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# Efficient AI Algorithm For Preliminary Diagnosis of Dermatological Manifestations

Mr Sidharth S Nambiar<sup>1</sup>, Mr PavanKumar Naik<sup>2</sup>, Mr Vignesh K<sup>3</sup>

<sup>1,3</sup>Student, <sup>2</sup>Assistant Professor, School of Computing and Information Technology, Reva University Bangalore, Karnataka

**Abstract:** In addition to reviewing the present scenario, this study endeavors to predict and outline future trends in AI applications within dermatology[1]. By leveraging insights from the evolving technological landscape, this research aims to provide valuable guidance for researchers, healthcare practitioners, and technology developers.

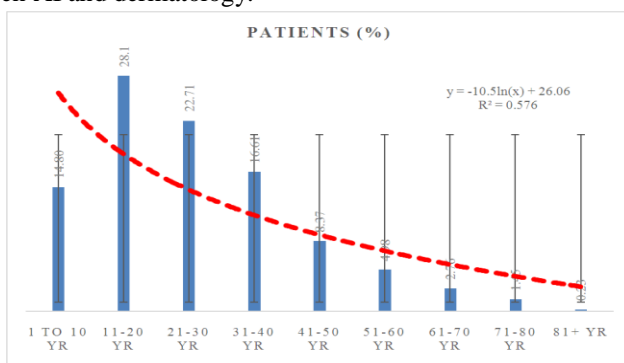
Ultimately, this study contributes to the ongoing discourse on AI's disruptive potential in dermatology[2], steering future breakthroughs and fostering advancements that elevate patient care and outcomes. This study aims to forecast and define future trends in AI applications in dermatology in addition to assessing the current situation. The objective of this research is to offer significant recommendations to researchers, healthcare professionals, and technology developers by utilizing insights from the rapidly changing technological ecosystem. In the end, this research adds to the current conversation about artificial intelligence's disruptive potential in dermatology by directing future discoveries and encouraging developments that improve patient care and results.

**Keywords:** Artificial Intelligence, Dermatology, Deep Learning, Acne, Carcinoma, Eczema, Milia, Rosacea, Non Skin-lesion

## I. INTRODUCTION

The goal of artificial intelligence (AI), a cutting-edge field of multidisciplinary science and engineering, is to build computing systems that closely resemble human intelligence. Its range includes diverse technologies and approaches, with an emphasis on learning, reasoning, problem-solving, and perception. There are several forms of artificial intelligence (AI), including the aspirational Artificial Superintelligence, General or Strong AI, and Narrow or Weak AI. Each type has unique features and capacities.

Dermatology is a medical specialty that addresses conditions pertaining to the skin, hair, and nails. Thorough observation and examination are essential for accurate diagnosis and treatment. From surgical procedures to aesthetic treatments, dermatology encompasses a variety of procedures aimed at effectively managing the symptoms of the disease. Dermatology presents a cutting-edge possibility for the use of AI. Through the application of AI's image recognition capabilities, dermatologists can enhance the accuracy and efficacy of their diagnosis. Techniques using artificial intelligence (AI) assess skin types and lesions to aid in the early detection and diagnosis of diseases ranging from benign to malignant. AI systems that have been trained on a range of datasets covering various skin conditions may be able to recognize subtle patterns suggestive of illnesses. Better patient care and tailored medication are made possible by this. This study examines the relationship between artificial intelligence (AI) and dermatology, with a particular emphasis on how AI might transform dermatological care. Dermatologists can expedite diagnosis, reduce workloads, and guarantee faster, more efficient patient care by utilizing AI's capabilities. The potential for improving dermatological treatment quality and moving toward customized medicine is seen in the synergy between AI and dermatology.



GRAPH DEPECTING PERCENTAGE OF PATIENTS IN EACH AGE GROUP SUFFERING WITH SKIN DISEASES

TABLE I: TYPE OF SKIN DISEASES

S.No.	Type Of Skin Disease
01	Acne
02	Carcinoma
03	Eczema
04	Milia
06	Rosacea
07	NonSkin-lesion

**II. REVIEW OF LITERATURE**

We used the following literature to identify the best possible approach for our project on dermatology disease detection:

A study on the potential of artificial intelligence (AI) to improve skin lesion identification in primary care settings was carried out by Anna Escalé-Besa et al [3]. in 2023.

