Title Deep learning-based classification system for evaluation of scalp conditions: Scalp photographic index AI

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Background: An accurate assessment of scalp conditions is important for personalized treatment. However, there has been no validated tool for objectively quantifying the characteristics of the scalp.

Objectives: To develop and validate a new classification and scoring system for evaluating scalp conditions and deep learning algorithms enable an automated assessment of the system

Methods: The Scalp Photographic Index (SPI) was devised to classify diverse scalp conditions and evaluate their severity. The correlation between SPI and the dermatologist's scalp assessment and scalp-related symptoms was analyzed. Internal consistency, inter-rater, and intra-rater reliability were evaluated. We developed five convolutional neural network (CNN) models that can evaluate SPI.

Results: SPI and the dermatologist's scalp assessment showed good correlations for all five scalp features. SPI grading demonstrated good reliability with excellent internal consistency, strong inter- and intra-rater reliability (Cronbach's $\alpha = 0.90$, Kendall's $W = 0.84$; P-value < 0.0001, intra-class correlation = 0.94; 95% CI 0.93-0.94). The accuracies of the dryness, oiliness, erythema, folliculitis, and dandruff CNN models were 91.3%, 90.5%, 89.6%, 87.3%, and 95.2%, respectively.

Conclusions: SPI is a validated system for classifying and scoring scalp conditions. The deep learning algorithms for SPI could accurately grade the severity of scalp conditions.