Nuevas tecnologías y el papel de la IA

Josep Malvehy

Servicio de Dermatología

Hospital Clínic de Barcelona

CONFLICTS

SPEAKER: Almirall, BMS, ISDIN, La Roche Posay, Leo, Novartis, Pierre Fabre, SunPharma, Roche, Sanofi

HONORARIA OR CONSULTATIONS FEES : Almirall, BMS, Biofrontera, GSK, ISDIN, La Roche Posay, Leo, Novartis, Polychem, SunPharma

GRANTS & RESEARCH SUPPORT: Almirall, Amgen, BMS, Biofrontera, Canfield, Cantabria, Fotofinder,

GSK, ISDIN, La Roche Posay, Leo, Mavig, Nevisense, Novartis, Polychem, Roche, iTOBOs (EU Grant), Castle Biosciences, NelaCare, and SkylineDx, Amlo Bioscience

Spouse/partner: Almirall, Amgen, BMS, Biofrontera, Canfield, Cantabria, Fotofinder, GSK, ISDIN, La Roche Posay, Leo, Mavig, Nevisense, Novartis, Pierre Fabre, Polychem, Roche

Other support (please specify): Abbie (educational activities), Lilly (educational activities), Novartis

Co-founder of Diagnosis Dermatologica sl and Athena Care sl.

Medical Advisor for Dermavision

ATHENA TECH

DIAGNOSIS DERMATOLOGICA

Clínic Barcelona

FOUNDING & COLLABORATIONS

M-Skip

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IDIBAPS Institut d'Investigacions Biomèdiques August Pi i Sunyer

Fundació La Marató de TV3

UPC UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

Universitat de Girona

ViCOROB Computer Vision and Robotics

International Skin Imaging Collaboration

Technology WORKING GROUP

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William Stoecker, MD		University of Missouri Health System, USA
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IA en dermatología

1. ¿Piensa que la IA puede mejorar su práctica profesional?

a. Sí puede mejorarla
b. No la cambiará de forma significativa
c. La empeorará
d. No tengo ni idea

IA en dermatología

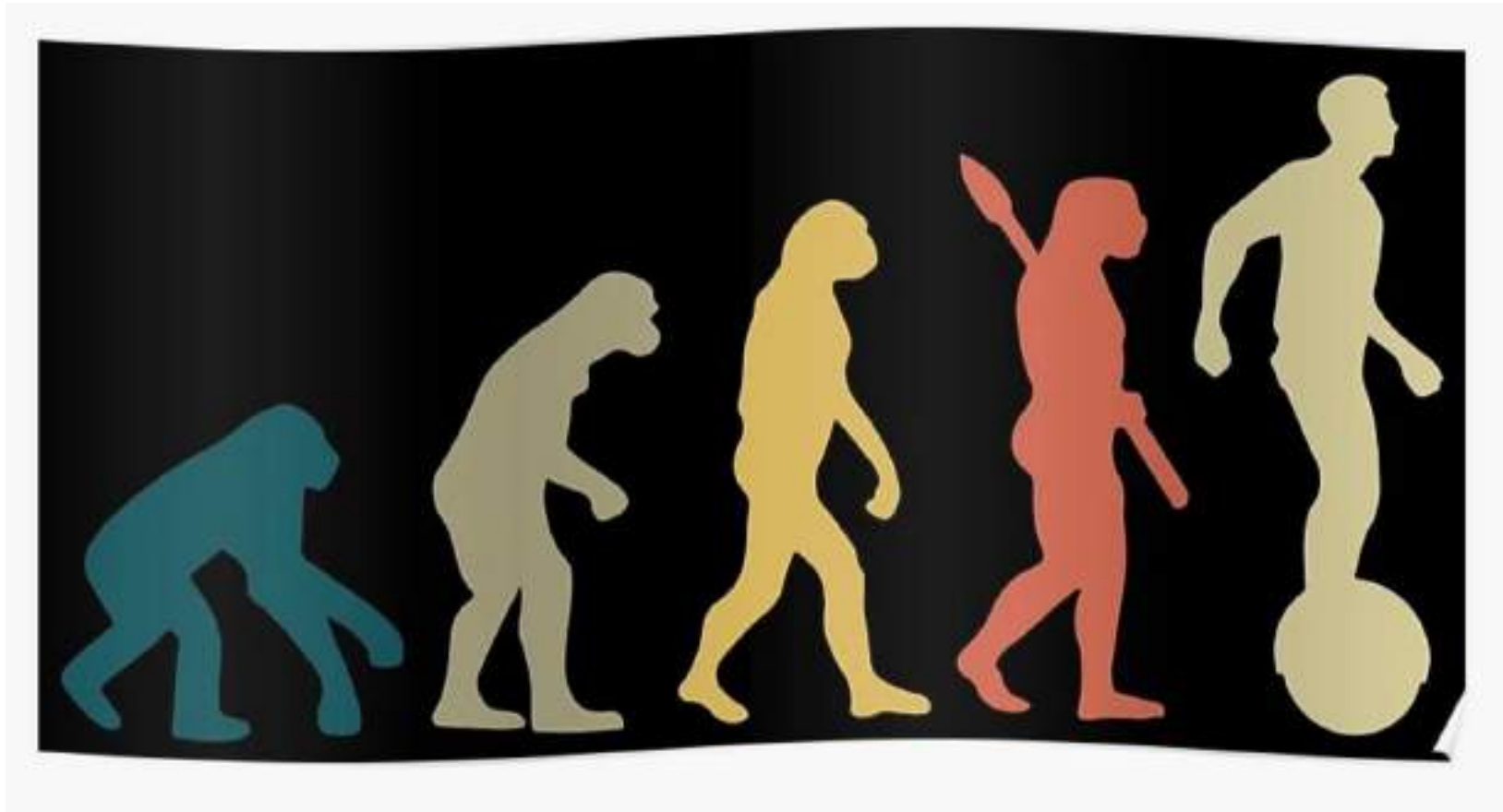
2. ¿Piensa que la IA cambiará su relación con el paciente?

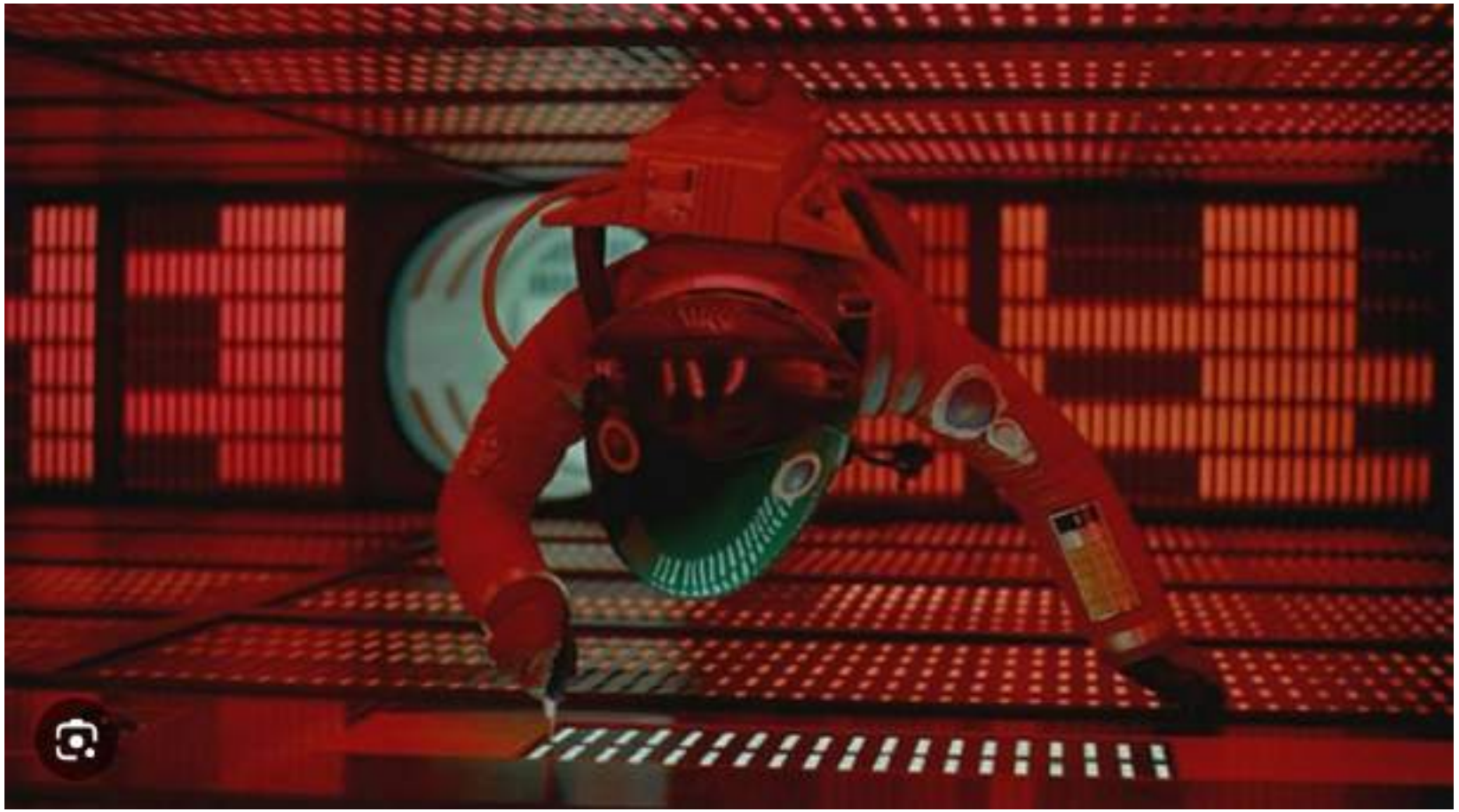
a. sí puede mejorarla
b. no la cambiará de forma significativa
c. la puede empeorar
d. no tengo ni idea

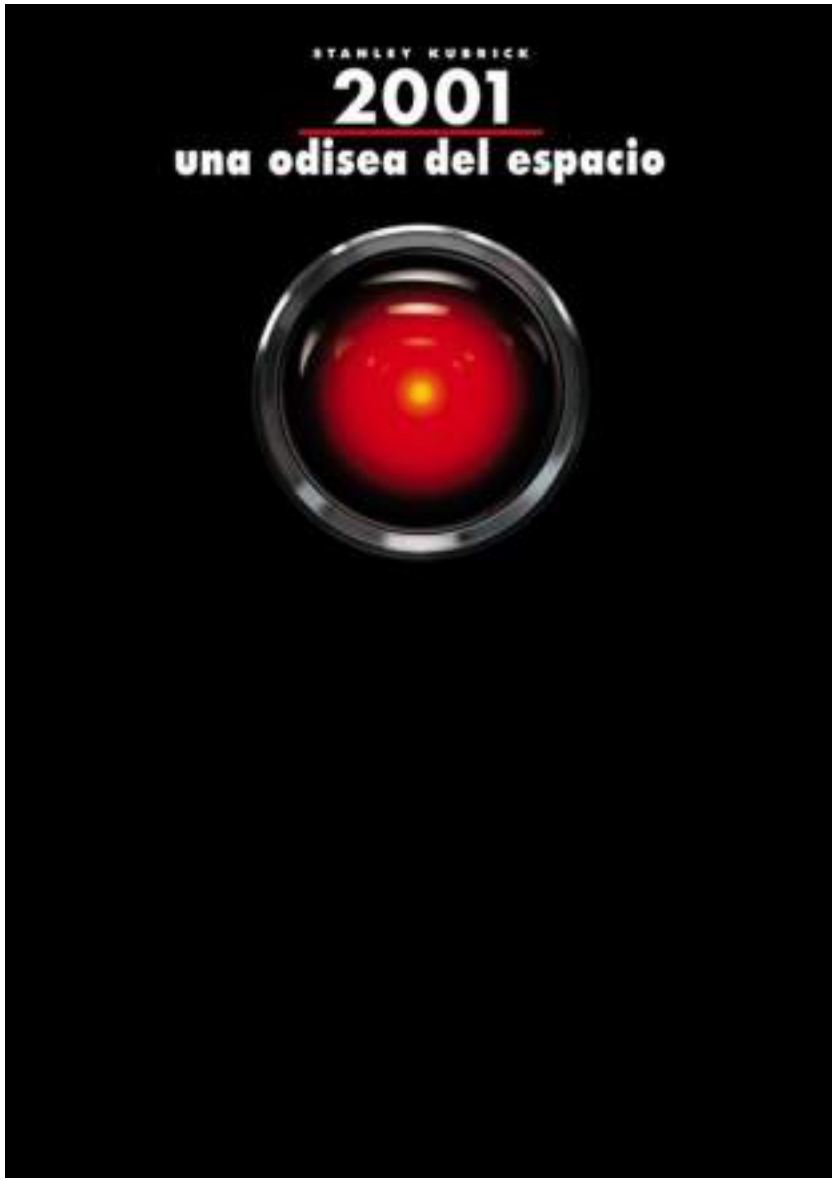
IA en dermatología

3. ¿Piensa que la IA debe incorporarse en la formación continuada del dermatólogo?

a. Sí
b. No
c. Sólo para los más jóvenes (a mi ya no me pilla...)
d. La IA me importa un comino






STANLEY KUBRICK
2001
una odisea del espacio

Geoffrey Hinton
2016

“Stop training Radiologists now”

https://www.youtube.com/watch?v=2HMPRXstSvQ
https://medium.com/unauthorized-storytelling/the-radiologist-is-here-to-stay-24da650621b5

Canfield, Casio, DermaMedical, Dermlite, Heine, Fotofinder

Vienna May 2022

Differences in Hand-held Dermatoscopes

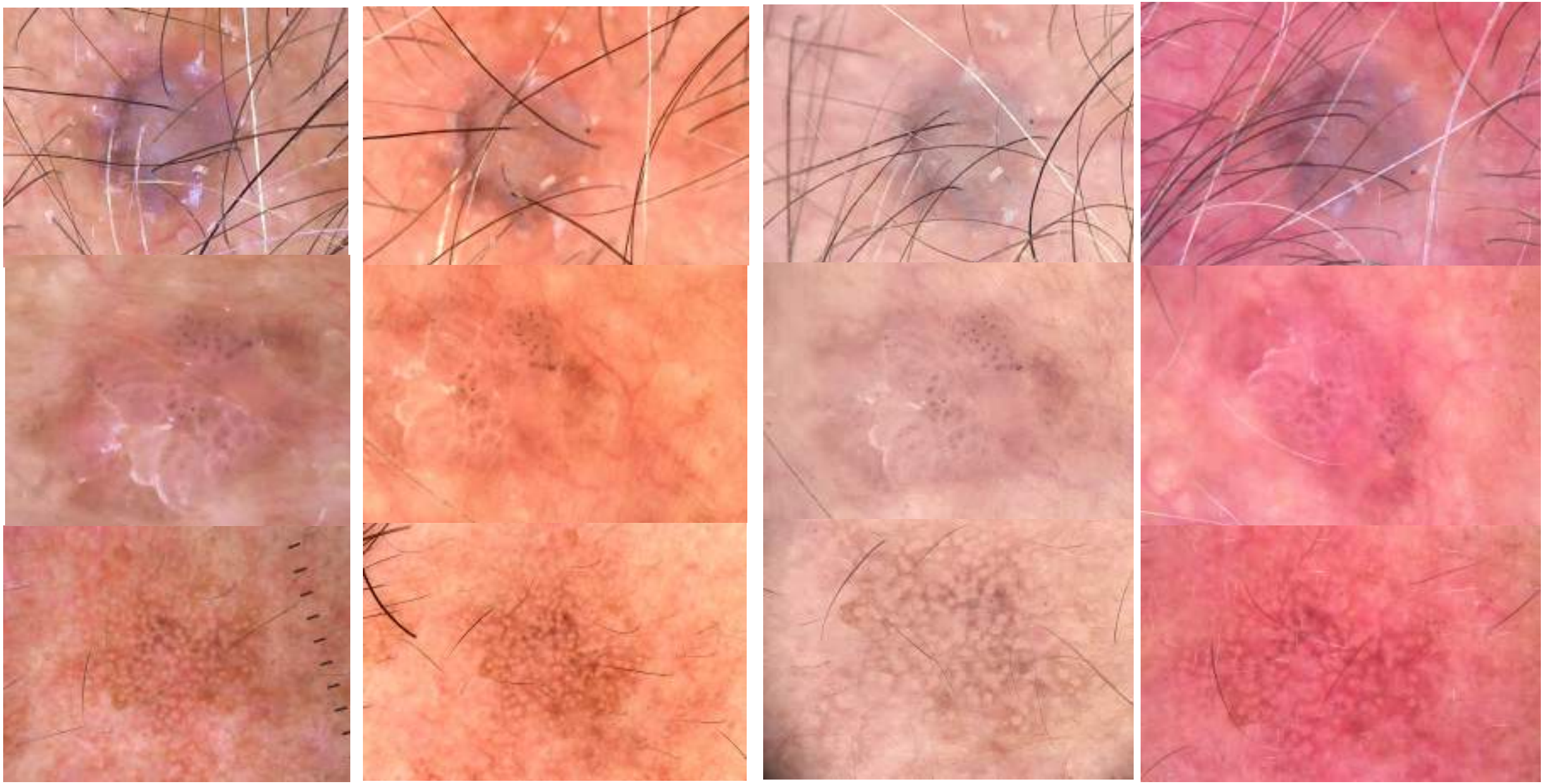
- Illumination: temperature of colour, number of LEDs (6-24)
- Field of view
- Magnification: 10x,20x
- Modalities: parallel, cross polarization/ contact / clinical mode
- Lighting (UV, “White”, orange,..)
- Capability to attach a photographic device (off-trade camera, cellular, digital device)
- Battery (rechargeable or not)
- Lighting Brightness (High, Low)
- Adjustable Spacer

