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AI Powered Skin Cancer Detection and Virtual Dermatology Support System using Pre-Trained CNN Algorithm

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Abstract: *This paper proposes an AI-powered system for skin cancer detection and virtual dermatology support using a pre-trained Convolutional Neural Network (CNN) algorithm. The research addresses the challenges of automatic skin cancer classification, such as the complexity and diversity of skin disease images and the interclass similarities among different skin lesions. The proposed system utilizes the VGG16 deep learning model to classify diseases with an improved accuracy rate. It also includes a chat interface to provide diagnostic information about classified diseases. The system aims to overcome limitations of existing methods, such as irrelevant feature extraction, difficulty in classifying multiple skin cancer images, misclassification errors, and the need for manual segmentation*

Keywords: CNN Algorithm, Virtual Dermatology Support System, VGG16, Chabot, NLP

I. INTRODUCTION

Skin cancer remains one of the most widespread and life-threatening diseases globally, requiring early and accurate diagnosis to improve patient outcomes. Traditional diagnostic methods are time-consuming, subjective, and often reliant on the expertise of dermatologists. To address these challenges, this project proposes an AI-Powered Skin Cancer Detection and Virtual Dermatology Support System that utilizes a pre-trained Convolutional Neural Network (CNN) model, specifically VGG16, to automate the process of skin lesion analysis and classification.

This system leverages advanced dermoscopic imaging, sophisticated image preprocessing techniques, and deep learning algorithms to enhance the reliability and accuracy of skin cancer diagnosis. It standardizes dermoscopic image acquisition, applies noise reduction and image enhancement, extracts critical features such as color and texture properties, and classifies lesions into benign or malignant categories with high precision. By integrating transfer learning techniques, the project achieves improved model performance even with specialized dermatological datasets.

Additionally, the system introduces an AI-powered Dermatology Chabot that offers virtual support by answering skin health-related queries. Using Natural Language Processing (NLP) techniques, the Chabot interprets user inputs and delivers instant, knowledge- based responses, thereby making dermatological support more accessible.

This innovative platform is developed under the guidance of academic and industry experts, combining the robust methodologies of medical imaging, artificial intelligence, and cloud-based technologies. It aims to democratize skin health diagnostics, reduce manual dependency, and enhance the overall efficiency of dermatological consultations through intelligent automation

II. CNN ALGORITHM

Convolutional Neural Network (CNN) is an advanced version of artificial neural networks (ANNs), primarily designed to extract features from grid-like matrix datasets. This is particularly useful for visual datasets such as images or videos, where data patterns play a crucial role. CNNs are widely used in computer vision applications due to their effectiveness in processing visual data. CNNs consist of multiple layers like the input layer, Convolutional layer, pooling layer, and fully connected layers.

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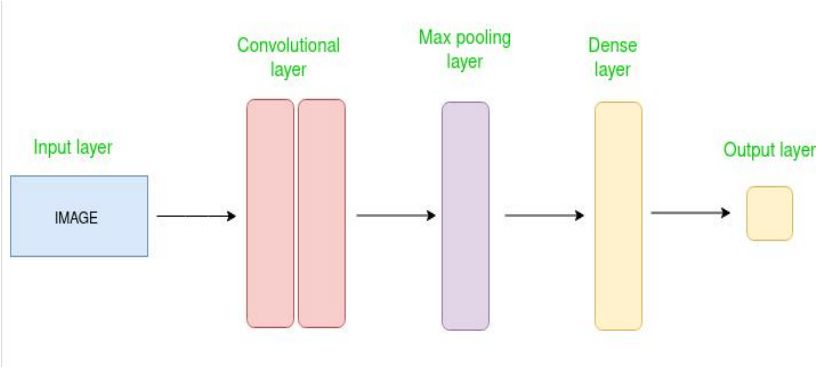

The system uses a pre-trained CNN model (VGG16) to classify skin cancer types based on dermoscopic images.
Analyzes the features extracted from images.
Predicts whether the lesion is benign or malignant.

III. VIRTUAL DERMATOLOGY SYSTEM

A Virtual Dermatology System is an online platform that provides skin-related medical support and diagnosis without needing a patient to visit a doctor physically.

