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Pilot study of use of neural network for quantitative before-and-after analysis of dermatologic cosmetic procedures

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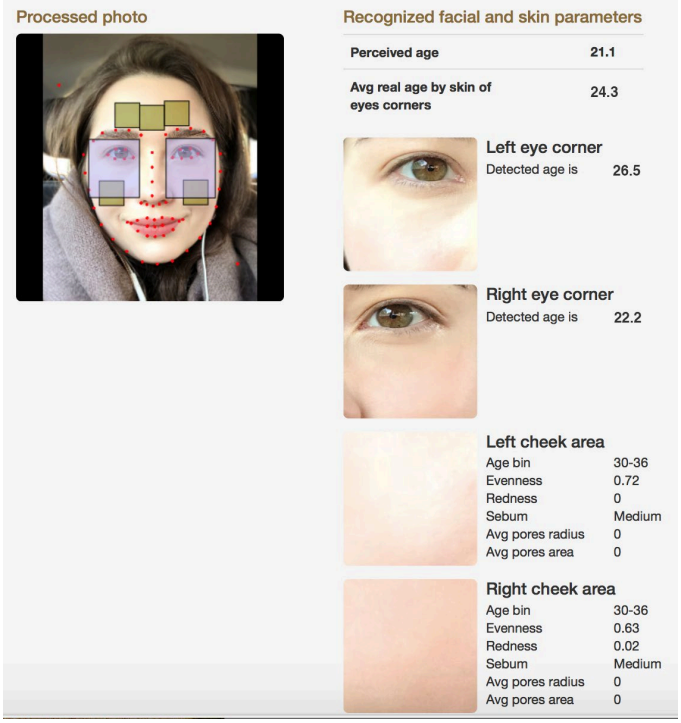
Background/Objectives: In dermatologic cosmetic procedures, quantitative measures of efficacy have historically been lacking. Before and after pictures provide an illustration of the effects of a procedure, but are often cherrypicked to show best outcomes rather than typical outcomes and are inherently subjective. Attempts to apply statistic analysis regarding degree of cosmetic improvement typically relies on various assessment scales, in which various metrics are subjectively graded on a Likert scale by two or more blinded scorers, and numerable results are then reconciled and statistical analysis is performed[1,2,3]. These methods are time-consuming and may require multiple revisions to attain acceptable inter- and intrarater reliability, which decreases study objectivity.

Methods: Here, we present an ongoing pilot study exploring potential for deep learning neural networks to perform visual facial analysis both before and after dermatologic cosmetic procedures, with the goal of creating a more accurate and reproduceable understanding of which facial characteristics are affected by the procedure. Youth Laboratories (ylabs.ai) has developed and trained a neural network for evaluation of skin parameters with the goal of analyzing skin health and disease biomarkers. An earlier version of this software was publicly available as a downloadable application called RYNKL. This software has since been updated to tailor it to this project. It currently tracks parameters including skin evenness, redness, sebum, porphyrins, skintone, pore characteristics, and estimated age (Figure 1).

In theory, this technology should be useful for measuring efficacy of almost any facial cosmetic procedure after appropriate validation. In the pilot study, we are focusing on full facial resurfacing procedures with CO2RE laser. Patients electively choosing to undergo this procedure are identified pre-procedure and consent is obtained for photography and software analysis of images. At this time, enrollment is limited to Caucasian females, as the neural network currently has the most reference images for this demographic. High resolution facial photographs are obtained prior to procedure and at 3 months post-procedure. All of the above-listed parameters are numerically rated by the RYNKL software, with the goal of determining which quantitative differences, if any, are measurable after healing from the procedure. Following collection of all before and after photographs, four blinded dermatology residents will also score each photograph for the same parameters for comparison of reliability between trained scorers and neural network. Photograph and data collection is ongoing at the time of this writing.

Discussion: Though neural networks have not been trained for this purpose previously, they are not entirely new to dermatology. Neural networks have already been trained to be comparable to board-certified dermatologists in the identification of skin cancers[4]. Though this study is still in the proof of concept phase, neural networks by their nature improve incrementally with each new image fed to them and thus become more powerful every day. The use of neural networks for improving the depth of dermatologic research is one of many developing usages.

Figure 1:



References:

1. Idriss N and Maibach HI. Scar assessment scales: a dermatologic overview. Skin Res Technol. 2009 Feb;15(1):1-5. PMID: 19152571
2. Carruthers A and Carruthers J. A validated facial grading scale: the future of facial ageing measurement tools? J Cosmet Laser Ther. 2010 Oct;12(5):235-41. PMID: 20825260
3. Narins RS et al. Validated assessment scales for the lower face. Dermatol Surg. 2012 Feb;38(2 Spec No.):333-42. PMID: 22316189
4. Esteva A et al. Dermatologist-level classification of skin cancer with deep neural networks. Nature. 2017;542(7639):115-118. PMID: 28117445