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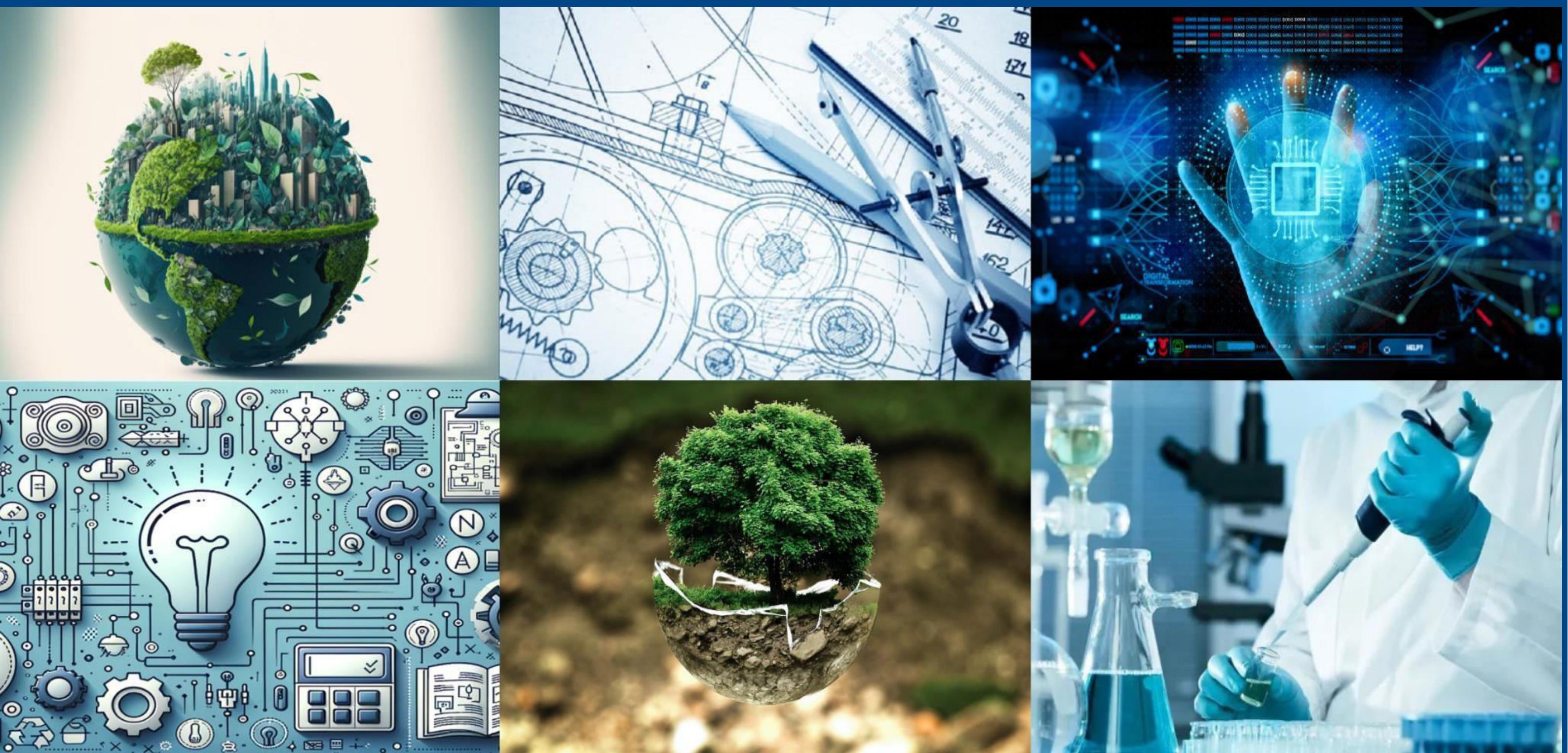

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AI-Enabled Skin Cancer Detection and Virtual Dermatology Assistant using Deep Learning

