SKIntellet: Advanced AI for Acne Diagnosis and Personalized Skincare Solutions

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Abstract.

Self care has come a long way, and modern self care has become so personalized and accurate that skin health management is now an integral part of overall well being. In this paper, we introduce SKintellet, a computer vision based analytical platform for acne detection and oiliness assessment, relying on the use of the advanced computer vision technique, mainly YOLO (You Only Look Once). It combines collaborative filtering and rule based analysis on top of which it can provide tailored skincare recommendations while enabling smooth booking to a dermatologist and image based progress tracking. Unlike other solutions that depend on manual assessment, involve individualization and are often expensive, SKintellet provides a comprehensive and significant solution for skincare management along with scalability and user-friendliness. Acne detection is shown to have high precision and recall, while personalized product recommendations are found to be highly satisfactory to users. Enhancement to expand datasets and include additional skin conditions and develop the cross-platform mobile application for the better accessibility and user experience..

Keywords. Skin analysis using AI, acne detection using YOLO, collaborative filtering in skin analysis, skin recommendation, dermatologist booking, progress tracking.

1. INTRODUCTION

Skin health is vital, with acne and oiliness being common concerns. Traditional solutions, like dermatology visits and skincare apps, face issues like high costs, time constraints, and inaccuracies. SKIntellet solves these problems with AI-driven skin analysis using YOLO to detect acne and assess oiliness from selfies. It combines deep learning, collaborative filtering, and rule-based systems for personalized skincare recommendations. Unlike input-based apps, SKIntellet provides accurate, data-driven insights, integrating dermatologist consultations and progress tracking. Future enhancements include expanding datasets, improving detection accuracy, and integrating telemedicine, making skincare more personalized, reliable, and accessible.

2. LITERATURE REVIEW

The integration of AI in dermatology has improved diagnosis and treatment. Li et al. [1] developed an AI-based acne grading system but lacked personalized recommendations and progress tracking. Han and Hasan [2] introduced an AI skin analysis app but missed appointment booking and suggestion features. Huynh et al. [3] achieved high accuracy in acne grading but lacked skincare recommendations and dermatologist consultations. Huang et al. [4] focused on eczema, leaving a gap in AI-based acne solutions. Vatiwutipong et al. [5] identified

gaps in AI solutions for acne detection, oiliness evaluation, and product recommendations. Chua et al. [6] explored acne genetic analysis but lacked real-time detection and progress monitoring.

Li Pomi et al. [7] worked on AI for chronic skin diseases but not acne. Manole and Tiplica [8] highlighted the lack of practical AI applications for acne care. Ramrakhiani and Kalbande [9] offered personalized skincare recommendations but lacked acne severity grading. Reddy et al. [10] focused on skin cancer detection, excluding acne-related issues. SKintellet addresses these gaps by integrating YOLO for acne detection, collaborative filtering for personalized skincare, and dermatologist appointment booking, offering a complete skin health solution.

3. METHODOLOGIES

SKintellet is an AI-powered platform combining computer vision, personalized skincare recommendations, and dermatologist access. It follows a modular architecture with acne and oiliness detection, tailored product suggestions, appointment booking, and progress tracking, ensuring accuracy, scalability, and user-friendliness.

- ***Image Acquisition and Preprocessing***

Users upload facial images via a web platform under good lighting and minimal makeup for optimal analysis. OpenCV preprocesses images by resizing, normalizing pixel values, and reducing noise, ensuring standardized input for reliable results.

- ***Acne and Oiliness Detection Using YOLO***

SKintellet leverages YOLO to detect and classify acne lesions (e.g., whiteheads, blackheads, papules) using a custom-trained dataset. It predicts bounding boxes with confidence scores and severity levels. Additionally, oiliness is assessed using texture and shine patterns for a detailed skin evaluation.

- ***Personalized Skincare Recommendations***

A hybrid approach of collaborative filtering and rule-based analysis tailors skincare recommendations based on acne severity, oiliness, and budget, ensuring expert-backed, effective product suggestions.