- Patients upload photos of their skin lesions (like rashes, moles, spots) into the system.
- The system uses AI models (like your CNN) to analyze the images automatically.
- It predicts whether the skin issue is benign (harmless) or malignant (cancerous).
- It gives instant advice or probability-based predictions.
- If needed, it redirects the user to contact a real dermatologist for further action

IV. VGG16

The VGG-16 model is a convolutional neural network (CNN) architecture that was proposed by the Visual Geometry Group (VGG) at the University of Oxford. It is characterized by its depth, consisting of 16 layers, including 13 convolutional layers and 3 full y connected layers. VGG-16 is renowned for its simplicity and effectiveness, as well as its ability to achieve strong performance on various computer vision tasks, including image classification and object recognition. The model's architecture features a stack of convolutional laye rs followed by max-pooling layers, with progressively increasing depth. This design enables the model to learn intricate hierarchical representations of visual features, leading to robust and accurate predictions.

V. NLP (NATURAL LANGUAGE PROCESSING)

Natural Language Processing (NLP) is a field that combines computer science, artificial intelligence and language studies. It helps computers understand, process and create human language in a way that makes sense and is useful. With the growing amount of text data from social media, websites and other sources, NLP is becoming a key tool to gain insights and automate tasks like analyzing text or translating languages.

VI. EXISTING SYSTEM

Proposes image segmentation scheme based on an algorithm, Support vector Machine (SVM) and Super pixel segmentation algorithm. Implemented Principal component analysis algorithm to extract the features and also implemented unsupervised method to classify the skin diseases.

Demerits:

- Irrelevant features are extracted.
- Difficult to classify multiple skin cancer images.

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- Misclassification error can be occurred.
- Manual segmentation can be needed.

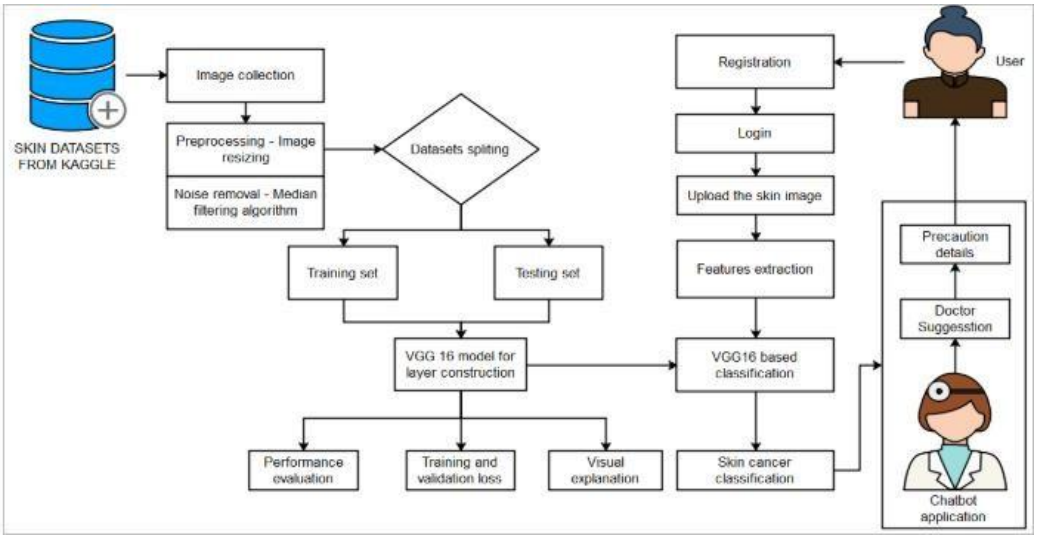
VII. PROPOSED SYSTEM

Given the rising prevalence of skin cancer and the significance for early detection, it is crucial to develop an effective method to automatically classify skin cancer. However, owing to the complexity and diversity of skin disease images, achieving automatic classification of skin cancer is challenging. First of all, different skin lesions have lots of interclass similarities, which could result in misdiagnosis So implement deep learning algorithm named as VGG 16 model to classify diseases with improved accuracy rate. And also provide the diagnosis information about classified diseases with Chabot interface.

