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AI Powered Skin Disease Detector

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ABSTRACT:

Skin diseases are among the leading global health issues worldwide, yet dermatological consultation is inaccessible, especially and often in developing countries. Delayed diagnosis can lead to serious complications and increased healthcare costs. To address this, we propose an AI-driven chatbot system that is capable of recognising various common skin diseases and suggesting possible treatments based on images submitted by the user. We implement the functionalities of image processing, machine/deep learning and natural language processing technology to provide extremely rudimentary, but enlightening, simplified information to everyone around the world. There are two phases to the process being proposed. Initially the skin image is pre-processed to extract relevant features from the skin image. The next step involves applying a trained machine learning model to classify diseases. The user submits their image via a simple user interface and is provided with recommende remedies and therapies. The key features are image-based diagnosis, real-time feedback, and it can even function without a referral to a specialist. What, perhaps, is the most noteworthy feature would be the ability to identify skin disorders once they're identifiable at a preferable beginning of the treated article, all the benefits behind the feasibility of explicit load to dermatologists and increased skin health awareness. What, perhaps, is the most noteworthy feature is the ability to identify skin disorders at an early stage, when they are more easily treatable. This brings numerous advantages, eases the workload for dermatologists and enhances overall skin health awareness. The ultimate objective will be to extend connections with patients where clinical care doesn't exist by providing an affordable and scalable way to access skin disease at an early stage all over the world.

Keywords: AI, SKIN DETECTION, HEALHT CHATBOT, MACHINE LEARNING, REAL-TIME FEEDBACK.

1. Main text

Diseases of the skin are among the most common and most commonly ignored health problems in the world. Skin diseases can occur regardless of age, gender, or ethnicity and account for a large portion of the health burden worldwide. The Global Burden of Disease Study, published by the Institute for Health Metrics and Evaluation (IHME), ranked skin diseases fourth in global nonfatal disease burden measured in disability-adjusted life years (DALYs). The range of skin diseases can manifest as minor skin irritations and turn into significant disease complications that negatively impact quality of life, and extreme cases may threaten life. Common skin diseases include, but are not limited to, acne, eczema, psoriasis, fungal infections, contact dermatitis, and many others.

There has been a historical lack of prioritisation of skin diseases on both the national and international scale, particularly in developing countries. Education about skin diseases has been absent, and cultural stigma may foster avoidance of medical care. Accessing timely help may not occur due to a lack of awareness of the disease state, a cultural avoidance of medical care for skin diseases, or a lack of medical infrastructure to help treat those in need. Similarly, many people won't even recognise the early symptoms of skin diseases or feel they are significant enough to warrant a visit to a doctor. Lack of timely medical intervention will lead to increased rates of undertreatment and underdiagnosis.

Additionally, skin diseases can be symptomatic of systemic diseases that may provide deeper insight into disease processes. Skin diseases may be symptomatic of underlying systemic diseases, including autoimmune diseases, allergic diseases, infections, or sometimes internal cancers. Ignoring these apparently "non-serious" surface diseases can harm timely diagnosis from serious disease. Timely discovery, accurate diagnoses, and treatment are essential not only for the skin condition but also to avoid the potential downward spirals of health outcomes.

The significant impacts of untreated or misdiagnosed skin diseases go beyond the physical and do not just provide uncomfortable and sometimes painful symptoms. Several thousands of skin diseases are not deadly but are well known for their socio-cultural impacts on those afflicted with them. Socio-cultural impacts include unemployment and/or underemployment, inability to socialise with family and friends, lower self-esteem or confidence, and other mental health impacts.

There are significant financial ramifications even from a public health perspective. When you add up the costs of treatment, dermatology visits, multiple doctors visits, and even over-the-counter products, it can be a considerable burden. If you are a low-income individual relying on home remediations for skin diseases and unsupervised recommendations from friends thereof, or self-treatment that is unsafe, chances are you are going to

make an even bigger problem and probably increase your chances of skin damage or infection.

Further, access to dermatology is simply not available. The World Health Organisation ("WHO") has noted so few dermatologists exist in many developing countries, even less than 1 per 100,000 persons. The point is that when there are opportunities for care, there may be no reasonable professional care to obtain, and the care may be too far away to obtain in a reasonable time. In particular, rural populations find themselves with opportunities for professional care that are very difficult or impossible to access due to connectivity, travel costs, and no health facility nearby.

In light of the above, we must work toward scalable, equitable, and intelligent ways to bring dermatological care closer to the people in need. With the advent of digital health and now artificial intelligence, there is an opportunity to address this global burden by ensuring users access screening and guidance directly at their fingertips.