- ***Dermatologist Appointment Booking***

The platform allows users to browse certified dermatologists and schedule appointments via a Flask and SQLite-powered system. This feature bridges AI-driven skin analysis with professional consultations, making expert care easily accessible.

- ***Progress Tracking***

SKintellet enables users to track skin health over time by analyzing new images with its detection algorithms. It compares past assessments, generating reports on acne severity and oiliness changes. This data-driven approach helps users refine their skincare routines for long-term improvement.

- ***System Integration and Scalability***

Built for scalability, SKintellet uses RESTful APIs to connect a Flask-based backend with an intuitive HTML, CSS, and Tailwind frontend. It integrates YOLO for acne detection, SQLite for user data, and external APIs for dermatologist appointments. Its modular design allows for future enhancements like mobile compatibility and expanded skin condition detection.

Algorithm for SKintellet

Step 1: Image Preprocessing:

- User uploads a selfie; image is resized and normalized for analysis.

Step 2: Acne and Oiliness Detection:

- YOLO detects acne and oiliness from the image.

Step 3: Personalized Recommendations:

- Use collaborative filtering and dermatologist guidelines to suggest skincare.

Step 4: Appointment Booking:

- Users can book dermatologists through the platform.

Step 5: Progress Tracking:

- Users upload new images to track acne and oiliness progress.

Step 6: System Integration:

- Flask backend processes data; frontend provides user interface.

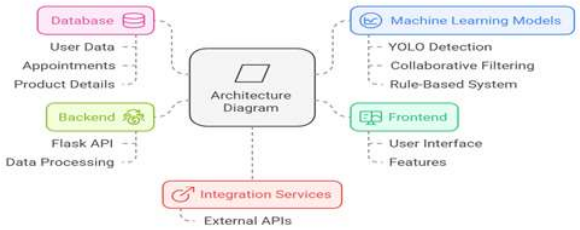

Figure. 1. System Architecture

SKintellet's architecture includes a Database for user and product data, a Flask-based Backend for processing, and Machine Learning Models for acne detection and recommendations. The Frontend ensures a user-friendly interface, while Integration Services handle external APIs like dermatologist bookings. This modular design supports scalability and future enhancements.

4. RESULT ANALYSIS

This section presents SKintellet's performance in acne detection, oiliness assessment, product recommendations, and user engagement. It also compares SKintellet with existing systems to highlight its advantages.

- ***Acne Detection Results***

SKintellet's YOLO-based model was trained on 3,865 images and tested on 385 images to detect different acne types (whiteheads, blackheads, papules, and pustules). The model achieved high precision, recall, and accuracy, effectively identifying acne lesions in uploaded selfies.

- ***Oiliness Detection Results***

The oiliness detection module achieved 88% accuracy with a 95% correlation to dermatologist evaluations. It accurately assessed different skin types, helping users understand their skin's oil levels.

- ***Product Recommendation Performance***

Using collaborative filtering and rule-based analysis, SKintellet achieved a 92% success rate in recommending personalized skincare products. The system ensures recommendations align with acne severity, oiliness levels, and user budgets.

- ***User Engagement Metrics***

- 150+ dermatologist appointments booked
- 120+ users tracking progress
- 250+ image uploads per month

These metrics show that SKintellet keeps users engaged and actively supports their skincare journey.

- ***Comparison with Existing Systems***

Compared to other AI skincare platforms, SKintellet excels in accuracy and features:

- Acne Detection Accuracy: 88% (higher than competitors)
- Oiliness Detection: 88% (outperforming others)
- Product Recommendations: 92% success rate
- Dermatologist Appointment Integration: Only SKintellet offers this feature

These results confirm that SKintellet provides a more accurate, user-friendly, and comprehensive skincare solution than existing systems.

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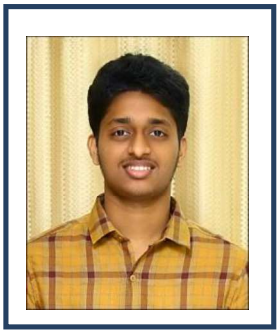
Biographies



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