Dermlite Foto . Olympus Mark II

D200 EOS Canfield

Fotofinder

Molemax Derma Medical



MyVeos | AK Imaging

Light source angle variation coupled with polarization allows for better visualization and sub-surface information gathering

37.5 Degree

Equivalent to the non-polarized image captured by a typical dermatoscope

Cross-Polarized

Removes skin surface reflectance and allows deepest possible visualization

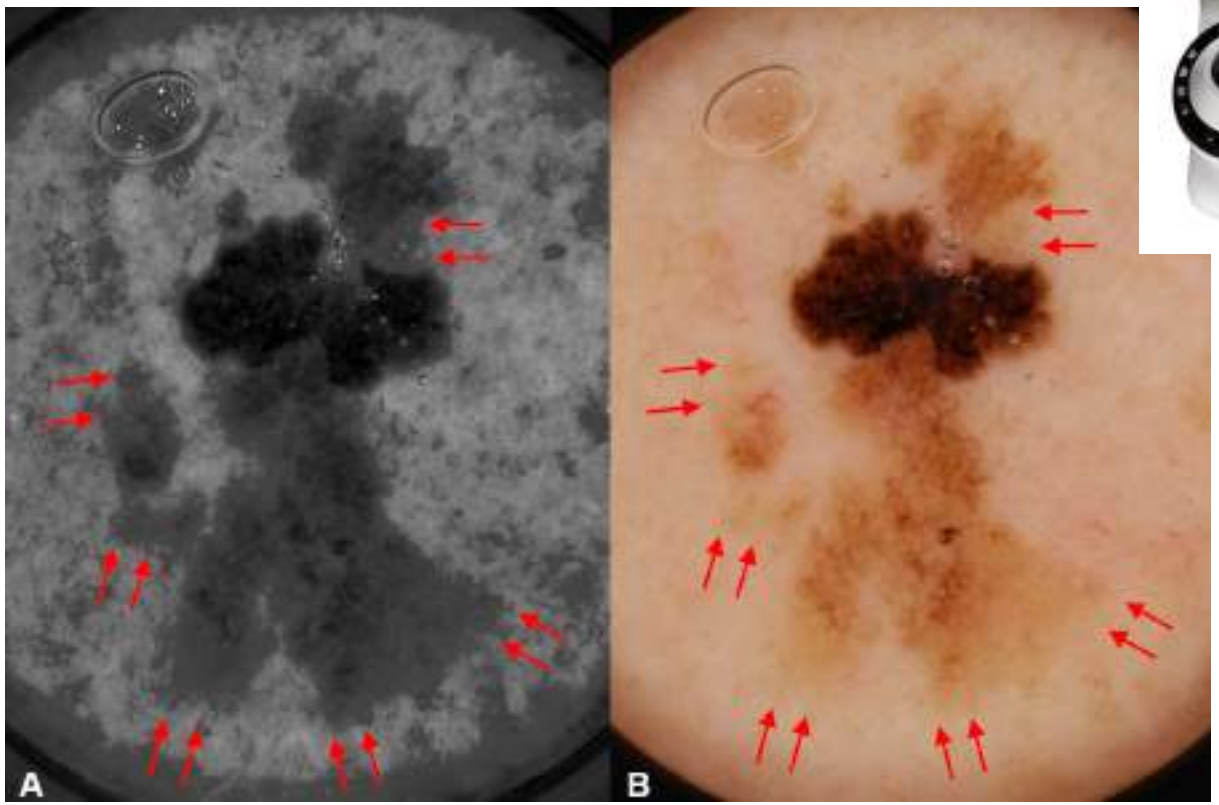
Parallel-Polarized

Enhances skin surface reflectance which is best for skin surface texture/topography

UV light dermoscopy

Dermoscopy with ultraviolet light utilizes the fluorescence emitted by skin lesions:

- Superficial micosis
- nail diseases
- *Demodex* mites
- scabies, and pigmented diseases
- Melanoma demmarcation for complete excision



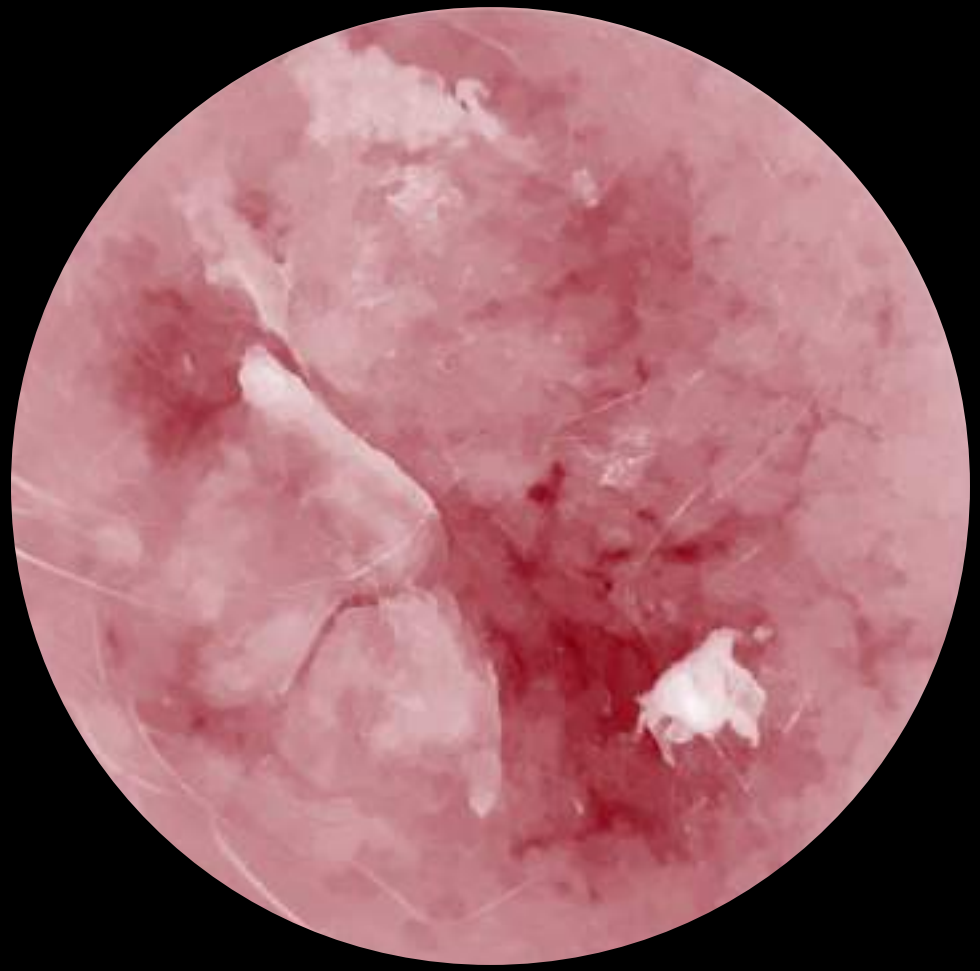
A digital camera integrated dermoscope with a built-in near- UV wavelength (405-nm) light source (DZ-D100 device (Casio Computer Co, Ltd, Tokyo, Japan). It is also more easily accessible than Wood's lamps because eye protection and a darkroom are not required to obtain images.

Sano T, Minagawa A, Suzuki R, Koga H, Okuyama R. Dermoscopy with near-ultraviolet light highlights the demarcation of melanin distribution in cutaneous melanoma. J Am Acad Dermatol. 2020;23:S0190-9622(20)32281-7.

MyVeos | AK Imaging

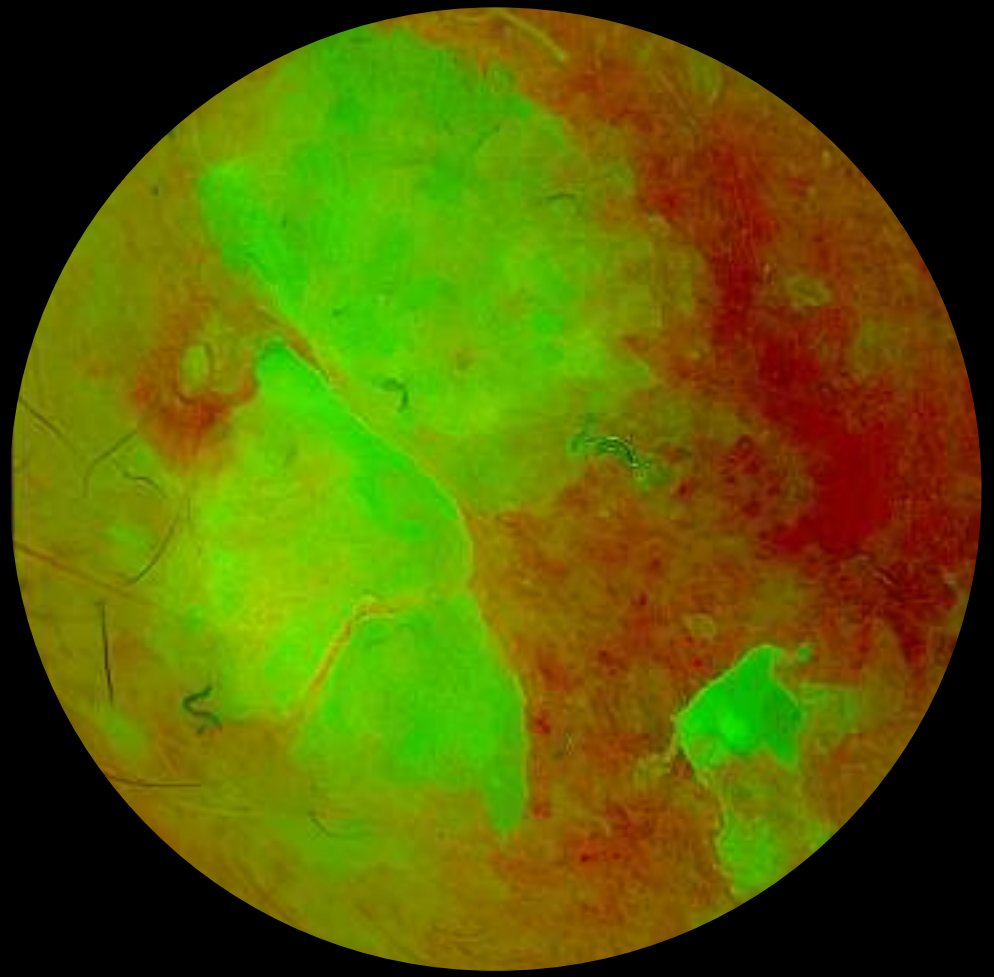
Additional image processing can assist in further visualization for vascular features, erythema, pigmentation, skin flakes, and fluorescence

