Enhancing skin health in post-epidemic with Beauty Model-Professional Skin Condition AI Detection Platform

Shih-Hsun Lin[1], Ming-Zhu Chen[1], Cheng-Dian Wu[1], Chih-Chi Chan[1], Yu-Jie Ke[1], Tzer-Long Chen[1*], Pei-Lun Sun[1*]

[1]Department of Healthcare Administration and Medical Informatics, Kaohsiung Medical University, Taiwan

*Corresponding Author: tlchen@kmu.edu.tw; u110020063@kmu.edu.tw

DOI:10.30211/JIC.202402.002

ABSTRACT

In the post-epidemic era, people no longer needed to wear masks during their everyday activities outdoors. Consequently, they have started to pay more attention to the condition of their skin. Patients with more severe anxiety may experience "appearance anxiety". The widespread use of the Internet and the popularity of skincare products have led many people to habitually seek information directly regarding symptoms and potential medications to promptly alleviate skin discomfort. Subsequently, they make their judgements before purchasing and utilize these products immediately. However, individuals lacking professional expertise may worsen their facial skin condition by using products that are not suitable for their skin if they make incorrect judgments. Implementing an identification platform to help individuals identify skin issues and find appropriate skincare measures would reduce incorrect assessments. The aim of this research is to develop the "Beauty Model-Professional Skin Condition AI Detection Platform" to train image recognition models for skin-related diseases. The model will be enhanced through the expansion of the image dataset to provide users with a comprehensive skin health assessment. This research will develop a set of web-based identification platforms tailored to align with the internet usage patterns of modern users. Once users import skin images, the system will automatically assess the current skin condition, which may include Ectopia, Dermatitis, Eczema, Urticaria, and Psoriasis, each varying in likelihood and necessitating specific medical guidance. We use the Google Teachable Machine platform to train the MobileNetV3 model for model selection in the detection system to improve collaboration with the web page operation. We aim for the "Beauty Model-Professional Skin Condition AI Detection Platform" to not only reduce appearance anxiety for individuals but also educate the public on accurately perceiving and caring for their facial and other skin areas, including common atopic dermatitis or similar conditions. Through technology, we can empower individuals to feel more confident about their appearance, leading to an improved quality of life.

Keywords: Appearance anxiety, Artificial Intelligence, Image classification, skin disease predictions.

1. Introduction

In recent years, the most discussed topic has been the spread of COVID-19, as the epidemic has led to significant changes in daily life. For instance, due to the highly contagious nature of the pandemic, individuals are attempting to refrain from unnecessary outdoor activities to prevent cluster infections. According to the 2021 statistics from the Ministry of Health and Welfare of the Republic of China, there was a decline in the overall number of medical visits across each department during the period of epidemic prevention. However, during the epidemic, dermatology visits increased by 2.2% as people experienced prolonged facial coverage, leading to common skin issues like redness, allergies, and acne vulgaris, which resulted in more visits to dermatology departments. Several common facial skin problems exist, one of which is acne vulgaris. Prolonged mask-wearing can lead to friction between the mask and facial skin, causing irritation and discomfort. Additionally, the warm and humid environment inside the mask can clog pores with skin oils, potentially resulting in acne vulgaris. Furthermore, mask-wearing can lead to variations in skin color. Since the mask covers certain parts of the face, it reduces exposure to ultraviolet rays but also contributes to uneven skin tone. In addition, various conditions such as age spots, dry cracks, eczema, acne scars, cellulite, keratosis pilaris, atopic dermatitis, and rosacea dermatitis may arise.

Now that the epidemic has decreased, people are gradually removing their masks and resuming their previous lifestyles. With no longer any places to conceal blemishes on their faces, individuals are prompted to reassess their facial skin conditions. However, skin redness caused by mask-wearing, acne scars, blemishes, and similar issues frequently leave individuals feeling dissatisfied and lacking self-confidence in their skin. This can lead to anxiety and obsession over minor flaws, resulting in what is commonly referred to as "appearance anxiety" [7-8]. Even more concerning is that, in order to improve their skin condition as quickly as possible, most individuals opt to purchase related medications or skincare products on their own, rather than seeking a medical diagnosis from a dermatologist first. Insufficient information about skin-related drugs can lead to the use of products that are not suitable for the skin, worsening the skin condition and forming a vicious cycle.

With the rapid development of information technology in recent years, we have noted a lack of integrated detection platforms for skin diseases. To address this gap, we have developed the "Beauty Model-Professional Skin Condition AI Detection Platform". This platform aims to offer a convenient, rapid, and effective method for individuals to gain insight into their facial skin condition and access precise information.

2. Literature Review

2.1 Appearance Anxiety

Appearance anxiety represents a common form of social evaluation anxiety in today's society. It involves an individual's fixation on their appearance and the ensuing negative social evaluation, resulting in persistent negative emotions including anxiety, distress, fear, and dissatisfaction. This phenomenon encompasses not only specific physical attributes related to a person's appearance, such as skin color, nose shape, eye shape, and face shape, but also body image characteristics such as height, weight, and muscle proportions. Although scholars lack a consistent and standardized

definition of "appearance anxiety", in this study, it is defined as a negative emotion that induces feelings of anxiety about one's physical appearance [1].

2.2 Eczema

Atopic eczema, also referred to as atopic dermatitis, represents the most common type of eczematous inflammation. Following the nomenclature of the World Allergy Organization, the condition will henceforth be denoted as "eczema". Eczema is a common skin condition typically originating in childhood. However, for numerous individuals, symptoms such as dry, sore, and itchy skin may persist into adolescence and adulthood. The management of eczema centers around identifying and avoiding irritants or triggers that may worsen eczema symptoms, consistent use of emollients to restore skin barrier function, and treatment of flare-ups with topical corticosteroids or topical calcineurin inhibitors (TCIs) [2].

