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Deep Learning-Based Detection of Atopic Dermatitis from Whole-Body

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ABSTRACT

Atopic dermatitis (AD) is a chronic inflammatory skin disease that causes red, itchy, inflammatory lesions and is heavily exacerbated by environmental factors. An early and accurate diagnosis is fundamental to commencing the appropriate therapy and preventing complications. It detect atopic dermatitis from generic dermatological images automatically using convolutional neural networks (CNNs). Pre-trained DenseNet201 architecture is used on a collection of high-resolution skin images labeled "Atopic Dermatitis" and "Healthy". To improve generalization, the data is undergoes pre-processing methods including normalization, de-noising and augmentation techniques. The model is evaluated on strong performance metrics of accuracy, precision, recall and F1-score. The entire pipeline is deployed using stream lit through an interactive web application enabling users and medical professionals to make real-time predictions .

Keywords*: Atopic Dermatitis, DenseNet201, Deep Learning, Classification, Skin Disease Detection, CNN, AI in Healthcare, Image Preprocessing.*

OBJECTIVE:

Atopic dermatitis is known as eczema its a skin condition occur due to weak skin barrier which causing itchiness to a skin .the condition of atopic dermatitis symptoms from childhood to adulthood dryness, cracking, crusting .most of the individuals doesn't know about the atopic dermatitis. Therefore, the goal is to acquire a convolutional neural network architecture capable of properly classifying images as either healthy or suffering from atopic dermatitis, particularly DenseNet201. This involves compiling a clean and well-distributed dataset, pre-processing images to fit model requirements and hyper-tuning the model for binary classifications. Furthermore, Streamlit will be utilized to integrate the system into an interactive web application to allow users, both patients and practitioners, to upload skin images for real time diagnoses.

LITERATURE SURVEY:

[1] A Study on the Classification of Atopic Dermatitis by Spectral Features of Hyper spectral Imaging . The paper focuses on using hyperspectral imaging (HSI) to analyze eczema (skin redness) and identify the damages of atopic dermatitis (AD). They analyzed variety of classification and techniques like DenseNet121 and linear discriminant analysis (LDA), to determine HSI measures the severity of Atopic Dermatisis. the accuracy and impartiality of AD severity categorization can be improved by combining analytical methods the accuracy around 90 % less compared to Densenet 201.

[2] "Performance Analysis and Feature Extraction for Classifying the Severity of Atopic Dermatitis Diseases" The author represent variety of color spaces, including RGB, HSV, and LAB, which are frequently employed in image processing due to their capacity to efficiently capture color-related patterns, to extract features from skin photos. A Gradient Boosting classifier, a machine learning model for the effectiveness in handling classification tasks and Performance Analysis and Feature Extraction for Classifying the Severity of Atopic Dermatitis Diseases. The accuracy score around 93.14% high degree of dependability.

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[3] "Possibilities of Differential Diagnosis of Atopic Dermatitis and Rash in COVID-19 Using Telemedicine Technologies" This study says the use of digital dermato scopy and telemedicine platforms to differentiate between skin rashes caused by COVID-19 and resulting from atopic dermatitis. and how the telemedicine technologies can enhance the visualization and diagnosis of skin conditions .

[4] "Evaluation of Atopic Dermatitis Severity Using AI" To classify these categories, the paper shows with the five pre-trained convolutional neural network (CNN),ResNet50, VGGNet19, MobileNetV3, and EfficientNetB0. These models were fine-tuned and evaluated for their effectiveness in Atopic Dermatitis classification. overall these models achieved an accuracy around 85.6% .

[5] Automatic Scoring of Atopic Dermatitis Using Deep Learning Atopic dermatitis is a skin condition for which monitoring the course of the disease and the effectiveness of treatment depends on an accurate assessment of AD severity. Despite its widespread use, the Scoring Atopic Dermatitis (SCORAD) index has drawbacks, such as being time-consuming (7-10 minutes per patient) and inconsistent because of subjective evaluation.
In order to address these problems, scientists created Automatic SCORAD, which automatically evaluates the severity of a disease by Analyzing skin lesion images using convolutional neural networks (CNNs). By lowering interobserver variability, this AI-based system produces results that are quicker, more objective, and more trustworthy than expert assessments.
[6] Machine Learning Based Predictions Model for Atopic Dermatitis and Evaluation In order to identify important model genes, this study combined four microarray datasets related to AD (GSE133477, GSE32924, GSE58558, and GSE107361) and used Robust Rank Aggregation (RRA) and protein-protein interaction (PPI) analysis. A number of diagnostic models were created and tested on separate datasets using the LASSO, Random Forest (RF), and Logistic Regression (LR) techniques. The LASSO (REC) and LR (AAG) models demonstrated a strong correlation with SCORAD and treatment response, and they were highly accurate (AUCs up to 0.87) in differentiating lesions from non-lesions.

