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AI-Enabled Skin Classification and Customized Product Recommendation

Dr. Gururaj J.P

Associate Professor, Government First Grade College, Davangere, India

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ABSTRACT: In this paper, we develop an AI-enabled skin classification and Customized Product Recommendation System using skin images for skincare recommendation. The system needs to learn deep learning along with some local image processing techniques in order to classify skin features out of user uploaded images. We have used a MobileNetV2-based model for skin image classification, and we have also performed some image preprocessing and data augmentation methods to develop the model. The system predicts what skin type you will have and this can be complemented by skincare product advice. The application further incorporates user registration and authentication, FAQ module, an administrative panel for managing users, as well as system content. The proposed system will be an automated, personalized and user-friendly skincare management platform that helps to minimize the dependence of manual skin assessment along with generic questionnaire-based recommendations.

KEYWORDS: Skin type classification, deep learning, convolutional neural network, MobileNetV2, transfer learning, product recommendation, image processing.

I. INTRODUCTION

Skin health is an integral part of personal well-being, and determining one's skin type is essential in choosing the appropriate topical products and developing a skincare routine. Since different skin types require different treatments, the use of irrelevant products will not yield the desired results. The conventional approach to determining the skin type is through manual inspection, a visit to a dermatologist, or completing a set of questionnaires. However, these methods are often associated with high costs, time constraints, and subjective evaluation based on the information provided by the user. The recent advances in the field of Artificial Intelligence (AI), including machine learning, deep learning, and image processing, offer a solution to this issue. AI systems can analyze the input data, identify patterns, and extract useful information, which enables the creation of an application that will help users find the skincare products suitable for their skin type. The AI-Enabled Skin Classification and Customized Product Recommendation System is aimed at providing the users with an automated, customized, and easy-to-use approach to skincare.

From a user's perspective, the system is straightforward: after uploading an image of their skin, they should receive recommendations of the relevant skincare products. In this system, the uploaded image is analyzed using deep learning algorithms capable of classifying the skin type based on the appearance of the skin. The MobileNetV2 model is used to predict the outcome based on the input data. Moreover, during the preprocessing stage, the data augmentation techniques are applied to improve the performance of the model. Once the user uploads an image, the system identifies relevant features, classifies the skin type, and recommends the products accordingly. In this way, the AI-Enabled Skin Classification and Customized Product Recommendation system allows users to make informed decisions regarding their skincare. In addition to the aforementioned features, the application offers registration and authentication services, an FAQ section, and an admin panel.

Overall, the system under consideration integrates the principles of deep learning, image processing, and customized product recommendation to address the limitations of conventional image analysis and provide a novel approach to skincare product recommendation. Thus, despite the simplicity of its interface, the system described above has multiple features that address the shortcomings of previous approaches and contribute to the field of personalized healthcare. The rest of this paper is organized as follows. Section 2 provides the background of the research area. The description of the proposed model and methodology is given in Sections 3 and 4. The results of the experiments are presented in Section 5, and the concluding remarks are given in Section 6.

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II. RELATED WORK

Saiwaeo et al. suggested a human skin-type classification system based on image processing and deep learning approaches. The article considered normal, oily, and dry skin types and used the CLAHE algorithm for image enhancement and image augmentation to improve the quality of the input data. The study examined the options for the convolutional neural network (CNN), including MobileNetV2, EfficientNetV2, InceptionV2, and ResNetV1. The results demonstrated the most accurate performance of EfficientNetV2, proving that deep learning methods can be successfully used to classify skin types with high accuracy. However, the study was limited by its focus on the problem of skin-type classification without developing a full-scale user-oriented solution with product management and recommendation features.

Kothari et al. developed a CNN-based system for cosmetic skin-type classification and product recommendation. The article demonstrated the power of deep learning methods for addressing the problem of classifying human skin into different types and used the obtained solution for recommending cosmetic products to users. The results of the study proved the feasibility of using CNNs to solve the tasks of skin-type classification and product recommendation. However, the CNN model used a small amount of data for training, which might affect the accuracy of the results, and the scope of the solution could be expanded by using a larger dataset.

Teja and Latha focused on the idea of using skin-type classification results for recommending products to users. The article showed that it was possible to suggest products to users based on their skin type predicted by a CNN model. However, the study could be expanded by incorporating more sophisticated approaches to recommend products to users. In addition, the use of advanced deep learning technologies could improve the accuracy of the results.