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ABSTRACT: The current state of affairs demonstrates that the detection of skin cancer is dependent on manual examination and biopsies, which are costly, time-consuming, and prone to human error. For prompt treatment and higher patient survival rates, early identification of skin abnormalities is essential. In order to accurately classify skin lesion images, this project automatically extracts features like colour, shape, and texture using the VGG16 deep learning model. To improve accuracy and do away with the need for manual segmentation, the system combines AI-driven automated classification with noise removal. Skin cancer detection is now accessible, effective, and user-friendly thanks to a chatbot-powered virtual dermatology assistant that answers questions, gives users information, and suggests doctors.

KEYWORDS: Deep Learning, VGG16, Skin Cancer Detection, Convolutional Neural Network, Chatbot, Artificial Intelligence.

I. INTRODUCTION

One of the most prevalent forms of cancer in the world is skin cancer, and survival and effective treatment depend greatly on early detection. Dermatologists perform biopsy tests after a clinical examination as part of traditional diagnostic procedures. These processes are frequently expensive, time-consuming, and prone to human error.Deep learning models, in particular Convolutional Neural Networks (CNNs), have demonstrated great promise in automating image-based disease detection as a result of advances in computer vision and artificial intelligence. This study suggests an AI-powered virtual dermatology assistant and skin cancer detection tool that uses an interactive chatbot interface for in-the-moment patient support and the VGG16 CNN architecture for automated classification.

1.1 Problem Motivation

Existing skin cancer detection systems rely heavily on manual processes and specialist expertise. They face several limitations such as:

- Dependence on manual feature extraction and segmentation.
- High misclassification rates due to irrelevant or missing features.
- Limited scalability and accessibility in rural or low-resource areas.

The motivation behind this project is to design an intelligent, automated system that can analyze skin lesion images, accurately detect cancerous patterns, and provide instant user guidance. This addresses both accessibility and affordability challenges in modern healthcare.

II. CONTRIBUTIONS

The key contributions of this project are as follows:

- Development of an **AI-based skin cancer detection system** using the **VGG16 CNN model**.
- Automatic extraction of essential image features such as color, shape, and texture.
- Integration of **noise removal techniques** to improve image quality and model performance.
- Implementation of a **chatbot-based virtual assistant** to interact with users, answer queries, and recommend dermatologists.
- Creation of an efficient, cost-effective, and scalable solution for early skin cancer detection.

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III. METHODOLOGY

3.1 Architecture Overview

The proposed system consists of the following major components:

1. **Image Acquisition:** Skin lesion images are collected from public datasets or user uploads.
2. **Preprocessing:** Images are resized, normalized, and denoised using Gaussian or median filtering.
3. **Feature Extraction:** The VGG16 deep learning model extracts critical features automatically without manual intervention.
4. **Classification:** The CNN classifies the image into benign or malignant categories.
5. **Chatbot Interface:** A natural language–based assistant interacts with users, provides diagnostic insights, and suggests medical professionals.

3.2 Mathematical Components

3.1 Convolution

Extracts spatial features using filters.

$$F(x,y) = (I * K)(x,y) = \sum_{a} \sum_{b} I(x-a, y-b) \cdot K(a,b)$$

Where Iis the input image, Kis the kernel, and Fis the feature map.

3.2 Activation (ReLU)

Introduces non-linearity:

$$f(x) = \max(0, x)$$

3.3 Pooling

Reduces feature map size to retain important information:

$$P_{out}(i,j) = \max_{(x,y)\in P(i,j)} F(x,y)$$

3.4 Classification (Softmax)

Generates class probabilities (benign or malignant):

$$P(y_i) = \frac{e^{Z_i}}{\sum_{j=1}^{n} e^{Z_j}}$$

3.5 Loss Function

Minimizes prediction error using categorical cross-entropy:

$$L = -\sum_{i=1}^{n} y_i \log(P(y_i))$$

Overall Expression:

$$Y = \mathrm{Softmax}(W \cdot f_{ReLU}(P(F(I,K))))$$

This ensures accurate classification of skin lesion images through efficient deep feature extraction.