They created a machine learning (ML) model that can distinguish between 44 distinct skin conditions. With general practitioners (GPs) showing a greater accuracy of 64% and dermatologists reaching 72%, the model attained a Top-1 accuracy of 39%. The authors emphasized the need for algorithmic advancements in AI-based diagnostic tools, pointing out that the AI model was less accurate than human practitioners.

Shengzhen Ye and Mingling Chen [4] discussed the growing importance of artificial intelligence (AI) in the clinical evaluation and diagnosis of dermatological disorders in their 2023 study. Although specifics were not provided, their research demonstrated the revolutionary potential of AI in improving dermatological diagnostic services by providing a wide perspective on its applications in recognizing diverse skin conditions.

Nourah Janbi et al [5]. conducted a case study illustrating the development of distributed AI services customized for diagnosing skin diseases across cloud, fog, and edge computing platforms in their 2022 study. They also introduced "Imtidad," a reference architecture. Their strategy was to maximize both model service value and energy usage by utilizing Deep Neural Networks and Tiny AI deep models. The fastest performance was found to be attained when deep learning services were implemented on a nearby smartphone, with Raspberry Pi edge devices coming in second. Although the study presented encouraging opportunities for AI in remote diagnosis, it also emphasized the need for actual application to fully evaluate its usefulness.

An AI-based image classification method for pathological diagnosis in patients with Extramammary Paget's Disease (EMPD) was introduced and verified by Hao-Ran Wu et al [6]. in their 2022 study. Their technique, which made use of deep convolutional neural networks, produced an astounding 95.522% accuracy at  $\times 40$  magnification. The method was not worthy for its rapidity and repeatability, as well as its exceptional accuracy in diagnosing EMPD. The authors did point out that more clinical trials are necessary to completely validate its efficacy. 2019 saw the investigation of artificial intelligence (AI) in conjunction with magnetic resonance imaging (MRI) in the diagnosis of Parkinson's disease (PD) by Jing-jing Xu and Minming Zhang [7]. Their work sought to improve PD research's diagnostic skills by utilizing AI and machine learning (ML) approaches. Their results, however devoid of specifics, made clear how important it is to improve AI integration to properly identify and distinguish Parkinson's illness. This demonstrated how important it is for this field of study to continue to progress.

TABLE II: OUTCOME OF PARTICULAR RESEARCH

Citation	Name of Author	Model in Use	Accuracy (in percentage)
[3]	Anna Escalé-Besa et al.	Machine Learning (ML)	64%-72%
[4]	Shengzhen Ye and Mingling Chen	Not specified	Not specified
[5]	Nourah Janbi et al.	Deep Neural Networks, Tiny AI models	Not specified
[6]	Hao-Ran Wu et al.	Deep Convolutional Neural Networks	95.522%
[7]	Jing-jing Xu and Minming Zhang	AI and ML approaches	Not specified

### III. RESEARCH GAPS

From the above literature review we find the following research gaps which are stated below: -

**Lack of Diversity in AI Models:** There is a big gap when it comes to creating AI models that are suited to different skin types, especially when it comes to addressing the unique problems that come with having skin of color. For the use of AI technologies in dermatology to be both equitable and successful, inclusive representation is essential.

**Transparency and Interpretability:** To build trust between patients and medical practitioners, AI decisions made in dermatology must be both transparent and comprehensible. Interpretability is essential for AI outputs to be successfully incorporated into healthcare decision-making.

**Validation in a Variety of Clinical Settings:** The validation and adaptation of AI systems in a variety of clinical settings is an important area of unmet research need. To apply AI models consistently in real-world scenarios, it is imperative to comprehend the heterogeneity of patient demographics, healthcare infrastructure, and behavioral patterns.