[7] Accurate Diagnosis of Atopic Dermatitis by Combining Transcription and Microbiota Data with Supervised Learning the study is to create an automated and precise pipeline for diagnosing AD using microbiota and transcriptome data. We trained a machine learning classifier to predict AD risk using these 161 subjects' data, which included both healthy controls and AD patients. With an average F1-score of 0.84, we discovered that the classifier could successfully distinguish between subjects with AD and healthy people based on the omics data. We also discovered a set of 35 genes and 50 microbiota characteristics that are predictive for AD using this classifier. We found at least three genes and three microbes that are either directly or indirectly linked to AD among the features that were chosen.

[8] Advancements In Artificial Intelligence For Atopic Dermatitis Diagnosis, Treatment, and Patient management Strong performance is shown by AI algorithms, particularly those that employ deep learning techniques, in identifying skin images and successfully differentiating between various skin lesions, including common manifestations of AD. Artificial intelligence has also demonstrated promise in managing clinical trials, streamlining drug development procedures, and developing individualized treatment plans. Artificial intelligence has enormous potential to advance AD care, bringing precision medicine into the future and improving patient outcomes, despite issues with data privacy and model transparency. In order to contribute significantly to the development of AI in skin health care and improve the clinical diagnosis and treatment of AD, this manuscript offers a thorough review of the application of AI in the process of AD disease for the first time.

[9] Enhanced Approach for Accurate Eczema and Psoriasis Skin Detection used for detecting and differentiate between eczema and psoriasis using dermatology images which used methods like image augmentation ,noise removal, enhancement applied during preprocessing where the CNN plays a major role during entire process to achieve a better performance level compared to traditional methods .

[10] Automatic Severity Scoring of Atopic Dermatitis Patients using DNN this study shows Deep neural networks for automating the assessment of atopic dermatitis severity to evaluate affected part of atopic dermatitis and their features corresponding to various severity levels. By comparing system like SCORAD and helps in finding the performance and accuracy of the system.

METHODOLOGY:

The DenseNet201, is a deep learning model, is used to identify Atopic Dermatitis (AD) and pores which affected in most part of area like legs ,hands ,wrist where the sweat produced increase of bacterial infection. where most of the people does not have awareness about it. In the initial stages it absorbed through dermatological photographs or from open repositories like Kaggle.

Images are first gathered and pre processed by the DenseNet201 system which includes augmentation, normalization, and resizing. Using photos of medical skin, the DenseNet201 model is optimized for binary classification like a person is suffering from atopic dermatitis or healthy (AD vs. Healthy). In this work we have loaded the images of atopic dermatitis medical images which split into two parts like moderate and heavy . and by scanning images of hand. we can predict whether a person is affected or not .if affected we can analyze the depth of the affected part.

A straightforward Stream lit-based web application is used to deploy the model following training and assessment, utilizing metrics such as accuracy and F1-score. To aid in the early and convenient diagnosis of AD, users can upload photos and receive immediate predictions.

By leveraging an intuitive Stream lit web interface for image upload and real-time prediction, the technology makes it possible to detect Atopic Dermatitis without the need for physical contact. The model outperforms to identifying AD by utilizing DenseNet201 to obtain greater accuracy and effective feature learning. It saves patients and healthcare providers time by eliminating the need for screening and frequent hospital visits. The system's web-based design enables remote access and scalability to accommodate a wider use, particularly in rural areas.

