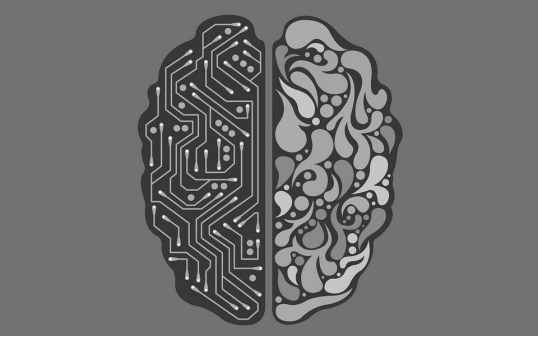

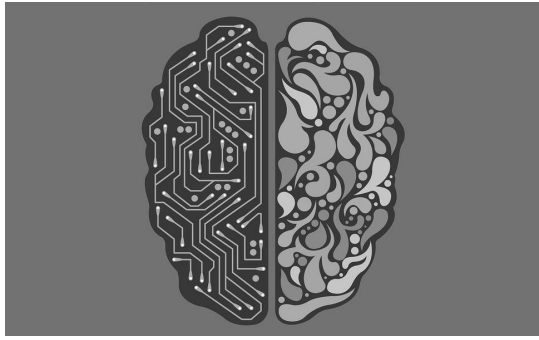

Health Disparities in Skin Cancer Prevention in the Age of Artificial Intelligence

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Disclosure

- Former member, American Academy of Dermatology (AAD) Augmented Intelligence Task Force

- Member, AAD Skin of Color and Skin Cancer Work Group

Skin cancer prevention in skin of color is challenging

1. Incidence is much, much lower in darker skin types.

2. When skin cancer develops it is often later, and clinical outcomes much worse.

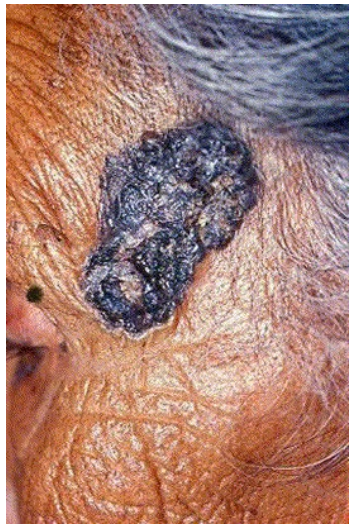
How can we approach prevention? Can AI Help?

Epidemiology of Skin Cancer in Skin of Color

Basal Cell Carcinoma (BCC)

Squamous Cell Carcinoma (SCC)

Melanoma



BCC incidence rates vary by racial group

- Rate per 100,000 population:
  - 1-2 Black
  - 5-6 Chinese
  - 15-17 Japanese (residents of Hawaii/Okinawa 30/26)
  - 50-90 Hispanic
  - 1500-2000 Non-Hispanic White

Gloster HM et al. J Am Acad Dermatol. 2006

SCC incidence rates vary by racial group

- Rate per 100,000 population:
  - 3 Black
  - 18-19 Chinese
  - 23 Japanese (Hawaii)
  - 15-30 Hispanic
  - 1000-1500 Non-Hispanic White

Gloster HM et al. J Am Acad Dermatol. 2006

Melanoma incidence rates vary by racial group

- Rate per 100,000 population:
  - 1 Black
  - 1.6 Asian/Pacific Islander
  - 4.9 Hispanic
  - 7 Indian/Alaskan Native
  - 37 Non-Hispanic White