2.3 Atopic Dermatitis

Atopic dermatitis is a common chronic inflammatory skin condition, typically characterized by severe itching and recurrent eczematous lesions. It affects up to 20% of children and 10% of adults in high-income countries. The prevalence and incidence of atopic dermatitis has risen in recent years. Atopic dermatitis mostly occurs in childhood, but in some cases, it may persist into adulthood or even emerge in middle age (adult-onset AD). The pathophysiology of atopic dermatitis encompasses various complex factors, including genetic predisposition, impaired skin barrier function, innate and adaptive immune responses, and pruritus. These factors collectively contribute to the development, progression, and chronicity of the disease. One of the most notable characteristics of AD is skin dehydration, primarily attributed to mutations in filaggrin. These mutations determine epidermal water loss, pH alterations, and antigen penetration [3].

2.4 Urticaria

Urticaria is a common skin condition characterized by the emergence of wheals with or without angioedema. Hives usually subside within 24 hours without leaving scars. Angioedema typically manifests as sudden swelling of the subdermis and subcutaneous tissue, which usually resolves in the mucosa and can last for up to 72 hours. Patients with severe urticaria may experience damage to the gastrointestinal tract and respiratory system. Urticaria significantly affects the quality of life of affected individuals. For patients experiencing frequent attacks, the effects can be more severe than those of eczema, acne, and psoriasis, and comparable to those of ischemic heart disease. Urticaria includes acute and chronic forms. Acute urticaria is often associated with a viral infection or an acute allergic reaction caused by food, medication, or insect bites. Identifying the cause of chronic is challenging. Chronic urticaria presents in various forms, including chronic spontaneous urticaria and chronic induced urticaria, depending on whether the attack is triggered by a specific stimulus. Chronic spontaneous urticaria is more prevalent than other types of chronic urticaria [4, 14].

2.5 Psoriasis

Psoriasis is a prevalent, chronic inflammatory skin condition that affects approximately 2-3% of the global population. According to reports, the prevalence of psoriasis varies from 30.3 per 100,000 people to 321.0 per 100,000 people and is influenced by genetic and environmental factors, including age, gender, geographical location, and race. Psoriasis can occur at any age, but it is particularly common among individuals aged 16-22 and 55-60. Additionally, it can significantly impact a patient's quality of life and their ability to generate income. The causes of psoriasis are complex and still not fully understood. It involves genetic susceptibility, environmental triggers, and immune dysregulation. Psoriasis is a multifaceted disease that can be categorized into various clinical types. The most common type of psoriasis is plaque psoriasis (also known as psoriasis vulgaris), which causes dry, itchy, and raised skin. These patches can appear anywhere on the skin, but they are frequently found on the elbows, knees, scalp, and lower back. Other types of psoriasis comprise guttate psoriasis, inverse psoriasis, pustular psoriasis, and erythrodermic psoriasis. An increasing number of studies indicate that psoriasis is a systemic disease linked with numerous comorbidities, including cardiovascular disease, metabolic syndrome, psoriatic arthritis, depression, and anxiety [5].

2.6 Machine Learning

Machine learning can be defined as a scientific discipline that centers on how computers learn from data and progressively improve their performance. It primarily relies on probability and statistics. However, it surpasses conventional statistical methods in decision-making effectiveness. The information extracted from the given dataset and provided to the algorithm is referred to as features. The role of the machine learning developer is to identify the subset of features that best align with the target, thereby enhancing the accuracy of the model. When considering the application of machine learning algorithms, there are essentially three steps to follow: training, testing, and validation. Training is crucial because the accuracy of the results relies on the quality of the training dataset [6].

2.6.1 Supervised learning

In supervised learning, training sets are equipped with specific objectives to guide the learning process. Two categories of supervised learning include classification and regression. In classification, trained systems utilize classification methods to assign inputs to categories, whereas in regression, the input is continuous rather than discrete. The root mean square error is employed to evaluate regression predictions, while accuracy is utilized to evaluate classification predictions. Supervised learning primarily revolves around classification, which entails selecting the optimal subgroups to describe new material instances, and prediction, which involves estimating unknown parameters. This method is commonly used to estimate and model risk while uncovering relationships that may not be immediately apparent to humans [6].

2.6.2 Unsupervised learning

When developers lack a clear understanding of the materials involved in the system, labeling the materials, and providing them as a training dataset becomes impossible. In such instances, machine

learning algorithms can be utilized to detect similarities and differences between data objects. In this approach, existing patterns are identified, and the data is clustered according to these patterns. In unsupervised learning, the system makes decisions without being trained on a dataset because it is not provided with labeled data that can be used for predictions. It is worth noting that unsupervised learning aims to identify naturally occurring patterns or groups in data [6].

2.6.3 Semi-Supervised learning

In semi-supervised learning, partial training datasets are provided. This type of training is useful when specific training materials can address particular learning outcomes. Semi-supervised learning algorithms are trained using both labeled and unlabeled data, exhibiting characteristics of both supervised and unsupervised machine learning algorithms [6].

2.6.4 Evolutionary learning

Evolutionary learning is primarily employed in the field of biology to understand biological organisms and predict their survival rates. This method also enables the prediction of the accuracy level of the results [6].

2.6.5 Deep learning

Deep learning represents an advanced form of machine learning that centers on neural networks to learn from and make predictions about data. Through this approach, it is feasible to implement complex generalized systems capable of addressing any type of problem and providing predictions about it [6].

