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Skin Disease Detection Using CNN

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Abstract:

Globally, skin diseases affect many people. Treatment and care for these diseases can only be effective if detected early and accurately. Machine learning and computer vision have advanced to the point that convolutional neural networks (CNNs) are now powerful tools for automatically detecting skin diseases. A study on the application of CNNs to skin disease detection is presented, demonstrating the potential of deep learning algorithms to aid dermatologists and healthcare professionals. An image dataset containing images of various skin diseases is used in the proposed method, including dermatitis, eczema, psoriasis, and other common conditions. High-level representations are captured from input images using a pre- trained CNN (Convolutional Neural Network) model, such as VGG-16. For disease detection, these learned features are fed into a classification layer. The CNN model learns to identify patterns that correspond to the various diseases after being trained on a vast collection of skin photos. An image of skin disease is fed into the model, and the model is trained to extract features that can be used to build a classification model that can accurately identify the disease..

Key Words: Skin disease detection ,CNN, techniques Image processing, python, Deep learning

1. INTRODUCTION

Skin diseases represent a significant burden on global healthcare systems, affecting millions of individuals worldwide. From common conditions such as acne and eczema to more severe disorders like melanoma, the prevalence and diversity of dermatological ailments underscore the pressing need for accurate and timely diagnosis. Traditional diagnostic approaches in dermatology rely heavily on visual inspection by trained clinicians, often leading to subjective assessments and variability in diagnosis. Moreover, limited access to specialized dermatologists in certain regions exacerbates disparities in healthcare delivery, hindering timely intervention and treatment. In response to these challenges, there has been growing interest in leveraging artificial intelligence (AI) and machine learning techniques to develop automated systems for skin disease detection. Among these, Convolutional Neural Networks (CNNs) have emerged as a powerful tool, capable of extracting intricate patterns and features from medical images with remarkable accuracy. CNNs' ability to learn hierarchical representations directly from raw image data makes them particularly well-suited for image classification tasks, including dermatological diagnosis. In this paper, we present a comprehensive investigation into the application of CNNs for skin disease detection. Our research aims to address the limitations of traditional diagnostic methods by harnessing the potential of CNN to automate and improve the accuracy of skin disease diagnosis. We begin by providing an overview of common skin diseases, highlighting their impact on individuals and healthcare systems. We then discuss the significance of early detection and the challenges associated with current diagnostic approaches. Subsequently, we introduce CNNs as a promising solution and review existing literature on their use in dermatological diagnosis. Finally, we outline the objectives and methodology of our study, emphasizing the importance of robust dataset curation, model development, and evaluation metrics. Through this research, we endeavor to contribute to the advancement of computer-aided diagnosis in dermatology, ultimately enhancing patient outcomes and healthcare delivery.

2. BODY OF THE PAPER

1. Skin diseases are common and can be dangerous if not treated early. Detecting them quickly is important. CNNs help by analyzing images and identifying skin problems automatically.
2 .A custom CNN was built with layers that detect patterns in the images. It had convolution, pooling, dropout, and fully connected layers. The final layer predicts the disease type.
3. The model shows that CNNs are useful for skin disease detection. They can help doctors diagnose faster and more accurately, especially in areas with few specialists.

Key Functional Modules

a. Image Input Module, Preprocessing Module ,Data Augmentation Module, CNN Feature Extraction Module ,Classification Module, Prediction Module

b. . User Interface Module (Optional)

Displays the prediction result to users through a simple interface (web or mobile).

Training and Evaluation Module

Trains the CNN model using labeled data and evaluates performance using accuracy, precision, recall, etc.

System Design

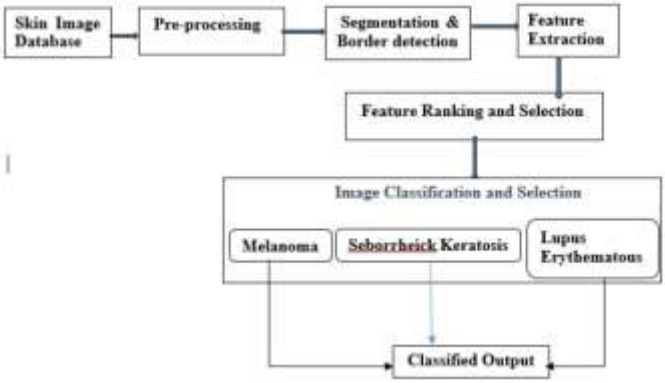
Skin image datasets (e.g., ISIC)

1. Image pre processing tools (resize, normalize, clean)
2. CNN model (for feature extraction and classification)
3. Deep learning frameworks (Tensor Flow, P y Torch)
4. GPU/Cloud systems (for fast training and prediction)
5 Soft max output layer (to predict disease class)
6 Evaluation metrics (accuracy, precision, recall

Table -1:

Year	Study/Project	Summary
2023	Sardin, S – The Guide Note-Taking Learning Model Effectively Improves studies' Mathematics Learning Creativity.	The study used a quantitative research approach with an experimental design. - Participants were divided into control and experimental groups.
2022	M.K. Shahzad- A Deep Learning Approach Based on Explainable Artificial Intelligence for Skin Lesion Classification	A deep learning model was developed for skin lesion classification. - The model utilized Convolutional Neural Networks (CNNs) for feature extraction and classification.
2023	Agarwal-"Skin Disease Classification Using CNN Algorithms" EAI Endorsed Transactions on Pervasive Health and Technology.	**Dataset**: Utilized a collection of over 25,000 images covering eight common skin conditions: dermatofibroma, melanocytic nevus, melanoma, and vascular lesion

Existing Block Diagram



Proposed Block Diagram

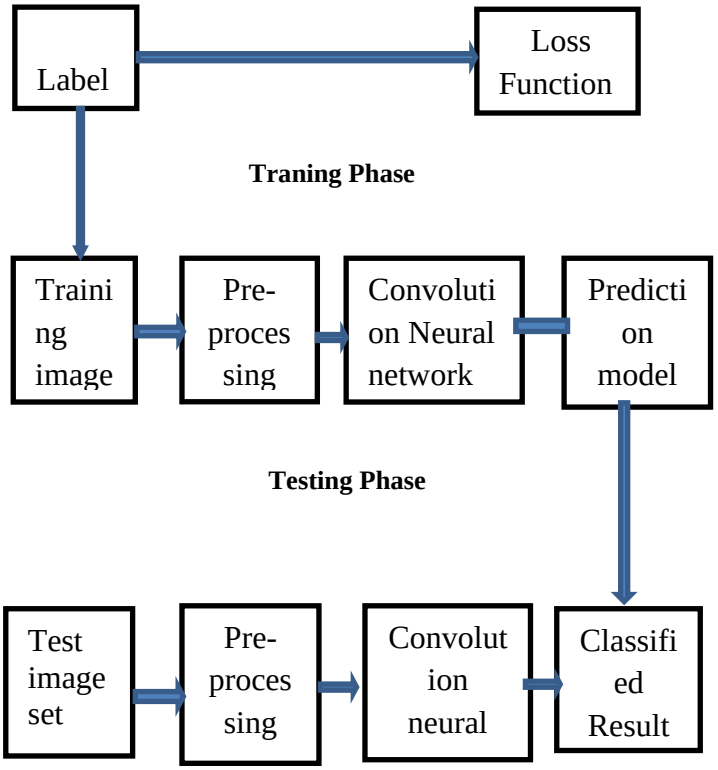


Fig -1: Figure

A Theoretical Perspective

Step 1 :(image pre-processing): In order to improve speed and model generalizability, we concentrated on simplifying the preprocessing processes in Stage 1 of our work on employing CNNs to classify skin diseases. To mitigate potential fluctuations in image contrast, a normalization method during training was introduced, scaling pixel values to a range between -1 and 1. In order to optimize the CNN model's training procedure for enhanced performance on a variety of skin lesion images, this method simplified the preprocessing step.

Step 2 (feature extraction): Six CNN models were used for feature extraction in Stage 2: Xception, ResNet50, DenseNet201, InceptionV3, VGG19, and Inception Resnet. Low-dimensional vectors of extracted features were used in place of retraining the models, which resulted in a considerable reduction in training time. With its numerous layers, CNN models are excellent at extracting features. By using convolutional and pooling layers after one another, they are able to capture geometric, edge, color, and texture features. While pooling layers perform thresholding and dimension reduction, convolution layers use digital filters.

Step 3 (metadata pre-processing): This removes missing data from the clinical data. Mostly the demographic features are finitely created categorical variables, represented as "strings" or "categories." The characteristics of these categories are converted to the categorical data format via one-hot encoding. For every floor within a It was decided to introduce a new

variable named category feature. A binary variable with the values 0 or 1 was allocated to each category.

Stage 4 (feature concatenation): In this stage, the information and picture features are combined to create a single feature vector. Initially, we fed the previously edited images of skin conditions into CNN's models. Convolutional, pooling, and auxiliary layers are used by CNN models to extract deep features.

Step 5 (skin lesion classification): The produced concatenated characteristics are given into a variety of machine learning classifiers. All of the skin lesion photographs were eventually divided into seven classes.

3.