Advantages of Proposed System:

- Extract the all features.
- Dimensionality can be reduced.
- Improve the classification accuracy.
- Automated classification of multiple skin cancers.
- AI driven chat interface of skin cancer related questions.

VIII. SYSTEM ARCHITECTURE DIAGRAM



IX. MODULES

1). Dermatology images:

In this module, we can input the dermoscopic skin images to analyze the diseases. Dermatoscopy is the examination of skin lesions with a dermatoscope. Also known as dermoscopy or epiluminescence microscopy, it allows for inspection of skin lesions unobstructed by skin surface reflections.

2). Removal of Noise:

Pre-processing is a common name for operations with images at the lowest level of abstraction both input and output are intensity images. In this module, resize the image and also implement median filtering algorithm to remove the noises in images.

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3). Features Extraction:

Feature extraction involves simplifying the amount of resources required to describe a large set of data accurately. In this module implement color and texture features are implemented. HSV color features are extracted and Texture features include statistical features.

4). Model Build:

The core of the model construction lies in the utilization of the VGG16 pre-trained architecture, renowned for its efficacy in image classification tasks. The architecture comprises a stack of convolutional and fully connected layers, enabling robust feature extraction from complex patterns within the skin cancer images. The final layers of the model are adjusted to accommodate the specific number of classes relevant to the skin cancer classification task. Following model construction, the next steps involve training the model on the prepared dataset. This training process entails adjusting the model's internal parameters using backpropagation and gradient descent to optimize its ability to accurately classify skin cancer images.

5). Classification:

The classification is the final step of the system. After analyzing the structure, each section individually evaluated for the probability of true positives. Skin diseases are classified using VGG 16 model in convolutional neural network model. So our proposed work overcomes irregular boundaries separation in skin image classification with improved accuracy.

6). Chat Application:

In this module, we can design the framework as Chat interface based on this interface, user input the questions related to skin diseases. Implement Natural language processing techniques to extract the keywords and provide the answers based on keywords.

7). Employee Review:

This module gives the registration process with the technical team details of name, email id, contact number, date of birth, address and password. With this, the technical team can log in to the technical home page. Then he can able to view the complete details of both freelance and in-house employee details. Next he also have an option to view full client details. Then he gets the input data from client and do the analyzing process and does the prediction. Here they will predict the best budget for the client. Then he will sent the pricing details to the manager / admin for further process.

X. CONCLUSION

The proposed system addresses the critical need for an effective and automated method to classify skin cancer, driven by the increasing prevalence of the disease and the importance of early detection. The solution leverages the VGG16 deep learning algorithm to achieve improved accuracy in classifying skin diseases and incorporates a Chabot interface to provide diagnostic information. This innovative approach aims to overcome the challenges posed by the complexity and diversity of skin disease images, including interclass similarities that can lead to misdiagnosis. By extracting all relevant features, reducing dimensionality, and automating the classification of multiple skin cancers, the system offers significant advantages over existing methods. Furthermore, the AI-driven chat interface enhances user interaction by providing immediate access to skin cancer-related information.

XI. FUTURE WORK

The proposed AI-powered skin cancer detection system using the VGG16 model demonstrates promising results, but several avenues for future enhancement can further improve its efficacy and applicability. One key direction is the integration of more advanced deep learning architectures, such as ResNet, Efficient Net, or Vision Transformers (ViTs), to potentially achieve higher accuracy and robustness in classifying diverse skin lesions. Expanding the dataset

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to include a wider variety of skin tones and rare dermatological conditions would address current limitations related to bias and generalizability. Additionally, incorporating real-time image analysis capabilities for mobile applications could enhance accessibility, enabling users in remote areas to receive preliminary diagnoses without specialized equipment.

Another critical area for future work is the enhancement of the Chabot interface using state-of-the-art natural language processing (NLP) techniques, such as transformer-based models (e.g., BERT or GPT), to provide more accurate and context-aware responses to user queries. Multilingual support could also be added to cater to a global audience. Furthermore, integrating telemedicine features, such as live consultations with dermatologists, would bridge the gap between automated diagnosis and expert validation, ensuring comprehensive patient care.

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