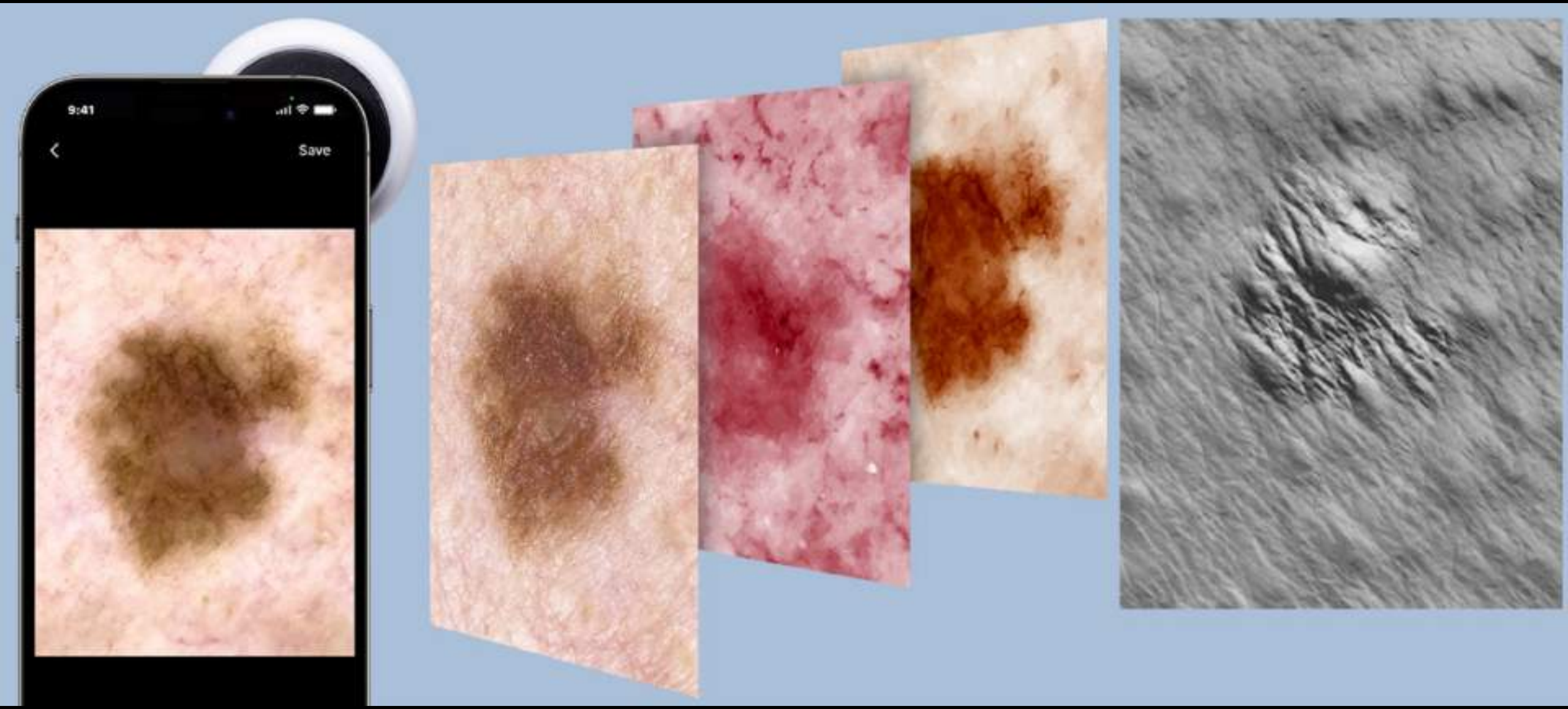
RBX-Red



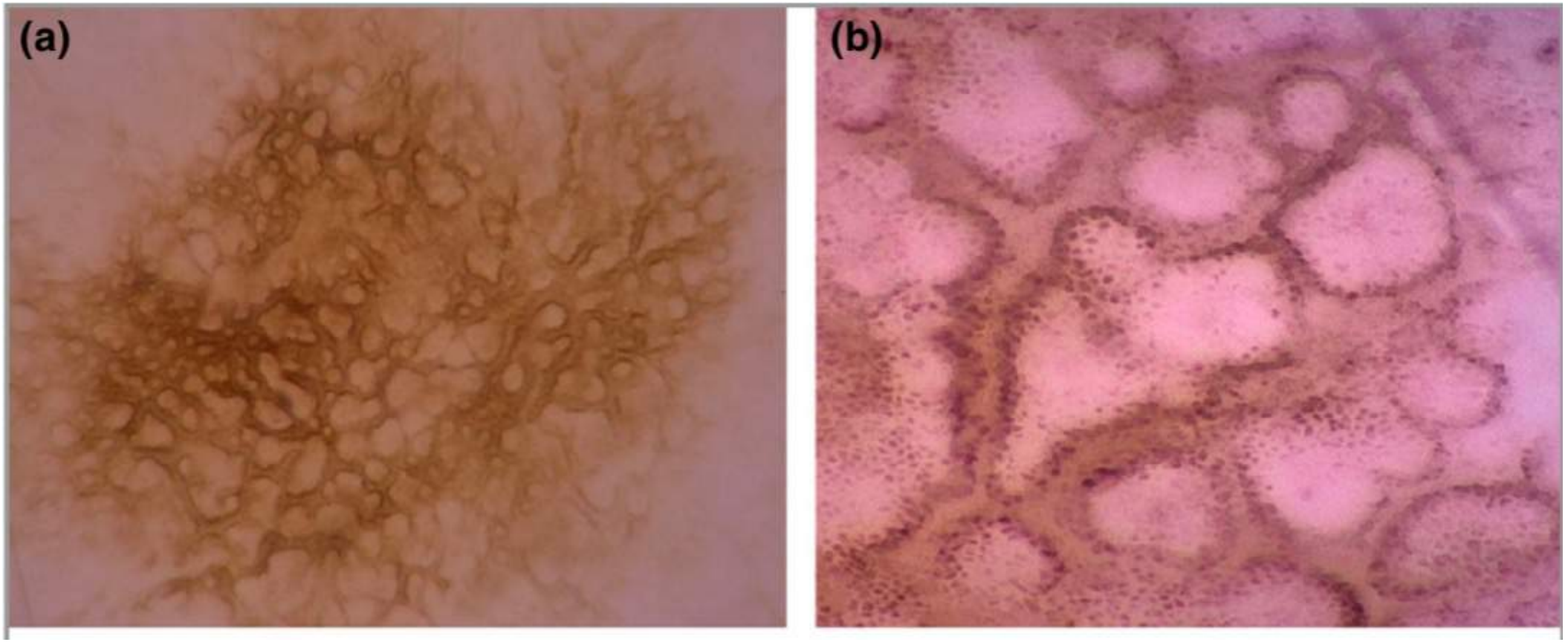
Hemoglobin Distribution

UV-Fluorescence



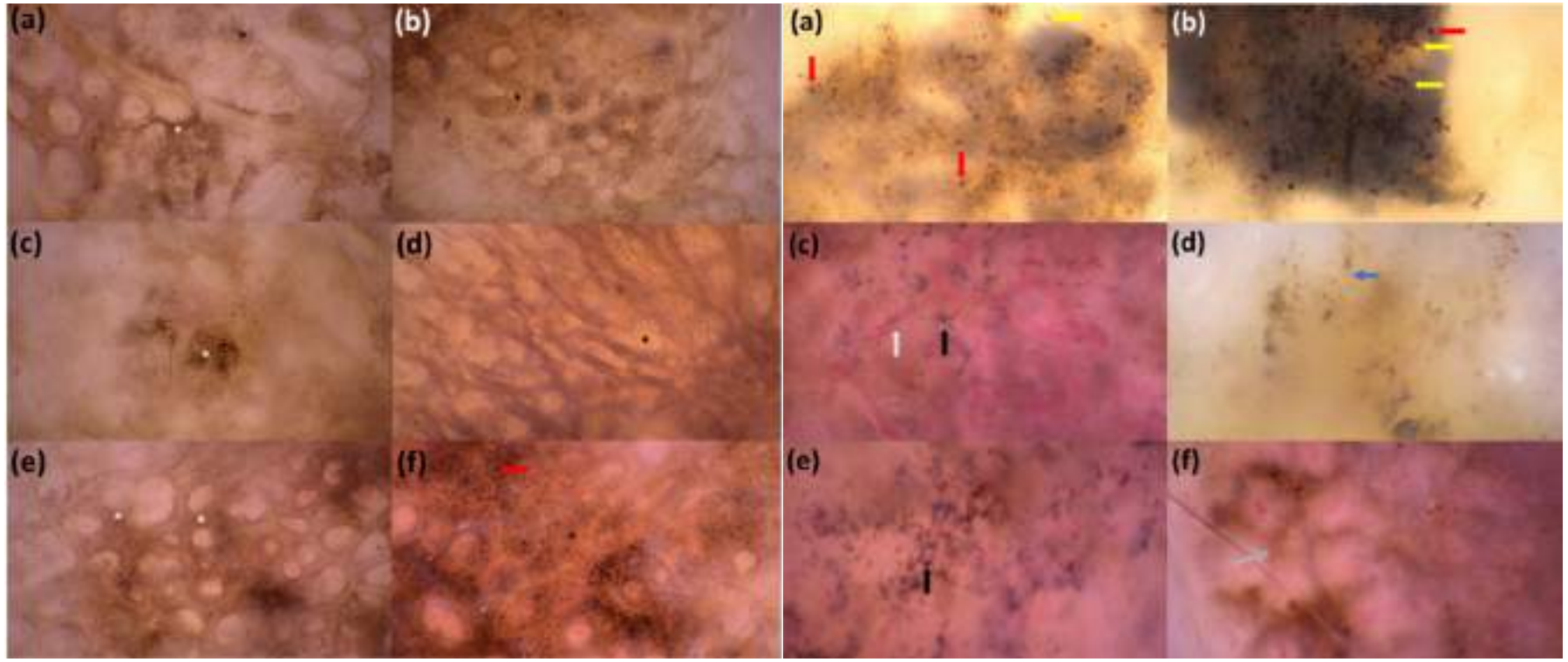

9:41
Save

Super-high magnification dermoscopy at 400x magnification (D400)



Dusi D, Rossi R, Simonacci M, Ferrara G. Image Gallery: the new age of dermoscopy: optical super-high magnification. Br J Dermatol. 2018 May;178(5):e330.

Super-high magnification dermoscopy at 400x magnification (D400)

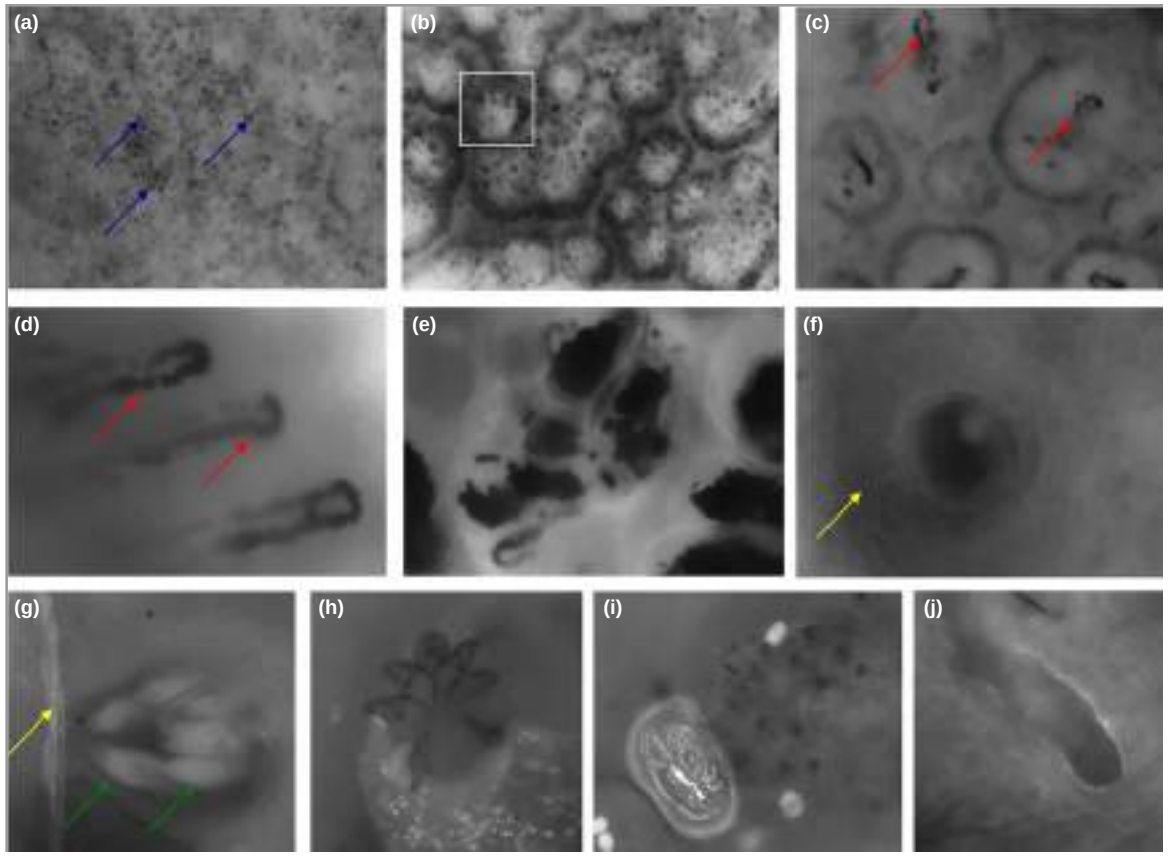


This study showed that D400 can reveal many elements not otherwise visible in traditional 20x dermoscopy, such as pigmented cells and their morphology, that could be useful for the diagnosis of MM.

Cinotti E, Tognetti L, Campoli M, Liso F, Cicigoi A, Cartocci A, Rossi R, Rubegni P, Perrot JL. Super-high magnification dermoscopy can add information for the differential diagnosis between melanoma and atypical nevi. Clin Exp Dermatol. 2021 Jan 23.

FLUORESCENCE-ADVANCED VIDEODERMATOSCOPY

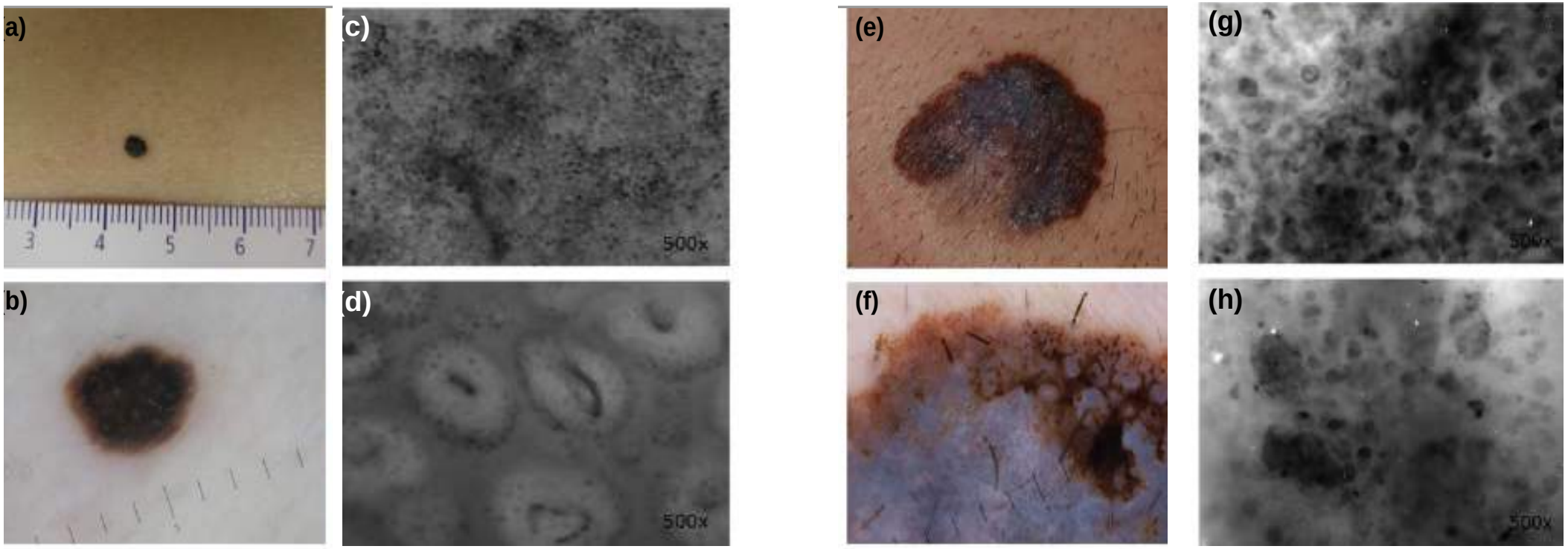
- FAV is an optical electronic system consisting of a handheld probe and a monochromatic light-emitting source with a λ of 405 nm (±5 nm) and a fixed angle of incidence.
- Optical penetration depth varying from 200 µm to 400 µm
- Visualization of subcutaneous structures to the point below the papillary dermis.
- To prevent light diffusion on the corneum stratus, glycerol is applied to the skin surface.
- The working mechanism underlying FAV exists in the ability of endogenous molecules to emit fluorescence after absorbing specific wavelengths.



Sanlorenzo M, Vujic I, De Giorgi V, et al. Fluorescence-advanced videodermatoscopy: a new method for in vivo skin evaluation. Br J Dermatol. 2017;177:e209-e10.

Scarfi F, Gori A, Silvestri F, et al. Fluorescence-advanced videoder- matoscopy: a promising and potential technique for the in vivo evaluation of vitiligo. Dermatol Ther. 2019;32:e12863.

FLUORESCENCE-ADVANCED VIDEODERMATOSCOPY



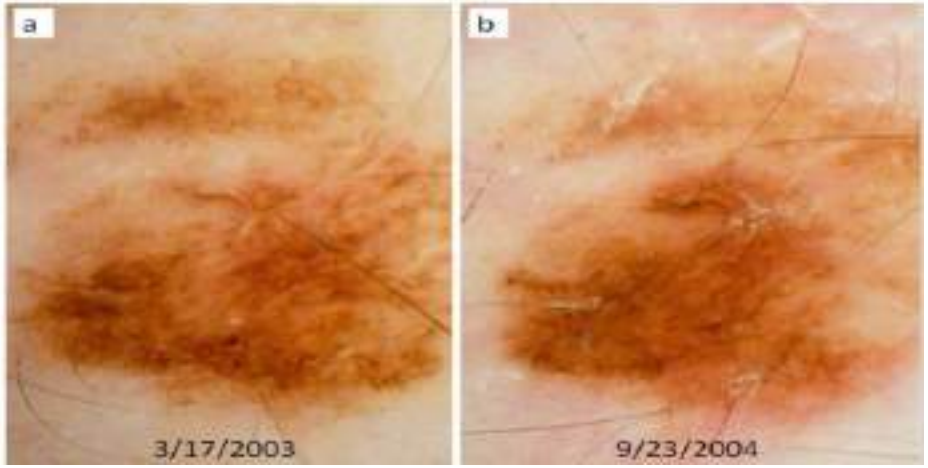
Scarfì F, Gori A, Topa A, et al. Image Gallery: In vivo fluorescence-advanced videodermatoscopy for the characterization of skin melanocytic pigmented lesions. Pediatr Dermatol. 2019;180:e104.

Cinotti E, Cortonesi G, Rubegni P. High magnification and fluorescence advanced videodermoscopy for hypomelanotic melanoma. Skin Res Technol. 2020;26:766–768.