Geetha and Bharath suggested a personalized skin-type classification and recommendation approach that could be used to help users select the most appropriate cosmetics on the market. The article stated that the key advantage of their approach was the use of the predicted skin type to recommend products to users rather than offering the same products to all individuals. The results of the study proved the feasibility of this approach. However, the system could be improved by designing a framework that would incorporate product management, user management, and recommendation features to develop a full-scale solution.

Bhagyawant et al. proposed a solution for predicting skin type and suggesting products based on the information predicted by the algorithm. The article indicated the possibility of using machine learning and image processing to help users identify their skin type and recommend appropriate products. The study showed that such a system could be used in practice. However, the recommendation results could be improved by using more advanced CNNs and artificial intelligence (AI) technologies.

Kadam et al. proposed a system for recommending products based on the type of human skin using AI and machine learning technologies. The article indicated that advanced AI and machine learning algorithms could be used to build a system that could recommend products to users. The study proved the feasibility of the solution but did not consider all aspects of the problem, and the use of AI technologies could simplify the process of product recommendation for users.
Chang et al. proposed a novel approach to classifying human skin using a CNN algorithm. The article described the use of a CNN model for identifying the type of facial skin with the use of spectrum images of human faces. The study used the Fitzpatrick skin type classification system and reported that the accuracy of the CNN model reached 92.59%. The results proved the possibility of using CNN models for the task of classifying skin types. The study was limited by the fact that it addressed only the problem of classification without providing the full-scale solution.

Saidah et al. proposed a novel solution for classifying facial skin into four categories using a CNN model. The study involved the use of microscopic images of human faces for classifying skin into normal, dry, oily, and combination skin types. The dataset used in the study was created using the microscopic camera, and the images were verified by a dermatologist. The results showed that the CNN model achieved an accuracy of 99.5% in classifying skin types. However, the solution was limited by the need to process microscopic images, whereas regular users would provide the images captured by their digital devices.

Chan et al. proposed a system for classifying human skin using a mobile application and deep learning algorithms. The system was designed to simplify the process of skin-type classification and used the TensorFlow Lite framework for implementing CNN models on Android devices. The results of the experiment showed that the proposed model achieved an accuracy of 96%, and the study proved the feasibility of using mobile applications for solving the problem

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of skin-type classification. However, the current work goes beyond the scope of this study by providing the full-scale platform that addresses the problem of personal skin-type classification and product recommendation.

Lee et al. proposed a novel technology for recommending skincare products using deep learning algorithms. The article showed that a CNN model could be used for analyzing user's facial skin to understand the mechanism of its work and predict the most appropriate products. The system was further equipped with the feature of analyzing the ingredients of skincare products. The results demonstrated that the system could recommend products to users with high accuracy. However, the current study used a complex approach to the problem, whereas it could be simplified by developing a CNN model for skin-type classification and product recommendation.

III. PROPOSED SYSTEM

In order to predict skin type, the new system uses an image-based deep learning pipeline in place of subjective questionnaires. Users submit images of their skin, which are then classified using a trained classification model. Based on this forecast, the system automatically creates personalized product recommendations. Instead of just creating a textbook classification model, the platform offers a comprehensive end-to-end solution that includes user registration and authentication, a FAQ module that provides users with guidance on a variety of topics, and an admin panel for managing users and content.

