Supplementary Online Content

Daneshjou R, Smith MP, Sun MD, Rotemberg V, Zou J. Lack of transparency and potential bias in artificial intelligence data sets and algorithms: a scoping review. *JAMA Dermatol*. Published online September 22, 2021. doi:10.1001/jamadermatol.2021.3129

This supplementary material has been provided by the authors to give readers additional information about their work.

eTable. Table of Characteristics Assessed in Each Study

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
A convolutional neural network trained with dermoscopic images performed on par with 145 dermatologists in a clinical melanoma image classification task[1]	30852421	2019	Combination of ISIC Archive and HAM10000 (ISIC 2018 Train)	Train, Internal Validation	12378 (Train set) 1359 (Internal validation set)	Not specified	Dermoscopic	Atypical nevi, melanoma	Melanomas – pathology Nevi – pathology (~24%), expert consensus panel of dermatologists (~54%), monitoring temporal change (~22%)	Melanomas – Y Nevi – Y	N	N	Y	N	Y	N	N
			MClass-Benchmark for clinical images collected from Department of Dermatology of the University Medical Center Groningen (subset of MED-NODE database)	Test	100	Not specified	Clinical	Nevi, melanoma	Melanomas – pathology Nevi – expert consensus panel of dermatologists	Melanomas – Y Nevi – Y	N	N	Y	N			
A deep learning system for differential diagnosis of skin diseases[2]	32424212	2020	Teledermatology service serving 17 primary-care and specialist sites from two states in the United States	Train, Internal Validation	64,837 for training	16,114 cases for training	Clinical	Acne, Actinic keratosis, Allergic contact dermatitis, Alopecia areata, Androgenetic alopecia, Basal cell carcinoma, Cyst, Eczema, Folliculitis, Hidradenitis, Lentigo, Melanocytic nevus, Melanoma, Post inflammatory hyperpigmentation, Psoriasis,	Expert consensus panel of dermatologists	Benign lesions: Y Basal cell carcinoma: N Melanoma: N Squamous cell carcinoma/squamous cell carcinoma in situ (SCC/SCCIS): N	Y Type I: 46 (0.3%) Type II: 2,807 (17.4%) Type III: 6,641 (41.2%) Type IV: 5,040 (31.3%) Y Type V: 510 (3.2%) Type VI: 46 (0.3%) Unknown: 1,024 (10.2%)	Y American Indian or Alaska Native: 142 (0.1%) Asian: 1,775 (11.0%) Black or African American: 1,087 (6.8%) Hispanic or Latino: 7,044 (43.7%) Y	N	Y	N	Y	N

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								Squamous cell carcinoma/squamous cell carcinoma in situ (SCC/SCCIS), Seborrheic keratosis/irritated seborrheic keratosis (SK/ISK), Scar condition, Seborrheic dermatitis, Skin tag, Stasis dermatitis, Tinea, Tinea versicolor, Urticaria, Verruca vulgaris, Vitiligo, Other				Native Hawaiian or Pacific Islander: 224 (1.4%) White: 5,475 (34.0%) Not specified: 367 (2.2%)					
				Test	14,883 images for testing	3,756 cases for testing	Clinical		52 cases of malignancy were biopsied (32 BCC, 6 melanoma, 14 SCC/SCCIS). All others were by an expert consensus panel of dermatologists.	Benign lesions: Y Basal cell carcinoma: N Melanoma: N Squamous cell carcinoma/squamous cell carcinoma in situ (SCC/SCCIS): N	Y Type I: 9 (0.2%) Type II: 2,807 (17.4%) 383 (10.2%) Type III: 2,412 (64.2%) Type IV: 724 (19.3%) Type V: 101 (2.7%) Type VI: 1 (0.0%) Unknown: 126 (3.4%)	Y American Indian or Alaska Native: 42 (0.1%) Asian: 473 (12.6%) Black or African American: 229 (6.1%) Hispanic or Latino: 1,631 (43.4%) Native Hawaiian or Pacific Islander: 61 (1.6%) White: 1,175 (31.3%) Not specified: 145 (3.9%)	N	Y			
A deep learning, image-based approach for automated diagnosis for inflammatory skin diseases[3]	32566608	2020	Department of Dermatology, The Second Xiangya Hospital, Central South University, China	Train, Internal Validation, Test	4740	Not specified; mentioned that images may be from the same patient	Clinical	Psoriasis, eczema, atopic dermatitis and healthy skin	Consensus panel of dermatologists	Y	N	N	N	Y	N	N	Y Smartphone application publicly available to physicians in China
A GAN-based image synthesis method for skin lesion classification[4]	32526536	2020	HAM10000 (ISIC 2018 Train)	Train, Internal Validation, Test	10,015	Not specified	Dermoscopic	Actinic keratosis, Intraepithelial carcinoma (Bowen's), Basal cell carcinoma,	Actinic keratosis: consensus, Intraepithelial carcinoma (Bowen's):	Actinic keratosis: Y, Intraepithelial carcinoma (Bowen's): Y, Basal cell	N	N	Y Data available on request	Y	N	N	N

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								Benign keratosis, Dermatofibroma, Melanocytic nevi, Vascular skin lesions, Melanoma	pathology, Basal cell carcinoma: pathology, Benign keratosis: consensus, Dermatofibroma: consensus, Melanocytic nevi: consensus, Vascular skin lesions: consensus, Melanoma: consensus	carcinoma: Y, Benign keratosis: Y, Dermatofibroma: Y , Melanocytic nevi: Y, Vascular skin lesions: Y, Melanoma: Y							
A machine learning-based, decision support, mobile phone application for diagnosis of common dermatological diseases[5]	32991767	2020	Dermatology practices across India	Train, Internal Validation, Test	7501 (This number was derived from Table 1 of the paper)	Not specified	Clinical	Acne, Actinic keratosis, Alopecia, Anogenital warts, Basal cell carcinoma, Bowen's disease, Bullous	Not specified	Cannot be determined	N	N	N	Y	Y	Y	N
			Public databases (Hellenic Dermatological Atlas, Atlas of Dermatology)	Train, Internal Validation, Test	8227 (This number was derived from Table 1 of the paper)	Not specified	Clinical	pemphigoid, Candidiasis, Chicken pox, Discoid lupus erythematosus, Eczema, Fixed drug eruption, Herpes zoster, Hidradenitis suppurativa,	Not specified	Cannot be determined	N	N	Y	Y			

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			All India Institute of Medical Sciences in New Delhi, an urban private practice in Gurugram, Haryana, India, and a rural health center in Jhajjar, Haryana, India	External Validation	4254	4254	Clinical	Ichthyosis, Impetigo and Pyodermas, Keloids/Hypertrophic scar, Keratoacanthoma, Lichen planus, Lichen sclerosus, Melanocytic nevi/Mole, Melanoma, Melasma, Milia, Molluscum contagiosum, Pemphigus, Pityriasis rosea, Pityriasis versicolor, Psoriasis, Rosacea, Seborrheic keratosis, Squamous cell carcinoma, Tinea capitis, Tinea cruris, corporis or faciei, Tinea manuum, Tinea pedis, Tinea unguium, Urticaria, Viral warts, Vitiligo/Leucoderma, Normal skin	Clinical examination, laboratory investigation and/or histopathology Not specified by disease	Cannot be determined	N	N	N	Y			

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A patient-oriented, general-practitioner-level, deep-learning-based cutaneous pigmented lesion risk classifier on a smartphone[6]	31907926	2020	Taipei Medical University	Train, Internal Validation, Test	5289	4635	Clinical	"High risk" and "low risk" pigmented lesions	High risk: consensus panel of dermatologists Low risk: consensus panel of dermatologists	High risk: N Low risk: Y	N	Y 100% Asian	N	Y	N	N (states that images were reserved "for later comparison of performance between models and general practitioners," but no such results are presented)	N
A Point-of-Care, Real-Time Artificial Intelligence System to Support Clinician Diagnosis of a Wide Range of Skin Diseases[7]	33065109	2020	VisualDx	Train, Internal Validation, Test	76,926 (69,195 training images, 3,869 internal validation images, and 3,862 test images)	Not specified	Clinical	No disease: characterizing morphology	No disease; morphology by consensus panel of dermatologists	Cannot be determined	N	N	Y VisualDx data is available with a subscription (additional permission needed for machine learning use)	N	Y	N (evaluated against board-certified internal medicine doctors but not dermatologists)	Y VisualDx DermExpert is commercially available
			Dataset 1: Selected by authors, not specified.	External Test	16	Not specified	Clinical		No disease; morphology by consensus panel of dermatologists	Cannot be determined	N	N	N	N			

