

# Characterizing dermatology mobile applications that use artificial intelligence

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To the Editor:

Dermatology mobile applications—which include uses for teledermatology, self-surveillance, self-diagnosis, and education—are rapidly increasing in number, with implications of shaping patient-provider relationships, patient education, and provider communication [1]. Additionally, research and advances in artificial intelligence (AI) for dermatology have made tremendous progress in the past few years, with some models achieving dermatologist-level diagnostic accuracy and outperforming primary care physicians and nurse practitioners [2,3]. As it continues to develop, AI may be available to patients via mobile applications.

We sought to identify and characterize mobile applications reporting use of AI. The Apple iPhone is the most popular smartphone and Apple iOS holds the largest share of smartphone operating systems in the United States [4]. As such, the Apple App Store was queried on May 22, 2021 for “dermatology,” “dermatology ai,” “dermatology artificial intelligence,” “derm,” “derm ai,” “derm artificial intelligence,” “skin ai,” and “skin artificial intelligence.” Applications were evaluated for the use of AI, and machine learning or computer vision (branches of AI). Non-English applications were excluded.

A total of 24 applications were included in this study. A majority were classified as diagnostic support tools

(63%), which suggested diagnoses using AI but stated they do not replace physician evaluation ([Table 1](#)). Applications also provided lesion tracking without diagnosis (4.2%), patient support (13%), clinical support for physicians (13%), and skin analysis for product recommendations without diagnosis (8.3%). Applications targeted pigmented lesions (29%), atopic dermatitis (13%), acne (17%), burns (4.2%), psoriasis (4.2%), general dermatology (17%), and cosmetic face analysis (17%). Six applications (25%) offered consults with or connection to a dermatologist. Three (13%) sold treatment products in-app while two (8.3%) only offered product recommendations. The majority of applications (58%) were available free and 38% were free with in-app purchases. Only one application required purchase to download.

Although statistics for downloads are not available, App Store reviews may be a proxy for the number of downloads. Accordingly, the 24 applications had a combined 13,882 reviews, with the top application having 11,186 reviews ([Table 2](#)). As such, the majority of the applications on our list may not be commonly downloaded.

Although our search may have missed AI applications (e.g., general medical applications not specifically for dermatology, or those only on non-iOS app stores), our study indicates the Apple App Store has a limited number of AI dermatology applications. However, this may quickly change as large corporations like Google release AI tools for dermatology [5]. As suggested by the disclaimers in

their descriptions, a majority of these applications may augment and support physicians rather than replace them. Despite disclaimers, they still provide preliminary diagnoses with some providing suggested treatments and products. As such, they may impact patient care decisions. The performance of these AI applications is unknown--the true use of AI, machine learning, or computer vision in this study was not assessed. Despite progress in the field, there are concerns regarding study limitations, data privacy, and exacerbation of inequalities via a lack of adequate representation of certain populations in training AI models [6]. Accordingly, it may be important for dermatologists to shape this relatively new technology to minimize biases and disparities that may arise and continue to evaluate these new tools, and be prepared to advise patients on their use.

## Potential conflicts of interest

Dr. Steven Feldman has received research, speaking and/or consulting support from Galderma, GSK/Stiefel, Almirall, Leo Pharma, Boehringer Ingelheim, Mylan, Helsinn, PHD Biosciences, Celgene, Pfizer, Valeant, Abbvie, Samsung, Janssen, Lilly, Menlo, Merck, Novartis, Regeneron, Sanofi, Novan, Qurient, National Biological Corporation, Caremark, Advance Medical, Sun Pharma, Suncare Research, Informa, UpToDate and National Psoriasis Foundation. He is founder and majority owner of [www.DrScore.com](http://www.DrScore.com) and founder and part owner of Causa Research, a company dedicated to enhancing patients' adherence to treatment. The remaining authors have no conflicts to disclose.

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**Table 1.** Characteristics of mobile applications with artificial intelligence.

|   |   | Number of applications | Percentage of applications (N=24) |
|---|---|------------------------|-----------------------------------|
| <b>Type of application and description</b>                          |   |                        |                                   |
| Diagnostic support  | Provides diagnosis, but states it is not meant to replace evaluation by a physician   | 15                     | 63                                |
| Lesion tracking   | Lesion tracking without diagnosis provided  | 1                      | 4.2                               |
| Patient support   | Patient support for pre-diagnosed disease management  | 3                      | 13                                |
| Skin analysis   | Analysis of skin to determine severity of pre-diagnosed disease, analyze wrinkles, spots, skin texture, and other non-diagnostic features | 2                      | 8.3                               |
| Clinical support  | Clinical decision support tool for physicians   | 3                      | 13                                |
| <b>Diseases</b>   |   |                        |                                   |
| General dermatology   |   | 4                      | 17                                |
| Acne  |   | 4                      | 14                                |
| Pigmented lesions   |   | 7                      | 29                                |
| Atopic dermatitis   |   | 3                      | 13                                |
| Psoriasis   |   | 1                      | 4.2                               |
| Burns   |   | 1                      | 4.2                               |
| Cosmetic face analysis  |   | 4                      | 17                                |
| <b>Available consult or communication with dermatologist</b>        |   |                        |                                   |
| Yes   |   | 6                      | 25                                |
| No  |   | 18                     | 75                                |
| <b>Sells treatment products directly through application</b>        |   |                        |                                   |
| Yes   |   | 3                      | 13                                |
| No  |   | 21                     | 88                                |
| <b>Offers treatment product recommendations without direct sale</b> |   |                        |                                   |
| Yes   |   | 2                      | 8.3                               |
| No  |   | 22                     | 92                                |
| <b>Cost to download application</b>                                 |   |                        |                                   |
| Free  |   | 14                     | 58                                |
| Free with in-app purchases available                                |   | 9                      | 38                                |
| Paid  |   | 1                      | 4.2                               |

**Table 2.** Characteristics of the top 10 most reviewed mobile applications with artificial intelligence.

| Application name               | Type of application | Target disease         | Rating* | Number of reviews |
|--------------------------------|---------------------|------------------------|---------|-------------------|
| MDacne - custom acne treatment | Face analyzer       | Acne                   | 4.6     | 11186             |
| TroveSkin                      | Diagnostic support  | Cosmetic face analysis | 4.3     | 701               |
| Miiskin Skin tracker & eHealth | Lesion tracking     | Pigmented lesions      | 4.4     | 686               |
| scanoma - mole check           | Diagnostic support  | Pigmented lesions      | 4.7     | 353               |
| Aysa                           | Diagnostic support  | General dermatology    | 4.8     | 284               |
| Acne intelligence              | Diagnostic support  | Acne                   | 3.6     | 216               |
| Rash ID - Rash identifier      | Diagnostic support  | General dermatology    | 3.6     | 191               |
| HealthAI - Skin cancer         | Diagnostic support  | Pigmented lesions      | 4.4     | 126               |
| EczemaLess, an AI eczema guide | Patient support     | Atopic dermatitis      | 4.6     | 51                |
| Skin cancer detector           | Diagnostic support  | Pigmented lesions      | 2.6     | 32                |