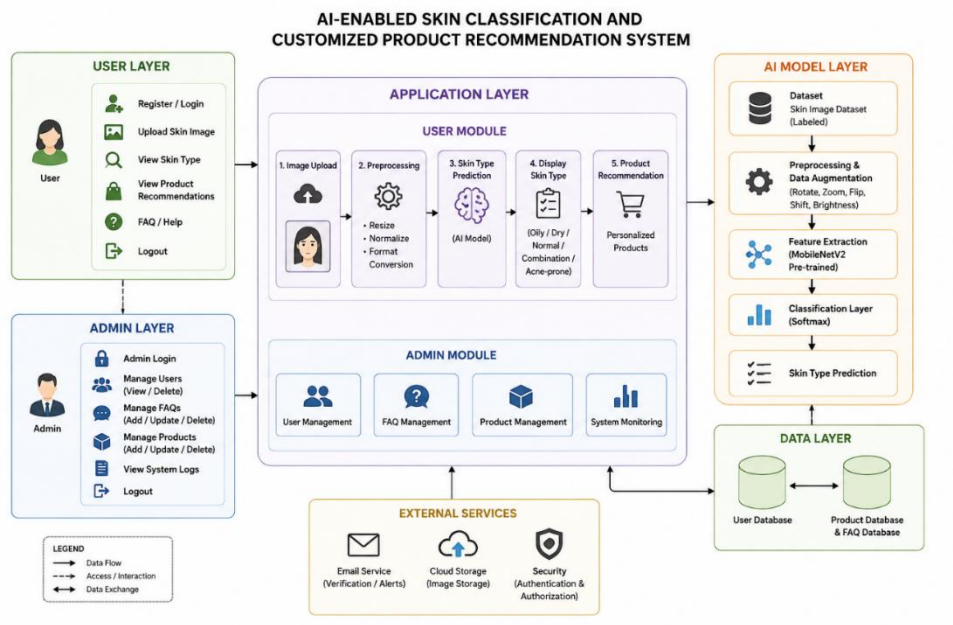

Figure 3: system architecture

The above architecture depicts the AI enabled skin classification and customized product recommendation system. The architecture can be broadly divided into five major layers namely, User Layer, Admin Layer, Application Layer, AI Model Layer, and Data Layer. The system also communicates with external services like email, cloud storage, and security services. The whole system takes the skin image from the user, processes it using the AI model layer, predicts the skin type, and recommends the customized skincare product.

1. User Layer: The user layer provides the user interface. The user logs in or registers to use the application. The user uploads their skin image, which is processed by the AI model. The user gets their skin type predicted and receives a customized skincare product. The user may find help from the FAQ/help section and may log out.
2. Admin Layer: This layer is for the system administrator. The administrator needs to log in to manage the application. The admin can manage the registered users and delete them if necessary. The admin can add, update, or delete any information from the FAQ section. The administrator can manage the skincare product database and can monitor the system. The admin may log out after managing the application.

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3. Application Layer: The application layer is the major working module of the whole system. The application layer can be further divided into two major modules namely, the user module and the admin module. The user module handles an image uploaded by the user and performs various operations like pre-processing, skin type prediction, displaying the result, and recommending skincare product. The application layer handles all the other operations performed by the admin.
4. User Module: The user module deals with all the operations performed by a normal user. The user uploads their skin image, which is then preprocessed. Preprocessing involves resizing, normalization, and converting the image into a suitable format so that the model can read it. After preprocessing, the image is given to the trained model for predicting the user's skin type. Once the skin type is known, the result is shown to the user. The application recommends a skincare product based on the predicted skin type.
5. AI Model: The AI model layer contains the image dataset, preprocessing and augmentation techniques, MobilenetV2 feature extractor, and the classification layer. The image augmentation techniques like rotation, zoom, flipping, shifting, and brightness are applied to create new images from the existing samples and increase the size of the training dataset. The images are then passed through the pretrained MobilenetV2 model to extract meaningful features. The features are then given to the classification layer, which uses soft-max to classify the inputs into a variety of classes.
6. Data Layer: The data layer consists of the User database, the Product database, and the FAQ database. The data layer stores any information required by the application. The user database stores the relevant information of the registered users. The product and FAQ database store information about the product and the frequently asked questions.
7. External Services: The system uses external services like the email service, cloud storage, and security authentication and authorization. Emails are useful in authenticating the registered users and can send direct messages to the users. The cloud storage helps the application store the user-uploaded images. The security system ensures that the application is safe and secure from external attacks.

IV. PROPOSED METHODOLOGY

A. Gathering and preparing a dataset: In this stage, a dataset of skin images is gathered and categorized by various skin types. Training and testing datasets are created by labeling the images according to their respective classes. Before the images are given to the classification model, they are prepared in a consistent format because the quality and diversity of the training data have a significant impact on the performance of a deep learning model. The fundamental dataset needed to create the skin type classification system is provided by this phase.

B. Preprocessing an image: The gathered skin photos are preprocessed in the second stage so that deep learning can use them. In order to meet the MobileNetV2 model's input requirements, the images are resized and converted. Preprocessing enables the model to efficiently extract valuable visual characteristics while preserving consistency among the input images. The image preprocessing implementation makes use of OpenCV.

C. Augmentation Of Data: The training images are subjected to data augmentation techniques during this phase in order to boost the dataset's variation. This is especially helpful in situations where there are few skin image options. Augmentation lessens the chance of overfitting and aids the model in learning various skin image appearances. Consequently, when the trained model gets new images from users, it can achieve better generalization.