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			Dataset 2: Selected by authors, not specified	External Test	222	Not specified	Clinical		No disease; morphology by consensus panel of dermatologists	Cannot be determined	Y Types I-III: 169 Types IV-VI: 53	N	N	Y			
A pretrained neural network shows similar diagnostic accuracy to medical students in categorizing dermoscopic images after comparable training conditions[8]	28569993	2017	Not specified	Train, Internal Validation	298	Not specified	Dermoscopic	Basal cell carcinomas, dermatofibromas, melanomas, melanocytic naevi, seborrheic keratoses and vascular lesions	Not specified	Cannot be determined	N	N	N	N	N	N (Medical students evaluated against the model's output but not dermatologists)	N
			Not specified	Test	50	Not specified	Dermoscopic		Not specified	Cannot be determined	N	N	N	N			
A superpixel-driven deep learning approach for the analysis of dermatological wounds[9]	31542688	2020	Neurovascular Ulcers Outpatient Clinic of the Clinical Hospital of the University of São Paulo, Ribeirão Preto, São Paulo, Brazil	Train, Internal Validation, Test	217	Not specified	Clinical	Arterial and venous ulcers (for wound quantification)	Clinical diagnosis	Y	N	N	Y	Y	N	N	Y
Acral melanoma detection using a convolutional neural network for dermoscopy images[10]	29513718	2018	Severance Hospital in the Yonsei University Health System, Seoul, Korea and Dongsan Hospital in the Keimyung University Health System, Daegu, Korea.	Train, Internal Validation, Test	724	275	Dermoscopic	Aacral melanoma and benign nevi	Pathology confirmed	Y	N	Y "Asians"	Y	Y	N	Y (compared diagnostic rate of model with those of 2 dermatologists)	N
Artificial Intelligence and Its Effect on Dermatologists' Accuracy in Dermoscopic	32915161	2020	ISIC Archive, with a large fraction of images coming from a subset of	Train Internal Validation Test	4944	Not specified	Dermoscopic	Melanoma and benign nevus	Pathology confirmed	Y	N	N	Y	Y	N	Y	N

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Melanoma Image Classification: Web-Based Survey Study[11]			HAM10000 (ISIC 2018 Trrain)														
Assessing the effectiveness of artificial intelligence methods for melanoma: A retrospective review[12]	31255749	2019	ISIC Archive, subset of dermoscopic images from ISDIS-ISIC (no specification of which year/what set)	Train, Internal Validation, Test	2200	Not specified	Dermoscopic	Melanoma and non-melanoma	Benign (non-melanoma): expert consensus Malignant (melanoma): pathology	Non-melanoma: Y Melanoma – Y	N	N	Y	Y	N	N	N
Assessment of Accuracy of an Artificial Intelligence Algorithm to Detect Melanoma in Images of Skin Lesions[13]	31617929	2019	7 United Kingdom hospitals	External Validation	289 (Fine tuning) 1550 (External validation)	514	Dermoscopic	Melanoma, dysplastic nevi, other	551 biopsied: 125 (22.7%) melanomas, 148 (26.8%) dysplastic nevi, and 278 (50.5%) received other diagnoses 999 lesions: described as thought to be “clinically benign”	Y	Y Type I: 61 (12.4%), Type II: 172 (34.9%), Type III: 184 (37.3%), Type IV: 62 (12.6%), Type V: 10 (2.0%), Type VI: 4 (0.8%), Missing: 8 (1.6%).	Y White: 484 (96.8%) Non-white: 16 (3.2%) Missing: 1 (0.1%)	N	Y	Y External validation only	Y	N
Association Between Surgical Skin Markings in Dermoscopic Images and Diagnostic Performance of a Deep Learning Convolutional Neural Network for Melanoma Recognition[14]	31411641	2019	Department of Dermatology, University of Heidelberg	External Validation	130	Not specified	Dermoscopic	Benign nevi, melanoma	Melanomas: pathology, Benign nevi: no change over 2 yeas	Y	N	N	N	Y	Y External validation only	N	N
Augmented Intelligence Dermatology: Deep Neural Networks Empower Medical Professionals in Diagnosing Skin Cancer and Predicting Treatment Options for 134 Skin Disorders[15]	32243882	2020	ASAN: Department of Dermatology at Asan Medical Center	Train, Internal Validation	120,780	20,765	Clinical	174 disorders	Clinical diagnosis and/or pathology	Cannot be determined	N	Y >99% Asian	N	Y	Y	Y	Y modelderm.com
			Normal: scraped from the internet and lesions	Train, Internal Validation	48,271	5,849	Clinical	Normal skin or nonspecific findings	Consensus panel of dermatologists	Y	N	Y >99% Asian	N specific web images not shared	Y			

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			cropped out from ASAN														
			MED-NODE: University Medical Center Groningen	Train, Internal Validation	170	Not specified	Clinical	Melanoma vs nevus	Pathology	Y	N	Y Mainly Caucasian	Y	Y			
			Web: scraped from the internet	Train, Internal Validation	51,459	Not specified	Clinical	174 disorders	Consensus panel of dermatologists	Cannot be determined	N	Y Mainly Caucasian	N specific web images not shared	Y			
			Edinburgh Dermofit Image Library	Test, External Validation	1,300	Not specified	Clinical	10 disorders	Pathology	Y	N	Y Mainly Caucasian	Y Commerciall y available	Y			
			SNU dataset: Department of Dermatology at Seoul National University Bundang Hospital, Inje University Sanggye Paik Hospital, and Hallym University Dongtan Hospital.	Test, External Validation	2,201	1608	Clinical	134 disorders	Clinical diagnosis and/or pathology	Cannot be determined	N	Y >99% Asian	Y Partially shared, additional data upon request	Y			
Automated detection of erythema migrans and other confounding skin lesions via deep learning[16]	30654165	2018	Online images	Train, Internal Validation, Test	1,718	Not specified	Clinical	Erythema migrans, tinea corporis, herpes zoster, and normal skin	Labeled by a single dermatologist	Y	N	N	N Specific web images not shared	Y	Y	N (only compared against convenience sample of 7 non-medically-trained humans)	N
			Mid-Atlantic region research participants	Test, External Validation	116	63	Clinical	Erythema migrans	Clinical diagnosis in person	Y	N	N	N	Y			

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Classification of the Clinical Images for Benign and Malignant Cutaneous Tumors Using a Deep Learning Algorithm[17]	29428356	2018	Asan: Department of Dermatology at Asan Medical Center	Train, Internal Validation, Test	17,125	4,867	Clinical	Basal cell carcinoma, squamous cell carcinoma, intraepithelial carcinoma, actinic keratosis, seborrheic keratosis, malignant melanoma, melanocytic nevus, lentigo, pyogenic granuloma, hemangioma, dermatofibroma, wart	12,656 pathology confirmed, others by clinical diagnosis code	Cannot be determined	N	Y >99% Asian	N	Y	Y	N	Y
			Additional Asan	Train, Internal Validation	159,477	17,888	Clinical	248 diseases	Pathology if available, otherwise clinical diagnosis code	Cannot be determined	N	Y >99% Asian	N				
			Atlas: multiple dermatology online atlases: D@nderm Atlas of Clinical Dermatology (http://www.danderm-pdv.is.kkh.dk/atlas/index.html) Dermquest (http://dermquest.com) Interactive Derm Atlas (http://www.dermatlas.net) DermIS (https://www.dermis.net/der	Train, Internal Validation	3,820	Not specified	Clinical	Basal cell carcinoma, seborrheic keratosis, malignant melanoma, melanocytic nevus, lentigo, wart	Not specified	Cannot be determined	N	N	Y				

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			misroot/en/home/index.htm) Loyola University Dermatology Medical Education Website (http://www.meddean.luc.edu/lumen/MedEd/medicine/dermatology/melton/atlas.htm) Dermatoweb (http://www.dermatoweb.net/) Dermatology Atlas (http://www.atlasdermatologico.com.br/) Hellenic Derm Atlas (http://www.hellenicdermatlas.com/en/?params=en)														
			MED-NODE: University Medical Center Groningen	Train, Internal Validation	170	Not specified	Clinical	Melanoma vs nevus	Pathology	Y	N	Y Mainly Caucasian	Y				
			Hallym dataset: Dongtan Sacred Heart Hospital,	Test, External Validation	152	106	Clinical	Basal cell carcinoma	Pathology		Not specified	104 Asian 2 Caucasian	N				

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			Hallym University, and Sanggye Paik Hospital, Inje University														
			Edinburgh dataset: Edinburgh Dermofit Image Library	Test, External Validation	1,300	Not specified	Clinical	Basal cell carcinoma, squamous cell carcinoma, intraepithelial carcinoma, actinic keratosis, seborrheic keratosis, malignant melanoma, melanocytic nevus, pyogenic granuloma, hemangioma, dermatofibroma	Pathology	Y	N	Y Mainly Caucasian	Y Commerciall y available				
Clinically Applicable Deep Learning Framework for Measurement of the Extent of Hair Loss in Patients With Alopecia Areata[18]	32785607	2020	Yonsei University Wonju Severance Christian Hospital	Train, Internal Validation, Test	2,716	679	Clinical	Alopecia areata	Pixel annotations by board certified dermatologist	Y	N	N	Y Partial: masks but not clinical images	Y	N	Y	Y
			Yonsei University Wonju Severance Christian Hospital	Test	400	100	Clinical		Pixel annotations by board certified dermatologist	Y	N	N	Y Partial: masks but not clinical images	Y			
Clinically Relevant Vulnerabilities of Deep Machine Learning Systems for Skin Cancer Diagnosis[19]	32931808	2020	International Skin Imaging Collaboration Challenge dataset 2018	Train, Internal Validation, Test	23,010	Not specified	Dermoscopic	Melanoma, benign nevi	Not specified	Cannot be determined	N	N	Y	Y	N	N	Y