Total Body Photography

24 Photos per patient (15-56)

Digital Dermoscopy

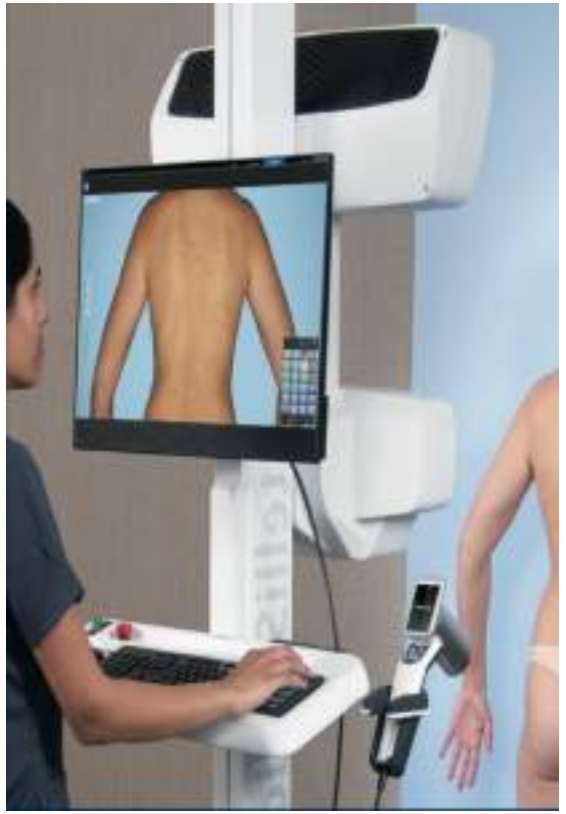


18.44 lesions /patient (15-25)

“Two steps method of digital follow-up”

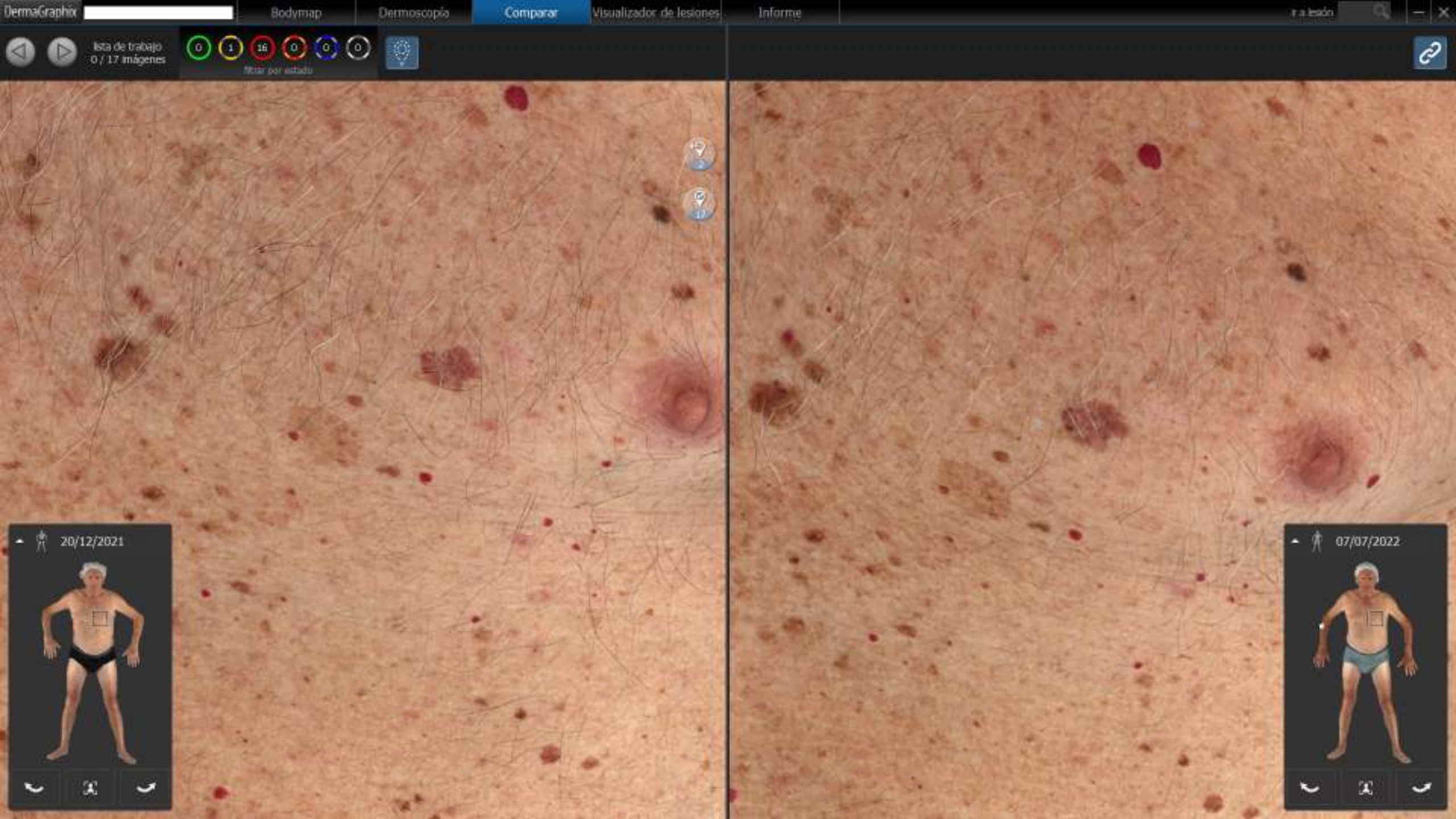
J Malvehy, S Puig, R Martí, et al. Follow-up of melanocytic skin lesions with digital total-body photography and digital dermoscopy: a two steps method. Clinics in Dermatol 2002

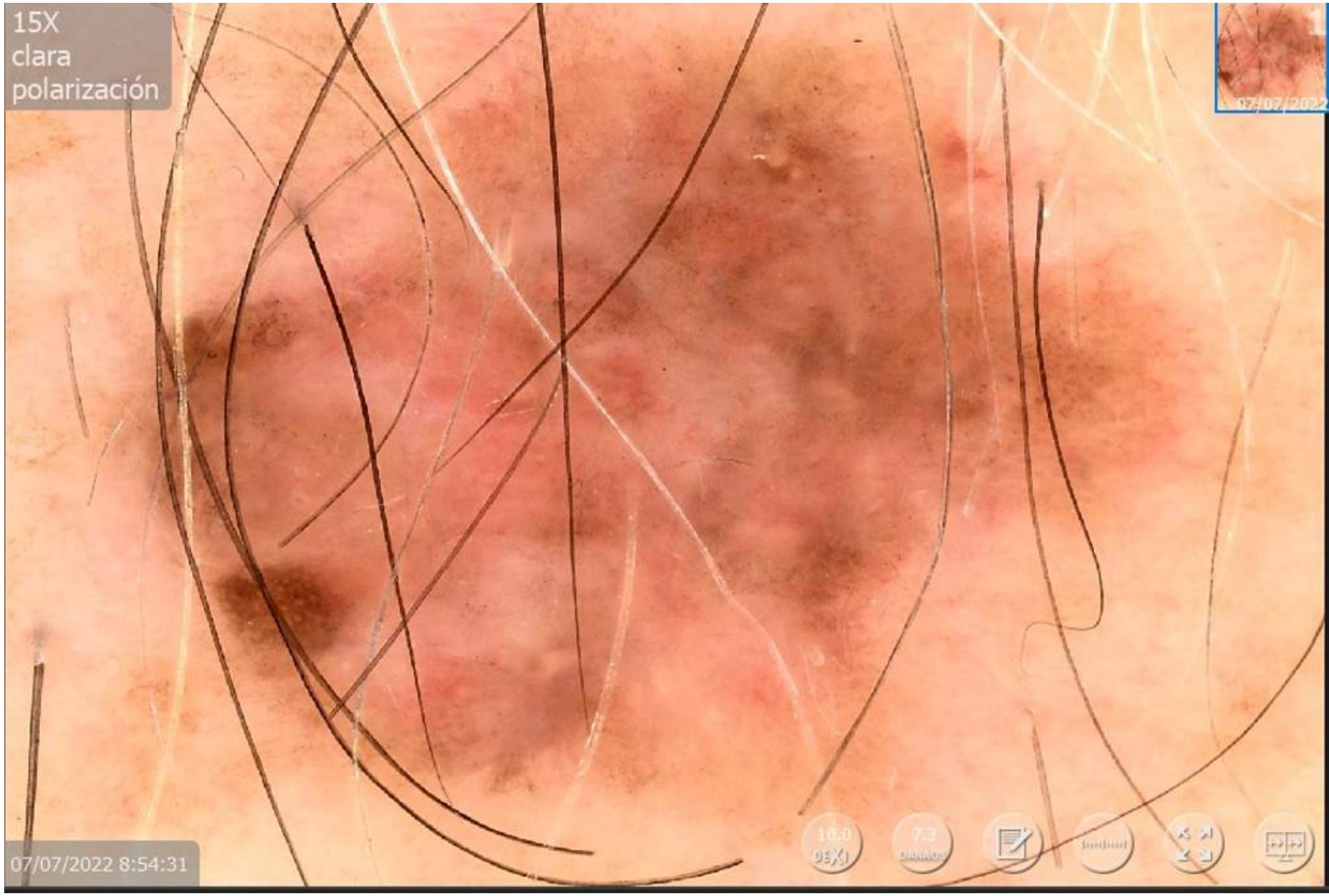
NEW TBP DEVICES

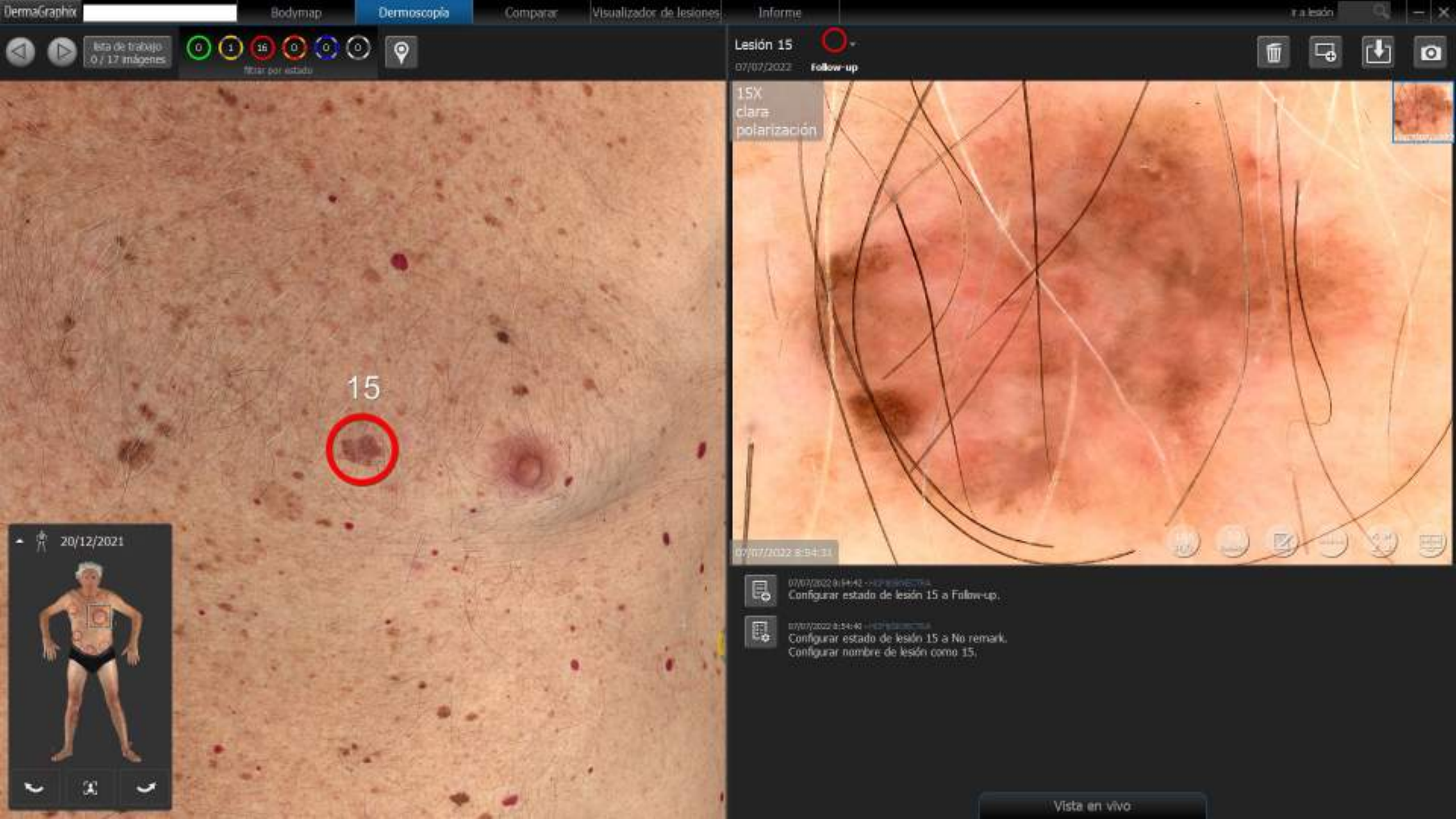


Automatic identification of lesions; detection of changes; lesion risk assessment; faster examination


DermaGraphix
Bodymap
Dermoscopy
Compare
Lesion Visualizer
Report
go to lesion
work list
0 / 31 images
0
0
27
2
0
0
hide filters
histogram
filter visible
Auto
sort by:
Relative Chang
Tue Jun 28 10:49:33 202
1838
LESIONS
Total Change
0
0
15.9
Relative Change
-15
0.3
15.9
Longest Diameter [mm]
2
9.2
16.3
Contrast
4.3
15.6
26.7
Border Irregularity
0.7
5.3
10
Color Variation
0
5
10
Hue
41.2
55
68.9
Nevus Confidence
0
80
100
Anatomic Site
All
Tracking Status
All
filter templates:
2/17/2023
4 cm
Type here to search
ESP
10:42 AM
4/19/2023


DermaGraphix
Bodymap
Dermoscopia
Comparar
Visualizador de lesiones
Informe
Ir a lesión
lista de trabajo
0 / 17 imágenes
0
1
16
0
0
0
filtrar por estado
20/12/2021
07/07/2022


15X
clara
polarización
07/07/2022 8:54:31


DermaGraphix
Bodymap
Dermoscopia
Comparar
Visualizador de lesiones
Informe
Ir a lesión
lista de trabajo
0 / 17 imágenes
0
1
16
0
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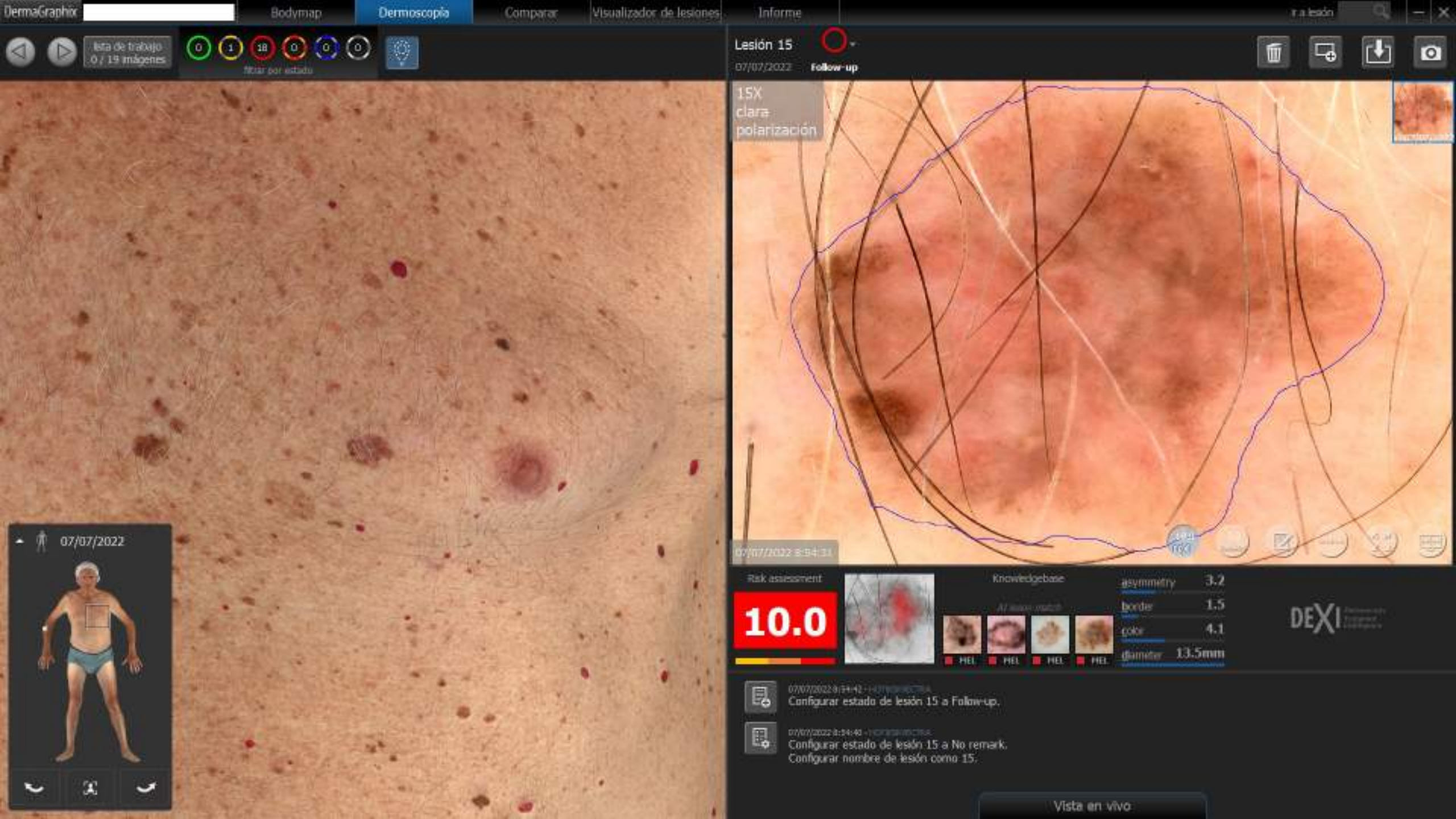
0
filtrar por estado
Lesión 15
07/07/2022
Follow-up
15X
clara
polarización
15
20/12/2021
07/07/2022 8:54:31
07/07/2022 8:54:42
Configurar estado de lesión 15 a Follow-up.
07/07/2022 8:54:40
Configurar estado de lesión 15 a No remark.
Configurar nombre de lesión como 15.
Vista en vivo