D. Feature extraction with MobileNetV2: The primary feature-extraction network in the fourth phase is MobileNetV2, which has been pretrained on the ImageNet dataset. Important visual characteristics are extracted from the input skin images by the pretrained MobileNetV2, which serves as a frozen backbone. Instead of training the entire deep learning network from scratch, transfer learning allows the system to make use of previously learned image features. Because of this, the method can be used to classify skin images using a small dataset.

E. Skin Type Grouping: A custom classification head receives the features that have been extracted after that. An average pooling layer, flattening layer, dropout layer, fully connected dense layer with ReLU activation, and final dense layer with softmax activation make up the classification head. Each target skin type category's probability is generated by the softmax layer, and the predicted skin type is determined by selecting the category with the highest probability.

F. Optimization and Model Training: The prepared training dataset is used in this phase to train the MobileNetV2-based classification model. The Adam optimizer and categorical cross-entropy loss are used by the model to learn. During training, a decaying learning-rate schedule is used to enhance optimization. To assess learning performance and

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detect potential overfitting or underfitting, training and validation accuracy and loss are tracked throughout the training epochs.

G. Model Assessment: A held-out test dataset that was not used during training is used to assess the developed model after training. A confusion matrix and classification report are used to evaluate the model's performance. Understanding the model's performance also takes into account training and validation accuracy and loss. In this stage, the MobileNetV2 classifier's ability to reliably differentiate between the target skin type categories is assessed.

H. Skin Type Prediction: A user uploads a fresh skin image via the web application during the prediction phase. The uploaded image is sent to the trained MobileNetV2 classifier after going through the same preprocessing steps used during model development. The model predicts the skin type after analyzing the image. The application receives the prediction and shows it to the user.

I. A personalized product recommendation: The recommendation component uses the prediction of the user's skin type to determine the right skincare products. The system makes use of a mapping between the anticipated skin types and appropriate skincare items. The corresponding product recommendations are retrieved and shown to the user based on the classification result. This links individualized skincare suggestions with the AI-based classification process.

J. Integrating web applications: The Python-based web application incorporates the trained classification model in the last stage. Users can register, log in, upload photos of their skin, get predictions about their skin type, and get product recommendations. User accounts, FAQ content, and associated application data are stored in MySQL, and users and FAQ data are managed by the administrator. As a result, the entire system offers a comprehensive workflow that includes everything from skin classification and customized product recommendations to user registration and image upload.

V. RESULTS

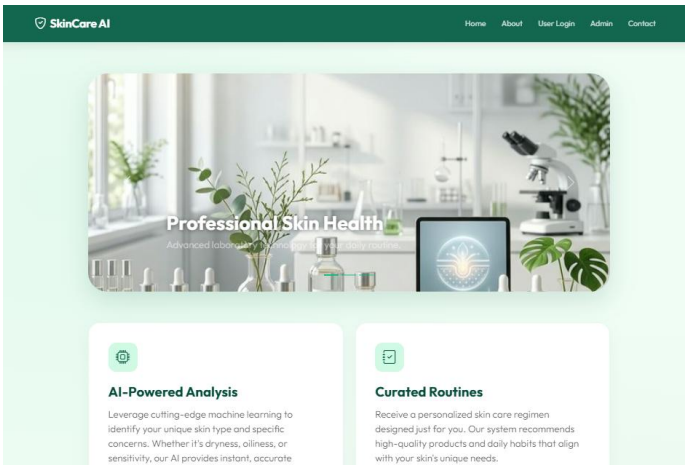

Figure 5.1: Home Page

This image(Fig 5.1) is the SkinCare AI website interface. The website offers a skin care service that can be described as an AI-driven personal skin care community. The website's header displays the main page's features, such as AI-Powered Analysis and Curated Routines. Under these features, the website offers a few options for users to choose from in order to address their specific needs and interest.

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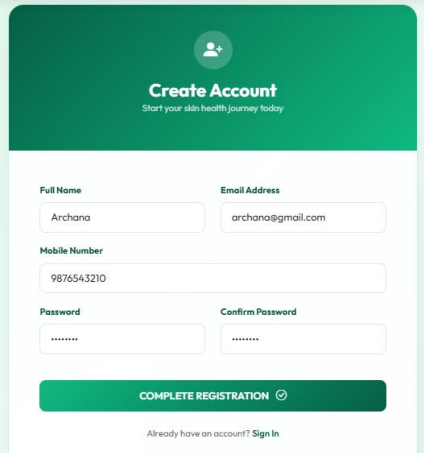

Figure 5.2: User registration page

This image (Fig. 5 .2) displays the SkinCare AI application's Create Account page, where new users can sign up by providing their password, email address, mobile number, and personal information.