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Comparison of the accuracy of human readers versus machine-learning algorithms for pigmented skin lesion classification: an open, web-based, international, diagnostic study[20]	31201137	2019	ISIC 2018 challenge train and test: Vienna Dermatologic Imaging Research Group (ViDIR) at the Department of Dermatology at the Medical University of Vienna (Vienna, Austria), and the skin cancer practice of Cliff Rosendahl in Queensland (Capalaba, QLD, Australia)	Train, Internal Validation, Test	11,210	Not specified	Dermoscopic	Intraepithelial carcinoma including actinic keratoses and Bowen's disease, basal cell carcinoma, benign keratinocytic lesions including solar lentigo, seborrheic keratosis and lichen planus-like keratosis, dermatofibroma, melanoma. melanocytic nevus, and vascular lesions	Pathology: >50% of all lesions, biology (>1.5 years sequential dermoscopic imaging without changes), and expert consensus in some cases of common, straightforward, non-melanocytic cases that were not excised.	Cannot be determined	N	N	Y	N	Y Mix of test and external test	Y	N
			External test set: Turkey, New Zealand, Sweden, and Argentina	External Validation	316	Not specified	Dermoscopic	Not specified	Not specified	Cannot be determined	N	N	N	N			
Computer algorithms show potential for improving dermatologists' accuracy to diagnose cutaneous melanoma: Results of the International Skin Imaging Collaboration 2017[21]	31306724	2020	ISIC 2017 challenge test	Test	150	Not specified	Dermoscopic	Melanomas (50), Benign nevi (50), and seborrheic keratosis (50)	Not specified	Cannot be determined	N	N	N	N	N	Y	N

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Data augmentation in dermatology image recognition using machine learning[22]	31140653	2019	DermNet NZ, Dermatology Atlas, Hellenic Dermatological Atlas, and Google Images	Train, Internal Validation, Test	1088	Not specified	Clinical	Acne, atopic dermatitis, impetigo, psoriasis, and rosacea	Not specified	Cannot be determined	Not Specified	Not specified	Y (partial, Google images not indicated)	Y	N	N	N
Deep learning-based classification of facial dermatological disorders[23]	33221639	2020 Epub	DermNet NZ, DermQuest, DermWeb, and Dermatoweb	Train, Internal Validation, Test	505	Not specified	Clinical	Acne vulgaris, psoriasis, hemangioma, seborrheic dermatitis and rosacea	Not specified	Cannot be determined	N	N	Y	Y	N	N	N
Deep Learning for Diagnostic Binary Classification of Multiple-Lesion Skin Disease[24]	33072786	2020	Department of Dermatology, Aarhus University Hospital (AUH), Denmark	Train, Internal Validation, Test	16,543	2,342	Clinical	Acne, rosacea, psoriasis, eczema, and cutaneous t-cell lymphoma	Diagnosed by trained dermatologists according to ICD-10 codes	Cannot be determined	Y Fitzpatrick skin type II and III	Y Danish	N	Y	N	N	Y
Deep learning outperformed 136 of 157 dermatologists in a head-to-head dermoscopic melanoma image classification task[25]	30981091	2019	ISIC Archive	Train, Internal Validation, Test	13,737	Not specified	Dermoscopic	Atypical nevi (18,566) and melanoma (2,169)	Melanomas: histopathological evaluation of biopsies. Nevi: either by histopathological examination (~24%), expert consensus (~54%) or by another diagnosis method, such as a series of images that showed no temporal changes (~22%).	Y	N	N	Y	N	N	Y	N
Deep learning-based, computer-aided classifier developed with dermoscopic images shows comparable performance to 164	32826613	2020	Dataset I: Department of Dermatology, Peking Union Medical College Hospital	Train, Internal Validation, Test	7,262	1,554	Dermoscopic	Basal cell carcinoma, melanocytic nevus, seborrheic keratosis, others	Basal cell carcinoma confirmed by pathology. Others by expert consensus	Y	Y Type IV	Y Asian	N	Y	N	Y	N

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dermatologists in cutaneous disease diagnosis in the Chinese population[26]			Dataset II: Department of Dermatology, Peking Union Medical College Hospital	Train, Internal Validation, Test	3,175	561	Dermoscopic	Psoriasis, other inflammatory disorders	Expert consensus	Y	Y Type IV	Y Asian	N	Y			
Deep Neural Frameworks Improve the Accuracy of General Practitioners in the Classification of Pigmented Skin Lesions[27]	33218060	2020	HAM10000 dataset from ISIC	Train, Internal Validation, Test	10,015	Not specified	Dermoscopic	Actinic keratosis, Intraepithelial carcinoma (Bowen's). Basal cell carcinoma, Benign keratosis, Dermatofibroma, Melanocytic nevi Vascular skin lesions, Melanoma	Actinic keratosis: consensus, Intraepithelial carcinoma, (Bowen's): pathology Basal cell carcinoma: pathology, Benign keratosis: consensus Dermatofibroma: consensus , Melanocytic nevi: consensus, Vascular skin lesions: consensus, Melanoma: consensus	Actinic keratosis: Y Intraepithelial carcinoma (Bowen's): Y Basal cell carcinoma: Y Benign keratosis: Y Dermatofibroma: Y Melanocytic nevi: Y Vascular skin lesions: Y Melanoma: Y	N	Y Nationality breakdown (as a percentage of the 10,015 images in the dataset): 2.0% Portuguese (PH2) 22.6% Australian (Rosendahl) Austrian (ViDIR) Not specified (Atlas and ISIC 2017)	Y	N	N	N (only against general practitioners)	N
Deep neural networks are superior to dermatologists in	31401469	2019	ISIC	Train, Internal Validation	4204	Not specified	Dermoscopic	Melanoma and nevi	Pathologically confirmed	Y	N	N	Y	Y	N	Y	N

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
melanoma image classification[28]			ISIC	Test	804	Not specified	Dermoscopic	Melanoma and nevi	Pathologically confirmed	Y	N	N	Y	Y			
Deep neural networks show an equivalent and often superior performance to dermatologists in onychomycosis diagnosis: Automatic construction of onychomycosis datasets by region-based convolutional deep neural network[29]	29352285	2018	Asan A1 – Asan Medical Center	Train, Internal Validation	49567	4557	Clinical	Onychomycosis, nail dystrophy, onycholysis, melanonychia, other nail disorders, normal	Diagnosis based on image by dermatologist and chart review	Y	N	N	Y	Y	Y	Y	Y
			Asan A2 – Asan Medical Center	Train, Internal Validation	3741	484	Clinical	Onychomycosis, nail dystrophy, onycholysis, melanonychia	Clinical diagnosis in clinic and fungal culture in 64.7%	Y	N	N	Y	Y			
			Inje B1 – Inje University	Test, External Validation	100	57	Clinical	Onychomycosis and nail dystrophy	Onychomycosis – positive KOH or fungal culture or successful treatment with antifungals. Note that all Inje B1 had positive fungal culture. Nail dystrophy – negative KOH or fungal culture, unresponsiveness to antifungals, or responsiveness to triamcinolone intralesional injection	Y	N	N	Y	Y			
			Inje B2 - Inje University	Test, External Validation	194	61	Clinical	Onychomycosis, nail dystrophy	Onychomycosis – positive KOH or fungal culture or successful treatment with antifungals. Nail dystrophy – negative KOH or fungal culture, unresponsiveness to antifungals, or responsiveness to triamcinolone	Y	N	N	Y	Y			

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
									intralesional injection								
			Hallym – Hallym University	Test, External Validation	125	25	Clinical	Onychomycosis, nail dystrophy	Onychomycosis – positive KOH or fungal culture or successful treatment with antifungals. Note all cases here were KOH confirmed. Nail dystrophy – negative KOH or fungal culture, unresponsiveness to antifungals, or responsiveness to triamcinolone intralesional injection	Y	N	N	Y	Y			
			Seoul – Seoul National University	Test, External Validation	939	169	Clinical	Onychomycosis, nail dystrophy	Onychomycosis – positive KOH or fungal culture or successful treatment with antifungals. Note all cases here were KOH confirmed. Nail dystrophy – negative KOH or fungal culture, unresponsiveness to antifungals, or responsiveness to triamcinolone intralesional injection	Y	N	N	Y	Y			
Deep-learning-based, computer-aided classifier developed with a small dataset of clinical images surpasses board-certified dermatologists in skin tumor diagnosis[30]	29953582	2018	University of Tsukuba Hospital	Train, Internal Validation, Test	6009	2296	Clinical	Malignant melanoma (MM), squamous cell carcinoma (SCC), Bowen disease, actinic keratosis, basal cell carcinoma (BCC), naevus cell naevus (NCN), blue naevus, congenital	All of the diagnoses were based on pathological examination except for the cases of congenital melanocytic naevus, naevus spilus and lentigo simplex.	Y	N	Y Asian	N	Y	N	Y	N

