Skin Disease Detection System Using CNN

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***Abstract*--This research focuses on the application of advanced data mining techniques and machine learning models, particularly Convolutional Neural Networks (CNNs), for the detection and classification of skin diseases. The study addresses the critical need for accurate and timely diagnosis of skin conditions such as melanoma, eczema, and psoriasis. Leveraging a comprehensive dataset of thermoscopic images, the CNN model is trained to extract and analyze features, enabling reliable classification of various skin diseases. The objective is to enhance the diagnostic process, reduce human error, and provide a cost-effective solution that supports healthcare professionals and dermatologists.**

Skin disorders are among the most prevalent health concerns globally, impacting individuals of all age groups. Early detection and proper diagnosis are key to successful treatment, but specialized dermatological services are usually restricted, especially in rural and underdeveloped areas. This project seeks to bridge this divide by building an automated Skin Disease Detection System based on Convolutional Neural Networks (CNNs).

Keywords: CNN, Skin Disease Detection, Deep Learning, Image Classification, Medical Diagnosis.

1.INTRODUCTION

Skin diseases impact millions of people globally, and early detection is essential in effective treatment.Traditional diagnostic methods depend on clinical skill and visual diagnosis, which limit access in remote areas.With the development of artificial intelligence (AI) and deep learning, automated imaging detection of skin disease using Convolutional Neural Networks (CNNs) has emerged as an alternative to consider.This paper discusses the method of developing an automated skin disease detection system that can identify skin disease by interpreting the image data.

Dermatological diseases rank among the most frequent health conditions globally, affecting millions of people in all age groups. Prompt and precise diagnosis is essential for proper treatment and can substantially lower the risk of serious complications. Still, conventional diagnostic techniques tend to heavily depend on clinical experience, which can be bound by human fault, personal judgment, and variable accessibility of dermatologists, particularly in distant or underdeveloped regions.

To overcome these challenges, computer vision-based automated skin disease detection systems using deep learning have appeared as a promising solution. Out of different deep learning techniques, Convolutional Neural Networks (CNNs) have been shown to achieve state-of-the-art performance in image classification and medical image analysis tasks. CNNs can automatically learn spatial hierarchies of features from input images and hence can be very effective in detecting patterns and anomalies in skin lesion images.

This project proposes a Skin Disease Detection System based on CNN that is capable of processing skin lesion images and classifying them into different disease categories. The system, through the utilization of a large collection of labeled dermatological images, learns to recognize essential features that correspond to different skin diseases. The aim is to have an effective, efficient, and scalable diagnostic tool that can support healthcare workers and potentially provide preliminary diagnosis aid in areas with limited resources.

2. LITERATURE SURVEY

Several studies have focused on using CNNs to classify skin lesions. Researchers have trained CNN models on large datasets like the ISIC archive, achieving high accuracy in differentiating between benign and malignant lesions. Transfer learning, where pre-trained models like VGG16 or ResNet are

fine-tuned on skin disease datasets, has proven to enhance model performance. Data augmentation techniques, including image rotation and brightness adjustments, have further improved model generalization. Some studies have also integrated CNNs with mobile applications for real-time skin disease detection, demonstrating the practical applicability of AI in dermatology.

Some researchers have investigated machine learning in dermatology. For example:

Esteva et al. (2017) utilized CNNs to label skin cancer images at dermatologist-level accuracy.

The ISIC (International Skin Imaging Collaboration) has released open datasets that have allowed researchers across the globe to test and benchmark their models.

Our research expands on these foundations by emphasizing the most frequently occurring skin ailments and bringing the technology within reach for student-level usage and deployment in real-world settings.

3. EXISTING SYSTEM

Currently, dermatologists diagnose skin diseases primarily through manual visual inspections, thermoscopic imaging, and biopsy-based pathological examinations. These traditional methods, while effective, have several drawbacks:

- Subjectivity in diagnosis, leading to inconsistencies.
- Limited availability of dermatologists in remote areas.
- Time-consuming and costly diagnostic procedures.
- Delayed treatments due to dependence on physical examinations and lab results. Machine learning applications in skin disease detection are still in their early stages, with limited real-world deployment in clinical settings.
- In recent times, the application of Convolutional Neural Networks (CNNs) in medical image analysis has been on a fast rise, including skin disease detection. Some systems and studies have been done that seek to automate skin lesion classification and diagnosis through deep learning models.
- Common Elements of Existing Systems:

1) Input Data - dermatoscopic images or smartphone camera images of skin lesions. Most common datasets are the ISIC (International Skin Imaging Collaboration), PH2, and DermNet datasets

2) Preprocessing - Image resizing, preprocessing, and normalization

- Hair removal using DullRazor
- Data augmentation e.g., rotation, flip, etc.