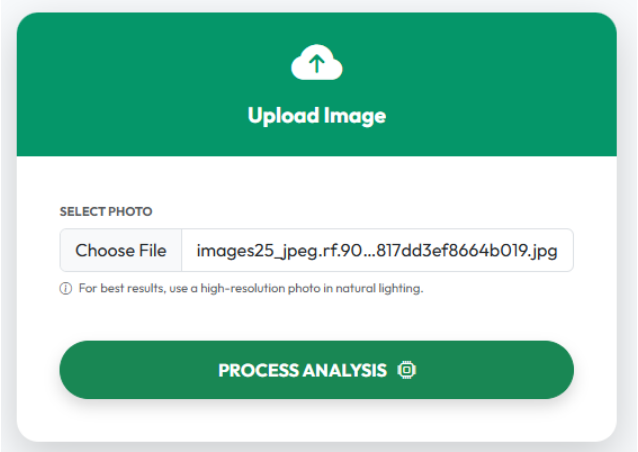

Figure 5.3: Image uploading image

This image (Fig 5.3) represents the page of uploading an image in the SkinCare AI application for users to pick an image they want to examine. The instruction asks to choose a clear photo in a good natural light for the best result.

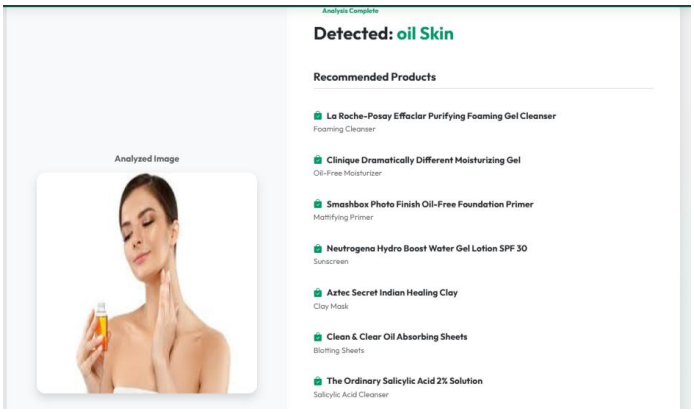

Figure 5.4: skin detection page

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This image(Fig 5.4) represents the skin analysis result page of the SkinCare AI application. After uploading a photo, the user receives information about their skin type, which in this case is oily skin. It also suggests some creams and treatments that are suitable for this skin type.

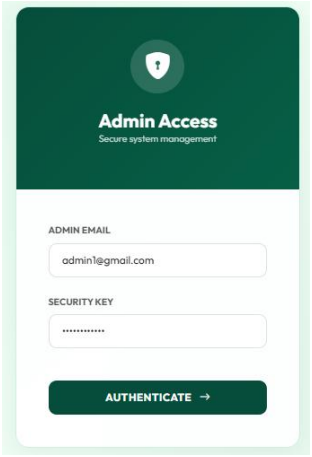

Figure 5.5: Admin Page

This image (Fig. 5.5) represents the page of SkinCare AI administrators who have authorized by email and security code to manage the application.

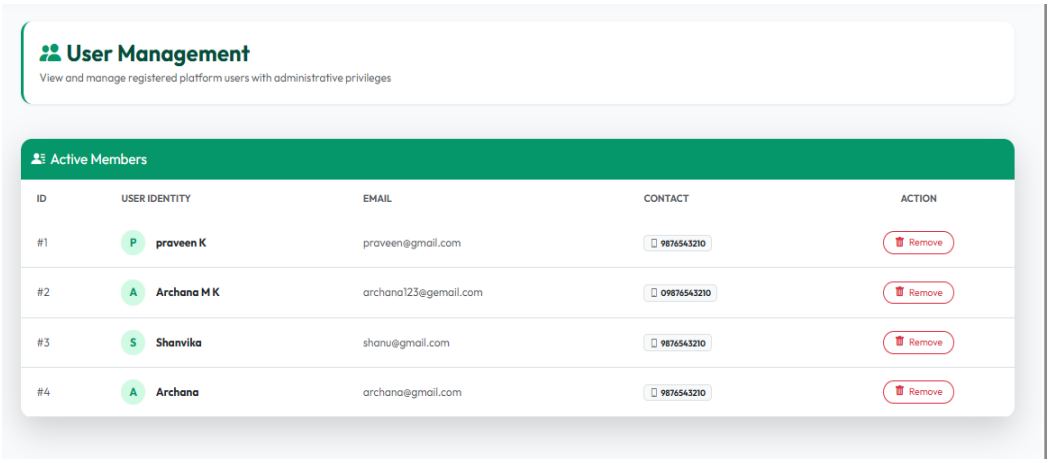

Figure 5.6: Register User List Page

This image (Fig 5.6) shows the user management page, which means the administrator can see all the users who registered on the application. It also has an option to delete users in case of necessary.

