Abstract

Privacy Protection With Facial Deidentification Machine Learning Methods: Can Current Methods Be Applied to Dermatology?

Hyeon Ki Jeong[1], PhD; Christine Park[2], BA; Ricardo Henao[3], PhD; Meenal Kheterpal[1], MD

[1]Department of Dermatology, Duke University, Durham, NC, United States

[2]Duke School of Medicine, Duke University, Durham, NC, United States

[3]Duke University, Durham, NC, United States

Corresponding Author:
Hyeon Ki Jeong, PhD
Department of Dermatology
Duke University
Duke University Medical Center, DUMC 3135
Durham, NC, 27710
United States
Phone: 1 919 684 3432
Email: hyeonki.jeong@duke.edu

Abstract

Background: In the era of increasing tools for automatic image analysis in dermatology, new machine learning models require high-quality image data sets. Facial image data are needed for developing models to evaluate attributes such as redness (acne and rosacea models), texture (wrinkles and aging models), pigmentation (melasma, seborrheic keratoses, aging, and postinflammatory hyperpigmentation), and skin lesions. Deidentifying facial images is critical for protecting patient anonymity. Traditionally, journals have required facial feature concealment typically covering the eyes, but these guidelines are largely insufficient to meet ethical and legal guidelines of the Health Insurance Portability and Accountability Act for patient privacy. Currently, facial feature deidentification is a challenging task given lack of expert consensus and lack of testing infrastructure for adequate automatic and manual facial image detection.

Objective: This study aimed to review the current literature on automatic facial deidentification algorithms and to assess their utility in dermatology use cases, defined by preservation of skin attributes (redness, texture, pigmentation, and lesions) and data utility.

Methods: We conducted a systematic search using a combination of headings and keywords to encompass the concepts of facial deidentification and privacy preservation. The MEDLINE (via PubMed), Embase (via Elsevier), and Web of Science (via Clarivate) databases were queried from inception to May 1, 2021. Studies with the incorrect design and outcomes were excluded during the screening and review process.

Results: A total of 18 studies, largely focusing on general adversarial network (GANs), were included in the final review reporting various methodologies of facial deidentification algorithms for still and video images. GAN-based studies were included owing to the algorithm's capacity to generate high-quality, realistic images. Study methods were rated individually for their utility for use cases in dermatology, pertaining to skin color or pigmentation and texture preservation, data utility, and human detection, by 3 human reviewers. We found that most studies notable in the literature address facial feature and expression preservation while sacrificing skin color, texture, pigmentation, which are critical features in dermatology-related data utility.

Conclusions: Overall, facial deidentification algorithms have made notable advances such as disentanglement and face swapping techniques, while producing realistic faces for protecting privacy. However, they are sparse and currently not suitable for complete preservation of skin texture, color, and pigmentation quality in facial photographs. Using the current advances in artificial intelligence for facial deidentification summarized herein, a novel approach is needed to ensure greater patient anonymity, while increasing data access for automated image analysis in dermatology.

Conflicts of Interest: None declared.

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KEYWORDS

artificial intelligence; privacy; facial deidentification; machine learning

Multimedia Appendix 1

Overview of included studies.
[PNG File , 311 KB-Multimedia Appendix 1]

Multimedia Appendix 2

Part 2 of Multimedia Appendix 1.
[PNG File , 238 KB-Multimedia Appendix 2]

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