DermaGraphix
Bodymap
Dermoscopia
Comparar
Visualizador de lesiones
Informe
Ir a lesión
lista de trabajo
0 / 19 imágenes
0
1
18
0
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0
filtrar por estado
Lesión 15
07/07/2022
Follow-up
15X
clara
polarización
07/07/2022
Risk assessment
10.0
Knowledgebase
asymmetry 3.2
border 1.5
color 4.1
diameter 13.5mm
MEL
MEL
MEL
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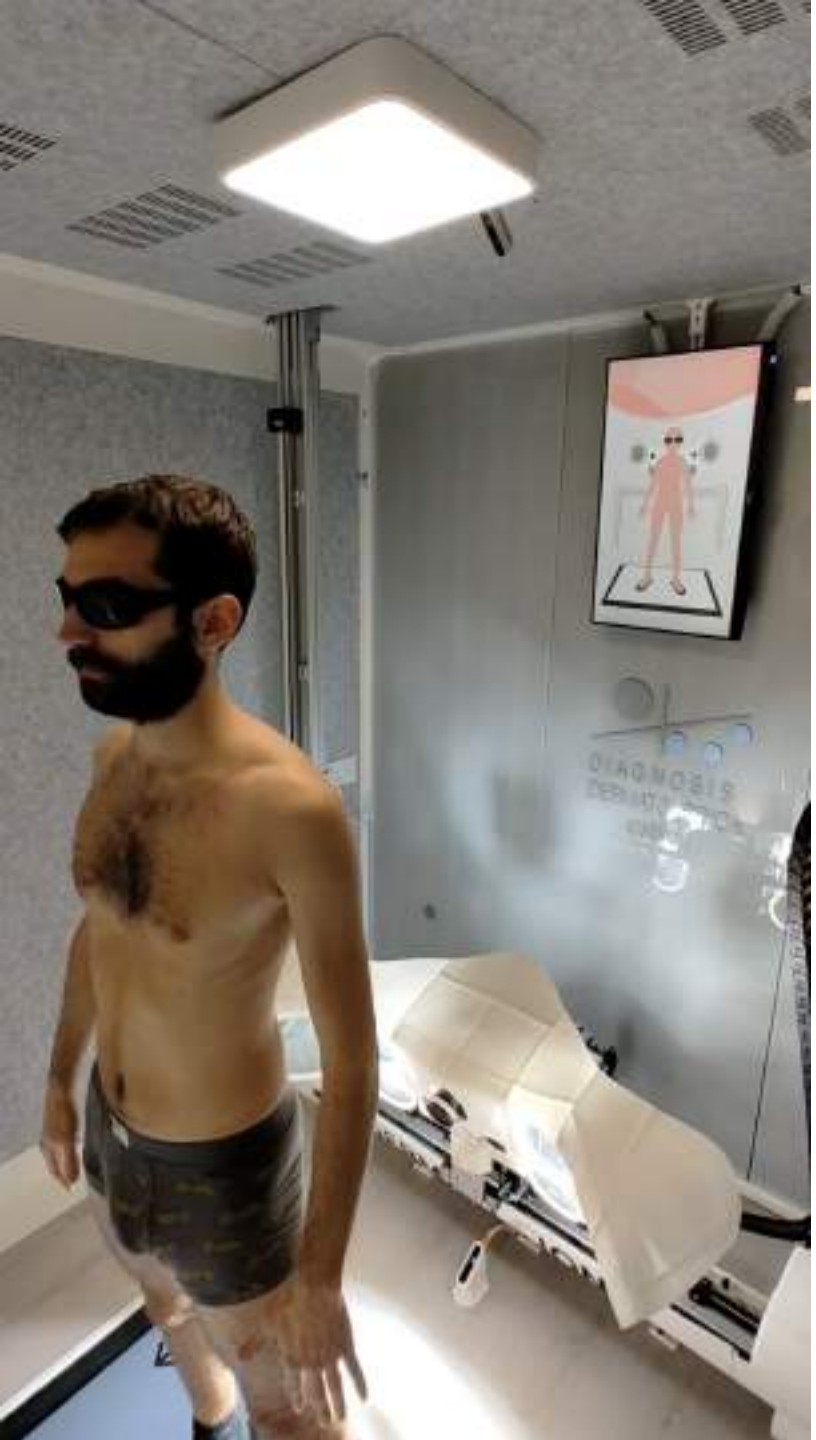
DEXI
Configurar estado de lesión 15 a Follow-up.
Configurar estado de lesión 15 a No remark.
Configurar nombre de lesión como 15.
Vista en vivo

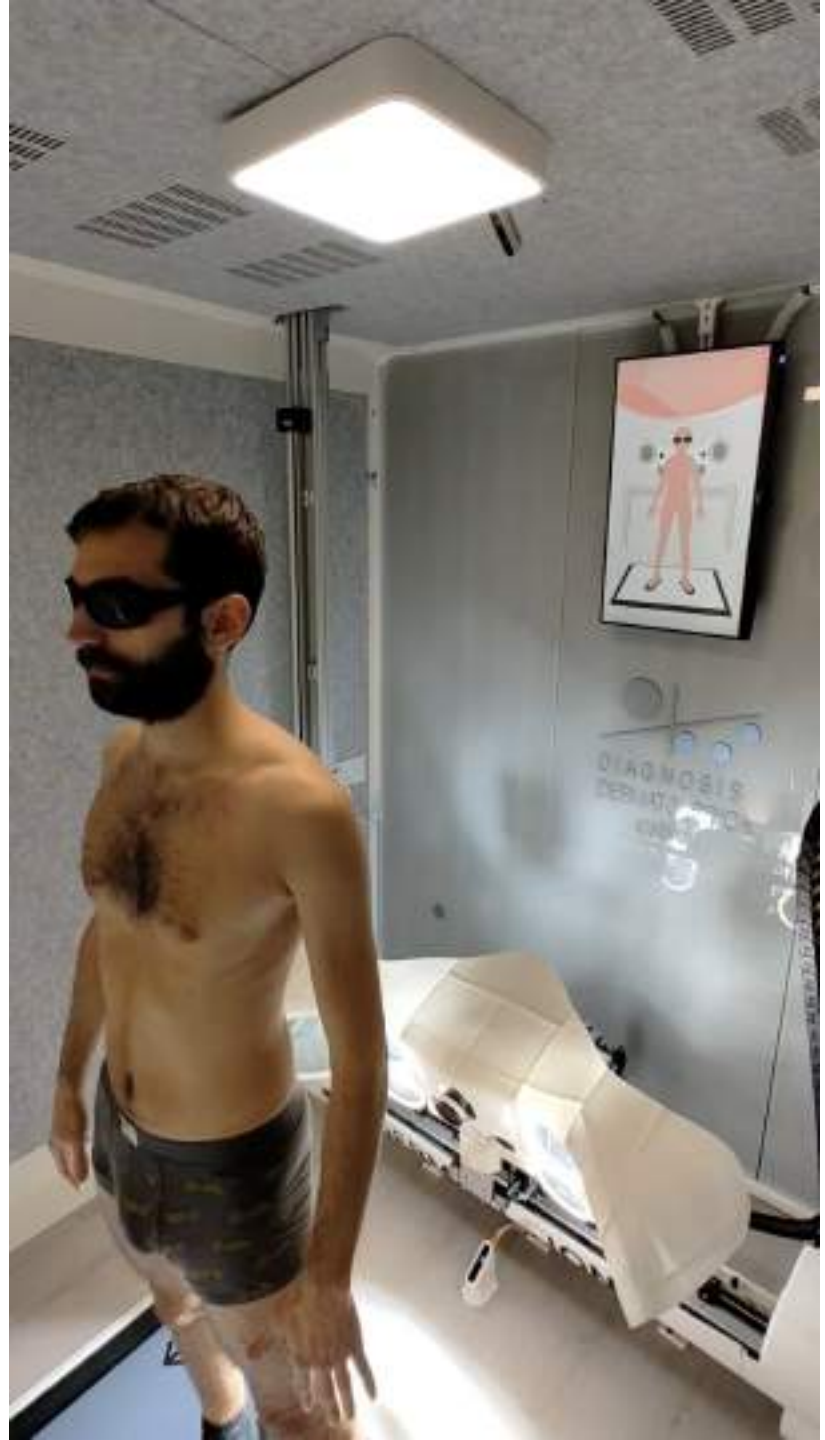


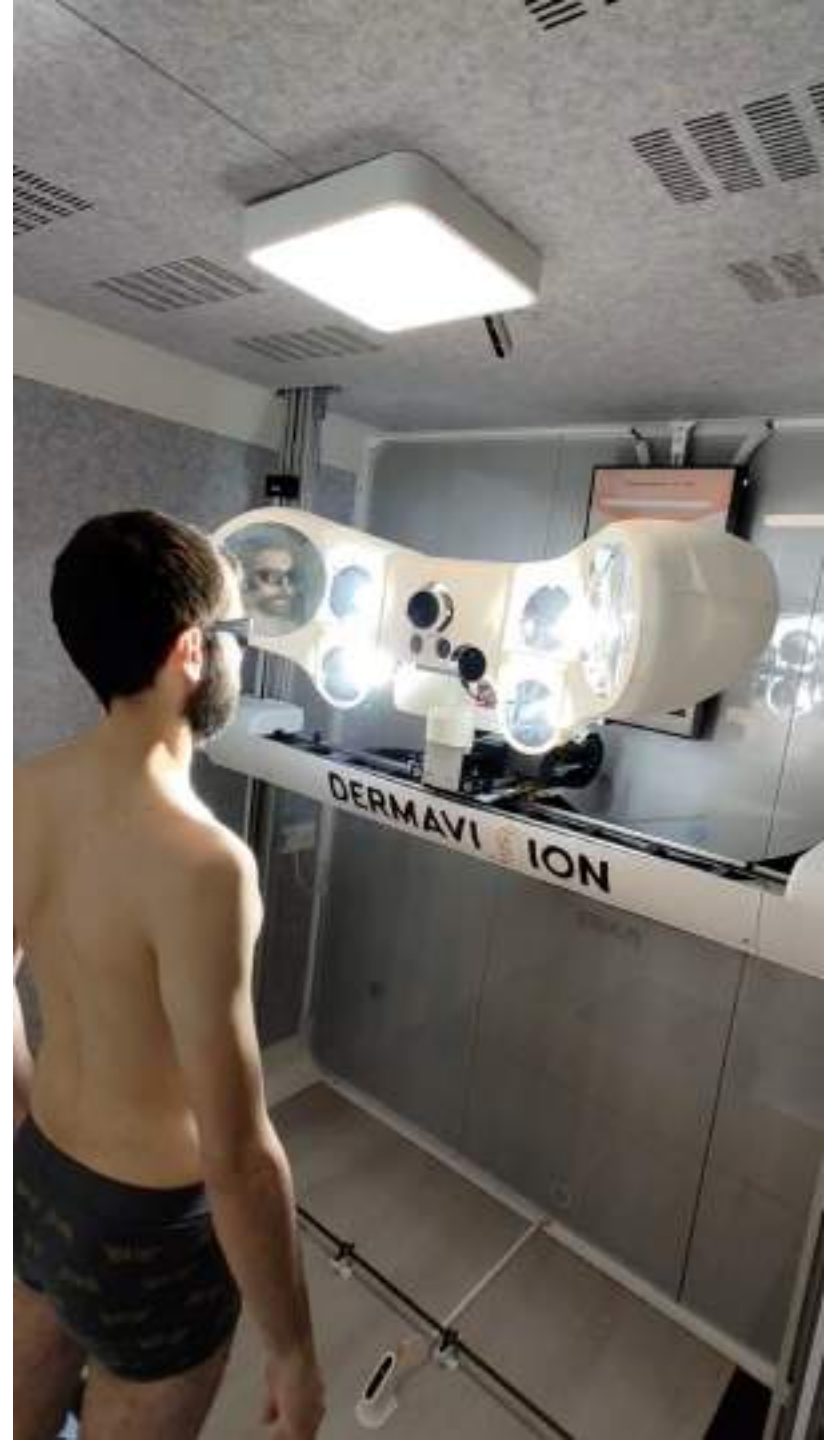
Deviskan: autonomous scanner

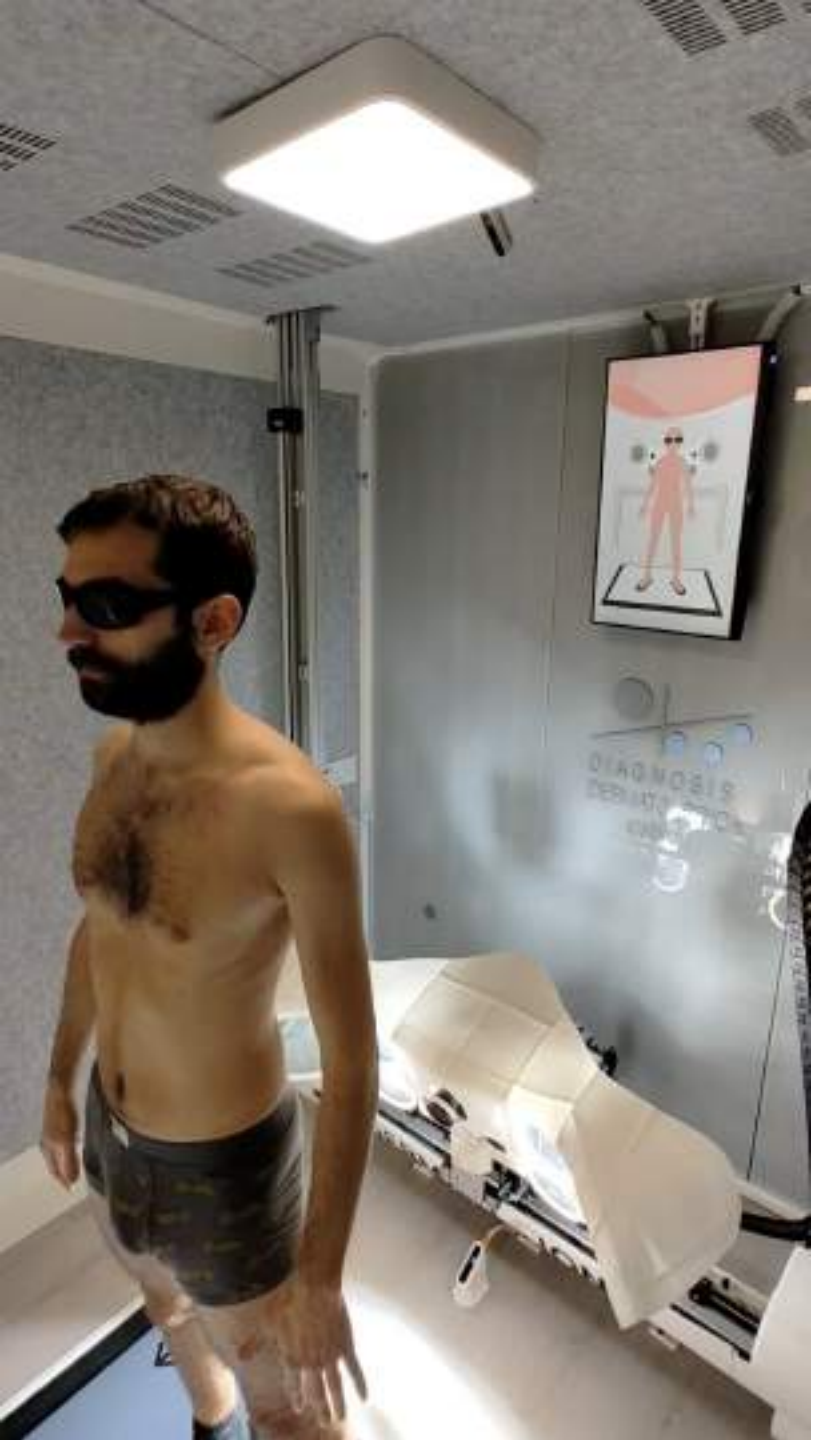
- Minimal human intervention for TBP and TBD
- High quality of imaging
- The patient follows the instructions of the robot
- Detection of body position
- TBP (n=36) with polarised light
- Software for the detection of lesions (Computer visión)
- Dermoscopic photos of the lesions

