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# Zephyre Derma Ai

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### ABSTRACT:

Zephyre is an innovative AI-powered platform designed to provide personalized skincare recommendations by combining real-time weather data with advanced skin analysis. The system leverages a trained Convolutional Neural Network (CNN) to classify skin types based on user-captured images, while simultaneously integrating key environmental factors such as temperature, humidity, and air quality. By utilizing cutting-edge image processing, predictive modeling, and web scraping techniques, Zephyre generates tailored skincare advice, ensuring that the recommendations are not only skin-type specific but also contextually relevant to the user's immediate environmental conditions. This integration of AI, weather data, and dermatological insights reduces the need for manual skin assessments, enhancing both personalization and accessibility. Zephyre's scalable and user-friendly design provides an innovative solution that bridges the gap between dermatology and real-time environmental adaptation, supporting a wide range of skin profiles and offering an effective tool for skincare optimization in an ever-changing climate.

**Keywords:** AI-powered skin analysis, personalized skincare recommendations, Convolutional Neural Network (CNN), real-time weather data, skin type classification, environmental factors, temperature and humidity, image processing, predictive modeling, web scraping, dermatological insights, skin health monitoring, environmental adaptation, skincare optimization, smart dermatology.

## **1. INTRODUCTION**

The Zephyre project is an innovative healthcare solution that combines artificial intelligence (AI) and weather data to enhance personalized skincare. It leverages a deep learning-based convolutional neural network (CNN) to classify skin types and conditions accurately. The system integrates real-time weather data to determine how environmental factors affect individual skin health. By analyzing these variables, Zephyre offers tailored skincare suggestions, helping users make informed decisions. The project aims to bridge the gap between dermatological care and weather awareness, ensuring a holistic approach to skin health. Additionally, it focuses on privacy and ethical considerations, ensuring user data is securely managed. Zephyre seeks to improve skin health over time with a responsive web interface and personalized recommendations.

# 2.REVIEW OF LITERATURE

#### 2.1 AI-Driven Skin Condition Classification: Revolutionizing Dermatology

AI, especially Convolutional Neural Networks (CNNs), is transforming dermatology by automating skin condition diagnosis. CNNs have shown to match or exceed dermatologist accuracy in identifying conditions like melanoma and acne. These AI systems are trained on vast datasets of skin images, improving diagnostic accessibility and early detection, especially in regions with limited healthcare access.

#### 2.2 Environmental Factors and Their Impact on Skin Health: A Deeper Understanding

Environmental factors like UV exposure, humidity, and temperature have significant effects on skin conditions. Research shows that these elements can exacerbate issues such as dryness, acne, and sensitivity. Understanding these influences is crucial for creating personalized skincare solutions that consider both internal and external factors, offering better skin health management.

#### 2.3 Personalized Skincare Solutions through Weather Data Integration: A Game Changer

Integrating weather data into skincare models allows for highly personalized recommendations. By factoring in real-time weather conditions such as UV levels and temperature, these systems provide tailored advice, such as sun protection tips or moisturizing recommendations, based on the user's environment. This integration enables proactive skincare management with real-time, context-aware feedback.

#### 2.4 Real-Time Data Management Systems: Transforming Dermatology with Scalability and Security

Real-time data management systems like MongoDB are essential for securely storing and analyzing skin health data. These systems enable the continuous tracking of skin conditions, offering scalable solutions that provide personalized, data-driven insights over time. The secure management of user data ensures privacy and compliance with regulations, which is crucial for user trust and long-term system viability.

### **3. EXISTING APPROACHES**

Existing approaches to skin health management have seen a significant shift towards the use of artificial intelligence (AI) and deep learning technologies, particularly in the area of skin condition classification. Convolutional Neural Networks (CNNs) are at the forefront of these advancements, demonstrating exceptional performance in diagnosing skin conditions from images. Esteva et al. (2017) developed a deep learning model that matched the diagnostic accuracy of dermatologists in identifying skin cancer, highlighting the potential of AI to revolutionize dermatology. These CNN models, trained on large annotated datasets, are capable of analyzing complex patterns in skin images and making accurate predictions across a variety of conditions, including acne, eczema, and melanoma. The use of such AI-based models is not only enhancing diagnostic accuracy but also enabling faster and more accessible skin health assessments, particularly in underserved regions where access to dermatologists may be limited.