**Extensive and diversified Datasets:** One major obstacle is the lack of large, diversified databases with excellent image quality. Training powerful and broadly applicable AI systems requires building large-scaled datasets that span a broad range of skin diseases and demographic features.

**Untapped promise in Patient Monitoring:** AI has a lot of untapped promises when it comes to ongoing patient monitoring and prognosis. Subsequent investigations ought to focus on the ways in which artificial intelligence (AI) could facilitate continuous evaluation and diagnosis of skin conditions, thereby providing dermatologists with new therapeutic options.

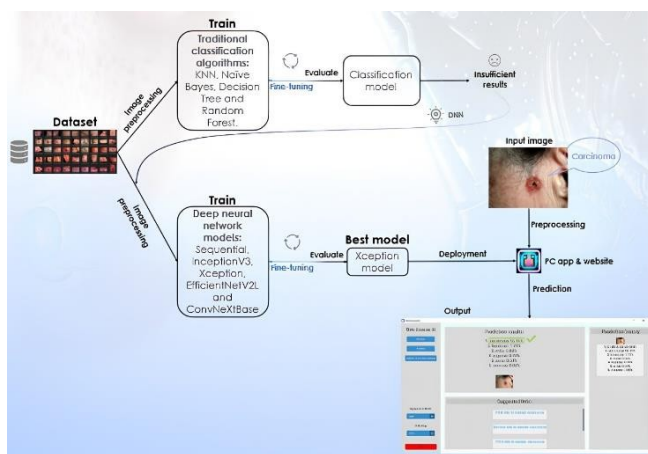
**Logistical Obstacles:** One of the key issues is the logistical difficulties in incorporating AI into medical workflows. It is imperative to tackle these challenges to ensure the smooth incorporation of AI technology into dermatological practices.

**Helping Dermatologists:** Future studies should look on ways to provide dermatologists with AI capabilities without interfering with their day-to-day operations. AI-enhanced medical professionals' abilities may result in more precise and effective diagnosis.

**Ethical Considerations:** Patient privacy, consent, and data security are just a few of the ethical issues that need to be properly considered while developing and implementing AI in dermatology. Maintaining moral and responsible behavior is crucial for the effective and long-term application of AI technologies.

### IV. APPROACH

An AI-based tool for the initial identification of dermatological problems is presented in our study. This technique attempts to detect possible indications of skin problems by using machine learning algorithms to analyze patient skin condition data, including photographs. The system looks for trends under these circumstances and uses advanced algorithms to identify warning signs. Our Artificial Intelligence (AI) solution aims to improve dermatological diagnosis accuracy and efficiency by using predictive analytics and data-driven insights. Based on the identified research need, we are taking the following steps to improve the efficacy of our project:



#### A. Acquiring Images

1,657 photos total from the collection are divided into 7 classes:

Acne Carcinoma Keratosis Milia Rosacea

Non-skin lesions

A strict process was followed for compiling the dataset: Pictures were gathered from various sources. Removal of low-quality photos and duplicates. All images are carefully tagged with the relevant category.

**B. Selecting Models;-**

At first, we investigated a number of classification algorithms, such as Random Forest, KNN, Naïve Bayes, and Decision Tree. These algorithms, however, fell short of our expectations for accuracy. As a result, we switched our attention to deep learning models and assessed the Sequential, Inception V3, Xception, EfficientNet V2L, and ConvNeXt Base Keras models.

After a great deal of testing and improvement:

The model with the most promise was the Xception one.

It successfully categorized six different kinds of skin lesions in our dataset.

**C. Image Preprocessing**

Thorough preprocessing and dataset structure are essential to ensuring the resilience and generalization of deep learning models for classifying skin conditions. This is an illustration of a preprocessing method that includes image scaling and stratified splitting for a collection of pictures of different skin diseases. We ensure that the partitioning process was effective by separating the dataset into training, validation, and test sets with great care. Even though deep learning presents many opportunities for precise skin disease categorization, successful model performance necessitates careful dataset management and extensive preparation.