YSTEM ARCHITECTURE

The system architecture for skin disease detection using Convolutional Neural Networks (CNN) is designed to handle the complete pipeline from image input to final disease classification. It consists of several interconnected modules that work together to ensure accurate and efficient diagnosis. The architecture includes the following key components:

1. **Image Acquisition Module**
   This module captures or receives input images of skin lesions. The images can be collected using digital cameras, dermatoscopes, or mobile devices. These images serve as the raw input data for the system.
2. **Preprocessing Module**
   Preprocessing is a critical step to standardize the input data. It includes resizing all images to a fixed size (e.g., 224×224 pixels), normalizing pixel values to a 0–1 scale, and removing noise such as hair or shadows using filtering techniques. Data augmentation techniques like rotation, flipping, and zooming are also applied to artificially expand the dataset and improve model generalization.
3. **CNN-Based Feature Extraction Module**
   The core of the architecture is a deep Convolutional Neural Network that automatically learns important visual features from the preprocessed images. The CNN contains multiple layers, including:
   - Convolutional layers for feature detection
   - ReLU activation layers for introducing non-linearity
   - MaxPooling layers for dimensionality reduction
   - Dropout layers to prevent overfitting
4. **Classification Module**
   After feature extraction, the output is passed to fully connected layers that interpret the learned features. The final output layer uses a softmax activation function to provide probabilities for each skin disease class. The class with the highest probability is selected as the final prediction.
5. **Model Training and Optimization Module**
   During development, the system is trained using labeled skin disease datasets. The training uses an optimizer like Adam and a loss function such as categorical cross-entropy. Model performance is validated using a separate test set and evaluation metrics such as accuracy, precision, recall, F1-score, and AUC.
6. **Output and User Interface Module**
   The final prediction is presented to the user, which could be a doctor or patient, through a graphical user interface (GUI) or command-line output. The result includes the predicted disease type and the confidence score.
7. **ExecutionEnvironment**
   The system is implemented using deep learning frameworks such as TensorFlow or PyTorch. It runs on a local machine with GPU support or cloud platforms for scalable deployment. For user interaction, optional front-end components may include a web or mobile application.

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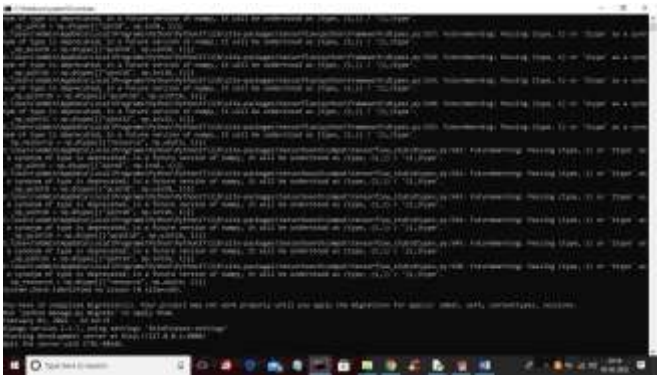
RESULTS:

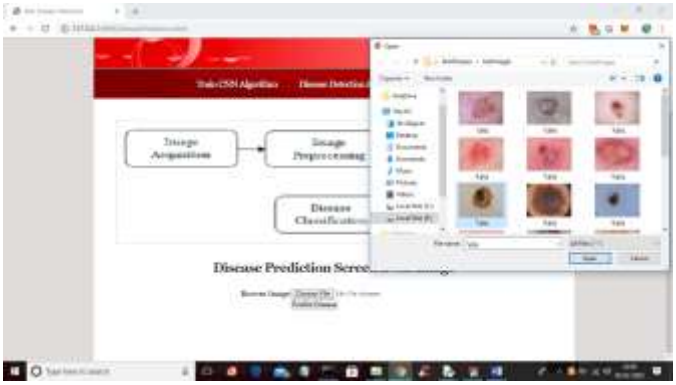
To run project double click on 'run.bat' file to start DJANGO web server and to get below screen



In above screen DJANGO server started and now open browser and enter URL as http://127.0.0.1:8000/index.html and press enter key to get below screen

In above screen click on 'Register Here' link to get below signup screen.

In above screen user is enter signup details and then press 'Register' button to complete signup process and to get below output.



In above screen selecting and uploading '7.jpg' and then click on 'Open' button to load image and then click on 'Predict Disease' button to get below output.

In above screen in blue colour text we can see CNN classify disease on image as 'Melanoma' and similarly you can upload and test remaining images

4. CONCLUSION

The majority of the human body is made up of skin. The most prevalent cause of illness in humans is skin conditions. In India, skin illnesses are a major burden and are growing daily. We have developed a skin disease detection system employing image processing and CNN (Convolutional Neural network) to lessen the development and spread of skin illnesses. The burden is caused by infectious diseases and infectious diseases. Since this illness identification model is based on a Python prototype, some results may be missing, but overall, the findings are between 80 and 90 percent accurate. Clinical methods can be time-consuming and may not always yield an accurate diagnosis, which is why the system was created. For this reason, these methods are excellent for identifying skin conditions. The function of CNNs and other image processing algorithms in the accurate and efficient diagnosis of skin disorders is discussed in this paper. Five diseases are listed and categorized in this article. Here, we provide a concise overview of the system and implementation technique for identifying skin diseases.

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BIOGRAPHIES

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