In parallel to AI-driven diagnosis, there is a growing recognition of the role that environmental factors, such as weather conditions, play in influencing skin health. Research by Suresh et al. (2019) emphasized the significant impact of weather variables, including temperature, humidity, and UV exposure, on skin conditions like dryness, sensitivity, and acne. This insight has led to the integration of weather data with AI models to offer more personalized and real-time skincare recommendations tailored to an individual's environmental context. Furthermore, real-time health data management systems, such as those built using MongoDB, allow for continuous tracking of skin health over time, providing valuable insights into how environmental and lifestyle changes affect skin conditions. Wang et al. (2020) demonstrated the utility of such databases in supporting AI models by facilitating the storage and analysis of user-specific data, ultimately enhancing the ability to offer personalized, data-driven skincare advice. These integrated approaches represent a shift towards more dynamic, user-centered methods for skin health management.

# 4. PROPOSED APPROACH

The proposed methodology for the Zephyre project integrates artificial intelligence and real-time weather data to provide personalized skincare recommendations. First, a Convolutional Neural Network (CNN) will be developed to classify various skin conditions, such as acne, dryness, and sensitivity, based on images captured by the user. This model will be trained on a diverse dataset of skin images, enabling it to accurately predict skin types and conditions. The classification results will then be combined with real-time weather data, including UV index, temperature, and humidity, retrieved from an API. These environmental factors will allow the system to offer tailored skincare suggestions, such as recommending sunscreen during high UV exposure or moisturizers during dry weather conditions.

Additionally, user-specific data, including skin type and environmental factors, will be securely stored in MongoDB for ongoing monitoring and analysis. This will enable the application to track changes in skin health over time and provide personalized insights based on long-term data. The methodology prioritizes user privacy and ensures data security by adhering to regulatory standards like GDPR. By integrating AI with real-time weather data, the system aims to enhance skincare management, offering users dynamic and context-aware recommendations to improve their skin health effectively.

## 5. SOFTWARE DESCRIPTION

- Python Backend development
- TensorFlow CNN model training
- Keras Deep learning framework
- OpenCV Image capture and processing
- Flask Web server integration
- HTML/CSS Frontend design and styling
- JavaScript Frontend interactivity
- MongoDB Database management
- Weather API Real-time weather data fetching
- GitHub Version control and collaboration
- Google Colab Cloud-based model training

# 6. METHODOLOGY

#### 6.1 Image Acquisition

The system captures high-quality skin images using a webcam interface embedded in the frontend application. It ensures consistent lighting and framing to maximize prediction accuracy. Captured images are immediately passed to the preprocessing pipeline for enhancement and analysis.

#### 6.2 Preprocessing

Captured images undergo preprocessing steps including resizing, normalization, and noise removal using Gaussian and median filters. Grayscale conversion is optionally applied for uniformity enhancement.

#### 6.3 Skin Condition Classification

The preprocessed image is fed into a trained Convolutional Neural Network (CNN) model built with TensorFlow and Keras, which classifies the skin into one of the predefined categories (e.g., oily, dry, acne-prone).

- Normal Skin
- Oily Skin
- Dry Skin
- Combination Skin
- Sensitive Skin
- Acne-Prone Skin
- Dehydrated Skin
- Mature Skin
- Hyperpigmented Skin
- Redness / Rosacea
- Textured Skin
- Dull Skin
- Eczema
- Allergy-Prone Skin
- Sun-Damaged Skin
- Uneven Tone
- Pimple-Prone Skin
- Open Pores
- Healthy Skin

#### 6.4 Weather Data Fetching:

Simultaneously, the system fetches real-time weather parameters (UV index, humidity, temperature) based on the user's geolocation using a secure Weather API.

#### 6.5 Derma Recommendation Generation

Based on the classified skin type and current weather conditions, the system queries OpenAI's API to generate personalized skincare tips or fetches recommendations scraped dynamically from verified dermatology websites.

#### 6.6 Data Storage and Analysis:

Predictions, weather data, and recommendations are stored securely in MongoDB to track user history, enabling longitudinal skin health monitoring and trend analysis.

### 6.7 Result Display:

The frontend dynamically displays the prediction, weather conditions, skincare suggestions, and an interactive confidence chart, providing users with actionable insights in a visually intuitive interface.