Gloster HM et al. J Am Acad Dermatol. 2006

Non-white race is associated with later detection

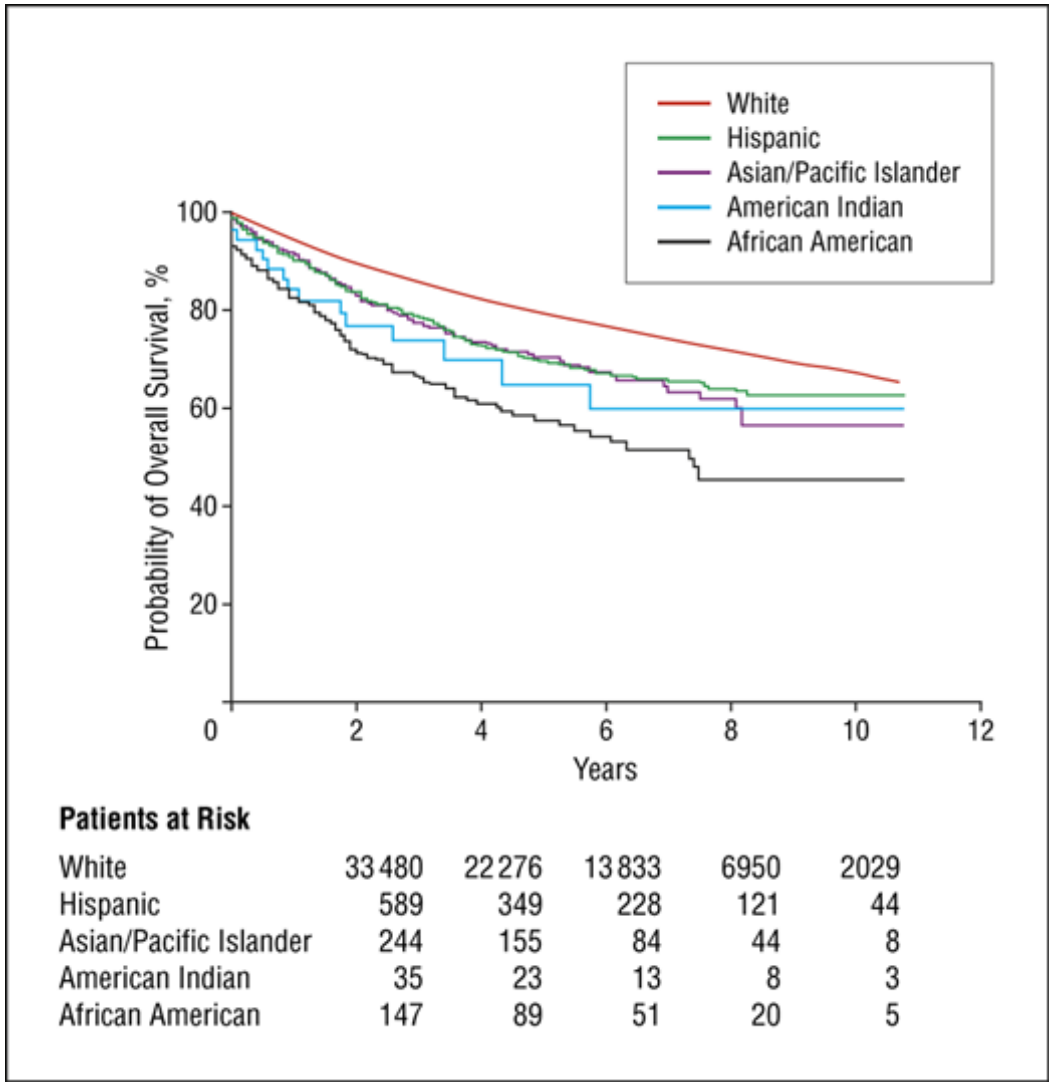
Table II. Primary cutaneous melanoma: relative risk for stages I through IV at presentation for white versus black patients

Stage	Blacks RR	95% CI
I	0.69	0.62-0.77
II	1.76	1.43-2.18
III	2.02	1.51-2.70
IV	2.49	1.80-3.44

CI, Confidence interval; *RR*, relative risk.