VI. CONCLUSION

This study introduced an AI-enabled skin classification and personalized product recommendation system that substitutes an automated, image-based deep learning pipeline for subjective, questionnaire-based skin assessment. The system provides a useful, approachable, and scientifically based method of individualized skincare advice by integrating a MobileNetV2-based transfer learning classifier with a full web platform that supports user management, administrative control, and an FAQ module. Functional testing demonstrated the feasibility of the suggested method as an alternative to manual skin assessment techniques by confirming that the core workflows—from registration through image-based prediction to product recommendation—operate correctly.

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6.1 FUTURE ENHANCEMENTS

- Application of sophisticated deep learning algorithms for the diagnosis of various skin conditions, including pigmentation, wrinkles, and dark spots.
- Design a mobile application that allows analyzing the user's skin using a camera.
- Connect the product to e-commerce marketplaces to allow users to purchase the recommended products.
- Introduce a feature that allows users to give feedback and rate the results of the algorithm.
- Attraction by adding a chatbot ambassador to assist users.
- Cloud deployment to ensure high levels of availability and scalability.
- Make the product available in multiple languages.
- Constant improvement of the product by training the model on a large amount of data.

REFERENCES

[1]. T. B. Teja and A. G. Latha, "Skin Type Classification and Personalized Cosmetics Recommendation," International Journal of Creative Research Thoughts, 2025.
[2]. M. Geetha and N. Bharath, "Personalized Skin Type Classification and Recommendations," International Journal of Scientific Research in Engineering and Management, 2025.
[3]. M. Bhagyawant, H. Itkar, A. Wankhade, S. Sandbhor, R. Chavan, and P. Deshpande, "Skin Type Prediction and Product Suggestion Using Machine Learning and Image Processing," 2025.
[4]. J. Lee, H. Yoon, S. Kim, C. Lee, J. Lee, and S. Yoo, "Deep Learning-Based Skin Care Product Recommendation: A Focus on Cosmetic Ingredient Analysis and Facial Skin Conditions," Journal of Cosmetic Dermatology, vol. 23, no. 6, pp. 2066–2077, 2024. DOI: 10.1111/jocd.16218.
[5]. V. S. Kadam, K. Dhande, P. Kadam, G. Chinchansure, and A. Jadhav, "A Cosmetic Product Recommendation System Based on Skin Type Using AI/ML," International Journal of Advanced Research in Science, Communication and Technology, 2023.
[6]. S. Saiwaeo, S. Arwatchananukul, L. Mungmai, W. Preedalikit, and N. Aunsri, "Human Skin Type Classification Using Image Processing and Deep Learning Approaches," Heliyon, 2023.
[7]. H.-T. Chan, Y.-W. Liao, S.-Y. Jhong, S.-C. Chien, K.-L. Hua, and Y.-Y. Chen, "A Skin Type Classification Method Using Mobile Device-Based Deep Learning Model," 2023 9th International Conference on Applied System Innovation (ICASI), 2023. DOI: 10.1109/ICASI57738.2023.10179572.
[8]. S. Saidah, Y. N. Fuadah, F. Alia, N. Ibrahim, R. Magdalena, and S. Rizal, "Facial Skin Type Classification Based on Microscopic Images Using Convolutional Neural Network (CNN)," Proceedings of the 1st International Conference on Electronics, Biomedical Engineering, and Health Informatics, pp. 75–83, 2021. DOI: 10.1007/978-981-33-6926-9_7.
[9]. A. Kothari, D. Shah, T. Soni, and S. Dhage, "Cosmetic Skin Type Classification Using CNN With Product Recommendation," 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), IEEE, 2021, DOI: 10.1109/ICCCNT51525.2021.9580174.
[10]. C. C. Chang, S. T. Hsing, Y. C. Chuang, C. T. Wu, T. J. Fang, K. F. Chen, and B. Choi, "Robust Skin Type Classification Using Convolutional Neural Networks," 2018 13th IEEE Conference on Industrial Electronics and Applications (ICIEA), pp. 2011–2014, 2018. DOI: 10.1109/ICIEA.2018.8398040.