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
								melanocytic naevus, Spitz naevus, sebaceous naevus, poroma, seborrheic keratosis, naevus spilus and lentigo simplex									
Dermatologist-level classification of skin cancer with deep neural networks[31]	28117445	2017	Open-access dermatology repositories, the ISIC Archive (dermoscopic images), the Edinburgh Dermofit Library, and data from the Stanford Hospital.	Train, Internal Validation, Test	129,450	Not specified	Clinical and Dermoscopic	Melanocytic lesions include malignant melanoma and benign nevi. Epidermal lesions include malignant basal and squamous cell carcinomas, intraepithelial carcinomas, pre-malignant actinic keratosis and benign seborrheic keratosis.	Images from the online open-access dermatology repositories are annotated by dermatologists, not necessarily through biopsy. The ISIC Archive data used are composed strictly of melanocytic lesions that are biopsy-proven and annotated as malignant or benign. The Edinburgh Dermofit Library and data from the Stanford Hospital are biopsy-proven and annotated by individual disease names.	Y	N	N	Y, partial - ISIC Archive and the Edinburgh Dermofit Library are available.	Y	N	Y	N
Dermoscopic diagnostic performance of Japanese dermatologists for skin tumors differs by patient origin: A deep learning convolutional neural network closes the gap[32]	33063398	2020	ISIC 2017 training/validation	Train, Internal Validation	2092	Not specified	Dermoscopic	Malignant melanoma (MM), basal cell carcinoma (BCC), melanocytic nevus (MN), or benign keratosis (BK) including solar lentigo, seborrheic keratosis and lichen planus-like keratosis	Benign nevi: expert consensus, Seborrheic keratosis: expert consensus, Melanoma: pathology	Y	N	N	Y	Y	N	Y	N
			HAM 10000 (ISIC)	Train, Internal Validation, Test	7071	Not specified	Dermoscopic		Actinic keratosis: consensus, Intraepithelial carcinoma (Bowen's): pathology,	Y	N	N	Y	Y			

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
									Basal cell carcinoma: pathology, Benign keratosis: consensus Dermatofibroma: consensus, Melanocytic nevi: consensus, Vascular skin lesions: consensus, Melanoma: consensus								
			BCN20000 (ISIC)	Train, Internal Validation	3141	Not specified	Dermoscopic		ISIC labels	Y	N	N	Y	Y			
			Shinshu Department of Dermatology at Shinshu University Hospital	Train, Internal Validation, Test	644	Not specified	Dermoscopic		Histopathology and/or definite clinical course along with the consensus of three dermoscopy experts	Y	N	Japanese	No	Yes			
			ISIC 2017 (test set)	Test	600	Not specified	Dermoscopic		Benign nevi: expert consensus, Seborrheic keratosis: expert consensus, Melanoma: pathology	Y	N	N	Y	Y			
Detection of Malignant Melanoma Using Artificial Intelligence: An Observational Study of Diagnostic Accuracy[33]	31921498		PH2	Train, Internal Validation, Test	6430	Not specified	Dermoscopic	Melanoma, benign, nonbenign	Melanoma: histopathology, Benign: not specified. Nonbenign: not specified (paper does not specify by dataset but indicates the 3 labels above)	Y	N	N	Y	N	N (states that the model was "trained and validated against a dataset of archived dermoscopic images of skin lesions" but does not specify whether there is or is not any overlap with the test datasets)	N	Y (DERM is owned by Skin Analytics, whose services are only available through clinical partners in the UK)
			Interactive Atlas of Dermoscopy published by EDRA,	Train, Internal Validation, Test		Not specified					N	N	Y	N			
			ISIC Archive	Train, Internal Validation, Test		Not specified					N	N	Y	N			
			"a variety of other sources"	Train, Internal Validation, Test	672	Not specified					N	N	N	N			

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
Development and accuracy of an artificial intelligence algorithm for acne grading from smartphone photographs[34]	31446631	2019	Acne dataset collected from France, South Africa, China, India	Train, Internal Validation, Test	5,972	1,072	Clinical	Acne	Three trained dermatologists with expertise in acne graded each patient's acne severity using the European GEA scale based on 3 image views. For each patient, the final GEA grade chosen was that confirmed by at least 2 out of the 3 dermatologists	Y	N	N Describes distinct ethnicities (Caucasian, African, Asian, Latin, Indian) but does not give breakdown by ethnicity	N	Y	N	N	N
Development and validation of two artificial intelligence models for diagnosing benign, pigmented facial skin lesions[35]	32772400	2020	Hospital for Skin Diseases at the Chinese Academy of Medical Science	Train, Internal Validation, Test	12,816	Not specified	Clinical	Acquired nevi of Ota, melasmas, café-au-lait spots, freckles, seborrheic keratoses, nevi of Ota, other	Complete consensus among 3 dermatologists with >3 years' experience	Y	N	N	N	Y	N	N	N
Development of a lightweight deep learning model for cloud applications and remote diagnosis of skin cancers[36]	33211346	2020	Department of Dermatology, Kaohsiung Chang Gung Memorial Hospital in Taiwan	Train, Internal Validation, Test	1,287	1,222	Clinical	Basal cell carcinoma, benign keratosis-like lesions, melanoma, melanocytic nevi	Pathology	Y	N	N	N	Y	N	N	N
			HAM10000 (ISIC 2018 Train)	Train, Internal Validation, Test	10,015	Not specified	Dermoscopic	Actinic keratosis, Intraepithelial carcinoma (Bowen's), Basal cell carcinoma, Benign keratosis, Dermatofibroma, Melanocytic nevi, Vascular skin lesions, Melanoma	Actinic keratosis: consensus, Intraepithelial carcinoma (Bowen's): pathology, Basal cell carcinoma: pathology, Benign keratosis: consensus, Dermatofibroma: consensus. Melanocytic nevi: consensus. Vascular skin lesions: consensus. Melanoma: consensus	Y Actinic keratosis: Y Intraepithelial carcinoma (Bowen's): Y Basal cell carcinoma: Y Benign keratosis: Y Dermatofibroma: Y Melanocytic nevi: Y Vascular skin lesions: Y Melanoma: Y	N	N	Y	Y			

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
Diagnostic accuracy of content-based dermoscopic image retrieval with deep classification features[37]	30207594	2018	EDRA, companion to Interactive Atlas of Dermoscopy	Train, Internal Validation, Test, External Test	888	Not specified	Dermoscopic	Benign keratinocytic lesions (seborrheic keratoses, solar lentigines and lichen planus-like keratoses), melanoma, nevus	Not specified	Cannot be determined	N	N	Y	Y	Y Trained three models based on each dataset and tested on both data in the dataset and data from other datasets.	N	N (three models developed on each dataset, but none released)
			ISIC 2017	Train, Internal Validation, Test, External Test	2750	Not specified	Dermoscopic	Benign nevi, seborrheic keratosis, melanoma	Benign nevi: expert consensus, Seborrheic keratosis: expert consensus, Melanoma: pathology,	Nevus: Y Seborrheic keratosis: Y Melanoma: Y	N	N	Y				
			PRIV	Train, Internal Validation, Test, External Test	16,691	Not specified	Dermoscopic	Angioma (including angiokeratoma), BCC (basal cell carcinoma), benign keratinocytic lesions (seborrheic keratoses, solar lentigines and lichen planus-like keratoses, dermatofibromas, inflammatory lesions (including dermatitis, lichen sclerosus, porokeratosis, rosacea, psoriasis, lupus erythematosus, bullous pemphigoid, lichen planus, granulomatous processes and artefacts), melanoma (all types), nevus (all types of melanocytic naevi), SCC (squamous cell carcinomas,	Pathology and clinical diagnosis	Cannot be determined	N	N	N				

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
								actinic keratoses, Bowen's)									
Diagnostic capacity of skin tumor artificial intelligence-assisted decision-making software in real-world clinical settings[38]	32810047	2020	Department of Dermatology of the China-Japan Friendship Hospital	External Validation	212	106	Clinical and dermoscopic	Melanoma, SCC, BCC, AKs, nevus cell nevus, seborrheic keratosis, hemangioma, dermatofibroma, epidermoid cyst	All lesions were surgically excised and histopathologically proven	Y	N	N	N	N	Y External validation	Y	Y (Youzhi AI)
Diagnostic performance of a deep learning convolutional neural network in the differentiation of combined naevi and melanomas[39]	31856342	2019	Collected from the departments of dermatology of the university medical centres of Heidelberg, Göttingen, and from the medical centre Thalkirchner Straße, Munich	External Validation	72	72	Dermoscopic	Benign nevi, melanoma	Melanomas (n = 36) – all histologically proven Excised benign nevi (n=34) – histologically proven In non-excised cases of benign naevi (n = 2), the diagnosis was based on expert consensus and an unremarkable follow-up over at least 2 years.	Y	N	N	N	N	Y External validation	Y	Yes Moleanalyzer-Pro
Diagnostic performance of the MelaFind device in a real-life clinical setting[40]	28332777	2017	Dermatology patients within a single clinical practice	External Validation	360	111	Dermoscopic	Melanomas and nevi. Targeted: pigmented skin lesions with one or more clinical (e. g. variegated color, border irregularity, eccentric hyperpigmentation, or asymmetry) or historical (e. g. recent	113 were excised for histological diagnosis (based on Melafind score or physician discretion). The rest were followed clinically.	Cannot be determined	N	N	N	N	Y External validation only	N	Y (MelaFind)