Dawes et al. JAAD 2016

Non-white race is associated with lower survival



Patients at Risk

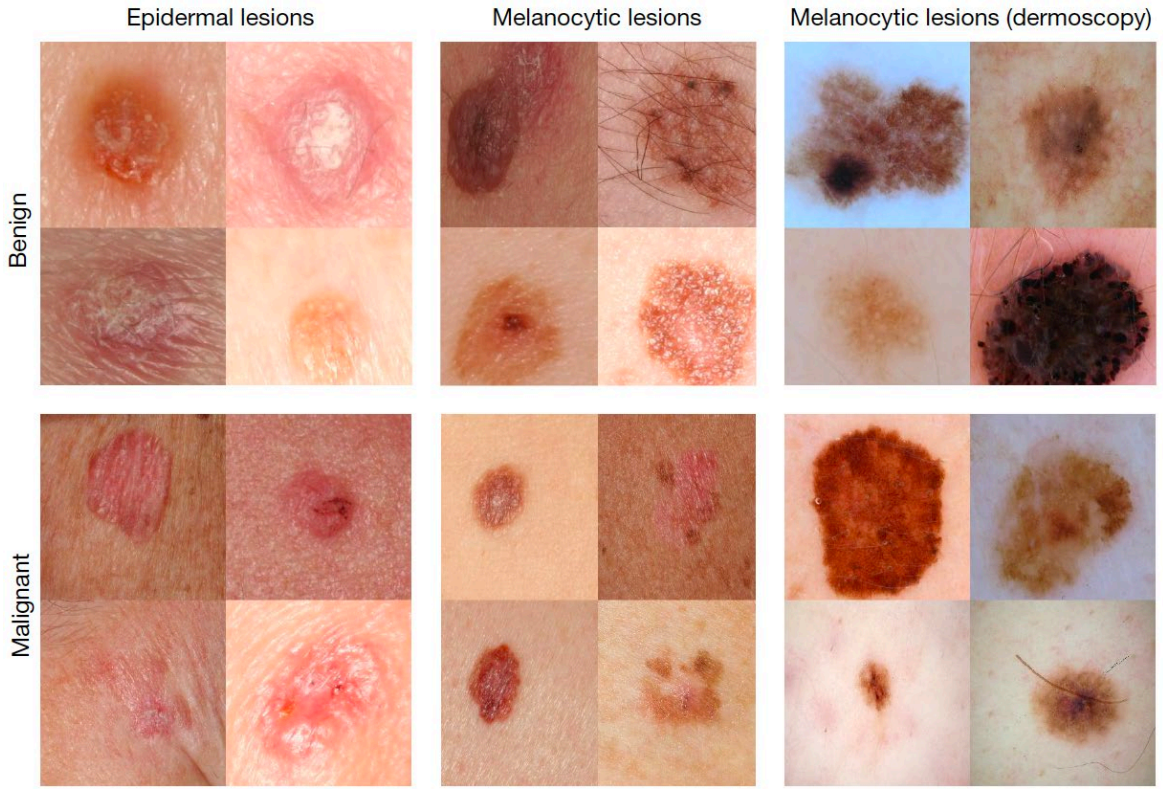
White	33 480	22 276	13 833	6950	2029
Hispanic	589	349	228	121	44
Asian/Pacific Islander	244	155	84	44	8
American Indian	35	23	13	8	3
African American	147	89	51	20	5

Cormier JN et al. Arch Intern Med 2006

Could Artificial Intelligence help with these melanoma disparities?