2.7 Google teachable machine

Google Teachable Machine (GTM) is a machine learning development platform provided by Google. The model employed by GTM is MobileNet V3, which is developed using the Convolutional Neural Network (CNN) architecture of deep learning. Currently, GTM primarily offers three projects (image project, audio project, gesture capture) for training the model and empowering users to utilize it. The accessibility of Google Tag Manager (GTM) makes it easy to operate, allowing teachers, students, or beginners without a professional machine learning background to train and utilize machine learning through three simplified major training processes (see Figure 1). The widespread adoption and application of machine learning today can be credited to the tool's user-friendly interface [13].

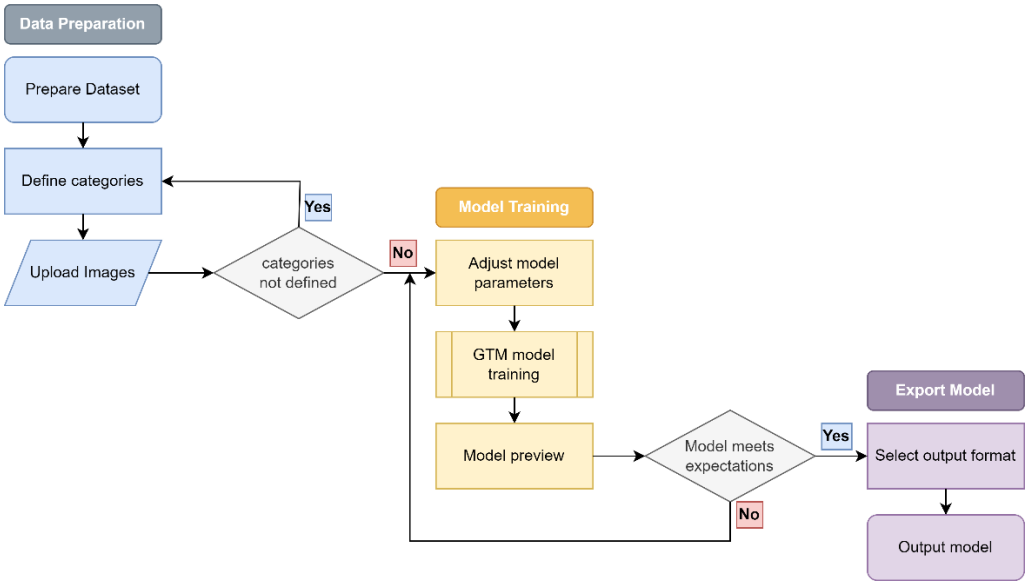


Figure 1. GTM training process (image project)

Source: By authors.

3. Research methodology

3.1 Research Purpose

This study is designed to meet the needs of users seeking to improve the skin condition of the face or other specific body parts. Its main core concept is to integrate artificial intelligence and image recognition technology, and it is committed to providing users with self-detection tools of skin conditions and tracking management tools. By allowing users to upload photos of their skin, the platform can quickly identify various skin conditions and provide brief introductions to related diseases or symptoms. In addition, this platform will also offer guidance on proper medication disposal and daily maintenance methods tailored to the diagnosis results, providing users with immediate and personalized advice. Through the proposed platform, this study aims to help users confidently and comfortably address skin appearance issues and gain a comprehensive understanding of their skin conditions in daily life, ultimately enhancing their quality of life.

3.1.1 Platform's architecture

The system architecture of this study is primarily divided into three parts: skin condition identification, various record inquiries, and hospital medical referrals. The schematic diagram of the system architecture is depicted in Figure 2.

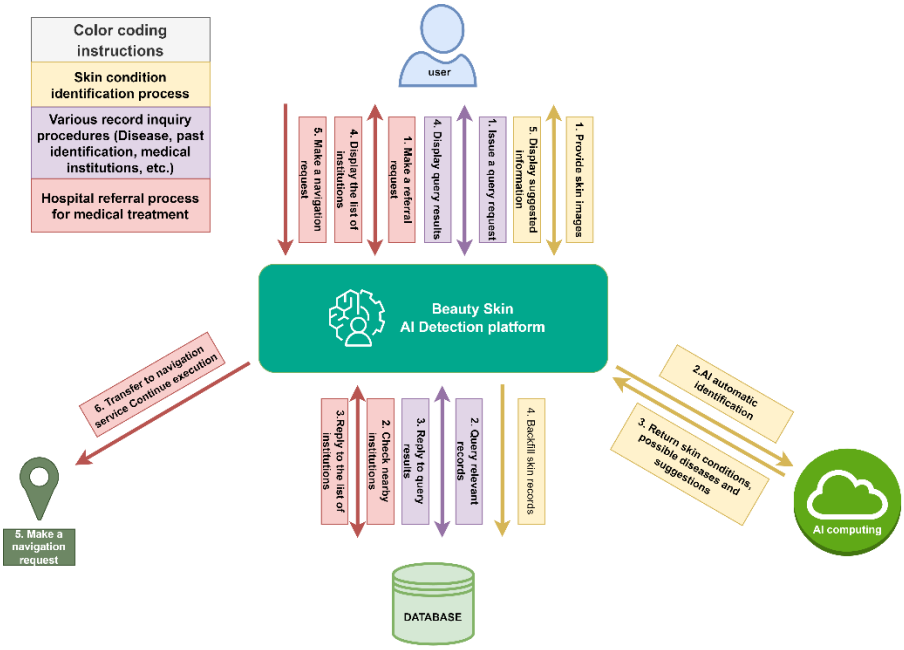


Figure 2. Platform Architecture diagram

Source: By authors.

When it comes to identifying skin conditions, users will upload skin images to the platform, which will then submit the images to AI algorithms for automatic identification. Once the AI calculation is completed, the platform will return relevant skin conditions, possible disease predictions, and corresponding suggestions. Subsequently, this information will be backfilled into the skin record database. Finally, the platform will display comprehensive recommendation information to the user, enabling them to gain a thorough understanding of their current skin condition and receive corresponding maintenance suggestions.