# 7. OUTPUT SCREENSHOT

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## Results 🌈

- Skin Type: redness\_rosacea
- Confidence: 8.95%

#### Suggestions:

 ## Skincare Advice for Rosacea-Prone Skin in Chennai's Current Weather Chennai's hot, humid, and sunny weather presents specific challenges for rosacea-prone skin. The high UV index, heat, and humidity can exacerbate redness, flushing, and inflammation. This skincare routine focuses on soothing, protecting, and minimizing triggers. \*\*Cleanser:\*\* \* \*\*Type:\*\* Choose a gentle, fragrance-free, non-foaming cleanser. Look for ingredients like ceramides or niacinamide which can support the skin barrier. Avoid sulfate-based cleansers as they can be too harsh. \* \*\*Method:\*\* Use lukewarm water - avoid hot water as it can trigger flushing. Gently massage the cleanser onto your face and rinse thoroughly. Pat dry with a soft towel; don't rub. \*\*Moisturizer:\*\* \* \*\*Type:\*\* Opt for a light, oil-free, and non-comedogenic moisturizer. Look for ingredients like hyaluronic acid for hydration and ceramides to repair the skin barrier. Green tea extract and aloe vera can also be soothing. Avoid potentially irritating ingredients like fragrances, alcohol, and essential oils. \* \*\*Method:\*\* Apply a small amount to damp skin after cleansing, both morning and evening. \*\*Sunscreen:\*\* \* \*\*Type:\*\* This is CRUCIAL for rosacea. Choose a broad-spectrum sunscreen with an SPF of 30 or higher. Mineral sunscreens containing zinc oxide or titanium dioxide are generally better tolerated by sensitive skin as they are less likely to cause irritation than chemical sunscreens. \* \*\*Method:\*\* Apply liberally 15-20 minutes before sun exposure. Reapply every two hours, especially after swimming or sweating. Consider wearing a wide-brimmed hat for added protection. Chennai's high UV index (13.13) necessitates diligent sun protection. \*\*Exfoliation:\*\* \* \*\*Type:\*\* Avoid harsh physical exfoliants like

protection. \*\*Exfoliation:\*\* \* \*\*Type:\*\* Avoid harsh physical exfoliants like scrubs, which can irritate rosacea-prone skin. If you choose to exfoliate, opt for a very gentle chemical exfoliant containing low concentrations of lactic acid or PHA (polyhydroxy acid) once or twice a week. Always patch test first. \* \*\*Method:\*\* Apply the exfoliant after cleansing and follow with your moisturizer. Be mindful of any increased sensitivity or redness, and discontinue use if irritation occurs. \*\*Hydration:\*\* \* \*\*Internal:\*\* Drink plenty of water throughout the day to stay hydrated. This helps regulate body temperature and can minimize flushing. \* \*\*External:\*\* Use a hydrating serum containing hyaluronic acid before applying your moisturizer. This helps to draw moisture into the skin. A hydrating mist can also provide a refreshing boost throughout the day. \*\*Additional Precautions for Chennai's Climate:\* \*\*Heat Management:\*\* Avoid prolonged sun exposure during peak hours. Seek shade and use air conditioning when possible. Carry a facial mist to cool your skin down if needed. \* \*\*Humidity Control:\*\* While you can't control the humidity, using a light, oil-free moisturizer can help prevent your skin from feeling overly oily and congested. \* \*\*Trigger Avoidance:\*\* Identify and avoid your personal rosacea triggers. Common triggers include spicy foods, alcohol, caffeine, hot beverages, and extreme temperatures. \* \*\*Cooling Compresses:\*\* If you experience flushing, apply a cool compress to the affected area to help reduce redness and inflammation. \* \*\*Consult a Dermatologist:\*\* If your rosacea is severe or you are unsure about which products to use, consult a dermatologist. They can recommend personalized treatments and skincare routines. \*\*Specific Product Recommendations:\*\* While I can't recommend specific brands, look for products formulated for sensitive skin and containing the ingredients mentioned above. Reading reviews from other rosacea sufferers can also be helpful. \*\*Final Thoughts:\*\* Managing rosacea in Chennai's climate requires consistent and diligent skincare. By following these tips and paying attention to your skin's needs, you can help minimize flare-ups and maintain a healthy, comfortable complexion. Remember that consistency is key, and it may take time to find the routine that works best for you.





Model loaded successfully. Kelcome to Zephyre: Your Weather-Powered Derma AI

Capturing image and predicting skin type...
Webcam is open. Starting the feed... 📷 Starting camera... press 's' to predict Press 'q' to quit 0s 102ms/step 1/1 -

Predicted Skin Type: dehydrated (29.80% confidence) # Predicted Skin Type: dehydrated

Enter your city name: coimbatore

Weather in coimbatore: Temperature: 34.88°C Humidity : 41% Condition : scattered clouds

🗑 Generating AI-based skincare advice...

📕 Gemini-Powered Skincare Tips: ## Skincare Routine for Dehydrated Skin in Scattered Clouds Weather

Scattered clouds mean the sun's intensity can fluctuate, making consistent un protection crucial. Dehydrated skin needs a focus on replenishing moistur e while also protecting its barrier. Here's a detailed routine:

\*\*1. Cleansing:\*\*

\* \*\*Morning:\*\* Opt for a gentle, hydrating cleanser that doesn't strip the kin's natural oils. Look for ingredients like hyaluronic acid, glycerin, or ceramides. Avoid foaming cleansers that can be drying. A milk or cream clea nser would be ideal.