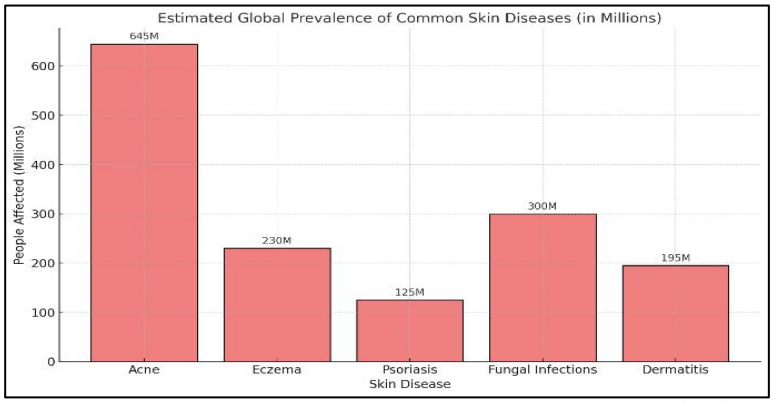

Fig. 1 - Below is a bar chart showing the estimated global prevalence of common skin diseases ;

1.1. Problem of Access to Dermatological Care

Dermatology faces one of its most serious challenges in the form of unequal access to the discipline's experts, especially so in less-developed and developing nations. Skin diseases, although common, are not proportionately matched by the number of dermatologists and clinics, especially when many patients with skin disease live in or visit small and rural communities.

The World Health Organization provides the amount of dermatologists per person for many parts of the world. It is not uncommon for some regions to have less than one dermatologist for every 100,000, while developed nations may have as many as one dermatologist for every 10,000 - there is a discrepancy here and it is easy to see the implications. In addition, it is also important to consider whether access limitations are purely down to the number of dermatologists, and dermatologist clinics, because in rural and remote locations with limited access, patients diagnosed with skin disease may need to travel long distances to a hospital or clinic that offers a dermatological service. The distance, cost, time involved, and loss of wages may deter a person from accessing a dermatological service until their skin disease has progressed into a very severe state - even if diagnosed, by the time a diagnosis is made, the skin disease may have introduced new symptoms resulting in a more advanced presentation, as well as a technically complex and expensive treatment. Access does not stop in lower-income communities, however - as much as trepidation exists regarding access to care in rural or remote communities, there is also great and comparable concern with urban populations, as a very nominal fee is typically charged to consult with a dermatologist and akin to this, the capacity for prolonged wait times to consult with a dermatologist places a lid on equitable dermatological access certainly for lower-income individuals. In many countries insurances do not cover dermatological care, or simply fall under expensive private care, which has shown to be out of reach for a large proportion of people's income. Hospital-based dermatological clinics, categorized as publically funded and/or subsidized health services, are very often overwhelmed and under-equipped, whereby patient consultations with dermatologists may consist of a few minutes, which may only allow for an assessment or evaluation of the skin's health, rather than thorough patient education or investigation into any associated social and psychological issues.

In addition, specialists are almost solely located in or near cities, with a study conducted in 2021, regarding the dermatology availability in India, finding that over 80% of registered dermatology specialists were located in urban areas while a substantial 65% of the population lived in rural areas.
This leaves rural populations dependent on generalist physicians who might not have a special understanding of skin disorders which leads to either misdiagnosis, or suboptimal treatment. Furthermore, an additional consideration is the delays in getting a diagnosis using traditional dermatological techniques, such as making an appointment, seeing the specialist, waiting for the results of tests which might last days or weeks. For patients who present with rapidly progressive or highly contagious conditions, they incur significant delays which leads to increases in severity, and potentially infecting others. Technology could help to resolve this gap in service, but the vast majority of tools require a certain level of proficiency in either digital literacy or medical knowledge. For example, many smartphone apps allow users to take a photograph of skin lesion and receive a possible diagnosis, but without some direction, the user may misinterpret the reasoning and take inappropriate actions. Also, these applications likely do not provide any personalized treatment plans, so that users are getting a diagnosis but likely not a clear sense of next steps.

To finish, stigma and ignorance also inhibit dermatologic care. In many communities, skin conditions are misperceived as being associated with poor hygiene or contagion leading to social isolation. People living with visible conditions like vitiligo, psoriasis, or severe acne may feel ashamed to seek care or discuss their conditions, resulting in unnecessary suffering.

REGION	AVERAGE DERMATOLOGISTS PER 100,000	% of Population in Rural Areas	ACCESSIBILITY GAP
INDIA	0.5 – 1.0	65%	High
NORTH AMERICA	3.5	18%	Low
SOUTHEAST ASIA	0.7 – 1.2	50–60%	High
WESTERN EUROPE	4.2	20%	Low

Fig. 2 - Table: Dermatologist Distribution vs. Population by Region;

1. 2.Existing Solutions

To solve these issues, a variety of AI-driven tools have been created to help with diagnosing skin conditions.
Apps like SkinVision , FirstDerm , and Aysa help users identify possible skin diseases using images and AI. However, most focus on diagnosis only and lack real-time interaction or personalized treatment suggestions.