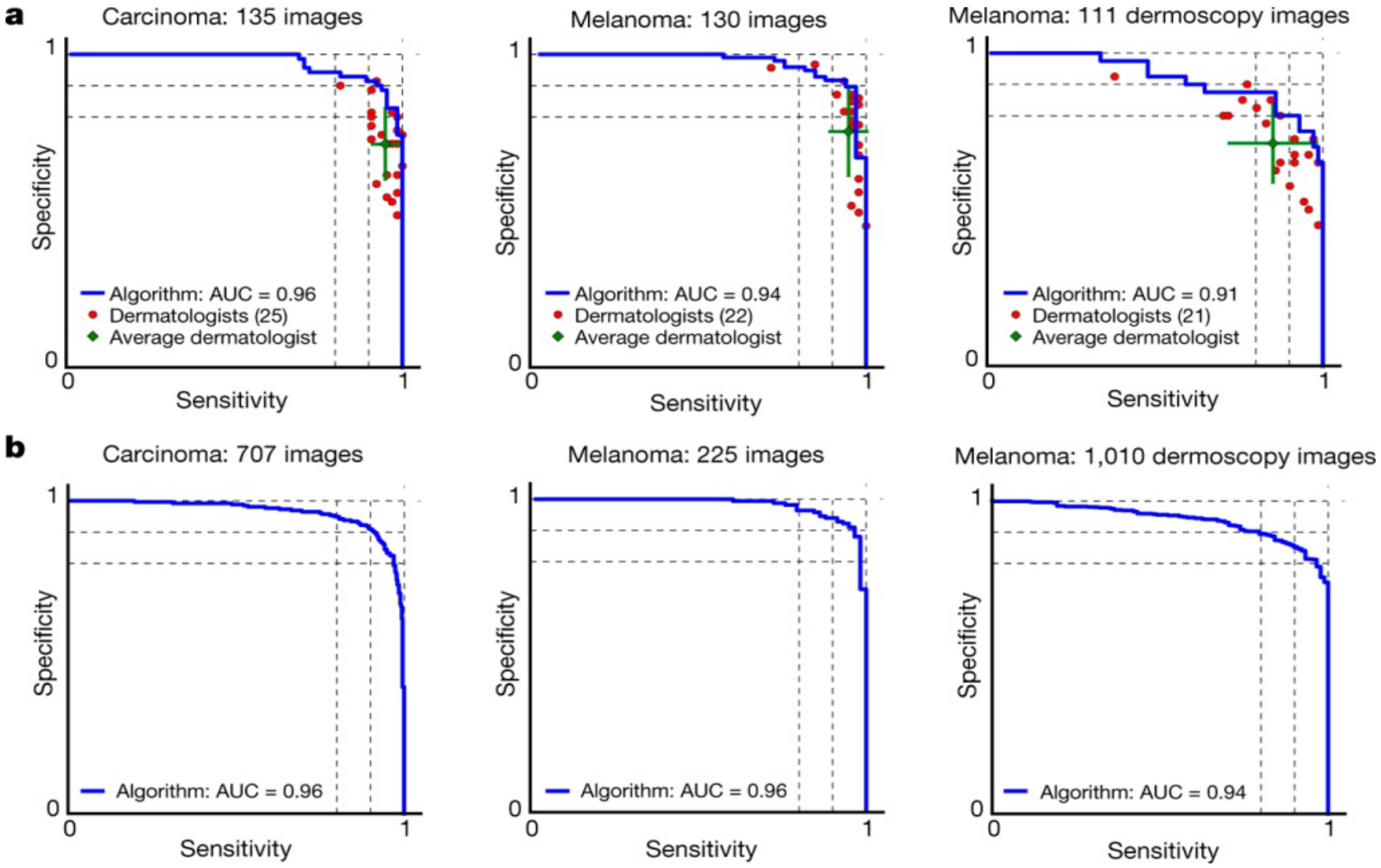
Dermatologist-level classification of skin cancer with deep neural networks

Andre Esteva[1]*, Brett Kuprel[1]*, Roberto A. Novoa[2,3], Justin Ko[2], Susan M. Swetter[2,4], Helen M. Blau[5] & Sebastian Thrun[6]



