

INNOVATIVE APPROACH FOR DERMATOLOGICAL DIAGNOSIS: DISTINCT BASED MULTI-MODAL FUSION OF AI

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ABSTRACT

This Paper Presents a novel approach for diagnosing various skin problems (Eczema, Psoriasis, Acne, Fungal infections, Rosacea) using dermoscopic images. The real challenges are the accurate level of prediction on skin disease is in poor condition. The traditional diagnosing methods won't give accurate result. With the use of Conventional Neural Network algorithm various image data sets taken as input and go for deep analysis with multi-modal techniques such as clinical images, patient history, and laboratory results and etc. Especially digital dermatology has been evolved for validating the dermoscopic images and produce accurate assessment, prediction of skin images. We discuss multimodal fusion of AI with Dermatology for future accurate diagnosing report, prediction of Skin lesions and diseases.

Keywords: Artificial Intelligence, Conventional Neural Network(CNN), Deep Learning, Dermatology, Multi Modal Fusion, Data Integration, Feature Extraction, Classification.

I. INTRODUCTION

As in the present world, the health care sector also has advancement in digitally. Especially in the diagnosis of skin care diseases, clinical Dermatology to digital Dermatology's in many aspects such as detecting basic skin diseases like Eczema, Acne, Fungal infections, Rosacea, Psoriasis and etc[1]. Artificial Intelligence can play a vital role in digital dermatology in quick finding level of skin infection, analyzing digital images, Report generation, Medicine Prescription for ordinary problems. [2]

But in the above method is categorized into Single Modal technology based on all clinical images taken for digital analysis [3]. Here the AI will only analysis the input of clinical images, so that prediction of result is limited based on limited clinical images.

II. RELATED WORK

For analyzing the dermatological disease, first we need to train the various algorithms with the data set. [4]. There are two kinds of dataset. One of the dataset is the Original image capture through clinicians and other images taken from web. The following are some of the web data sets which having number of skin disease images such as ISIC (International Skin Imaging Collaboration), ham10000, An Atlas of Clinical Dermatology, DermNet, VisualDx, DermExpert and etc[5].

The following are the some skin disease types such as Rosacea, Eczema, and Acne. These Skin disease images were taken for image analysis using Conventional Neural Network (CNN) algorithm.

2.1. Rosacea Skin disease



Fig.1. Image of Rosacea Skin affected face

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In the above Rosacea skin disease, while analyzing the skin image using AI, there are some issues arise in prediction of result because the trading of data set is only Single Modal type.

2.2 ECZEMA

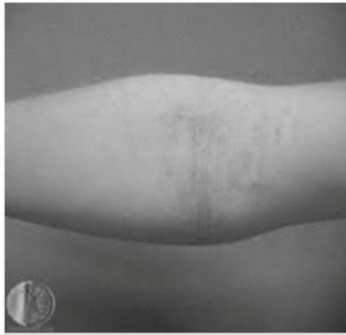


Fig.2 Image of Eczema Skin affected Hand

Eczema skin disease is one of the common skin problem will appear due to heat. Its symptoms are cracked skin in red color [6]. Other symptoms are fluid comes from the affected portion of the skin, when the skin disease become worse.

In these cases, the AI CNN algorithm has used to analyze the patches of skin, analyze pixel by pixel of the given image data set by producing the level of issues in very quick report. Even though we achieve quick report of single modal type, it is also a narrow report not considering the various factors of the eczema skin affected patient.

2.3 ACNE

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Fig.3: Image of Acne Skin Disease

Another common problem of skin disease, most of the people affected is Acne skin disease. This let to worst look of face, increasing negative mind thoughts about their beauty and etc. AI based CNN algorithm used to understand and analysis patient's different type of skin lesions [7, 8, and 9].

By this analysis, AI can detect automatically the level of diseases and suggest prescription, leads to identify the skin disease type, level of disease, and suggest what treatment can do. The trained algorithm CNN and Deep learning algorithm will predict the disease and give automatic solution [10, 11, and 12]. As today we are having Digital AI Apps (Digital Dermatological & Tele-Dermatological) where patient they scan the skin part to be checked. Here lot of problems identified by AI algorithm, analyzing the accurate level of the given input images. If the input images are not in the standard condition, AI won't detect and predict the accurate values. Hence, we need to follow standard input image, then AI will prediction of the various report which helpful to both patient and dermatologists.

The following table dataset is used to train the AI for comparison of Input Image and prediction and report generation for any suggestion:

Dataset Name	No of Trained Images	Prediction
Dermnet from Kaggle	312 Acne, Rosacea Images	Quick Analysing and predicting prescriptions by similarity Skin Lesions.
Dermnet from Kaggle	Eczema	Comparing Skin Lesions

HAM10000_images	collection of 10000 multi-source	Multi-source dermatoscopic images of common pigmented skin lesions
Dermoscopic Images	>10000 Images	Melanoma Versus Melanocytic nevi

Table.1 Dataset & Prediction

III. METHODOLOGY

While using Single Modal concept of Artificial Intelligence analyzing various Images through different layers of Neural Network by the Input, Hidden and Output layer in analyzing the type and output result of skin Disease[13,14]. But the prediction is not having great accuracy. The following diagram using the general Neural Network Layers.