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
								enlargement, recent change in color) characteristics of melanoma									
Effects of Label Noise on Deep Learning-Based Skin Cancer Classification[41]	32435646	2020	HAM10000 (ISIC 2018 Train) ISIC Archive	Train, Internal Validation, Test	804	Not specified	Dermoscopic	Actinic keratosis, intraepithelial carcinoma (Bowen's), basal cell carcinoma, benign keratosis, dermatofibroma, melanocytic nevi, vascular skin lesions, melanoma	Actinic keratosis: consensus, Intraepithelial carcinoma (Bowen's): pathology, Basal cell carcinoma: pathology Benign keratosis: consensus, Dermatofibroma: consensus. Melanocytic nevi: consensus, Vascular skin lesions: consensus, Melanoma: consensus	Actinic keratosis: Y Intraepithelial carcinoma (Bowen's): Y Basal cell carcinoma: Y Benign keratosis: Y Dermatofibroma: Y Melanocytic nevi: Y Vascular skin lesions: Y Melanoma: Y	N	Y Nationality breakdown (as a percentage of the 10,015 images in the dataset): 2.0% Portuguese (PH2) 22.6% Australian (Rosendahl) Austrian (ViDIR) Not specified (Atlas and ISIC 2017)	Y	N	N	N	N
Enhanced classifier training to improve precision of a convolutional neural network to identify images of skin lesions[42]	31233565	2019	ISIC Archive (dermoscopic images)	Train, Internal Validation	13,637	Not specified	Dermoscopic	Melanomas and benign nevi	Melanoma – biopsy proven Nevi were made either by histopathological examinations (~24%), by expert consensus (~54%), or by another type	Y	N	N	Y	Y	N	N	N

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
			International Symposium on Biomedical Imaging 2016 Challenge (ISIC 2016)	Test	379	Not specified	Dermoscopic		of diagnosis such as a series of images with no change overtime (~22%).		N	N	Y	Y			
Expert-Level Diagnosis of Nonpigmented Skin Cancer by Combined Convolutional Neural Networks[43]	30484822	2019	Clinical images from primary skin cancer clinic in Queensland, Australia	Train	7895	Not specified	Clinical	Actinic keratoses and intraepithelial carcinoma (Bowen's), basal cell carcinoma (all subtypes), benign keratosis-like lesions (including solar lentigo, seborrheic keratosis, and lichen planus–like keratosis), dermatofibroma, melanoma, invasive squamous cell carcinoma and keratoacanthoma, benign sebaceous neoplasms, and benign hair follicle tumors	Pathology	Y	N	N	N	Y	Y	Y	N
			Dermoscopic images from primary skin cancer clinic in Queensland, Australia	Train	5829	Not specified	Dermoscopic		Pathology	Y	N	N	N	Y			
			Educational slides photographed and excised in the practice of one of the authors.	Internal Validation	340 dermoscopic 635 clinical	Not specified	Clinical and dermoscopic		Pathology	Y	N	N	N	Y			

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
			Multiple sources, including the Medical University of Vienna, the image database from C.R., and a convenience sample of rare diagnoses.	Test	2072	Not specified	Clinical and dermoscopic	Actinic Keratosis, Intraepithelial Carcinoma (Bowen's), In Situ Squamous Cell Carcinoma, Basal Cell Carcinoma, Atypical Fibroxanthoma, Kaposi Sarcoma, Merkel Cell Carcinoma, Melanoma, Melanoma Metastases, Morbus Paget, Neurofibrosarcoma, Keratoacanthoma, Invasive Squamous Cell Carcinoma, Sebaceous carcinoma, Syringoid carcinoma, Trichilemmal carcinoma, Fibrous papule, Angiofibroma, Angioma; Angiokeratoma, Benign Inverted Follicular Keratosis, Lichen Planus-like Keratosis, Seborrheic Keratosis, Clear Cell Acanthoma, Chromoblastomycosis, Chondrodermatitis nodularis helicis, Collagenoma, Cyst, Dermatitis, Dermatofibroma, Eccrine poroma, Epidermolytic acanthoma, Acral	Not specified	Y	N	N	N	Y			

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
								fibrokeratoma, Cylindroma; Hidradenoma; Spiradenoma, Lichen sclerosus, Mastocytosis, Molluscum contagiosum, Morphea, Neurofibroma, Neurilemmoma, Nevus, Pilomatrixoma, Porokeratosis, Prurigo nodularis, Pseudolymphoma, Psoriasis, Pyogenic granuloma, Scar, Sebaceous epithelioma, Sebaceous hyperplasia, Sebaceous adenoma, Skin tag, Fibroma, Syringocystadenoma, Trichilemmoma, Trichoepithelioma, Trichoblastoma, Tungiasis, Vascular malformation, Venous lake, Viral wart, Xanthogranuloma							
From Deep Learning Towards Finding Skin Lesion Biomarkers[44]	31946474	2019	ISIC 2018	Train, Internal Validation, Test	10,015	Not specified	Dermoscopic	Actinic keratosis, Intraepithelial carcinoma (Bowen's), Basal cell carcinoma, Benign keratosis, Dermatofibroma, Melanocytic nevi, Vascular skin lesions, Melanoma	Actinic keratosis: consensus, Intraepithelial carcinoma (Bowen's): pathology, Basal cell carcinoma: pathology, Benign keratosis: consensus,	Actinic keratosis: Y Intraepithelial carcinoma (Bowen's): Y Basal cell carcinoma: Y Benign keratosis: Y Dermatofibroma: Y	N	Y Nationality breakdown (as a percentage of the 10015 images in the dataset): 2.0% Portuguese (PH2)	Y	Y	N	N	N

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
									Dermatofibroma: consensus. Melanocytic nevi: consensus, Vascular skin lesions: consensus, Melanoma: consensus	Melanocytic nevi: Y Vascular skin lesions: Y Melanoma: Y		22.6% Australian (Rosendahl) Austrian (ViDIR) Not specified (Atlas and ISIC 2017)					
Human-computer collaboration for skin cancer recognition[45]	32572267	2020	HAM10000	Train	10,015	Not specified	Dermoscopic	Actinic keratosis, Intraepithelial carcinoma (Bowen's), Basal cell carcinoma, Benign keratosis, Dermatofibroma, Melanocytic nevi, Vascular skin lesions, Melanoma	Actinic keratosis: consensus, Intraepithelial carcinoma (Bowen's): pathology, Basal cell carcinoma: pathology, Benign keratosis: consensus, Dermatofibroma: consensus, Melanocytic nevi: consensus, Vascular skin lesions: consensus, Melanoma: consensus	Actinic keratosis: Y Intraepithelial carcinoma (Bowen's): Y Basal cell carcinoma: Y Benign keratosis: Y Dermatofibroma: Y Melanocytic nevi: Y Vascular skin lesions: Y Melanoma: Y	N	Y Nationality breakdown (as a percentage of the 10,015 images in the dataset): 2.0% Portuguese (PH2) 22.6% Australian (Rosendahl) Austrian (ViDIR) Not specified (Atlas and ISIC 2017)	Y	Y		Y	Y (available upon request)

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
			ISIC 2018	Test	1412	Not specified	Dermoscopic	Actinic keratosis, Intraepithelial carcinoma (Bowen's), Basal cell carcinoma, Benign keratosis, Dermatofibroma, Melanocytic nevi, Vascular skin lesions, Melanoma	Routine pathology evaluation (n=786) Biology (that is, >1.5 years of sequential dermoscopic imaging without changes (n= 458) Expert consensus in common, straightforward, non-melanocytic cases that were not excised (n= 260) In vivo confocal images (n=7)	Y	Y, partial Description yes, breakdown no Skin types I-III	Y, partial "Mainly European ancestry"	Y	Y			
			Telemedicine dataset	External Validation, Test	1,521 images (596 lesions)	93	Dermoscopic	Actinic keratosis Intraepithelial carcinoma (Bowen's) Basal cell carcinoma Benign keratosis Dermatofibroma Melanocytic nevi Vascular skin lesions, Melanoma	Face-to-face examination by an experienced board-certified dermatologist (H.P.S.) or the histopathologic report, in cases where the lesion was removed, served as the ground truth.	Cannot be determined	N	N	N				

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
			Department of Dermatology at the Medical University of Vienna for dermoscopy images taken between April and September 2019	External Validation	79	Not specified	Dermoscopic	Actinic keratosis Intraepithelial carcinoma (Bowen's) Basal cell carcinoma Benign keratosis Dermatofibroma Melanocytic nevi Vascular skin lesions, Melanoma	Lesion was excised and had a definite histopathologic diagnosis and if lesions were examined by a physician who was responsible for the face-to-face diagnosis of at least two other cases in this time period	Y	N	N	N	Y			
Keratinocytic Skin Cancer Detection on the Face Using Region-Based Convolutional Neural Network[46]	31799995	2020	Primary training dataset (Asan Medical Center, MED-NODE, Seven-point Checklist Dermatology Dataset, images on the internet).	Train, Internal Validation (Note: secondary and tertiary training were created from primary training dataset)	182,348	Not specified	Clinical	178 disorders	Clinical diagnosis and manual annotation based on image findings	Cannot be determined	N	Y, partial - Asan Medical Center - Asian Others not specified	Y, partial – MED-NODE and Seven-point Checklist Dermatology Dataset are available	Y	Y	Y	Y https://rcnn.modelderm.com
			Asan Medical Center Validation	Test	1570	386	Clinical	basal cell carcinoma, squamous cell	Biopsy-proven		No	Asian	No	Yes			