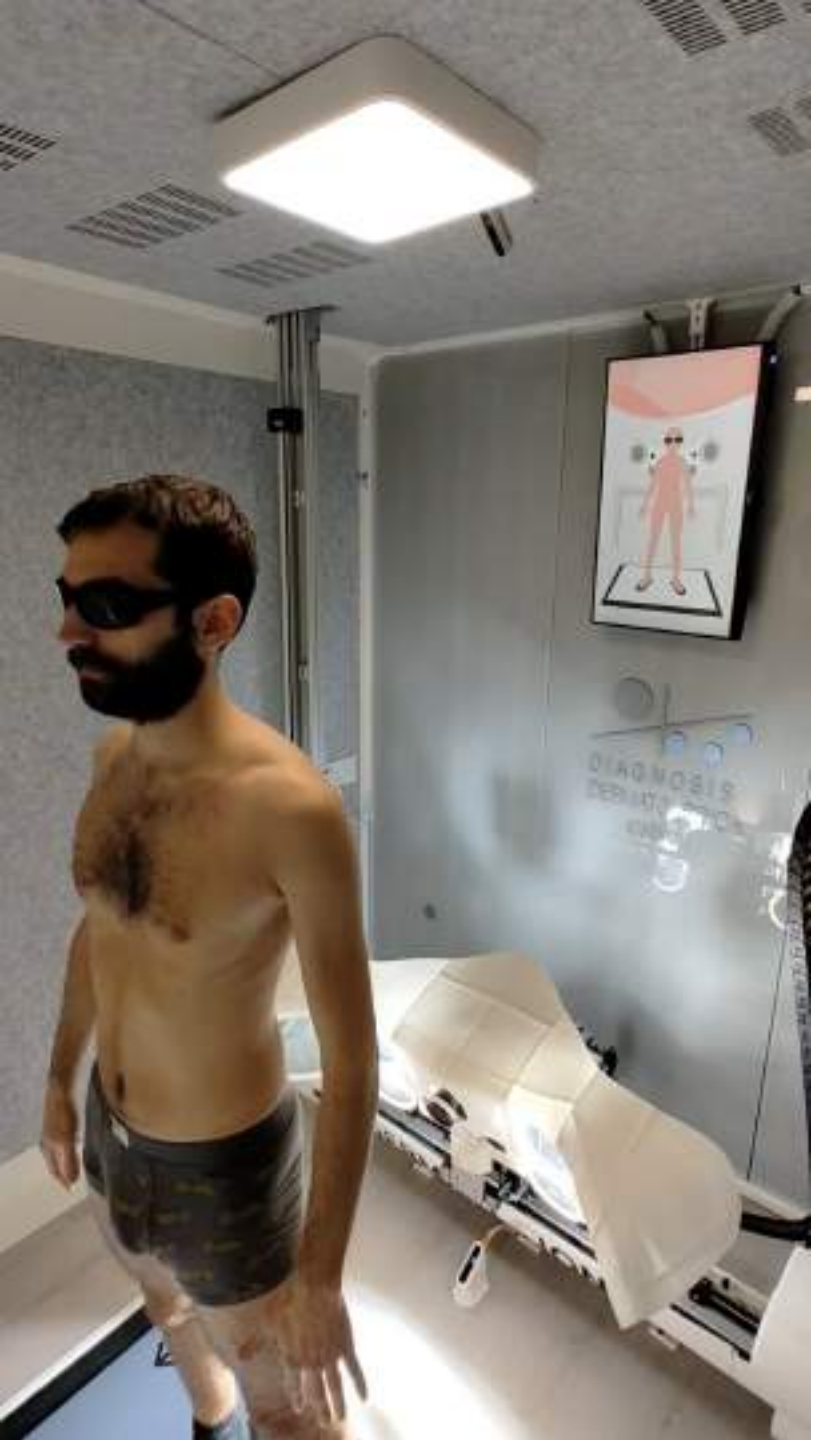
- Preliminary results in 50 volunteers
- Time of imaging = 10 min (6-12 min)
- Number of lesions = 40

Comparative analysis of dermoscopic image quality obtained using a new automatised device and current manual dermoscope. N. Ricart, E. Campmol, N. Lobos, J. Gimenez, S. Andreani, L. Serra, J.Malvehy . EADO 2022

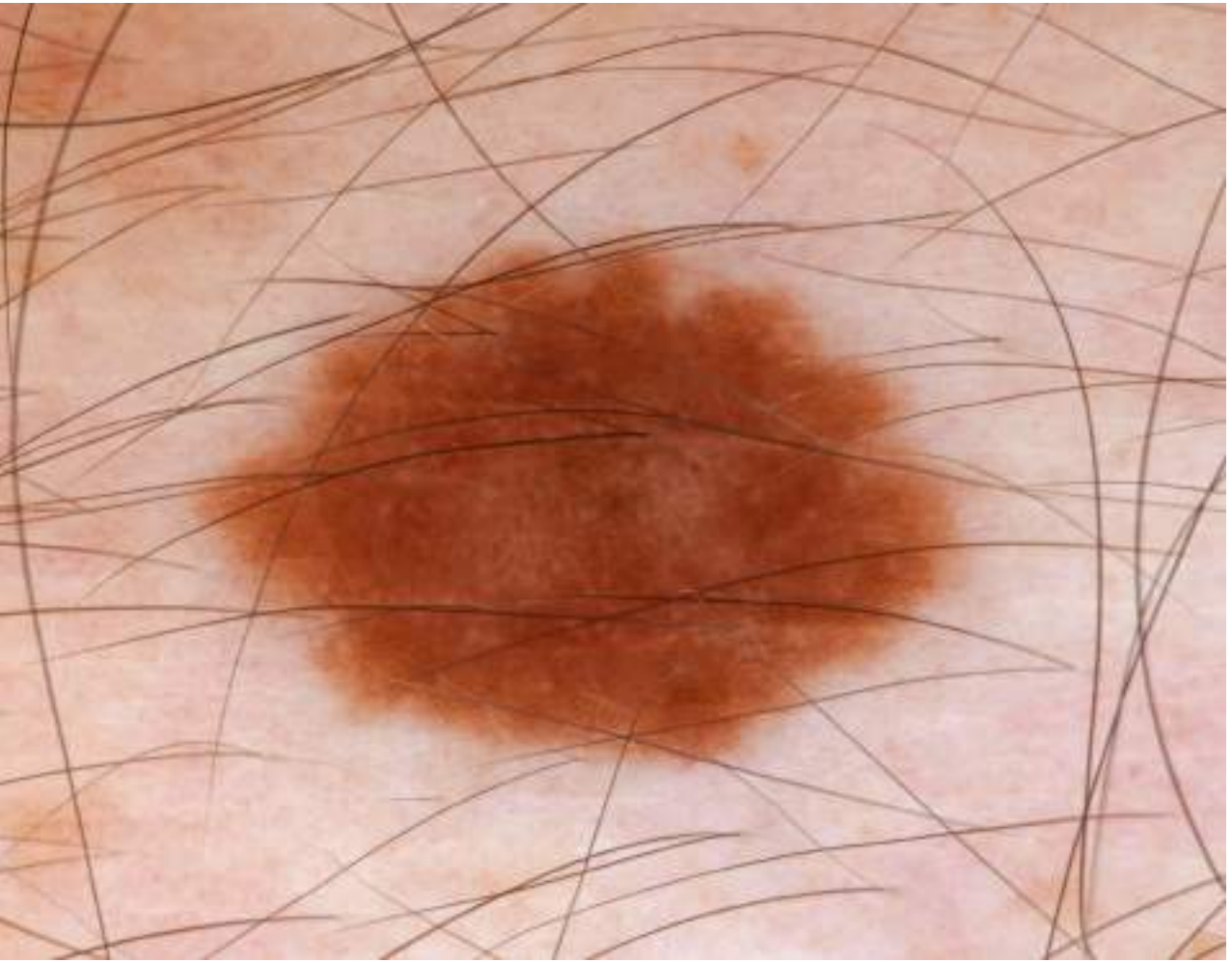



DERMAVI ION


DIAGNOBIS


DIAGNOSIS

Comparative analysis of dermoscopic image quality obtained using a new automatised device and current manual dermoscope. N. Ricart, E. Campmol, N. Lobos, J. Gimenez, S. Andreani, L. Serra, J.Malvehy . EADO 2022



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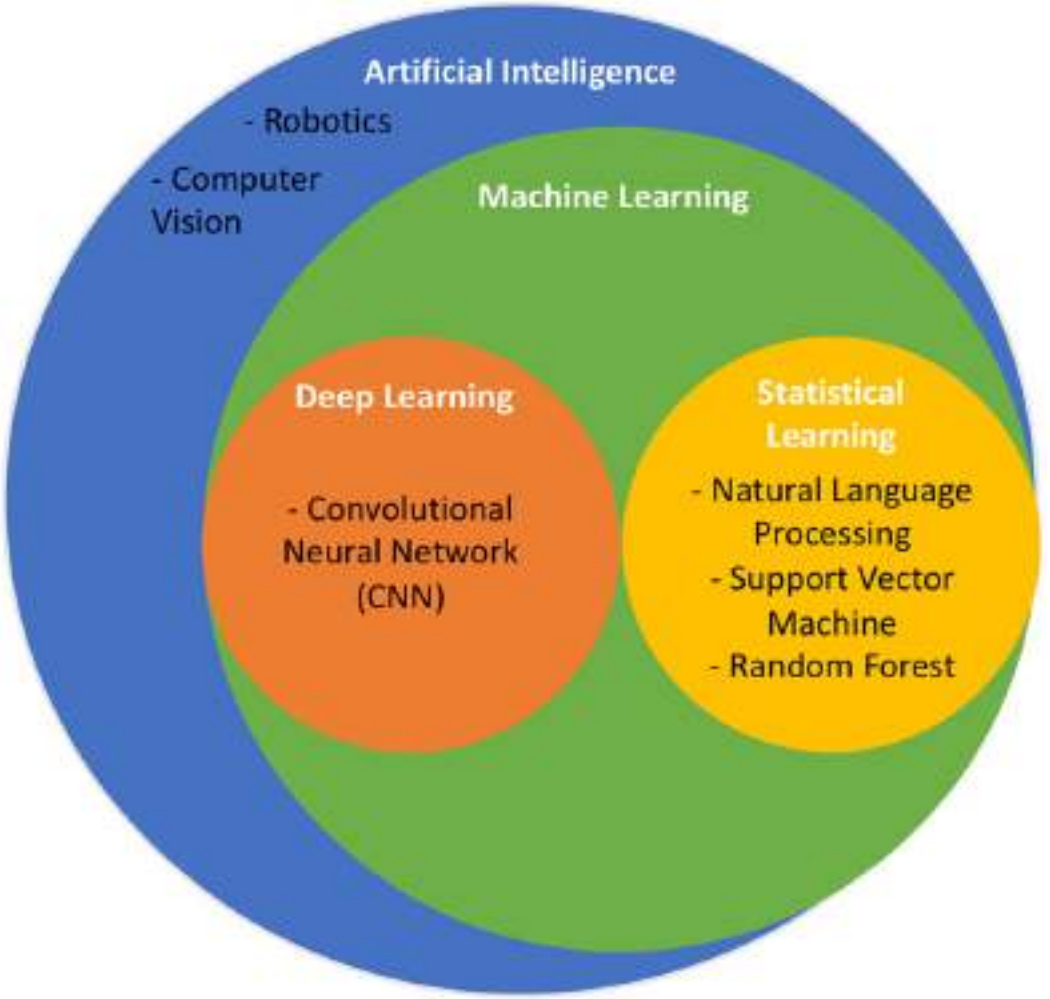
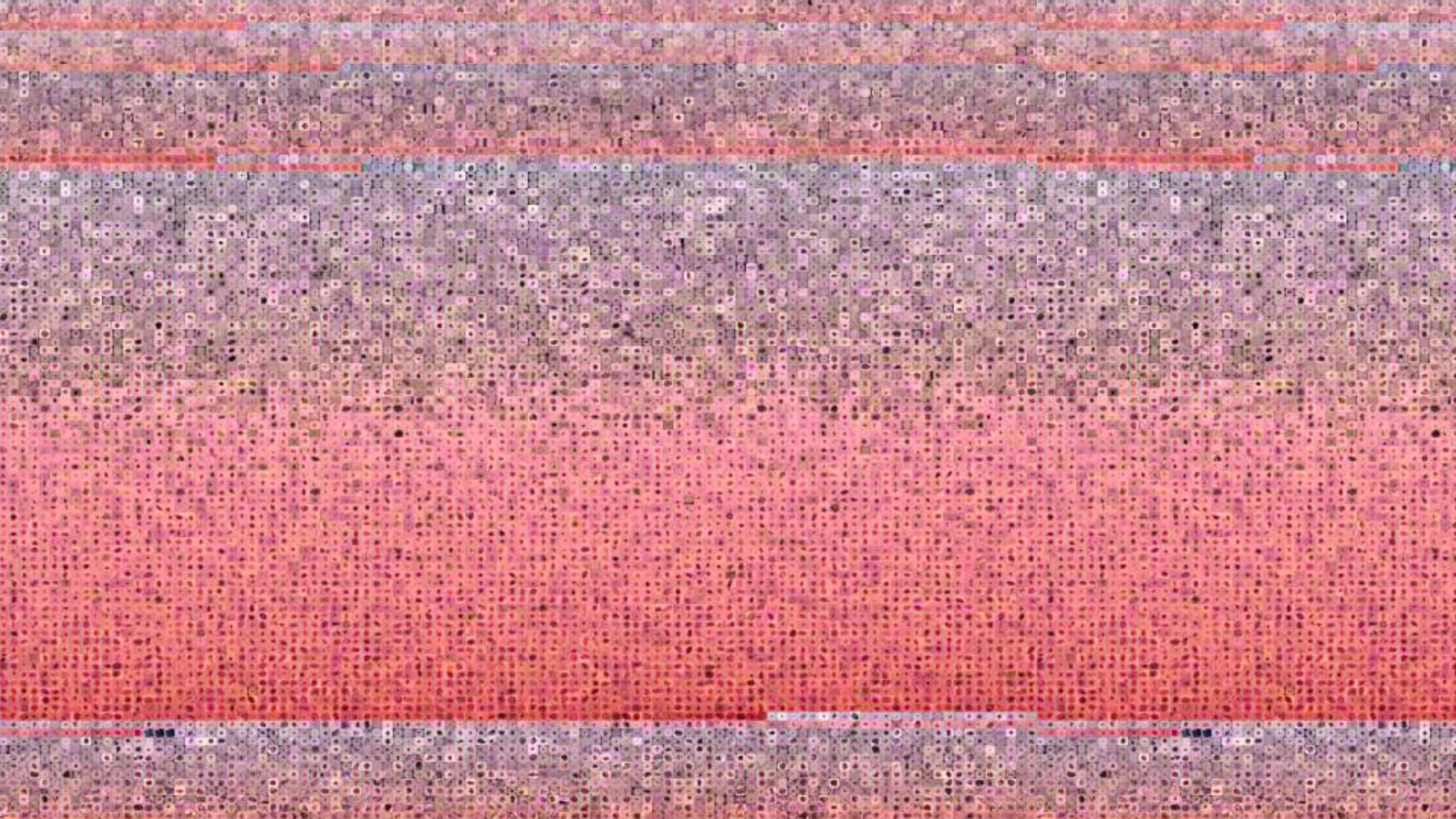
ARTIFICIAL INTELLIGENCE IN DERMATOLOGY

Applications for ML in dermatology

1. Tumour/disease classification using clinical/ dermoscopy images
2. Classification using dermatopathology images
3. Assessment of skin diseases using mobile applications and personal monitoring devices
4. Facilitating large-scale epidemiology research
5. Education-Gaming
6. Quality assurance
7. Precision medicine



Chan S, Reddy V, Myers B, et al. Machine Learning in Dermatology: Current Applications, Opportunities, and Limitations. Dermatol Ther (Heidelb). 2020 Jun;10(3):365-386.