When users need to query various records, they can do so by sending a query request to the platform. After receiving the user's request, the platform will send relevant queries to the database to retrieve the information the user needs. After being retrieved, the database will send the query results to the platform, including pertinent information such as the user's previous skin condition, diagnosis results, and records of past suggestions provided to the user. Finally, the platform compiles and displays the query results on the user's terminal, allowing them to conveniently view the required skin records and gain a better understanding of the development trends of their skin conditions.

When users need to find medical institutions for treatment, they can send a referral request to the platform to initiate the process. After receiving the user's request, the platform will send relevant queries to the database to obtain information about nearby medical institutions. After being retrieved, the database will send the query results to the platform, which will include the names, addresses, relevant contact information, and other details of nearby medical institutions. The platform will present the query results to users as a list of hospitals, enabling them to conveniently select a medical facility. If the user wishes to access navigation services, they can send a navigation request to the platform. The platform will then proceed to execute the navigation service, guiding the user to the

selected medical institution.

3.1.2 Platform's functions

The functions of the proposed platform are illustrated in Figure 3. The functions include identifying and tracking skin conditions over the long term, offering users an introduction to related diseases, providing daily maintenance suggestions and medication recommendations, and offering personalized medical advice to the public. If a patient requires the resources of a medical institution, this platform will also serve as an intermediary and refer the patient to a medical institution for a more comprehensive skin condition test.

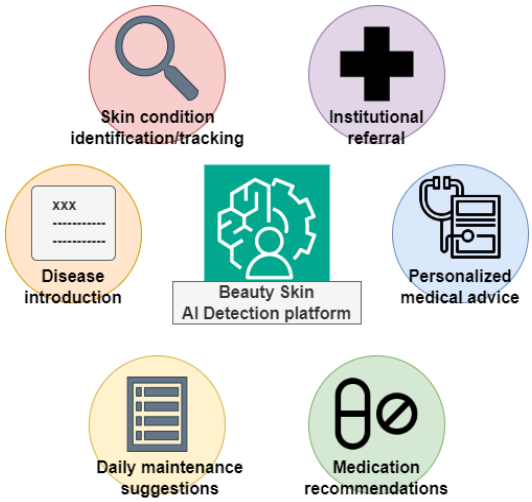


Figure 3. Six major functions of "Beauty Skin AI Detection Platform"
Source: By authors.

A. Skin condition identification and tracking:
Users can upload photos of their face, hands, or other skin areas, and the platform will utilize artificial intelligence image recognition technology to instantly diagnose skin issues and identify conditions such as atopic dermatitis, psoriasis, urticaria, and eczema. Additionally, the platform offers a long-term trend tracking feature. Through continuous AI skin detection, the system will create a historical record of individual users' skin conditions and present personalized skin health trends. This function is not limited to beauty applications; it can also be extended to clinical medical diagnosis. By using platform data as a reference, doctors can accurately assess the patient's skin condition and develop effective treatment plans.

B. Disease information:
After completing the skin identification, the platform will provide a brief explanation of any related skin diseases. First, the system will explain the potential causes of the disease, including genetics, immune system abnormalities, external stimuli, and other physiological or environmental factors. Secondly, the platform will provide information about the

symptoms of the disease to improve users' understanding. Finally, the platform will elaborate on the potential impact on the human body and explore the possibility of spreading to other parts. By explaining test results in three main aspects, users can gain a preliminary understanding of skin disease conditions.

C. Daily maintenance recommendations:

After the system completes skin identification, it will provide suitable daily maintenance methods based on the identification results to enhance skin health. During the cleansing process, the platform may recommend the use of cleansing products with specific ingredients, such as mild products suitable for people with sensitive skin, to ensure that the skin is not overly irritated. Additionally, the system will offer recommendations for alternative maintenance approaches, including dietary adjustments, lifestyle improvements, and precautions for specific environmental factors. With the personalized recommendations, users can establish an effective daily skincare routine to achieve long-term skin health goals.

D. Medication recommendations:

After identifying the skin condition, the platform will not only offer medication recommendations for skin symptoms but also inform users about prescribed medications from medical institutions, including specific drug names, main ingredients, and administration methods. It will also explain the effects of the medications. What symptoms can be improved or alleviated? To ensure users have relevant drug knowledge, the platform will also provide explanations about the potential side effects and contraindications, as well as any special considerations when using the drug to avoid unnecessary risks. The medication suggestions provided above are intended to help users gain a comprehensive understanding of the drugs and achieve improved therapeutic effects.

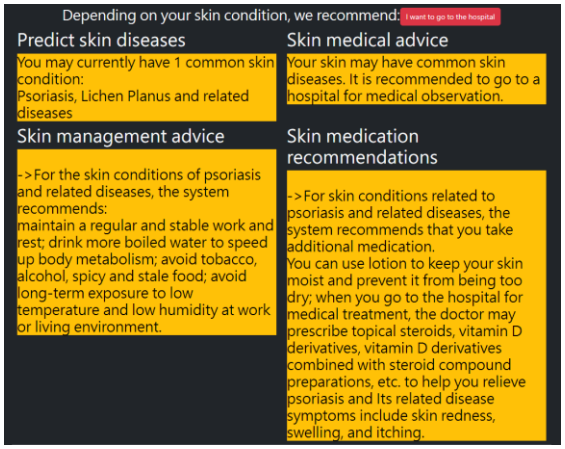
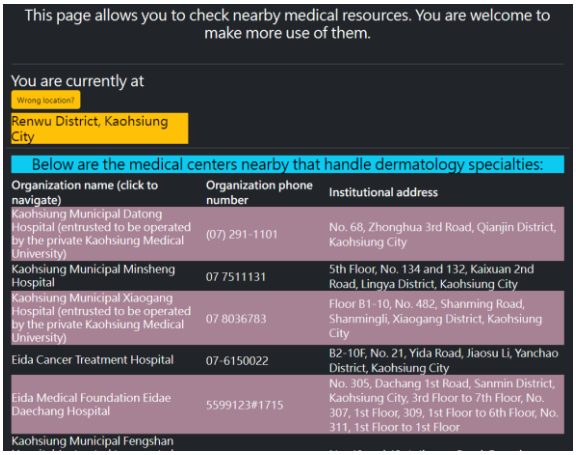
E. Personalized medical advice:

All the aforementioned recommendations and information will be customized to the user's individual skin conditions and requirements, guaranteeing that the platform's advice and suggestions align with the user's actual situation. This customized function will assist users in regaining their understanding of the skin. Improved health confidence and increased willingness to seek treatment.

F. Institutional referral:

The platform will automatically list nearby medical institutions based on the user's current location, making the medical treatment process more convenient. This function will help reduce the time spent on inquiries, thereby improving the efficiency of medical treatment. Considering that users may be accustomed to a specific type of medical institution or prefer to seek medical treatment in a particular area, the platform can also use manual adjustment of the regional menu to search for more medical treatment options.

Table 1. Platform screen diagram

Identification results page (diseases, medications, maintenance and medical advice)	Institution referral page
	

Source: By authors.

3.2 Research Design

This study will utilize the skin-related disease dataset published on the Kaggle academic research platform for data pre-processing. It will exclude photos that could potentially impact model identification. Additionally, it will supplement the missing feature images in the original dataset, enabling the model to be used for subsequent identification, ensuring maximum effectiveness in the process.

3.2.1 Create an image dataset

When initially selecting the sample set, we specifically focused on four common skin diseases: atopic dermatitis, eczema, urticaria, and psoriasis. During the screening, we will exclude patients who may affect the identification results or who have personal information visible in the images, such as the hospital name, medical record number, and other private details. After excluding images, we will also recode the data to ensure its validity and de-identification.

To enhance the model's ability to identify objects, we will augment the original image dataset [9] by adding samples and simulating real-life scenarios through random scaling, rotation, and brightness adjustments of the images [10]. This augmentation will enable the model to be more effective in real-world applications handling the challenges posed by uncertain factors such as varying lighting, angles, and image quality, thereby enhancing the model’s stability.

3.2.2 Training the identification model

To implement the skin condition recognition function of the proposed platform, we opted to

utilize the Google Teachable Machine (GTM) platform for model training. We used MobileNet V3 as the foundational model and trained the recognition model using the image projects provided by GTM [15]. In the data preparation stage, we initially define categories for representative skin disease imaging data and then classify them into the corresponding skin categories. During the model training stage, we adjusted the model parameters to enhance recognition performance and continuously trained the model using the training function of GTM to optimize it as much as possible. Table 2 displays the model parameters utilized for training in this study.

Table 2. Model parameters

Param	Epochs	Batch Size	Learning Rate
Value	250	16	0.01

Source: By authors

At the same time, we reviewed the results at the model preview stage. If the model fail to meet expectations, we then revisit the data preparation step and make additional adjustments and improvements to the dataset or categories until the model achieves the desired results. Finally, choose the appropriate model format during the model output stage to ensure successful deployment to the "Limei Model-Professional Skin Condition AI Detection Platform" server.

3.2.3 Evaluation of model effectiveness

This study employs three effectiveness indicators to assess the recognition impact of the training model [11]. These indicators are the number of images depicting True Positives, False Positives, True Negatives, and False Negatives. as the basis for calculation.

Recall is used to evaluate the model's ability to identify true positive (TP) samples, representing the proportion of all positive samples that the model can correctly identify. The higher the recall rate, the stronger the model's ability to identify true positives. The calculation formula is represented by equation (1).

$$Recall = \frac{TP}{TP + FN}, \tag{1}$$

Accuracy is an indicator used to evaluate the model's ability to recognize a specific disease category. It represents the proportion of samples correctly attributed to that category among all samples identified by the model as the same disease category. The accuracy value ranges between 0 and 1. The closer the value is to 1, the more accurate the model is in identifying the disease. The calculation formula is given by equation (2).

$$Precision = \frac{TP}{TP + FP}, \tag{2}$$

F1-Score: It is a harmonic mean with a value ranging from 0 to 1. The closer the value is to 1,

the better the performance of the model. The F1-Score is primarily used to comprehensively evaluate the results of Recall and Precision in order to summarize the overall performance of model identification. The calculation formula is given by equation (3).

$$F1-Score = 2 \times \frac{Precision \times Recall}{Precision + Recall}, \tag{3}$$

4. Empirical research

4.1 Results of Skin Disease Identification

After reviewing the dataset and incorporating additional samples, the training dataset now includes a total of 1886 external skin images. This comprises 317 normal images, 199 atopic dermatitis images, 476 psoriasis images, and 381 urticaria images. Zhang, please locate 503 images of eczema, a skin disease. Subsequently, we randomly divided the training dataset into data for GTM training and test data for subsequent performance analysis at a ratio of 9:1. Table 3 presents the final identification results of each disease by the model.

Table 3. Skin disease identification results performance table

Skin	F1-Score	Recall	Precision
Normal	0.9256	0.9057	0.9463
Atopic dermatitis	0.8905	0.9196	0.8632
Eczema	0.8696	0.8489	0.8914
Urticaria	0.9216	0.9265	0.9168
Psoriasis	0.8559	0.8361	0.8767

Source: By authors.

