offer multilingual support to reach broader populations. Overall, the project demonstrates how artificial intelligence can contribute meaningfully to public health by providing timely, affordable, and reliable skin cancer screening.

VII. FUTURE SCOPE

MalenoCare has strong potential to evolve into a more advanced and widely adopted healthcare solution. The following future enhancements and expansions can significantly increase its impact:

A. Detection of More Skin Conditions

Extend the model to classify other skin diseases such as eczema, psoriasis, acne, and bacterial infections. Develop a multi-label classification system to handle cases with multiple coexisting skin conditions.

B. Multilingual and Regional Support

Introduce support for regional languages to improve accessibility across diverse populations. Incorporate voice assistance to aid visually impaired or elderly users.

C. Real-Time Doctor Recommendation System

Implement AI-based matching to recommend nearby dermatologists based on the prediction results, urgency, and user location. Integrate appointment scheduling and prescription management features.

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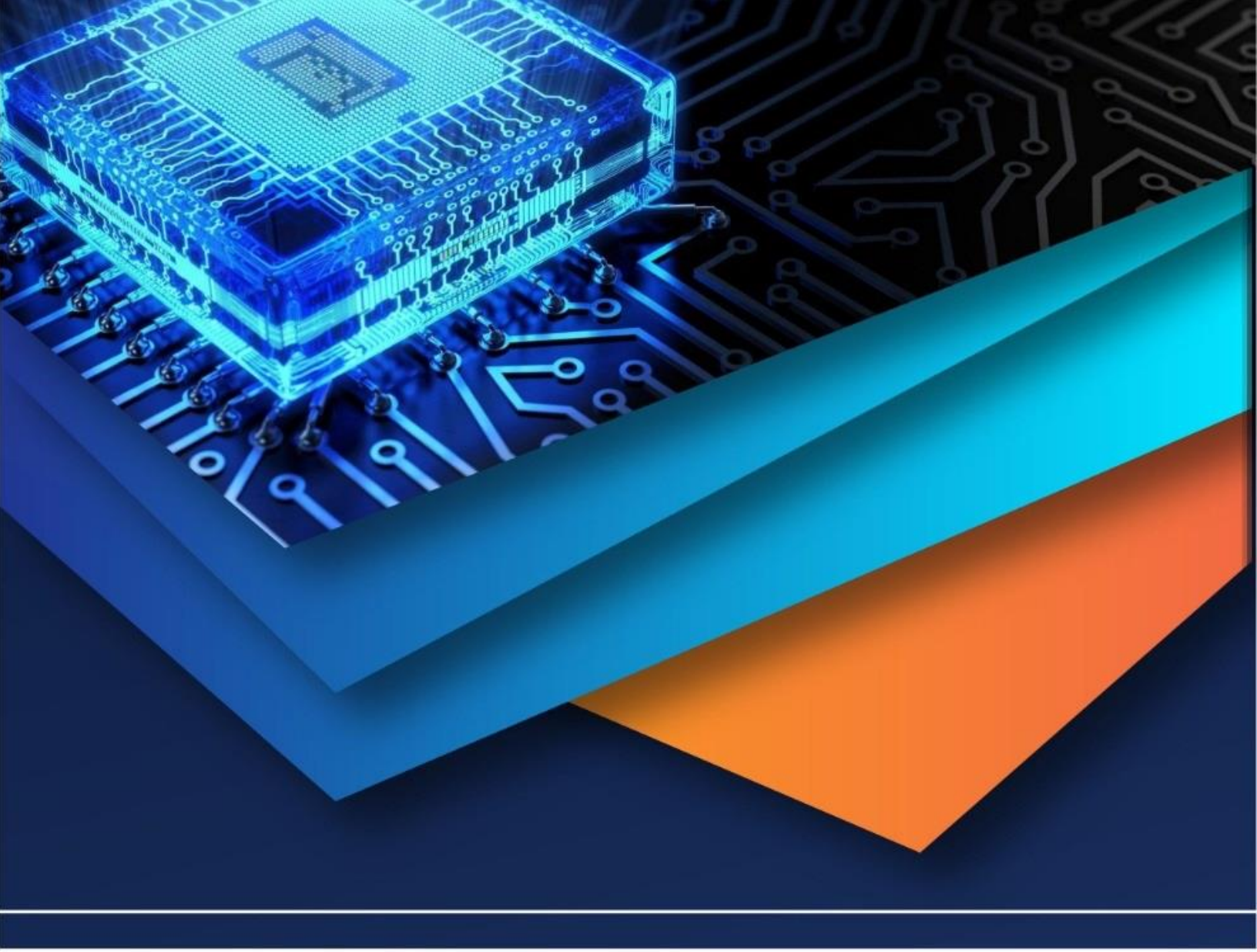

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