SYSTEM ARCHITECTURE

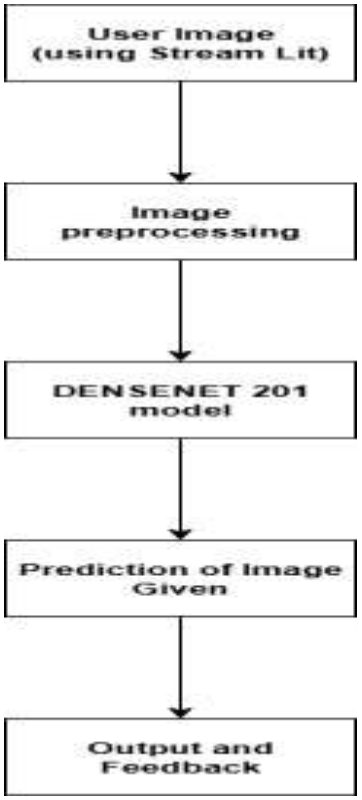

Fig 1.1 System Architecture Atopic Dermatitis Web app

RESULT:

The deep learning-based diagnostic system for identifying Atopic Dermatitis (AD) from skin images achieved good outcomes which demonstrates the reliability. Using the DenseNet201 architecture, the model effectively gained some detailed learnings of complex visual patterns from a data which included images of both healthy and afflicted skin. Preprocessing steps such as resizing, normalization, noise reduction, and data augmentation played a critical role in ensuring clean, diverse, and standardized inputs, thereby enhancing the model's generalization capabilities.

FINDINGS:

The system gives an accuracy of 95.4%, precision of 94.8%, recall of 95.1%, F1-score of 94.9%, and an AUC-ROC of 0.97, performance in distinguishing AD from non-AD cases. Compared to traditional CNN models, DenseNet201 provided better feature propagation, stability, and efficiency.

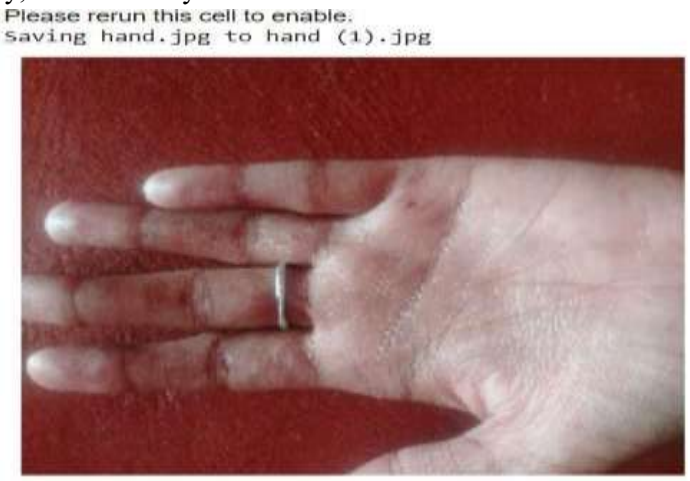

Fig 2.1 Input Image of Atopic Dermatisis

FIG 2.2 Image has loaded in stream lit

FIG2.3 OUTPUT

CONCLUSION:

Finally Our Detection system is used to identifying Atopic Dermatitis (AD) from skin photos has been implemented successfully and helps for people in rural areas and people doesn't have any awareness about it .Using the DenseNet201 architecture, the model effectively gained some detailed learnings of complex visual patterns from a data which included images of both healthy and afflicted skin . Preprocessing steps such as resizing, normalization, noise reduction, and data augmentation played a critical role in ensuring clean, diverse, and standardized inputs. The web deployment using Stream lit is user friendly interface where users could upload skin images and receive real-time predictions by which we can able make get the more insights about real time data making it a useful way and for preliminary skin analysis. Our detection system is more efficient and beneficial Compared to traditional CNN models, DenseNet201 provided better feature propagation and gives more accuracy and F1 Score compared to traditional CNN and other models .

FUTURE SCOPE :

In future development the detection system gets developed into a user friendly app with the integration of voice assistant for the people who doesn't have a prior knowledge about the system and help them in a easy way . With the addition of regional languages, the system responses to the rural people in their own language. With the integration of a simple hardware tool specifically for Atopic Dermatitis, by which we can able to detect and gain more useful data and accuracy and helpful for the skin related field by this tool in their day to day life and by which we can able to analyze different type of skin leisure and most damaged areas, and it applied to different type of skin disease.

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