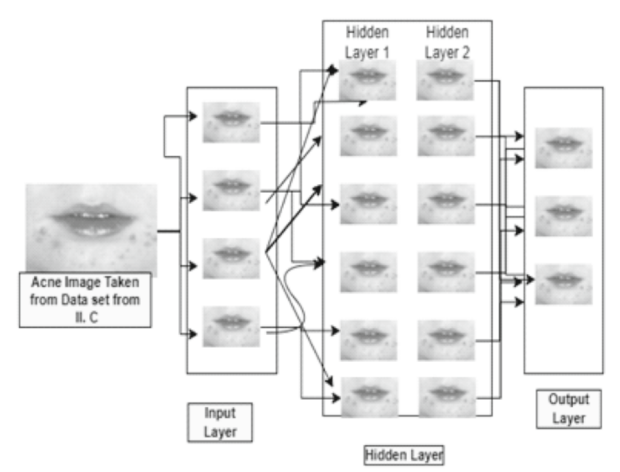


Fig.4 General Neural Network Layers

3.1 In a regular Neural Network there are three types of layers:

To increase the Single Modal concept in AI dermatology, we involve the CNN algorithm to easily identify the type of skin problem and prediction of various problems [15, 16].

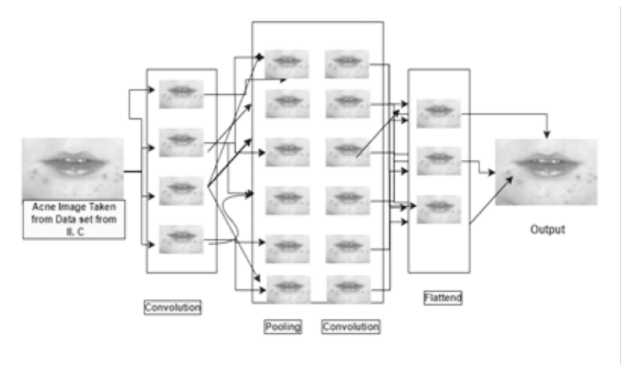


Fig.5 CNN Network Layers

The above Acne image is involved and extract image features by filters and separated into a matrix format. Then the next step is rectified linear map with setting non negative value to zero.

$$R(Z) = \max(0, Z)$$

After pooled convolution filter process is over, we need to arrange the filter images in a matrix arrangement known as flattened. At last the final filtered extraction of depth of accurate image analysis result is found.

IV. RESULT ANALYSIS OF MULTI MODAL FUSION AI WITH CNN

The following are the various key features in collection of data and preprocessing feature extraction from different modalities, multi-modal fusion, and classification. To achieve distinct multi-modal we collect clinical images, patient history, and laboratory results from electronic health records (EHRs) and preprocess them to ensure compatibility and consistency [17]. Next, we extract relevant features from each data modality using specialized techniques tailored to the nature of the data. These features are then fused using a distinct-based approach, which preserves the unique characteristics of each modality while capturing complementary information. Finally, we train a machine learning classifier on the fused feature representation to perform skin disease diagnosis.

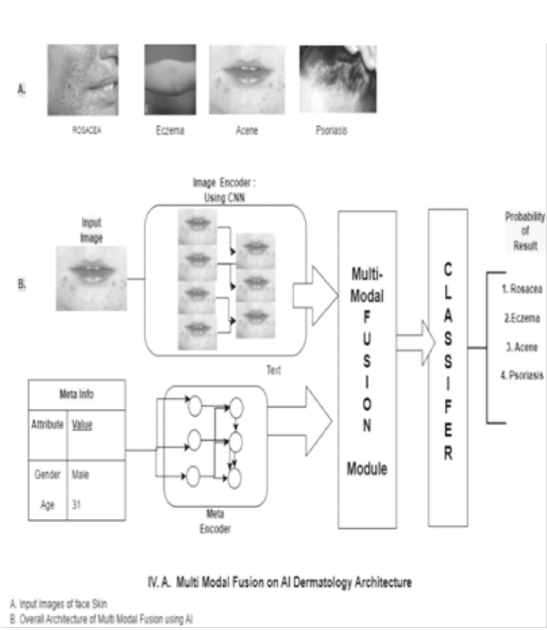


Fig.6 Multi modal fusion of AI Dermatology Architecture

In the above diagram (Multi modal fusion of AI Dermatology Architecture) A deep neural network was developed with two extraction filter, one of them is information from image data from the Original collection through Mobile Application or Clinical Medical Tools and another metadata from the Public dataset domain. In this multimodal fusion, we need to train on the public dataset with Distinct Modalities for most accurate prediction and

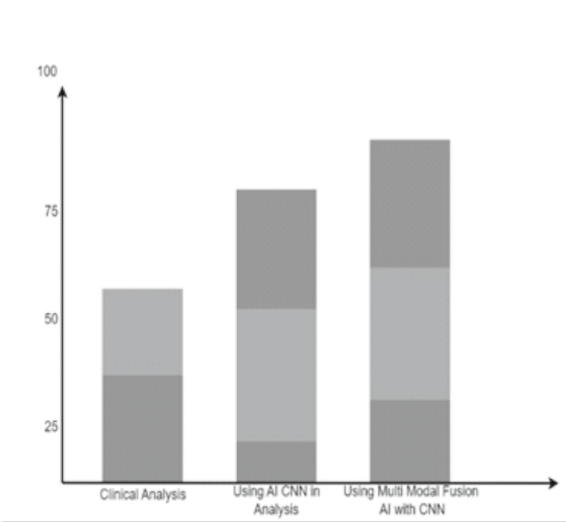


Fig.7 Analysis after using Multi modal fusion

with CNN

So that we use multimodal fusion module effectively cross check and combine image features and Meta features for analyzing and reproducing the report as quick and more accuracy of predictive results.

V. CONCLUSION

For achieving the new standards in analyzing the skin lesions AI has to upgrade with Multi Modal Fusion technology by get together Skin Lesions input, Patient Other information (age, skin type, place of living) and International Skin Lesions data set for related comparison. With this we can achieve quick report generation and accuracy level will be high.

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