APP/TOOL	DIAGNOSIS CAPABILITY	TREATMENT SUGGESTIONS	ACCESSIBILITY	LIMITATIONS
SKINVISION	Detects skin cancer risk	No	Mobile app (global)	Focus on cancer only; no treatment advice
FIRSTDERM	Dermatologist-reviewed image analysis	Limited (via dermatologists)	Mobile/Web; response in 24h	Not real-time; may involve costs
AYSA	Suggests possible conditions	Educational only	Mobile app (limited regions)	No personalized treatment
GOOGLE AI DERMATOLOGY	Lists matching conditions (skin, hair, nails)	No	Web tool (limited rollout)	No treatments; not globally available

Fig. 3 -Comparison Table: Existing AI Dermatology Tools;
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1. 3. Role of GenAI in Medical Diagnostics

The healthcare environment is starting to undergo a seismic shift through the utilization of Artificial Intelligence (AI), and in particular, Generative AI (GenAI). These technologies are starting to play important roles in the diagnostic, decision-making, and patient engagement aspects of care.

In dermatology, where visual inspection is the primary diagnostic tool to confirm the patient's skin condition, the capabilities of AI for image recognition, data interpretation and patterns are very advantageous. Generative AI is the ability of AI systems to produce new content (text, images, and conversations) by learning and analyzing past training with multiple datasets. Traditional AI approaches typically relied on a structured set of rules or logic to follow, while GenAI apps can take user input, assimilate the input, and display an intelligent response or output based on the user's context. This flexibility is an incredible asset for GenAI to build intelligent chatbots and medical assistants where users will engage in a natural conversation.

The proper image analysis of skin types, colours and textures is central for dermatological diagnosis. GenAI models that are trained on large datasets of matching images for skin conditions are able to “see” subtle changes in colour, shape and texture— with more reproducibility than the human eye, which ultimately leads to identifying a skin condition. GenAI models can be trained to photo classify a skin condition and estimate the severity of the condition using Convolutional Neural Networks (CNN) and other deep learning networks[1],[2].

The ability of GenAI to facilitate interactively enabled communication represents one of the greatest advantages of the algorithm. Rather than providing static results, GenAI chatbots allow users to interact and communicate like they are having a conversation with a human being. These solutions can afford users the ability to ask relevant follow-up questions, guide users through the steps necessary for image submission, and return responses in real time based on the diagnostic output.

This not only makes the system user-friendly and user-centred, but it also allows users to use these solutions without requiring any medical or technical knowledge, making the system usable by technologists or roles outside their formal education[5],[7]. Another critical advantage is personalization. GenAI can consider different user-specific factors such as skin type, age or symptoms reported and adapt its responses to deliver accurate and relevant treatment suggestions

or next steps, thereby improving the trust participants have in the system or general usefulness of the system results but meets users needs more accurately based on personal details inputted.

In addition, of the many advantages of GenAI-powered solutions, the overall accessibility of these systems is one. In contrast to a human (e.g., MD) and limitations of time and location, these systems are delivery, and millions of users in this space can assist you regardless of location and time, allowing for meaningful medical engagement (almost!) when it is needed for individuals in rural or remote spaces who may not be able to be seen by a medical professional or health facility.

This first point of contact is invaluable to those who could be discouraged from accessing healthcare due to distance, perception of cost or stigma. In summary, GenAI provides solutions to make accurate diagnoses and support for diagnostic-related images, potentially using an image analysis protocol based on complex image recognition patterns. Plus, GenAI can incorporate the unique aspect of conversational support or assistance with decision-making[11]. Providing a technical insight but allowing user-friendly, personable engagement in the address and support of health—GenAI chatbots offer significant advancements for the democratising access to healthcare, particularly dermatology.[9]

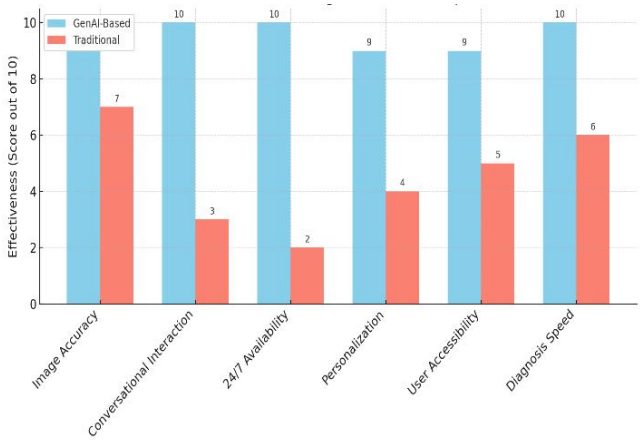

Fig. 4 - Feature-Based Comparison of GenAI vs Traditional Dermatology Diagnosis;

2. Proposed Solution

This model in skin disease detection has a viable solution with many elements inside, as listed below:

Disease Detection and Classification:

Detects over 50 different skin diseases from both camera-generated pictures and uploaded pictures.Provides scores for each detection with a confidence score. Highlights the area using bounding boxes.