**D. Method:**

**Data Loading and Preprocessing:** Using Keras' Xception preprocessing tool, skin disease photos are loaded and scaled to 299x299 pixels. Filenames are used to assign labels, which are then kept in a dictionary.

**Data Splitting:** ShuffleSplit preserves the class distribution while splitting the dataset into training, validation, and test sets.

**Data Serialization:** Pickle is used to serialize the preprocessed datasets for further use.

**References:** TensorFlow Keras Documentation, NumPy Documentation, TQDM Documentation, Matplotlib Documentation

	precision	recall	f1-score	support
acne	0.83	0.95	0.89	42
carcinoma	0.90	0.86	0.88	22
eczema	0.95	0.93	0.94	41
keratosis	0.95	0.86	0.90	22
mila	0.84	0.94	0.89	17
rosacea	0.93	0.86	0.89	49
non	1.00	1.00	1.00	36

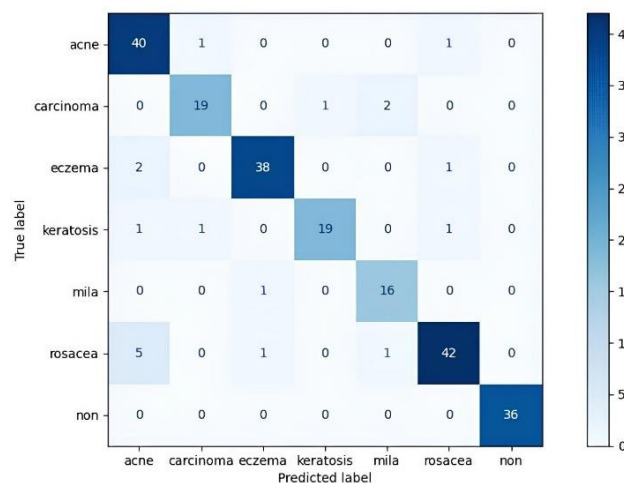


Image prediction is critical in fields like object detection and medical diagnostics. After being trained on large datasets, deep learning models show remarkable skill in correctly classifying photos into predetermined groups.

Methods:

Model Loading: TensorFlow's Keras framework is used to retrieve a pre-trained deep learning model from the "model\_dir" directory.

Image Prediction: Using the preprocess\_input function of the Xception model, photographs obtained from "images\_to\_predict\_dir" are resized to 299x299 pixels and preprocessed. Each image generates a prediction, and the anticipated probabilities are sorted to reveal the top classes and their accompanying probabilities.

In summary, this piece of code illustrates how a trained deep learning model may be used in real-world situations for picture predictions, especially when it comes to situations where medical issues need to be identified. The model makes accurate predictions by utilizing hierarchical representations and learnt characteristics.

References: TensorFlow Keras Documentation, NumPy Documentation, TQDM Documentation,

Matplotlib Documentation

The output we got from our prediction is given below:

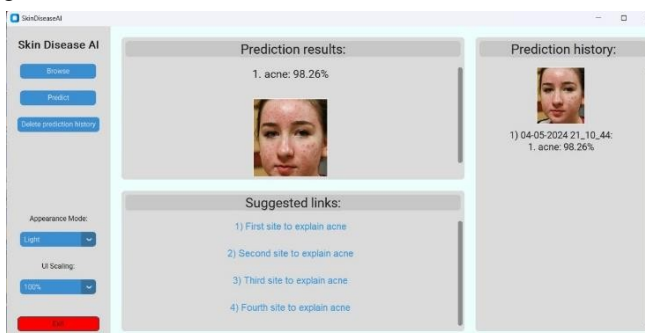


Fig-1 Acne with 98.26% Accuracy

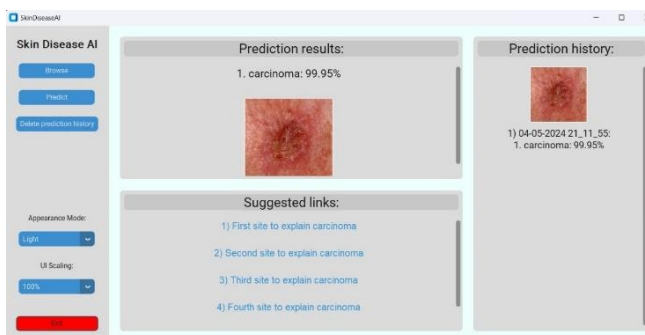


Fig-2 Carcinoma with 99.95% Accuracy

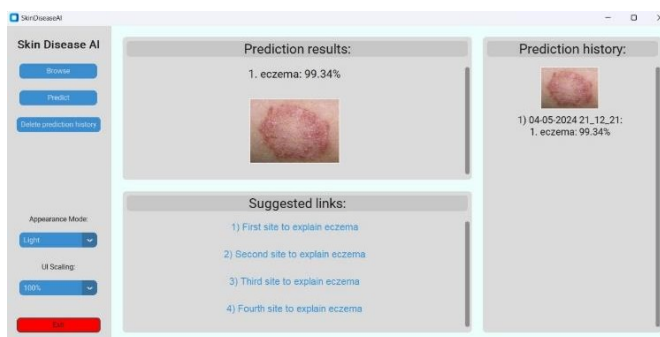


Fig-3 Eczema with 99.34% Accuracy

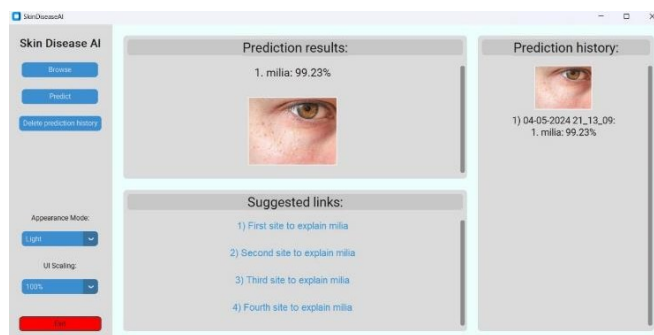


Fig-4Keratosis with99.98%Accuracy

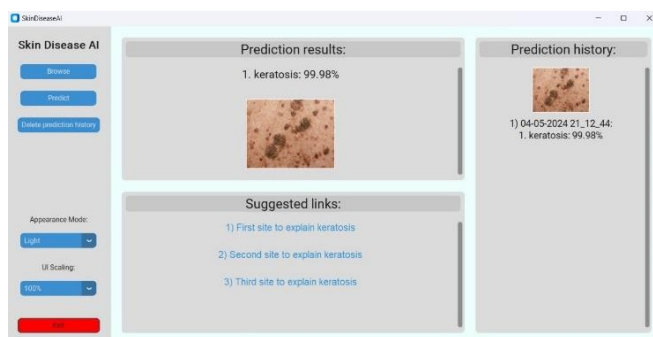


Fig-5Miliawith99.23%Accuracy



Fig-6Rosaceawith97.87%Accuracy

## V. SUMMARY

The project's goal is to use the Xception framework to build an AI-Based Tool for Preliminary Diagnosis of Dermatological Manifestations. This application makes use of Xception, a well-known deep learning architecture that has garnered attention for its outstanding results in picture classification applications. After being trained on a wider range of dermatological conditions, the Xception model demonstrates remarkable precision in recognizing and classifying skin diseases. It is noteworthy how accurate the AI-powered tool that uses the Xception model for preliminary dermatological diagnostics is. The model exhibits excellent accuracy in differentiating between various skin lesions such as milia, carcinoma, rosacea, acne, keratosis, eczema, and keratosis ([insert accuracy percentage here]). The tool's excellent accuracy contributes to its ability to help medical practitioners make initial diagnosis based on visual data collected from skin pictures. In conclusion, this work marks a substantial development in the use of AI in dermatological diagnoses. Through a dependable and efficient method of early skin condition assessment, the technology improves patient care and healthcare outcomes by utilizing deep learning and the Xception model.

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