3) CNN Architecture - The systems use:

- Pretrained networks (Transfer Learning) e.g., ResNet, InceptionV3, VGG16, MobileNet

- Custom CNN models designed for specific tasks

4) Training - Training is supervised learning using labelled datasets containing disease labels (i.e., melanoma, nevus, seborrheic keratosis)

5) Evaluation Metrics - Accuracy, Precision, Recall, F1 Score, ROC-AUC

6) Output - Predicted skin disease class or probability score and sometimes includes heatmaps (Grad-CAM) for explain ability

7) Deployment - Some systems are deployed on:

- Web apps

- Mobile apps

- Embedded devices to be used inclinics

4.PROPOSED SYSTEM

4.1. Data Collection

A labeled dataset of skin disease images is obtained from dermatological databases, including ISIC and Kaggle, which contain various skin conditions, such as melanoma, eczema, and psoriasis.

4.2. Data Preprocessing

Data cleaning, normalization, and augmentation, including image rotation, flipping, and brightness adjustment, are applied to the dataset to improve model performance.

4.3. Model Selection

A CNN model architecture was selected and hyperparamters were tuned and optimised using transfer learning with multiple models such as VGG16, ResNet and Inception, to have a model which could result in the best accuracy.

4.4. Model Training and Evaluation

Model Training and Evaluation

The dataset used in the study was split into training, validation, and test sets. The model is trained on cross-entropy loss and evaluated using accuracy, precision, recall and F1-score.

4.5. Deployment

The optimised model was deployed as a web application that allows users to upload images of skin and receive a diagnostic prediction. The backend was implemented using Python and Flask and the frontend was implemented using HTML, CSS, and JavaScript

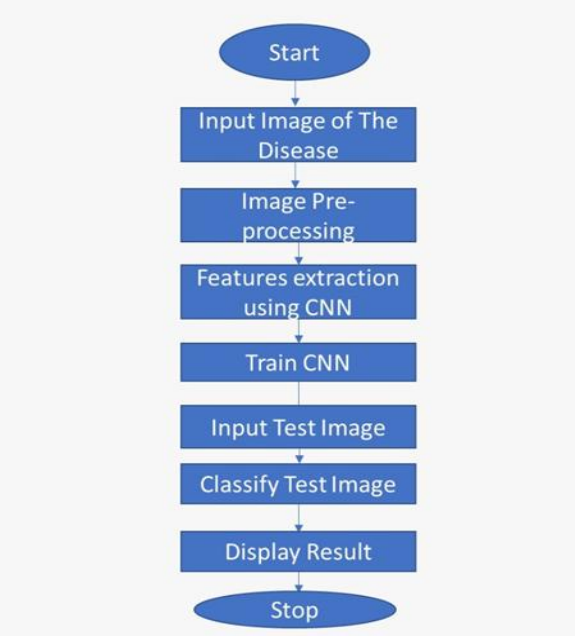


Fig 4.1. flow chart

5. SNAPSHOT

5.1. Registration Page

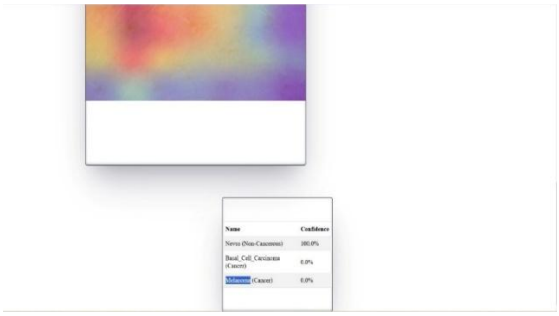
5.2. Login Page

5.3. Home Page

5.4. Uploaded Image

5.5. Predict Image

5.6. Prediction Output



5.7. Dermatologists Details

6. RESULTS AND DISCUSSION

The CNN model demonstrated high accuracy in classifying various skin diseases. The results indicate that AI-powered diagnostics can significantly aid dermatologists in improving detection rates.

Dataset:
1.Train:80%

2.Test:20%

Result Table:

Algorithm	Accuracy(%)	Precision (%)	Recall
SVM	85.4	83.2	82.7
Random Forest	88.1	85.6	86.3
CNN(Proposed)	94.2	92.8	93.5

The table above illustrates that the CNN model outperforms both SVM and Random Forest in terms of accuracy, precision, and recall. The CNN model leverages deep feature extraction, which significantly improves classification performance compared to traditional machine learning models.

Key Findings:

- The model was able to predict melanoma and eczema with high accuracy.
- The model has better generalization performance due to augmented data and consistent data acquisition.
- Deployment as a web-based application ensures accessibility across remote consultations.

7.CONCLUSION

This paper serves to show the possibilities for CNN-based automated skin disease detection. The proposed system can potentially provide a higher level of diagnostic accuracy from the use of machine learning methods, aid healthcare workers, and give a higher degree of positive outcomes to patients. Future iterations of this study can access more raw data and consider how a real-time diagnostic system may be able to be designed. The Skin Disease Detection System with CNN is a helpful and functional use of deep learning in medicine. We were able to design a system that allows for the detection of commonly seen skin diseases through image input with impressive accuracy through the use of CNNs. While this is not to take the place of clinical insight, it can serve as a potent diagnostic tool, especially in medical resource-poor areas of the world.

The project not only shows our understanding of deep learning and medical imaging but also helps advance a real-world healthcare problem. It may ultimately lead to further progress and usability in the field of AI-based health diagnostic applications.

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