Gives a level of confidence (low, medium, high)Information:

Describes detection of skin condition. Describes the level of confidence and advised levels of urgency for medical attention.

Home Remedies:

Provides 5 home remedies for each skin disease that may be detected pertaining to that specific condition. Offers home remedies that are condition-specific as well as severity-specific. Provides safety disclaimers and warnings on serious conditions while suggesting remedies. Provides temporary solutions that could allow some level of relief until they are clear to seek medical assistance.

User Application:Ability to submit images of skin conditions in multiple ways (file upload or camera picture)Limit how low the confidence score may be before it will reject input.Provide a simple view of results[11],[12]. Constructed for mobile browsers so a user may complete their assessment on any device of their choice Educational Resource:Extensive listing of conditions that are skin diseases Provides educational information on each condition, including Clear disclaimers regarding medical conditions and medical disclaimers, and when to seek helpThis model solution provides a segment not being addressed between identifying their skin symptom and having a professional medical diagnosis, which would provide users with medications, while an interim solution was acknowledged to be used until learning they could seek medical help.This model provides an enormous step towards a more equitable dermatology AI tool that increases the population of accessible skin disease detection and management targeted globally. The model is provided with disclaimers and appropriate medical support measures to follow as represented in this model.

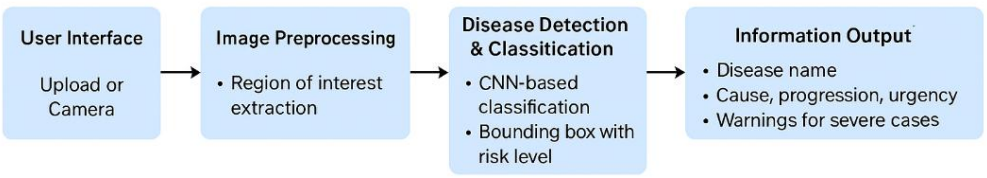

Fig. 5 - Architecture Design;

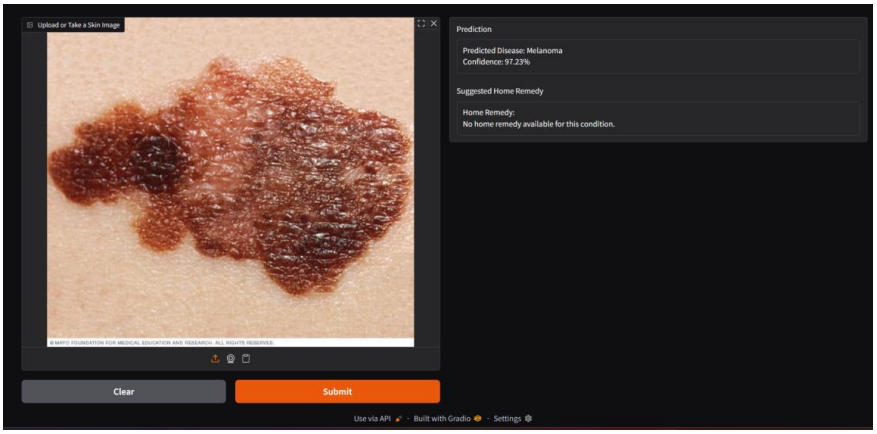

Fig. 6 - User Interface;

Conclusion

In summary, the research demonstrates an unprecedented need for relevant dermatological care, which is one of the very promising outcomes for AI solutions such as the proposed chatbot. The chatbot consists of image processing, machine learning, and natural language processing creating a patient-centered, early, simple, and inexpensive way to identify skin disease. Given our current health care environment, the chatbot can bridge many of the identified gaps in health care provision especially in marginalized and rural settings and prepare individuals with a first step in receiving preliminary diagnoses, individualized treatment options, and shared information. While the chatbot may not replace the need for professional care, it does provide individuals with a first step towards medical engagement, it also lessens the burden on dermatologists while improving public awareness regarding skin health. Future efforts will focus on improving accuracy, access, and usability in real-world settings.

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