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
			Hallym National University Validation	Test, External Validation	542	142	Clinical	carcinoma, malignant melanoma, squamous cell carcinoma in situ, seborrheic keratosis, actinic keratosis, hemangioma, pyogenic granuloma, melanocytic nevus, and dermatofibroma)	Biopsy-proven		No	Asian	No	Yes			
			Chonnam University Validation	Test, External Validation	732	145	Clinical		Biopsy-proven		No	Asian	No	Yes			
Man against machine reloaded: performance of a market-approved convolutional neural network in classifying a broad spectrum of skin lesions in comparison with 96 dermatologists working under less artificial conditions[47]	31912788	2020	Convenience sample, not otherwise specified	External Validation	100	Not specified	Clinical and Dermoscopic	Melanoma, basal cell carcinoma, squamous cell carcinoma, actinic keratosis, Bowen's disease, melanocytic nevi of various types, seborrheic keratosis, solar lentigo, angioma, dermatofibroma	Histopathology for 100% of malignant lesions Histopathology for 75% of benign lesions, unremarkable follow-up >2 years for 25% of benign lesions	Malignant lesions – Y Benign lesions – Y	N	N	N	N	Y	Y	Y (Moleanalyzer Pro)
			MSK-1	External V alidation	1100	Not specified	Dermoscopic	Not specified in paper	Not specified in paper	Cannot be determined	N	N	Y	N			
			ISIC 2018 Challenge (sub-set)	External Validation	1511	Not specified	Dermoscopic	Not specified in paper	Not specified in paper	Cannot be determined	N	N	Y	N			
Man against machine: diagnostic performance of a deep learning convolutional neural network for dermoscopic melanoma	29846502	2018	ISIC Archive and cooperating dermatologists	Train, Internal Validation	Not specified	Not specified	Dermoscopic	Non-melanoma Melanoma	Benign (non-melanoma): expert consensus Malignant (melanoma): pathology	Non-melanoma: Y Melanoma – Y	N	N	Y	Y	Y	Y	N

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
recognition in comparison to 58 dermatologists[48]			Validated image library of the Department of Dermatology, University of Heidelberg, Germany	Test, External Validation	300	Not specified	Dermoscopic	20% Melanoma 80% benign nevi of "different subtypes" not otherwise specified	Melanomas (20%) all verified by pathology Of the benign nevi (80%), 2/3 were non-excised lesions confirmed by follow up examinations	Y	N	N	N	N			
			ISIC 2016 International Symposium on Biomedical Imaging (ISBI) challenge	Test	100	Not specified	Dermoscopic	Non-melanoma Melanoma	Benign (non-melanoma): expert consensus Malignant (melanoma): pathology	Non-melanoma: Y Melanoma – Y	N	N	Y	Y			
Melanoma detection by analysis of clinical images using convolutional neural network[49]	28268581	2016	Digital image archive of the Department of Dermatology of the University Medical Center Groningen (MED-NODE)	Train, Internal Validation, Test	170	Not specified	Clinical	Melanoma, benign nevi	Not specified	Cannot be determined	N	N	Y	Y	N	N	N
			Synthesized images	Train, Internal Validation, Test	5950	Not specified	Clinical	Melanoma, benign nevi	Not specified	Cannot be determined	N	N	N				
Melanoma detection using adversarial training and deep transfer learning[50]	32252036	2020	ISIC 2016	Train, Internal Validation, Test	1279	Not specified	Dermoscopic	Benign, Melanoma	Benign (non-melanoma): expert consensus Malignant (melanoma): pathology	Y	N	N	Y	Y	N	Y	N (model is named Melanet but no mention of public or commercial availability)
			"Synthesized images obtained via generative adversarial training from ISIC 2016 dataset"	Train, Internal Validation, Test	727	Not specified	Dermoscopic	Benign, Malignant									
Melanoma recognition by a deep learning convolutional neural network-	31972395	2020	6 "dermoscopic image sets were randomly	External Validation	780	Not specified	Dermoscopic	Superficial spreading melanomas, macular nevi, lentigo maligna	melanoma cases (n = 180) - histopathological diagnosis	Y	N Mentions that "most images were derived from	N	N	N	Y (external testing only)	N	Y (Moleanalyzer-Pro®)

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
Performance in different melanoma subtypes and localizations[51]			selected from image libraries of Departments of Dermatology, Universities of Heidelberg, Munich and Lyon					melanomas, facial solar lentigines/seborrheic keratoses/nevi, nodular melanomas, papillomatous/dermal/blue nevi, mucosal melanomas, mucosal melanoses/macules/nevi, acrolentiginous melanomas, acral (congenital) nevi, nail, subungual melanomas, subungual (congenital), nevi/lentigines/ethnical type pigmentations	benign lesions (n = 600) - either based on histopathology (n = 363, 60.5%), or on an unremarkable follow-up by sequential digital dermoscopy over at least 2 years (n = 210, 35.0%), or on expert opinion (n = 27, 4.5%)		fair skinned patients"					
Multiclass Artificial Intelligence in Dermatology: Progress but Still Room for Improvement[52]	33049269	2020	ISIC 2018, JID editorial images	External Validation	100	Not specified	Clinical	Cutaneous melanomas, basal cell carcinomas, squamous cell carcinomas	Sequentially biopsied	Y	N	Y 100% Caucasian	Y	Y	Y External validation only	N	Y (modelderm.com)
Multimodal skin lesion classification using deep learning[53]	30187575	2018	Not specified other than a "Multiple skin cancer clinics"	Train, Internal Validation, Test	At least 5834. Not directly specified: each case contained at least a dermoscopic and macroscopic clinical image of the lesion, but may have also contained an image with a "general	2917 cases	Clinical and Dermoscopic	Benign nevi, melanoma, basal cell carcinoma, squamous cell carcinoma, pigmented benign keratoses	100% of cases with histopathological diagnosis	Y	N	N	N	Y	N A comparison to ISIC 2017 for single image analysis; however no external testing of multimodal analysis (main task of the paper)	N	N

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
					overview of the body"												
Multiple skin lesions diagnostics via integrated deep convolutional networks for segmentation and classification[54]	32028084	2020	ISIC 2016	Train, Test	1279	Not specified	Dermoscopy	Melanoma, "benign"	Benign (non-melanoma): expert consensus Malignant (melanoma): pathology	N	N	Y	Y	Y	N	N	N
			ISIC 2017	Train, Internal Validation, Test	2750	Not specified	Dermoscopy	"Benign", seborrheic keratosis, melanoma	Benign nevi: expert consensus Seborrheic keratosis: expert consensus Melanoma: pathology	N	N	N	Y	Y			
			HAM10000 (ISIC 2018 Train)	Train, Internal Validation, Test	10,015	Not specified	Dermoscopy	Actinic keratosis, Intraepithelial carcinoma (Bowen's), Basal cell carcinoma, Benign keratosis, Dermatofibroma, Melanocytic nevi, Vascular skin lesions, Melanoma	Actinic keratosis: consensus, Intraepithelial carcinoma (Bowen's): pathology, Basal cell carcinoma: pathology, Benign keratosis: consensus, Dermatofibroma: consensus, Melanocytic nevi: consensus, Vascular skin lesions: consensus, Melanoma: consensus	Actinic keratosis: Y Intraepithelial carcinoma (Bowen's): Y Basal cell carcinoma: Y Benign keratosis: Y Dermatofibroma: Y Melanocytic nevi: Y Vascular skin lesions: Y Melanoma: Y	N	N	Y	Y			
Novel Approaches for Diagnosing Melanoma Skin Lesions Through Supervised and Deep Learning Algorithms[55]	26872778	2016	Various repositories (http://www.bccancer.bc.ca/health-professionals/clinical-resources/skin-cancer-atlas, https://dermnetnz.org, meddean.luc.edu)	Train, Internal Validation, Test	992	Not specified	Dermoscopy	Melanoma, "non-melanoma" not otherwise specified	Not specified (presumably pre-labeled in the contributing datasets)	N	N	N	Y	Y	N	N	N