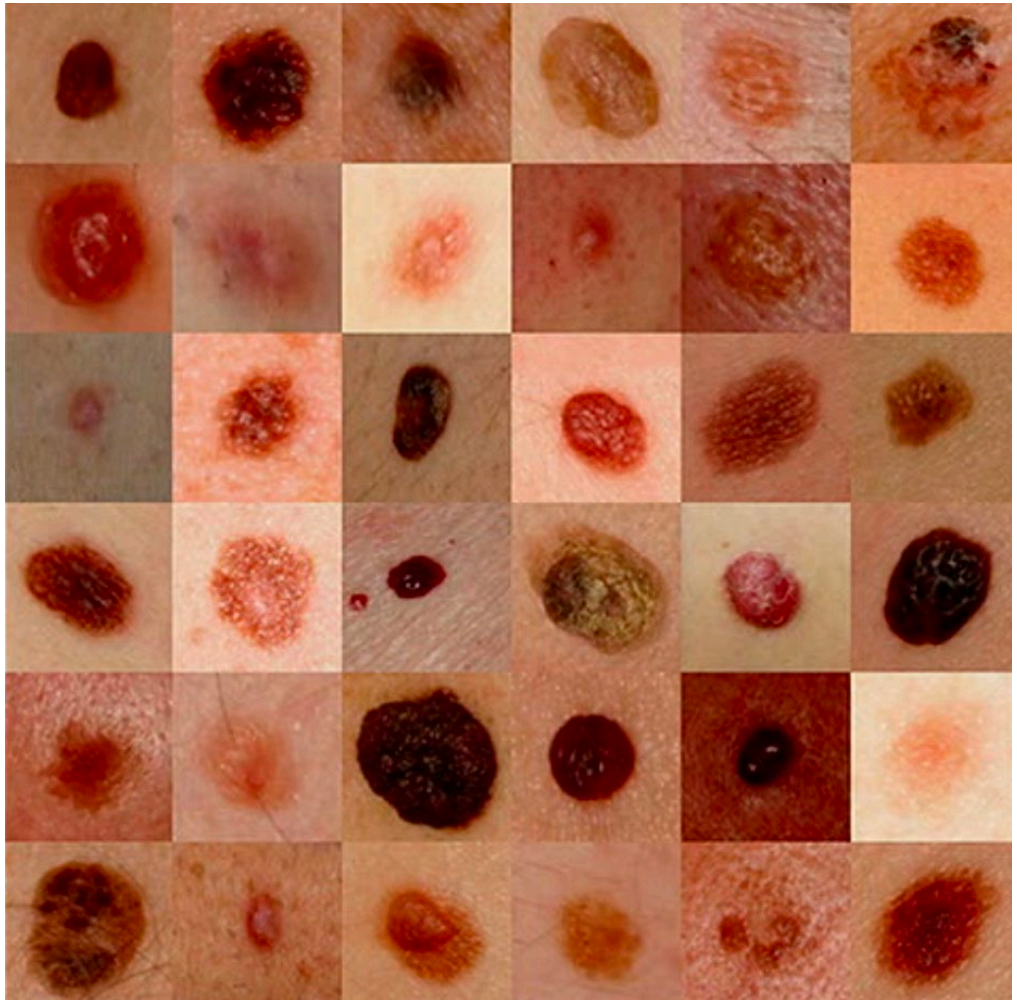
Nature 2017

Skin cancer classification performance of the CNN and dermatologists



A Esteva *et al. Nature* 1–4 (2017) doi:10.1038/nature21056

Lack of diversity of skin types



Study excluded acral lesions which are most melanomas in darker skin types

Esteva et al. Nature 2017

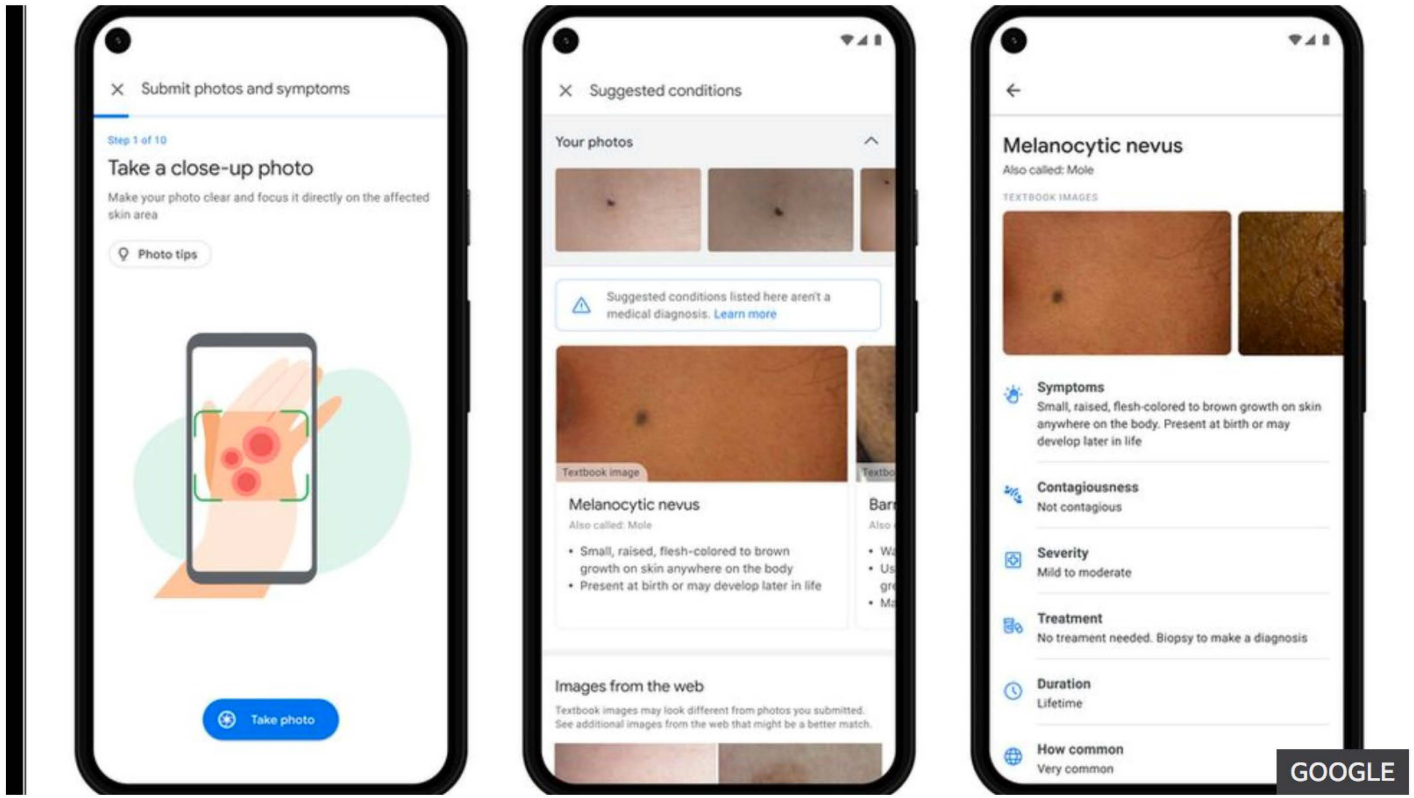
But skin cancer really isn’t a big deal in darker skin types!!!

Disparities may worsen for inflammatory disorders

Google AI tool can help patients identify skin conditions

By Zoe Kleinman
Technology reporter

18 May



Google has unveiled a tool that uses artificial intelligence to help spot skin, hair and nail conditions, based on images uploaded by patients.

ARTICLES
https://doi.org/10.1038/s41591-020-0842-3
nature medicine

A deep learning system for differential diagnosis of skin diseases

Table 1 | Dataset characteristics

Characteristics	Development set	Validation set A	Validation set B (enriched subset of 'A')
Fitzpatrick skin types (6 types)[b]			
Type I (%)	46 (0.3%)	9 (0.2%)	0 (0.0%)
Type II (%)	2,807 (17.4%)	383 (10.2%)	104 (10.8%)
Type III (%)	6,641 (41.2%)	2,412 (64.2%)	607 (63.0%)
Type IV (%)	5,040 (31.3%)	724 (19.3%)	195 (20.2%)
Type V (%)	510 (3.2%)	101 (2.7%)	24 (2.5%)
Type VI (%)	46 (0.3%)	1 (0.0%)	0 (0.0%)
Unknown (%)	1,024 (10.2%)	126 (3.4%)	33 (3.4%)

Liu, Y *et al. Nat Med* 2020.

Review

September 22, 2021

Lack of Transparency and Potential Bias in Artificial Intelligence Data Sets and Algorithms