2017: AI “better than dermatologist” at detecting skin cancer

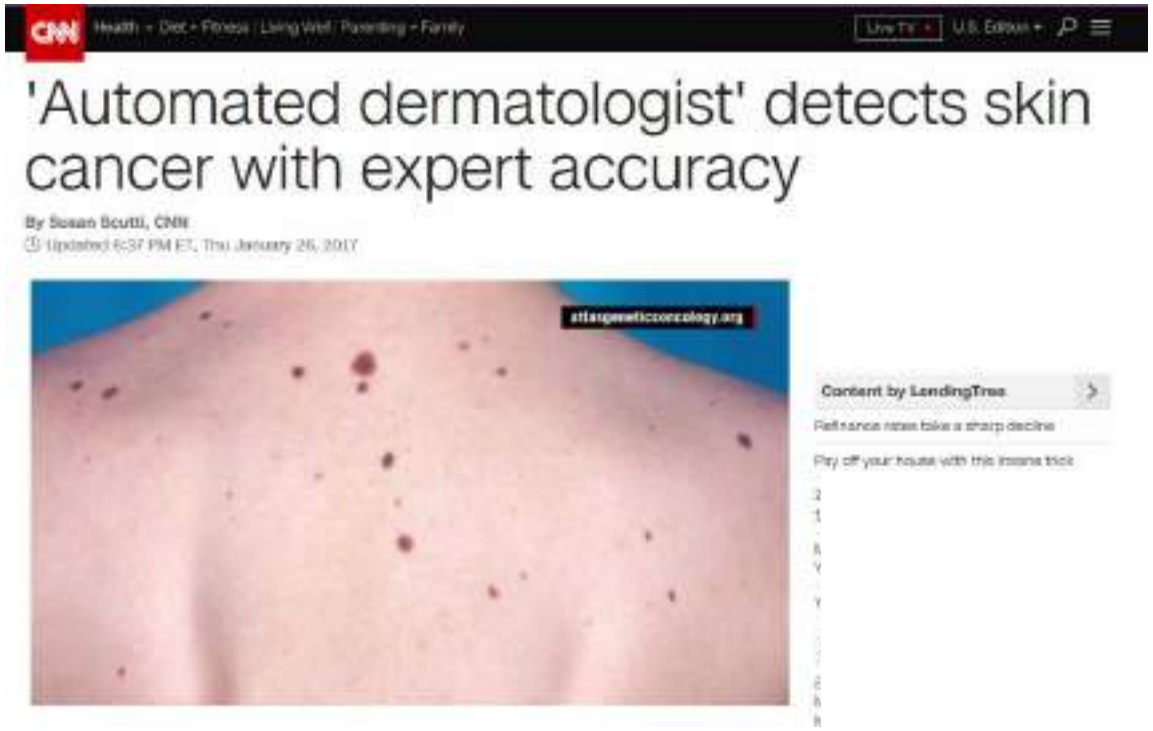
BBC

Health

Artificial intelligence 'as good as cancer doctors'

26 January 2017

By James Gallagher



Man againts Machine?

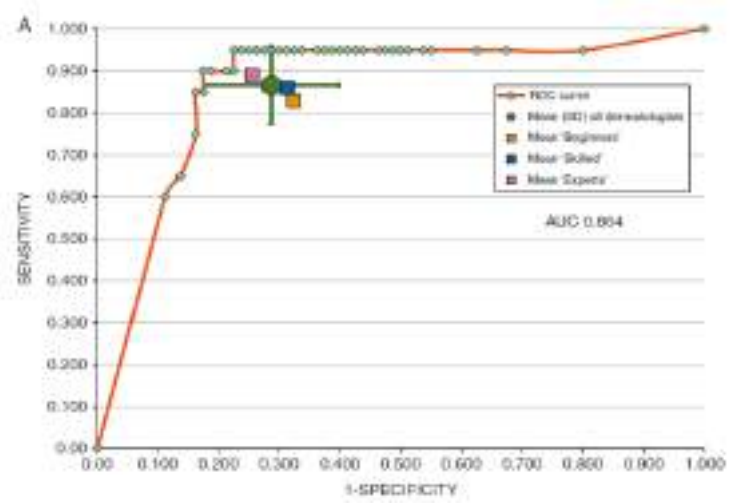
ESMO GOOD SCIENCE BETTER MEDICINE BEST PRACTICE

Annals of Oncology 29: 1836–1842, 2018
doi:10.1093/annonc/mdy166
Published online 28 May 2018

ORIGINAL ARTICLE

Man against machine: diagnostic performance of a deep learning convolutional neural network for dermoscopic melanoma recognition in comparison to 58 dermatologists

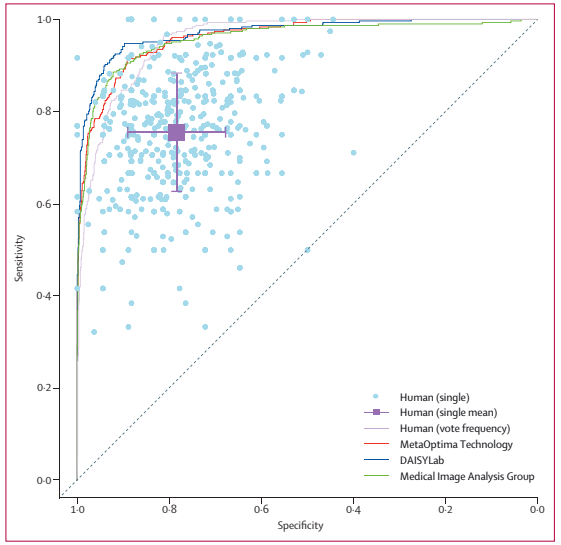
H. A. Haenssle[1*,†], C. Fink[1†], R. Schneiderbauer[1], F. Toberer[1], T. Buhl[2], A. Blum[3], A. Kalloo[4], A. Ben Hadj Hassen[5], L. Thomas[6], A. Enk[1] & L. Uhlmann[7]



CrossMark

Comparison of the accuracy of human readers versus machine-learning algorithms for pigmented skin lesion classification: an open, web-based, international, diagnostic study

Philipp Tschandl, Noel Codella, Bengü Nisa Akay, Giuseppe Argenziano, Ralph P Braun, Horacio Cabo, David Gutman, Allan Halpern, Brian Helba, Rainer Hofmann-Wellenhof, Aimilios Lallas, Jan Lapins, Caterina Longo, Josep Malvehy, Michael A Marchetti, Ashfaq Marghoob, Scott Menzies, Amanda Oakley, John Paoli, Susana Puig, Christoph Rinner, Cliff Rosendahl, Alon Scope, Christoph Sinz, H Peter Soyer, Luc Thomas, Iris Zalaudek, Harald Kittler

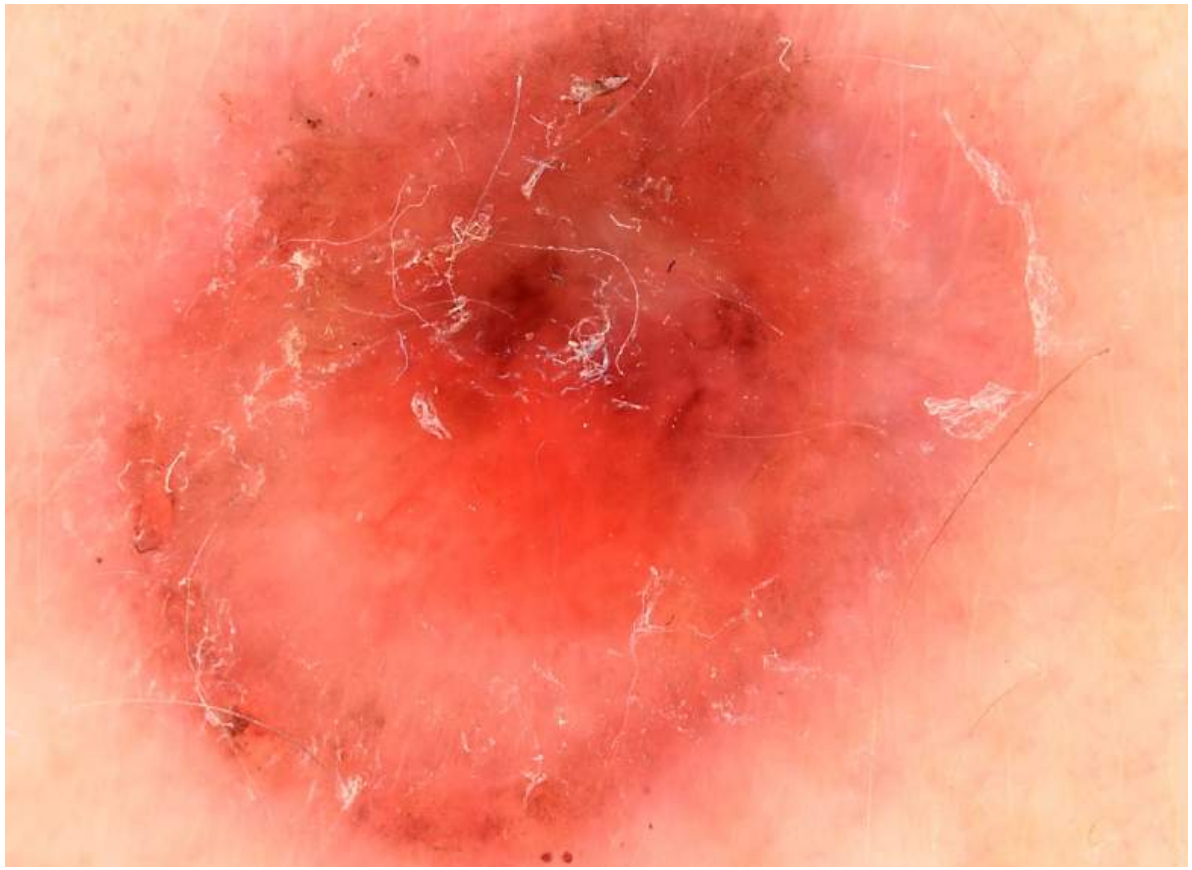


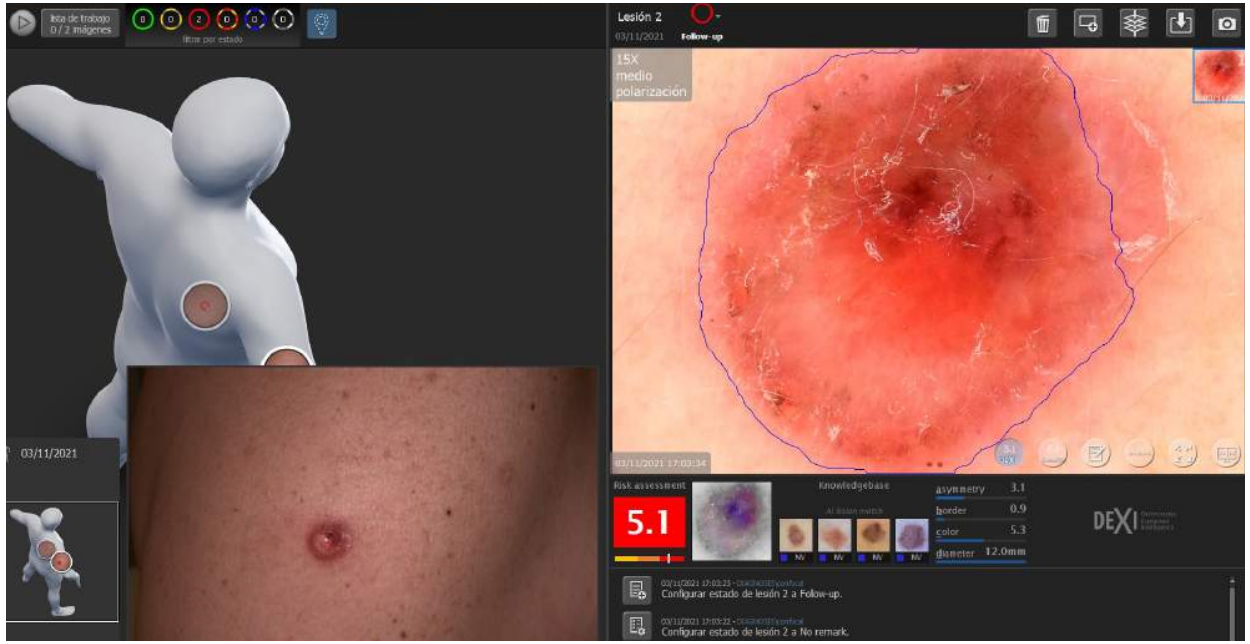
Geoffrey Hinton 2017

Stop training Dermatologists now?

https://www.youtube.com/watch?v=2HMPRXstSvQ
https://medium.com/unauthorized-storytelling/the-radiologist-is-here-to-stay-24da650621b5

72 years old patient. Previous in situ SCC treated with shave biopsy in another center





72 years old patient. Previous in situ SCC treated with shave biopsy in another center

Original

Bordes

Estructura

Área	10,57 mm²
Perímetro	19,95 mm
Diámetro	2,7 x 4,8 mm

Puntuación calculada automáticamente:	0,89

0.0 - 0.2 | 0.21 - 0.49 | 0.50 - 1.0

⚠ Los resultados se basan en estadísticas. ¡El diagnóstico es responsabilidad del médico!

Original

Bordes

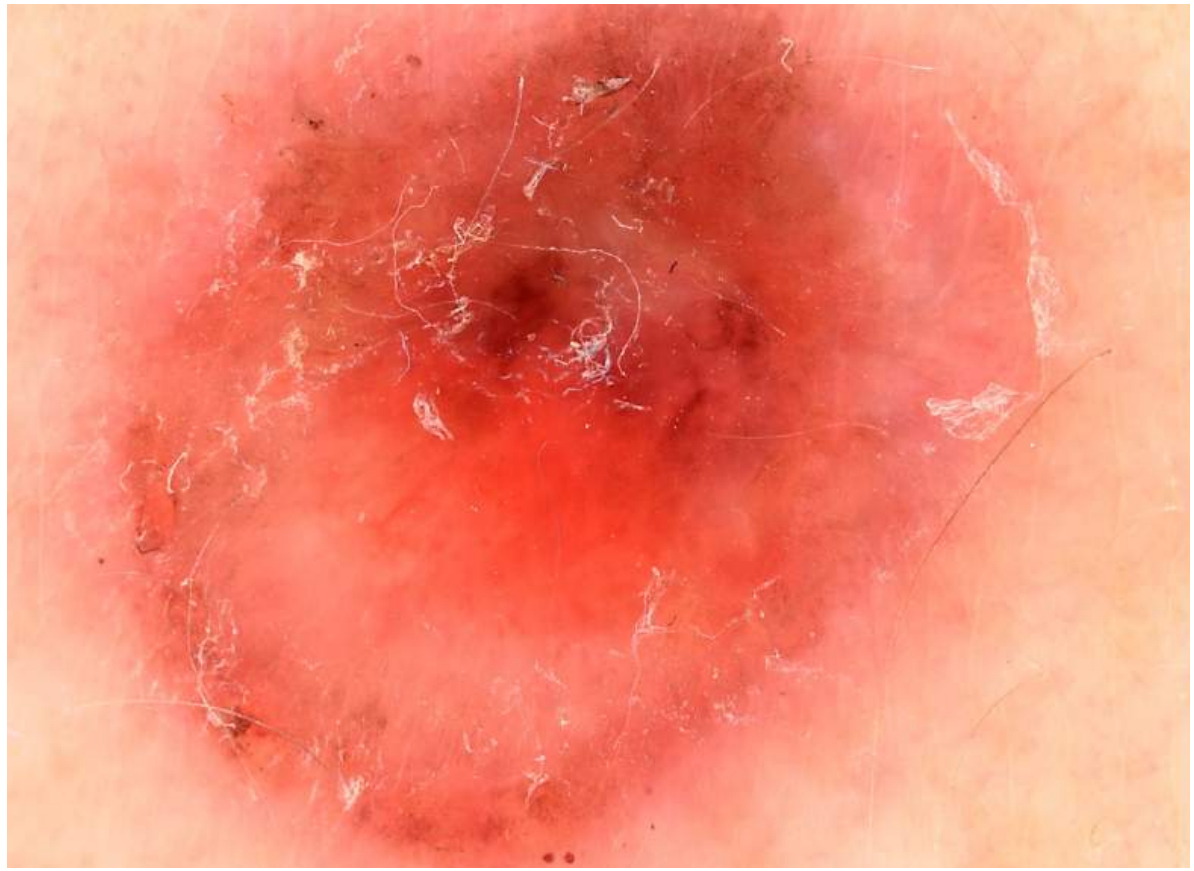
Estructura

Área	30,04 mm²
Perímetro	45,49 mm
Diámetro	5 x 7,6 mm

Puntuación calculada automáticamente:	0,85

0.0 - 0.2 | 0.21 - 0.49 | 0.50 - 1.0

⚠ Los resultados se basan en estadísticas. ¡El diagnóstico es responsabilidad del médico!