The recognition model exhibits the highest recall rate in urticaria, reaching 0.9265, while the highest accuracy rate is observed in normal skin, at 0.9463. Overall, the model demonstrates the most effective recognition for normal skin. The system's model identification results are visually depicted in Figure 4.

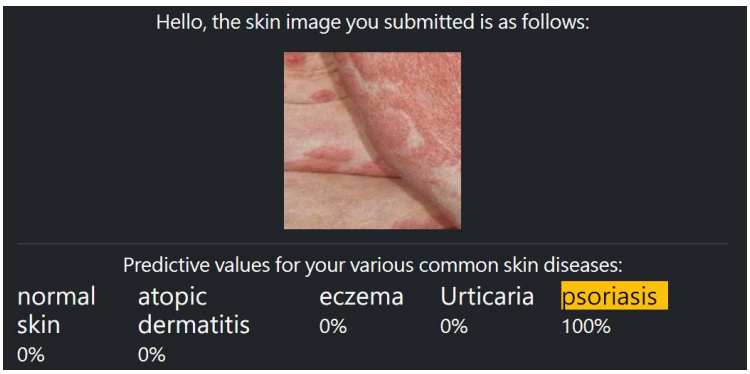


Figure 4. Schematic diagram of model identification results (taking psoriasis as an example)

Source: By authors.

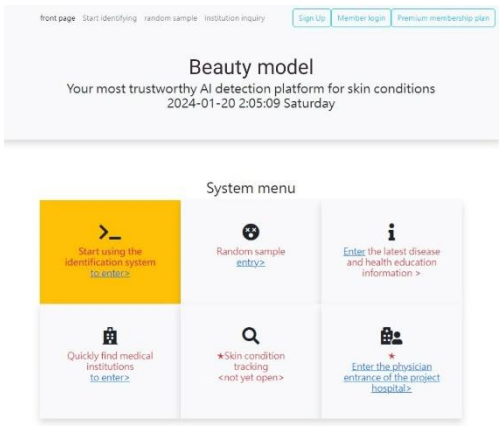
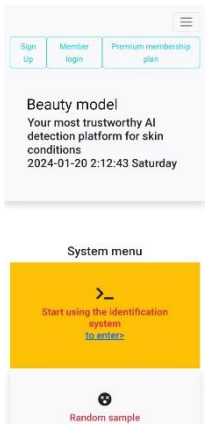
4.2 Web Server

After confirming the model's proficiency in identifying various skin conditions, we successfully deployed it on the "Beauty Model-Professional Skin Condition AI Detection Platform" web server. With a focus on improving user experience in medical treatment, the platform seamlessly integrates query and navigation functions for medical institutions. Users only need to provide relevant information, and the platform acts as an intermediary, automatically processing the data and returning accurate results. The real-time responses provided by the platform contribute to the efficiency of users' medical treatment.

4.2.1 Platform interface design

Considering the modern users' inclination towards mobile web browsing, our platform leverages the BootStrap open-source framework to automatically adapt the layout to different device sizes, providing users with diverse browsing experiences. Table 4 compares the interface layout on desktop and mobile terminals.

Table 4. Comparison of desktop and mobile layouts

Desktop	Mobile
	

Source: By authors.

4.2.2 Disease identification function

For improved user convenience and enhanced system usability, the system will generate a QR code with interactive data when users upload images. This allows users to effortlessly upload files using their mobile phones by scanning the QR code. Once photo recognition is completed, users can perform additional operations on their mobile phones. Figure 5 depicts the comprehensive system process for identifying skin diseases. The following provides a concise overview of the user interface

process:

I. Navigate to the home page of the testing platform.

II. Select the "Identification System" function.

III. Upload photos of the affected area using your computer or mobile phone.

IV. Crop the photo to the appropriate size

V. View disease identification results and platform recommendations

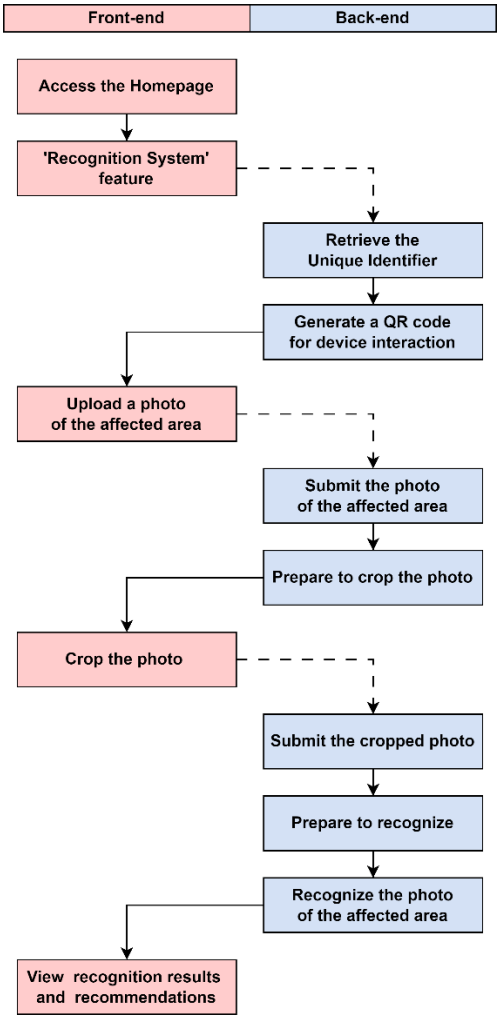


Figure 5. Full system flow chart of skin disease identification function

Source: By authors.