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IV. EXPERIMENTAL RESULTS

4.1 Dataset

The system was tested using publicly available dermatology image datasets such as **ISIC** and **HAM10000**, containing labeled images of **benign and malignant** skin lesions. All images were resized to **224×224 pixels** and normalized before being fed into the **VGG16** model.

4.2 Evaluation Metrics

Performance was evaluated using standard metrics:

Accuracy (A):

$$\mathbf{A = \frac{TP + TN}{TP + TN + FP + FN}}$$

Precision (P):

$$\mathbf{P = \frac{TP}{TP + FP}}$$

Recall (R):

$$\mathbf{R = \frac{TP}{TP + FN}}$$

F1-Score:

$$\mathbf{F1 = \frac{2 \times P \times R}{P + R}}$$

Where TP, TN, FP, and FN represent true positives, true negatives, false positives, and false negatives respectively.

4.3 Performance Analysis

The proposed **VGG16-based CNN** achieved high accuracy in classifying skin lesions compared to traditional ML models like **SVM** and **Decision Trees**. The integration of **noise removal** improved image clarity, leading to better feature extraction.

Model	**Accuracy (%)**	**Precision (%)**	**Recall (%)**	**F1-Score**
SVM	82.5	80.3	79.8	80.0
CNN (Custom)	88.4	86.9	87.2	87.0
Proposed VGG16 CNN	94.6	93.8	94.2	94.0

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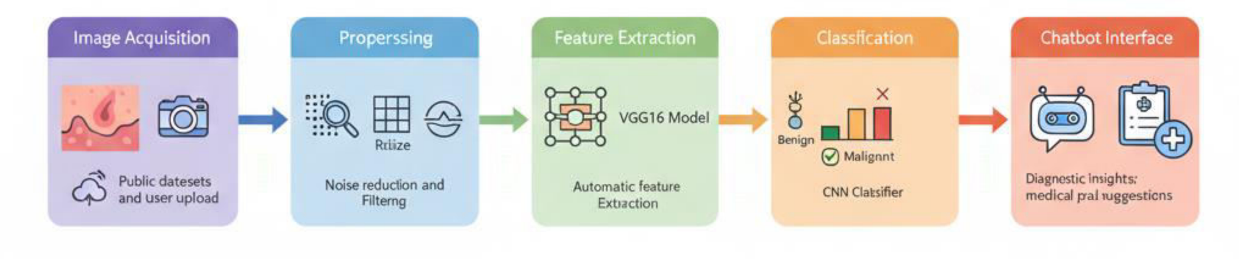
FIGURE



V. CONCLUSION

This project successfully demonstrates an AI-enabled approach for automatic skin cancer detection using deep learning. The integration of the VGG16 CNN model provides high accuracy, while the chatbot-based dermatology assistant ensures accessibility and user engagement. The system minimizes manual effort, enhances reliability, and supports early diagnosis, ultimately improving patient care outcomes.

Future enhancements include expanding the dataset for improved generalization, enabling multilingual chatbot interactions, and integrating mobile application support for wider accessibility.

VI. ACKNOWLEDGEMENTS

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REFERENCES

1) V. R. Allugunti, "A machine learning model for skin disease classification using convolution neural network," Int. J. Comput., Program. Database Manage., vol. 3, no. 1, pp. 141–147, Jan. 2022.
2) A. Kumar, A. Vishwakarma, V. Bajaj, and S. Mishra, "Novel mixed domain hand-crafted features for skin disease recognition using multi headed CNN," IEEE Trans. Instrum. Meas., vol. 73, pp. 1–13, 2024.
3) L. Liu, X. Zhang, and Z. Xu, "An adaptive weight search method based on the grey wolf optimizer algorithm for skin lesion ensemble classification," Int. J. Imag. Syst. Technol., vol. 34, no. 2, Mar. 2024, Art. no. e23049.