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
Past and present of computer-assisted dermoscopic diagnosis: performance of a conventional image analyzer versus a convolutional neural network in a prospective data set of 1,981 skin lesions[56]	32534243	2020	Images collected from patients at increased melanoma risk	External Validation	1981	435	Dermoscopic	Melanocytic nevi, seborrheic keratoses, vascular lesions, dermatofibromas, melanomas, basal cell carcinomas	In 785 (39.6%) excised lesions, the results of the histopathological examinations were used as a reference standard. In the remaining 1196 (60.4%) non-excised benign lesions, the diagnoses were based on expert consensus (H.A.H., J.K.W., K.S.) in combination with an uneventful follow-up by sequential digital dermoscopy for at least 2 years.	N	N	N	N	N	Y External validation only	N	Yes CNN = Moleanalyzer-Pro™ CIA = Moleanalyzer-3™/Dynamole™
Performance of a deep learning-based application for the diagnosis of basal cell carcinoma in Indian patients as compared to dermatologists and non-dermatologists[57]	33040407	2020	Public archives (Hellenic Derm Atlas, http://www.danderm.dk/atlas)	Train, Internal Validation	17,784	Not specified	Clinical	Basal cell carcinoma, seborrheic keratosis, keratoacanthoma, viral warts, sarcoidosis, congenital melanocytic nevus, melanoma, keloids, cylindroma, granuloma faciale, nodulocystic acne, nevus sebaceous, rosacea, verrucous, epidermal nevus, nevus comedonicus, angioluymphoid hyperplasia with eosinophilia, angiofibrome, hyperplastic port-wine stain, discoid	BCC lesions – proven by histopathology Non-BCC lesions – consensus diagnosis by 2 dermatologists, or confirmed by histopathology	BCC: Y Melanoma: Cannot be determined (grouped into non-BCC but not specified whether melanomas in the set of images were biopsy-proven) Other non-BCC lesions: Y	N	N	Y	N	Unclear what the source of the test images were	Y	N (Mobile app has been developed but no indication in this paper whether it is available, commercially and/or by request)
			Images from dermatologists across India	Train, Internal Validation		Not specified	Clinical				N	“Indian skin” only, not otherwise specified	N				

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
								lupus erythematosus									
			Test dataset	Test	100	Not specified	Clinical	BCC and non-BCC	BCC lesions – proven by histopathology Non-BCC lesions – consensus diagnosis by 2 dermatologists, or confirmed by histopathology	Y	N	N	N	N			
Performance of a deep neural network in teledermatology: a single-centre prospective diagnostic study[58]	33037709	2020	Patients from telemedicine dermatology visits from a single academic medical center	External Validation	340	281	Clinical	5 categories and 13 subcategories: (1) ‘inflammatory’ (subcategories: dermatitis, acne/rosacea, autoimmune, papulosquamous and other); (2) ‘infectious’ (subcategories: bacterial, viral, fungal and parasitic); (3) ‘neoplastic’ (subcategories: malignant and benign); (4) ‘alopecia’ (subcategories: scarring and non-scarring); and (5) ‘other’ (e.g. burn, scar, striae and among others)	2 approaches: First, if the patient was recommended to return for an in-person clinic visit, the diagnosis from this visit (and any associated laboratory testing or skin biopsies) was used as the reference standard. Second, if no in-person clinic visit was performed, a panel of 6 dermatologists evaluated the case and established the reference standard based on consensus agreement. No specification of which lesions	Cannot be determined	Y Type I: 7 (2.1%) Type II: 59 (17.4%) Type III: 190 (55.9%) Type IV: 84 (24.7%) Type V: 0 (0%) Type VI: 0 (0%)	N	N	N	Y External validation only	Y	Y (http://modelderm.com)

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
									were biopsied vs. only clinically assessed/consensus								
Prospective, comparative evaluation of a deep neural network and dermoscopy in the diagnosis of onychomycosis[59]	32525908	2020	Clinical images obtained from four hospitals (not otherwise specified)	External Validation	90	90	Clinical	Onychomycosis	Direct microscopy with KOH and/or fungal culture were performed to confirm the diagnosis in all cases	Y	N	No	N	Y	Y External validation only	Y	Y (https://nail.modelderm.com)
Real-time burn depth assessment using artificial networks: a large-scale, multicentre study[60]	32826097	2020	Department of Burn Reconstruction Surgery, Xiangya Hospital	Train, Internal Validation, Test	484	Not specified	Clinical	Shallow burns, moderate burns, deep burns	Actual healing time of the burns designated categorization into shallow, moderate, or deep, and then experienced burn experts circled the actual wound surface (no discussion of number of reviewers, consensus process, etc.)	N Paper specifically says histopathology is the Gold Standards	N	N	N	Y	N	Y	N
Region Extraction and Classification of Skin Cancer: A Heterogeneous framework of Deep CNN Features Fusion and Reduction[61]	31327058	2019	PH2	Test	200	Not specified	Dermoscopy	"Benign", "common nevi", melanoma	Assessment performed by an expert dermatologist based on clinical features	Melanoma – N	N	N	Y	Y	Y	N	N
			ISIC 2016 International Symposium on Biomedical Imaging (ISBI) challenge	Train, Internal Validation, Test	1279	Not specified	Dermoscopy	Non-melanoma, melanoma	Benign (non-melanoma): expert consensus Malignant (melanoma): pathology	Non-melanoma: Y Melanoma – Y	N	N	Y				
			ISIC 2017 International Symposium on Biomedical Imaging (ISBI) challenge	Train, Internal Validation, Test	2750	Not specified	Dermoscopy	Benign nevi, seborrheic keratosis, melanoma	Benign nevi: expert consensus Seborrheic keratosis: expert consensus Melanoma: pathology	Nevus: Y Seborrheic keratosis: Y Melanoma: Y	N	N	Y				

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
Results of the 2016 International Skin Imaging Collaboration International Symposium on Biomedical Imaging challenge: Comparison of the accuracy of computer algorithms to dermatologists for the diagnosis of melanoma from dermoscopic images[62]	28969863	2018	ISIC 2016 International Symposium on Biomedical Imaging (ISBI) challenge	Test	100	Not specified	Dermoscopic	Melanoma, benign nevi, lentigines	All melanomas and a majority of the nevi/lentigines (n = 869, 84%) had been histopathologically examined. Nonhistopathologically examined nevi (n = 162) originated from a longitudinal study of children; selection from this dataset was biased to include lesions with the largest diameters, and all images were reviewed by ≥2 dermatologists to confirm their benign nature	Y	N	N	Y	N	N	Y	N
Ros-NET: A deep convolutional neural network for automatic identification of rosacea lesions[63]	31849118	2019	Ohio State University (OSU) Division of Dermatology	Train, Internal Validation, Test	41 (each image contains 3 different views)	41	Clinical	Rosacea	Identifiable features of images are blacked out before the development of the algorithm, and the ground truth was provided by an experienced dermatologist	Y	N	N	N	Y	N	N	N
Smart identification of psoriasis by images using convolutional neural networks: a case study in China[64]	31541556	2019	XiangyaDerm-Pso9 dataset from Xiangya hospital	Train, Internal validation, Test	8,021	Not specified	Clinical	Lichen planus (LP), parapsoriasis (Par), lupus erythematosus (LE), basal cell carcinoma (BCC), squamous cell carcinoma (SCC), eczema (Ecz), pemphigus (Pem), psoriasis (Pso) and seborrheic keratosis (SK)	All images are verified by pathological examination and medical history by 3 professional dermatologists who have been engaged in dermatology for more than 10 years from Xiangya Hospital	Y	N	N	N	Y	N	Y	N
Superior skin cancer classification by the combination of	31518967	2019	ISIC Archive (most from HAM10000	Train, Internal Validation, Test	11,444	Not specified	Dermoscopic	Melanoma, nevus, basal cell carcinoma, actinic keratosis, Bower's	11,444 images, 6390 of which had been biopsy verified (note test	Y	N	N	Y	N	N	Y	N

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
human and artificial intelligence[65]			(ISIC 2018 Train))					disease, squamous cell carcinoma, seborrheic keratosis, lentigo solaris, lichen ruber planus	set only came from biopsy verified samples)								
Systematic outperformance of 112 dermatologists in multiclass skin cancer image classification by convolutional neural networks[66]	31419752	2019	ISIC Archive (most from HAM10000 (ISIC 2018 Train))	Train, Internal Validation, Test	11,444	Not specified	Dermoscopic	Actinic keratosis, intraepithelial carcinoma (Bowen disease), squamous cell carcinoma, basal cell carcinoma, benign keratosis, including seborrheic keratosis, solar lentigo, lichen planus–like keratosis, melanocytic nevi, melanoma	11,444 images, 6390 of which had been biopsy verified (note test set only came from biopsy verified samples)	Y	N	N	Y	N	N	Y	N
The Application of Deep Learning in the Risk Grading of Skin Tumors for Patients Using Clinical Images[67]	31300897	2019	XiangyaDerm	Train, Internal Validation, Test	4,500	Not specified	Clinical	Junctional nevus, intradermal nevus, dermatofibroma, lipoma, seborrheic keratosis, Bowen's disease, basal cell carcinoma, actinic keratosis, squamous cell carcinoma, malignant melanoma	Each image has a corresponding pathological diagnosis, then confirmed by information in the medical record and doctors' experience	Y	N	N	N	Y	N	Y	N
The Development of a Skin Cancer Classification System for Pigmented Skin Lesions Using Deep Learning[68]	32751349	2020	Department Dermatologic Oncology in the National Cancer Center Hospital (Tokyo, Japan)	Train, Internal Validation, Test	5846	3551	Clinical	Malignant melanoma, base cell carcinoma, benign nevi, seborrheic keratosis, senile lentigo, hematoma/hemangioma	All malignant tumors were biopsied and diagnosed histopathologically. Benign tumors were diagnosed clinically using dermoscopy, and those cases that were still difficult to differentiate were biopsied to make confirmed diagnosis.	Y	N	N	N	N	N	Y	N