4.2.3 Institute query and navigation functions

If users require hospital referrals, they can utilize this function to promptly locate nearby medical facilities that offer professional skin treatment. Figure 6 illustrates the complete system process for the institute's inquiry and navigation function. The following is a brief description of the user interface process:

I. Access the institute's inquiry function.

II. Grant platform access to your location

III. Browse the list of nearby medical facilities.

IV. Select the institution you wish to attend.

V. Utilize the navigation service for follow-up operations.

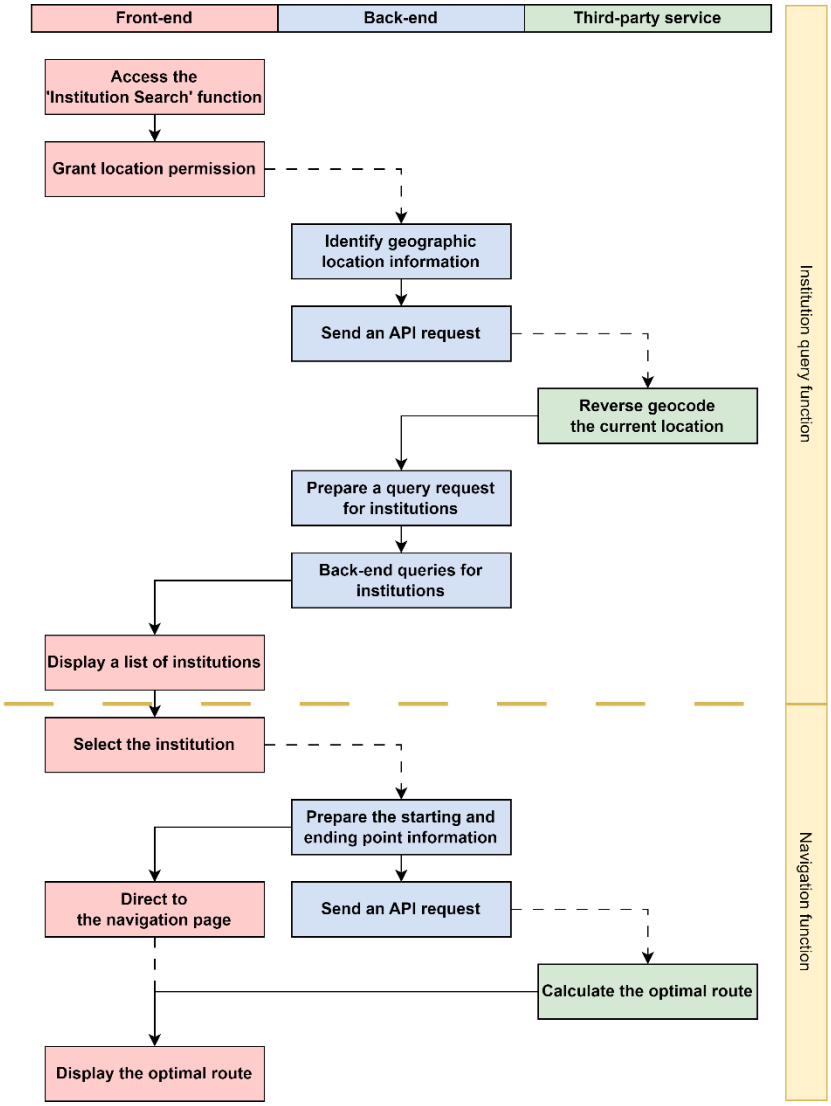


Figure 6. Full system flow chart of institution query and navigation functions

Source: By authors.

4.2.4 Public site information

The Skin disease detection platform is now open for public use. The public site information and related platform operation instructions are shown in the table below:

Table 5. Research site and related information

Information	**Link**
Official Platform Website(ch.)	home.bacons.cc/beauty
Platform Recognition Result Page(ch.)	home.bacons.cc/beauty/result.php?uid=100

Source: By authors.

5. Conclusion

5.1 Model Identification Platform

In this study, we conducted a manual review of the image dataset, assessed the images, and added missing feature images for each classification. The recognition model was trained using the GTM platform, and subsequent verification validated the model's robust recognition capabilities. Upon users uploading photos, the system automatically generates results and offers medical advice. To enhance user access to the model, we exported the final model and deployed it on a web-based system. We integrated several features and optimized it for mobile usage to align with current user practices. Ultimately, nearly 80% of users expressed satisfaction or higher with the overall system performance.

5.2 Webpage Recognition Platform

After launching the webpage identification platform to the public, we collected feedback from users regarding their experiences with the platform. Between the end of October and December 13 in the Republic of China, a total of 194 individuals participated, with 37 valid questionnaires completed. According to statistics, users' feedback on the system process (Q2-2) and interface design (Q2-5) is entirely satisfactory. Concerning the overall system performance, nearly 80% of users provided satisfactory evaluations. Detailed statistics are presented in Table 6.

Table 6. User satisfaction statistics table (the lowest is 1, the highest is 5)

Question	1	2	3	4	5
Q2-1	0	3	9	14	11
Q2-2	0	0	15	19	3
Q2-3	1	3	4	27	2
Q2-4	0	4	5	22	6
Q2-5	0	0	7	26	4

Source: By authors.

5.3 Improvement

After releasing the webpage identification platform to the public, we collected feedback from users regarding their experiences with the platform. Between the end of October and December 13 in the Republic of China, a total of 194 individuals participated, and 37 valid questionnaires were completed. According to statistics, users' feedback on the system process (Q2-2) and interface design (Q2-5) was entirely satisfactory. Regarding the overall system performance, nearly 80% of users provided satisfactory evaluations. Detailed statistics are presented in Table 6.

Integrate user feedback for any satisfaction rating of 2 points or less and propose ways to improve negative experiences.