\* \*\*Evening: \*\* Use the same gentle cleanser or a slightly more effective

\* \*\*Evening:\*\* Use the same gentle cleanser or a slightly more effective cl eanser if you wore makeup or sunscreen. Double cleansing (using an oil-based cleanser followed by a water-based one) can be helpful for removing sunscre en and makeup thoroughly without over-drying.

\*\*2. Exfoliation:\*\*

\* \*\*Frequency:\*\* Limit exfoliation to 1-2 times a week maximum for dehydrate d skin. Over-exfoliation can worsen dehydration and damage the skin barrier. \* \*\*Type:\*\* Choose a chemical exfoliant like a gentle AHA (glycolic or lacti c acid) or a PHA (polyhydroxy acid like gluconolactone) which are less irrit ating than physical scrubs. These help to remove dead skin cells and improv e the absorption of subsequent products.

\* \*\*Precaution:\*\* Avoid exfoliating if your skin is irritated, inflamed, or sunburnt.

\*\*3. Hydration:\*\*

\* \*\*Toner (Optional):\*\* A hydrating toner with ingredients like hyaluronic a cid, rosewater, or aloe vera can add an extra layer of moisture after cleans

ing. \* \*\*Serum:\*\* A hyaluronic acid serum is a must for dehydrated skin. Hyaluro nic acid attracts and holds moisture to the skin. Other beneficial serums nclude those containing ceramides, niacinamide (vitamin B3), and panthenol ( vitamin B5), which help strengthen the skin barrier and reduce inflammation. \* \*\*Essence (Optional):\*\* A lightweight essence can boost hydration before a pplying your moisturizer. Look for similar hydrating ingredients as toners.

#### \*\*4. Moisturizer:\*\*

\* \*\*Daytime:\*\* Choose a lightweight, yet hydrating moisturizer that contains humectants (like hyaluronic acid and glycerin) to draw moisture into the sk in, emollients (like shea butter and ceramides) to soften and smooth the ski n, and occlusives (like squalane and dimethicone) to lock in moisture. \* \*\*Nighttime:\*\* Opt for a richer, more occlusive moisturizer to seal in hy dration overnight. Look for ingredients like shea butter, jojoba oil, or ce particle. ramides.

\*\*5. Sunscreen:\*\*

\* \*\*Essential, even on cloudy days:\*\* Scattered clouds still allow UV rays t o penetrate, so sunscreen is crucial. Choose a broad-spectrum sunscreen with an SPF of 30 or higher.

\*\*Type:\*\* Look for a sunscreen formulated for the face that is comfortable and won't clog pores. Mineral sunscreens (containing zinc oxide or titaniu m dioxide) are generally better tolerated by sensitive or dehydrated skin. \* \*\*Reapplication:\*\* Reapply every two hours, especially after sweating or s wimming.

\*\*6. Other Precautions:\*\*

\*Avoid hot showers:\*\* Hot water can strip the skin of its natural oils, e xacerbating dehydration. Opt for lukewarm water instead. \* \*\*Use a humidifier:\*\* A humidifier can add moisture to the air, helping to prevent dehydration, especially in dry climates or during winter months. \* \*\*Drink plenty of water:\*\* Internal hydration is just as important as topi cal hydration. Aim to drink eight glasses of water a day. \* \*\*Limit alcohol and caffeine:\*\* These substances can dehydrate the body an

d skin.

#### **8.CONCLUSION**

In conclusion, the condition of human skin is influenced by a wide range of environmental and physiological factors, necessitating intelligent, real-time monitoring systems. Early detection and personalized skincare recommendations are crucial for both cosmetic enhancement and prevention of more serious dermatological conditions. Through the development of Zephyre, this paper demonstrated how the integration of CNN models for skin analysis, combined with real-time weather data, can significantly enhance the accuracy and relevance of skin care advice. The system's modular architecture allows for easy extension and future integration of more advanced deep learning models to improve performance and prediction robustness. Although current results show promising classification accuracy, challenges such as variability in lighting conditions, data scarcity for rare skin types, and real-world deployment considerations still remain. Future work will focus on expanding the dataset, refining the CNN architecture, incorporating texture-based and

spectral analysis techniques, and ensuring clinical reliability to support dermatologists and general users alike. The findings of this research mark a pivotal move toward making personalized dermatological care accessible, precise, and dynamically adaptable to environmental factors.

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