Title	PMID	Pub Year	Dataset Sources	Use of Dataset (Train, Internal Validation, Test, and/or External Validation)	Number of images used	Number of patients	Clinical or Dermoscopic	Diseases	Label	Gold Standard? (Y/N)	Fitzpatrick skin type description and breakdown (Y/N)	Ethnicity or race description and breakdown (Y/N)	Data Available (Y/N)	Image processing described (Y/N)	External test set used for statistical reporting? (Y/N)	Data evaluated in intended use setting by dermatologist (Reader study include)? (Y/N)	Model Available? (Y/N)
The effects of skin lesion segmentation on the performance of dermoscopic image classification[69]	32882594	2020	ISIC 2017	Train, Internal Validation, Test	2750	Not specified	Dermoscopic	Benign nevi, seborrheic keratosis, melanoma	Benign nevi: expert consensus, Seborrheic keratosis: expert consensus, Melanoma: pathology	Nevus: Y Seborrheic keratosis: Y Melanoma: Y	N	N	Y	Y	N	N	N
			ISIC 2018 Challenge (HAM10000)	Train, Test	10015	Not specified	Dermoscopic	Actinic keratosis, Intraepithelial carcinoma (Bowen's), Basal cell carcinoma, Benign keratosis, Dermatofibroma, Melanocytic nevi, Vascular skin lesions, Melanoma	Actinic keratosis: consensus Intraepithelial carcinoma (Bowen's): pathology Basal cell carcinoma: pathology Benign keratosis: consensus Dermatofibroma: consensus Melanocytic nevi: consensus Vascular skin lesions: consensus Melanoma: consensus	Actinic keratosis: Y Intraepithelial carcinoma (Bowen's): Y Basal cell carcinoma: Y Benign keratosis: Y Dermatofibroma: Y Melanocytic nevi: Y Vascular skin lesions: Y Melanoma: Y	N	N	Y	Y			
Towards improving diagnosis of skin diseases by combining deep neural network and human knowledge[70]	30066649	2018	Peking Union Medical College Hospital	Train, Internal Validation, Test	1067	Not specified	Dermoscopic	Melanocytic nevus, seborrheic keratosis, basal cell carcinoma, psoriasis dermoscopic	Dermoscopic image reviewed by two dermatologists → if consensus, image labeled; if no consensus, a third dermatologist assessed → if common agreement reached, image labeled; if no common agreement reached, histopathological biopsy performed, then imaged labeled	Cannot be determined	N	N	N	Y	N	N	N

eMethods. Gold Standard Used

The following diseases (as identified in “Disease” column) require biopsy/histopathological diagnosis to meet the gold standard:

- Melanoma
- Dysplastic nevi
- Basal cell carcinoma
- Squamous cell carcinoma
- “High risk” pigmented lesions
- Intraepithelial carcinoma (Bowen’s disease)

For all other diseases, clinical exam with consensus among experienced dermatologists +/- long term (i.e. 2 year) follow-up is sufficient to meet the gold standard.

eFigure. Mappings

Number Dataset or Paper
1 ISIC
2 MED-NODE: University Medical Center Groningen
3 Hellenic Dermatological Atlas
4 D@nderm Atlas of Clinical Dermatology (http://www.danderm.dk/atlas)
5 Visualdx
6 Neurovascular Ulcers Outpatient Clinic of the Clinical Hospital of the University of São Paulo, Ribeirão Preto, São Paulo, Brazil
7 PMID 29513718 data
8 Edinburgh Edinburgh Dermofit Image Library
9 SNU dataset: Department of Dermatology at Seoul National University, Bundang Hospital, Inje University Sanggye Paik Hospital, and Hallym University Dongtan Hospital.
10 Dermquest (http://dermquest.com)
11 Interactive Derm Atlas (http://www.dermatlas.net)
12 DermIS (https://www.dermis.net/dermisroot/en/home/index.htm)
13 Loyola University Dermatology Medical Education Website (http://www.meddean.luc.edu/lumen/MedEd/medicine/dermatology/melton/atlas.htm)
14 Dermatoweb (http://www.dermatoweb.net/)
15 Dermatology Atlas (http://www.atlasdermatologico.com.br/)
16 Yonsei University Wonju Severance Christian Hospital Alopecia areata
17 DermNet NZ
18 DermWeb (http://www.dermweb.com/photo_atlas/)
19 Asan Medical Center PMID 29352285
20 Inje University PMID 29352285
21 Hallym University PMID 29352285
22 Seoul National University PMID 29352285
23 PH2
24 Interactive Atlas of Dermoscopy published by EDRA
25 Seven-point Checklist Dermatology Dataset (http://derm.cs.sfu.ca)
26 http://www.bccancer.bc.ca/health-professionals/clinical-resources/skin-cancer-atlas
27 2018 JID editorial images (hosted by ISIC website)
28 Teledermatology service serving 17 primary-care and specialist sites from two states in the United States.
29 Department of Dermatology, The Second Xiangya Hospital, Central South University, China
30 Dermatology practices across India
31 All India Institute of Medical Sciences in New Delhi, an urban private practice in Gurugram, Haryana, India, and a rural health center in Jhajjar, Haryana, India
32 Taipei Medical University
33 PMID 33065109 Dataset 1
34 PMID 33065109 Dataset 2
35 PMID 28569993 Train set

36 PMID 28569993 Test set
37 7 United Kingdom hospitals
38 Department of Dermatology, University of Heidelberg
39 ASAN: Department of Dermatology at Asan Medical Center
40 Normal: scraped from the internet and lesions cropped out from ASAN
41 Web: scraped from the internet
42 PMID 30654165 Online images
43 Mid-Atlantic region research participants
44 ASAN: Department of Dermatology at Asan Medical Center PMID 29428356
45 Additional ASAN: Department of Dermatology at Asan Medical Center PMID 29428356
46 Hallym dataset: Dongtan Sacred Heart Hospital, Hallym University, and Sanggye Paik Hospital, Inje University
47 PMID 31140653 Google Images
48 Department of Dermatology, Aarhus University Hospital (AUH), Denmark
49 Dataset I: Department of Dermatology, Peking Union Medical College Hospital
50 Dataset II: Department of Dermatology, Peking Union Medical College Hospital
51 University of Tsukuba Hospital
52 Stanford hospital PMID 28117445
53 Shinshu Department of Dermatology at Shinshu University Hospital
54 PMID 31921498 "a variety of other sources"
55 Acne dataset collected from France, South Africa, China, India
56 Hospital for Skin Diseases at the Chinese Academy of Medical Science
57 Department of Dermatology, Kaohsiung Chang Gung Memorial Hospital in Taiwan
58 PRIV
59 Department of Dermatology of the China-Japan Friendship Hospital
60 Collected from the departments of dermatology of the university medical centres of Heidelberg, Göttingen, and from the medical centre Thalkirchner Straße, Munich
61 PMID 28332777 Diagnostic performance of MelaFind
62 Clinical images from primary skin cancer clinic in Queensland, Australia
63 Dermoscopic images from primary skin cancer clinic in Queensland, Australia
64 Educational slides photographed and excised in the practice of one of the authors.
65 Multiple sources, including the Medical University of Vienna, the image database from C.R., and a convenience sample of rare diagnoses.
66 PMID 32572267 Telemedicine dataset
67 Department of Dermatology at the Medical University of Vienna for dermoscopy images taken between April and September 2019
68 Primary training dataset (Asan Medical Center, MED-NODE, Seven-point Checklist Dermatology Dataset, images on the internet).
69 Asan Medical Center Validation
70 Hallym National University Validation
71 Chonnam University Validaiton
72 PMID 31912788 convenience sample
73 Validated image library of the Department of Dermatology, University of Heidelberg, Germany
74 6 dermoscopic image sets were randomly selected from image libraries of Departments of Dermatology, Universities of Heidelberg, Munich and Lyon
75 Not specified other than a “Multiple skin cancer clinics”
76 Images collected from patients at increased melanoma risk PMID 32534243
77 Images from dermatologists across India
78 PMID 33040407 Test set
79 Patients from telemedicine dermatology visits from a single academic medical center
80 PMID 32525908 Dataset
81 Department of Burn Reconstruction Surgery, Xiangya Hospital
82 ROS-NET Ohio State University (OSU) Division of Dermatology
83 XiangyaDerm-Pso9
84 XiangyaDerm
85 Department Dermatologic Oncology in the National Cancer Center Hospital (Tokyo, Japan)

86 Peking Union Medical College Hospital
87 PMID 30852421
88 PMID 32424212
89 PMID 32566608
90 PMID 32526536
91 PMID 32991767
92 PMID 31907926
93 PMID 33065109
94 PMID 28569993
95 PMID 31542688
96 PMID 29513718
97 PMID 32915161
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101 PMID 32243882
102 PMID 30654165
103 PMID 29428356
104 PMID 32785607
105 PMID 32931808
106 PMID 31201137
107 PMID 31306724
108 PMID 31140653
109 PMID 33221639
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112 PMID 32826613
113 PMID 33218060
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126 PMID 28332777
127 PMID 32435646
128 PMID 31233565
129 PMID 30484822
130 PMID 31946474
131 PMID 32572267
132 PMID 31799995
133 PMID 31912788
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136 PMID 32252036
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149 PMID 31849118
150 PMID 31541556
151 PMID 31518967
152 PMID 31419752
153 PMID 31300897
154 PMID 32751349
155 PMID 32882594
156 PMID 30066649

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