5.3.1 The identification result is inaccurate

The main reason for this outcome is the significant inconsistency between the recognition result presented to the user after completing the recognition process and the expected results. This

discrepancy leads users to question the accuracy of the recognition result. Upon reviewing the reasons for the inaccurate results on the form, we found that most users entered images that should have been identified as psoriasis. However, the platform presented the identification result as urticaria, even for those without professional knowledge. Users can also easily notice that the identification results do not align with the medical definition of skin diseases, which raises doubts about the platform and results in an unsatisfactory experience. We will continue to enhance the service model in the future to improve the accuracy of identifying various skin diseases.

5.3.2 The layout is difficult to read

The platform offers text descriptions and color-coded indicators to illustrate the severity of skin diseases after completing the identification process. It also provides predictions and medical advice related to skin diseases. However, when the majority of users are over 45 years old, selecting a customer group may result in feedback that is excessively text-heavy and dense. The platform lacks additional auxiliary tools, such as a magnification function or text-to-speech feature, to aid users in understanding the recognition results. This omission makes it challenging for them to comprehend the output. For future enhancements, we should consider integrating voice assistance and graphic explanations to enhance user-friendliness, especially for the elderly [12].

5.3.3 Covering the affected area

When this platform collects training data, it will first capture clear image parts and eliminate any models that may cause interference. However, in real-life scenarios, not all images are clear and easily distinguishable. Aside from tattoos and birthmarks, which can interfere with identification results, clothing and other fabrics can also obstruct the skin from being identified. It remains to be determined whether the model can accurately differentiate these hand-interfered images.

References

[1] Wu, Y., Xue, Y., Zhao, X., Han, S. and Wu, W. Unravelling the veil of appearance anxiety: exploring social media use among Chinese young people. BMC psychology, 2024, 12(1), 9. DOI:10.1186/s12888-020-03000-5.

[2] Greenwell, K., Ghio, D., Sivyer, K., Steele, M., Teasdale, E., Ridd, M.J. and Muller, I. Eczema Care Online: development and qualitative optimisation of an online behavioural intervention to support self-management in young people with eczema. BMJ open, 2022, 12(4), e056867. DOI:10.1136/bmjopen-2021-056867.

[3] Fania, L., Moretta, G., Antonelli, F., Scala, E., Abeni, D., Albanesi, C. and Madonna, S. Multiple roles for cytokines in atopic dermatitis: from pathogenic mediators to endotype-specific biomarkers to therapeutic targets. International Journal of Molecular Sciences, 2022, 23(5), 2684. DOI:10.3390/ijms23052684.

[4] Li, J., Mao, D., Liu, S., Liu, P., Tian, J., Xue, C. and Zhang, J. Epidemiology of urticaria in China: a population-based study. Chinese Medical Journal, 2022, 135(11), 1369-1375. DOI: 10.1186/s12888-020-03000-5.

[5] Guo, J., Zhang, H., Lin, W., Lu, L., Su, J. and Chen, X. Signaling pathways and targeted therapies for psoriasis. Signal Transduction and Targeted Therapy, 2023, 8(1), 437. DOI:10.1038/s41392-022-00925-z.

[6] Jayatilake, S.M.D.A.C. and Ganegoda, G.U. Involvement of machine learning tools in healthcare decision making. Journal of healthcare engineering, 2021. DOI:10.1155/2021/6679512.

[7] Sarangi, A., Yadav, S., Gude, J. and Amor, W. Video conferencing dysmorphia: assessment of pandemic-related body dysmorphia and implications for the post-lockdown era. Cureus, 2022, 14(3). DOI: 10.7759/cureus.22965.

[8] Novita, S., Andriani, D., Erika, Lipowski, M. and Lipowska, M. Anxiety towards Covid-19, fear of negative appearance, healthy lifestyle, and their relationship with well-being during the pandemic: a cross-cultural study between Indonesia and Poland. International Journal of Environmental Research and Public Health, 2022, 19(12), 7525. DOI: 10.3390/ijerph19127525.

[9] Yuan, Z., Yuan, H., Li, C., Dong, G., Tan, C. and Zhou, C. Scaling relationship on learning mathematical reasoning with large language models. arXiv preprint arXiv:2308.01825.Mamillapally, 2023.

[10] Nagaraju, M., Chawla, P., Upadhyay, S. and Tiwari, R. Convolution network model based leaf disease detection using augmentation techniques. Expert Systems, 2022, 39(4), e12885.DOI:10.1111/exsy.12885.

[11] Grandini, M., Bagli, E., and Visani, G. Metrics for multi-class classification: an overview. arXiv preprint arXiv:2008.05756, 2020.

[12] Hussain, S. and Khan, H. K.The Role of Images in the Teaching and Learning of English: Practices, Issues, and Possibilities. Pakistan Languages and Humanities Review, 2022, 6(4), 338-348. DOI:10.47205/plhr.2022(6-IV)31.

[13] Carney, M., Webster, B., Alvarado, I., Phillips, K., Howell, N., Griffith, J. and Chen, A. Teachable machine: Approachable Web-based tool for exploring machine learning classification. In Extended abstracts of the 2020 CHI conference on human factors in computing systems, 2020, 1-8. DOI:10.1145/3334480.3382839.

[14] He, L., Yi, W., Huang, X., Long, H. and Lu, Q. Chronic urticaria: advances in understanding of the disease and clinical management. Clinical reviews in allergy & immunology, 2021, 1-25. DOI:10.1007/s12016-021-08886-x.

[15] Qian, S., Ning, C. and Hu, Y. MobileNetV3 for image classification. In 2021 IEEE 2nd International Conference on Big Data, Artificial Intelligence and Internet of Things Engineering (ICBAIE), 2021, 490-497. DOI: 10.1109/ICBAIE52039.2021.9389905.