A Scoping Review

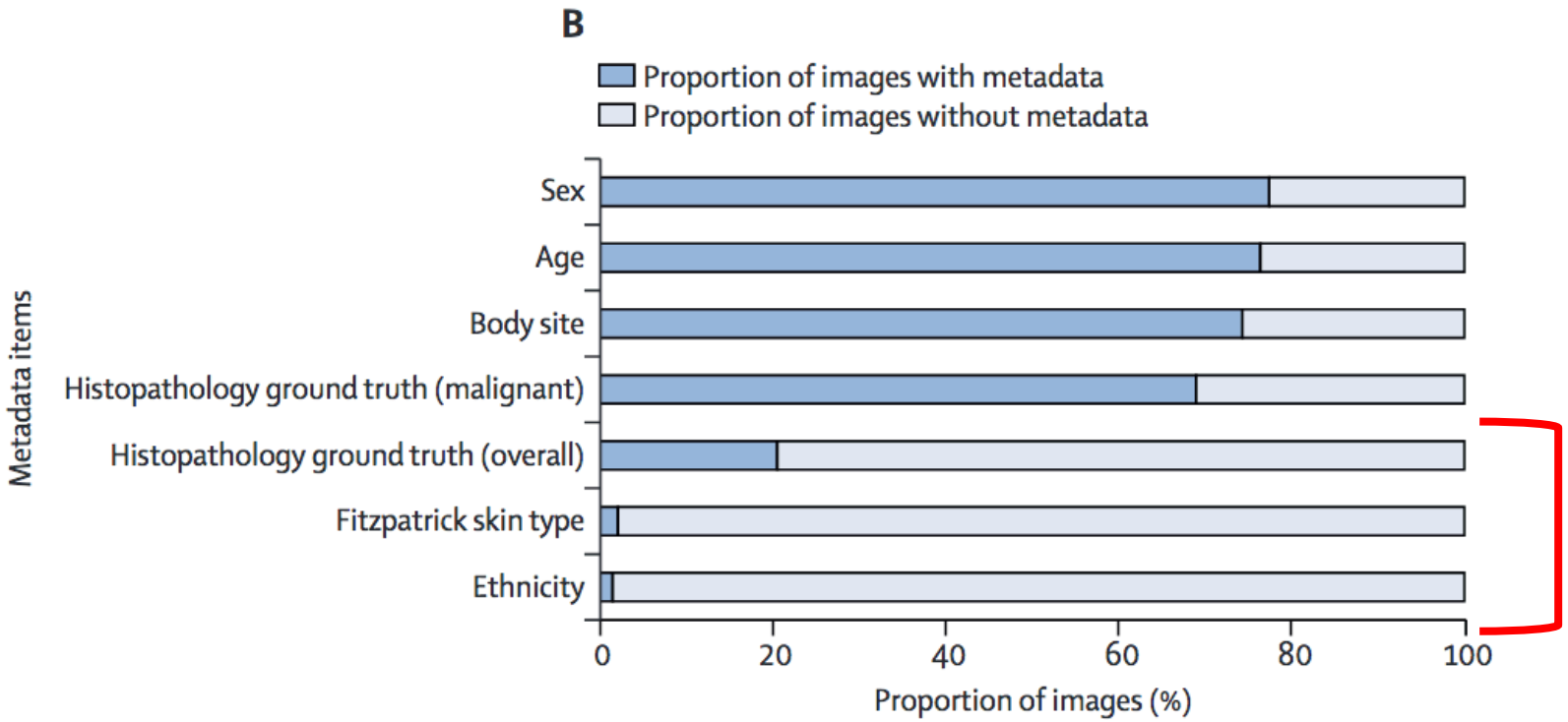
Table 1. Summary of Key Findings

Description	No./total No. of studies (%)
Developed a novel algorithm	57/70 (81.4)
With novel algorithms that tested on an external test set	14/57 (24.6)
With tasks involving cutaneous malignant neoplasms	56/70 (80.0)
Involved cutaneous malignant neoplasms and reported biopsy-proven labels for all cutaneous malignant neoplasms	36/56 (64.3)
Reported any race or ethnicity information for ≥1 data set	14/70 (20.0)
Reported any Fitzpatrick skin tone information for ≥1 data set	7/70 (10.0)
Stated that the AI model developed or used was publicly accessible	21/70 (30.0)

Abbreviation: AI, artificial intelligence.

Daneshjou R, et al. JAMA Derm 2021

Characteristics of publicly available skin cancer image datasets: a systematic review



Wen et al. *Lancet Digital Health*. 2022

Problems with AI in dermatology

- ML algorithms are only as good as the inputs used to train them.
- Without representative inputs, we are at risk of worsening disparities in health care outcomes.
- We have a chance to intervene before a health care disparity potentially widens.

Solutions for AI in darker skin

- Oversample skin lesions in skin of color.
- Design a separate algorithm for darker skin tones (less ideal).
- Find digital solutions using image manipulation techniques to mimic dark skin.

Thank you

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- Robert Wood Johnson Foundation
- American Cancer Society

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