Scar with no scc

Clear cell acanthoma

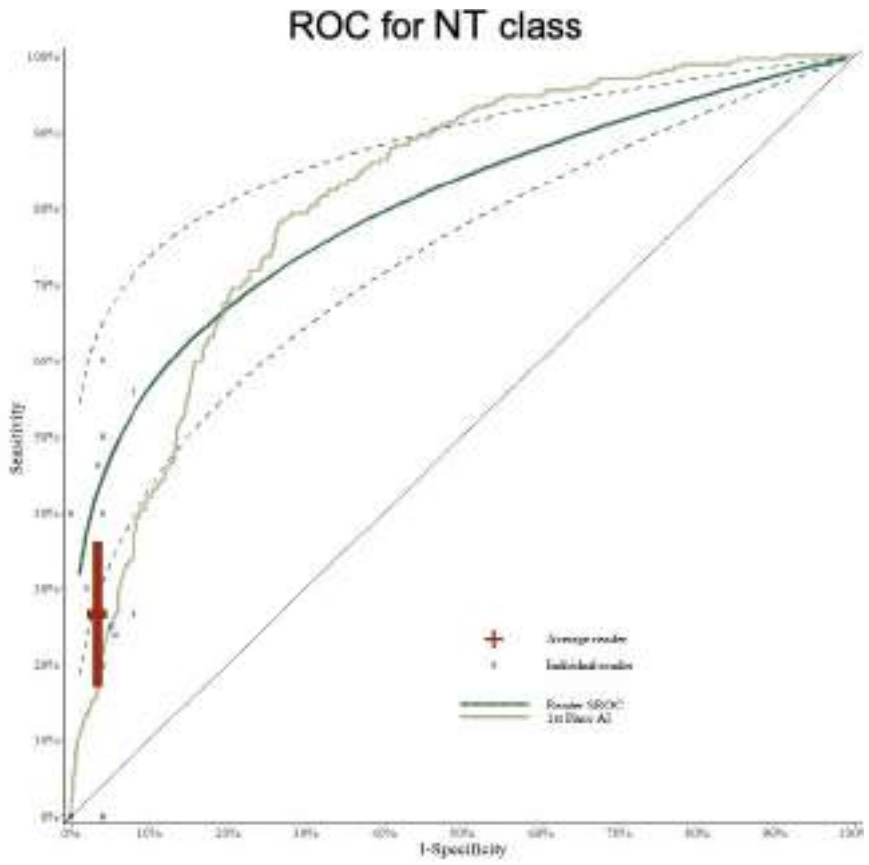
Current Deficiencies of AI for Skin Cancer Diagnosis: Validation of prediction models for skin cancer detection on dermoscopy images in the 2019 International Skin Imaging Collaboration (ISIC) Grand Challenge. Digital Lancet Oncology 2022 (in press)

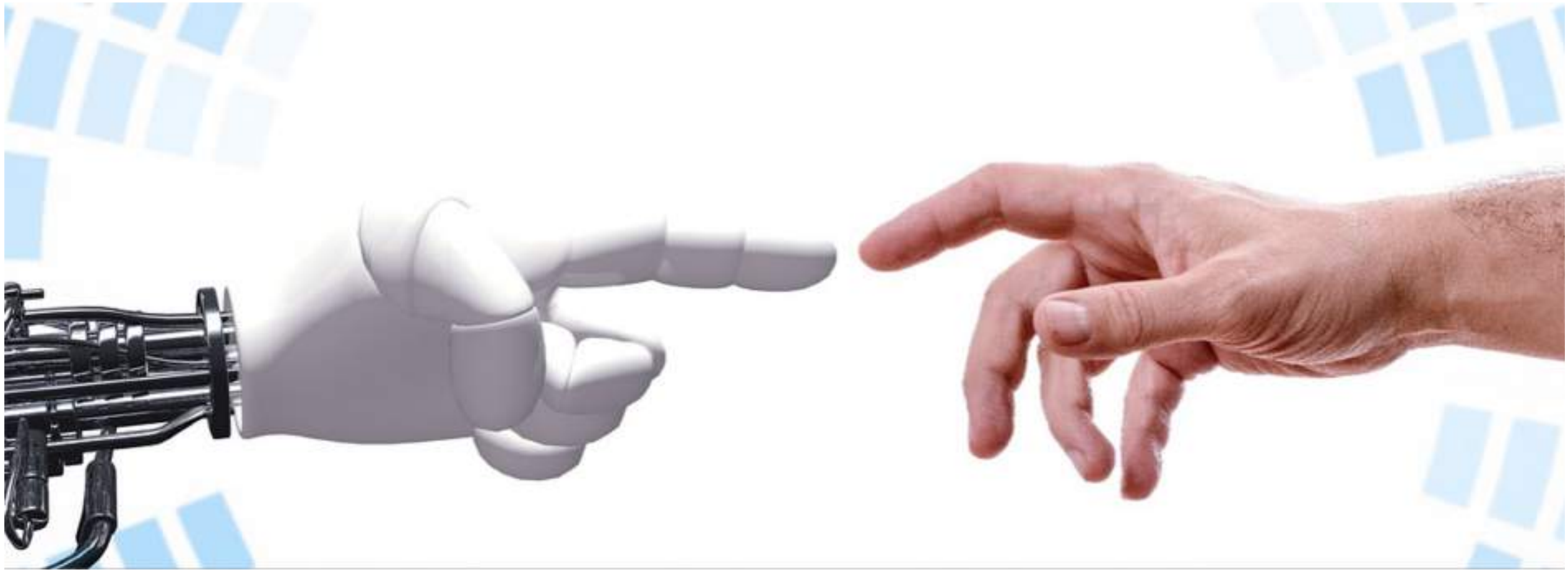
Marc Combalia MS, Noel Codella PhD, Veronica Rotemberg MD, Cristina Carrera MD, Stephen Dusza PhD, David Gutman MD, Brian Helba, Harald Kittler MD, Nicholas R. Kurtansky BS, Konstantinos Liopyris MD, Michael A. Marchetti MD, Sebastian Podlipnik MD, Susana Puig MD, Christoph Rinner PhD, Philipp Tschandl MD, Jochen Weber, Allan Halpern MD, and Josep Malvehy MD

Methods: A large dermoscopic image classification challenge was designed to quantify impacts to diagnostic accuracy from shifts in statistical distributions of data, disease categories not represented in training datasets, and imaging or lesion artifacts.

Factors that may be beneficial to performance, such as clinical metadata and external training data, were also evaluated. 25,331 training images across 8 diseases were provided to challenge participants.

Conclusions: We have identified specific deficiencies and safety issues in AI dermatologic diagnostic systems which should be addressed in future diagnostic evaluation protocols to improve safety and reliability in clinical practice.





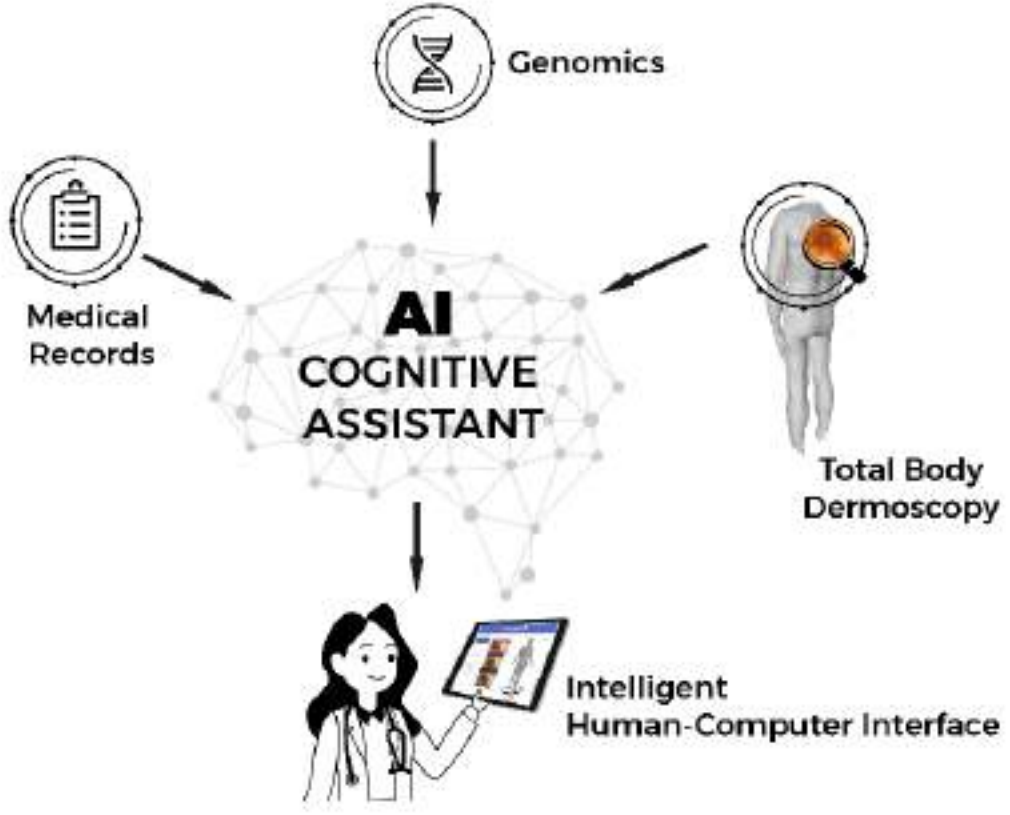
Augmented Intelligence - Human Machine Collaboration - Nature 2020

Single human raters (top) achieve the lowest mean accuracy (64.8%, 95% CI 62.4%to 67.3%; n = 600 images).The highest accuracy is achieved by combining AI-based multi-class probabilities and human collectives (bottom), which is significantly higher than for collectives alone (81.0%, 95% CI 78.2% to 83.9%;P = 8.6 Å~ 10−9; n = 600 images).

Clínic Barcelona

iTOBOs: Intelligent Total Body Scanner for Early Detection of Melanoma (EU H2020)

- **New diagnostic tool** for the early detection of melanoma, exploiting **all the available information** of the patient.
- This **holistic assessment tool** should understand the specific characteristics of every patient in order to enable a **personalised, early detection of melanoma**.



Clinical information

- *45 years old woman*
- *No medications*
- *Previous MM (n=2 ; stage 1A; trunk; 2011,2014)*
- *Familial MM (3 members; Lung Ca, Breast Ca)*

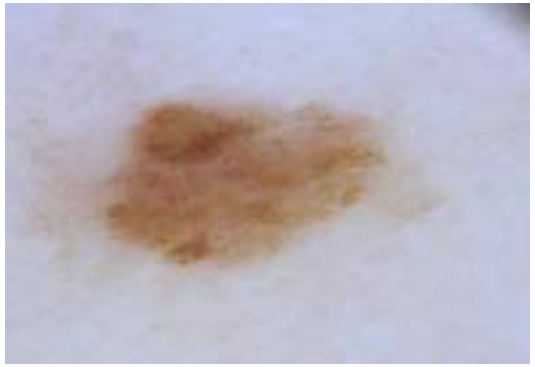
Phenotype

- *Skin color 3*
- *Photodamage= 3*
- *235 skin pigmented lesions*

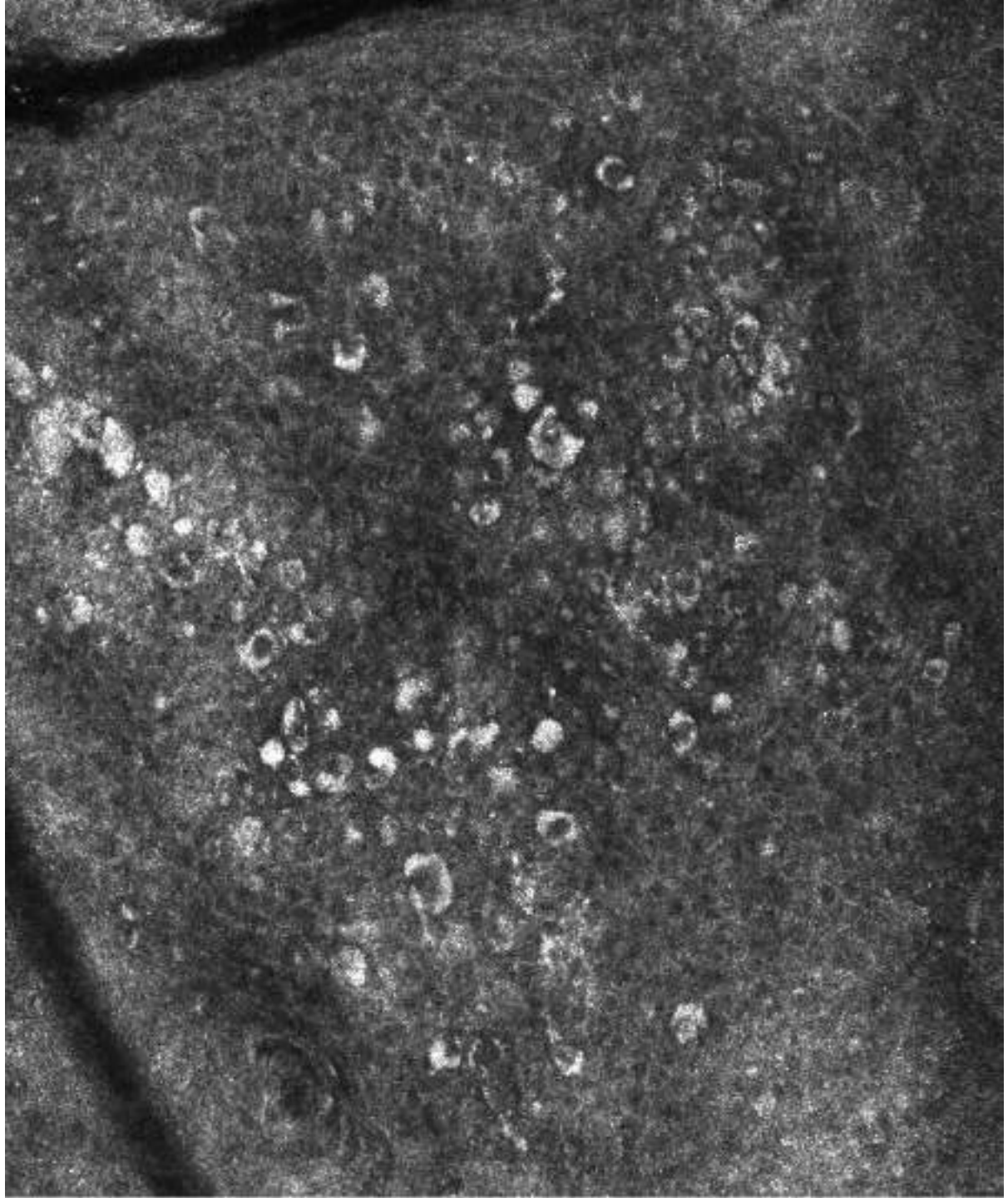
Reticular 70%; homogeneous 25%;
Combination patterns 5%; Brown light and dark
Others: seb ker =3; angiomas= 11; Other: 12
Trunk=70%; lower extrem=20%; upper extre=7%;Other=3% ; special sites=0%

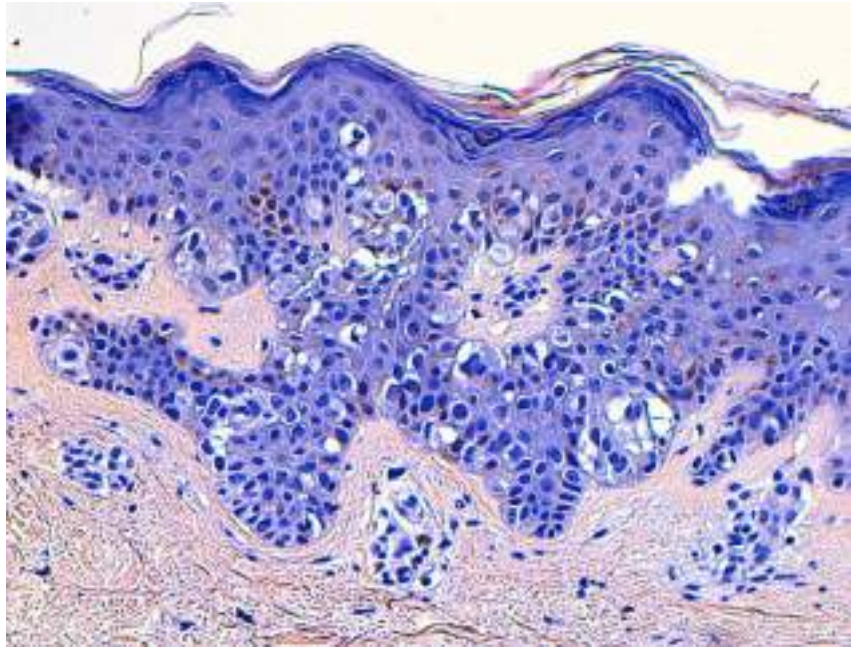
Genetics

*CDKN2A G*101w
MITF wt, POT-1 wt, TERT wt
MC1R wt
Polygenic risk score= 2,45

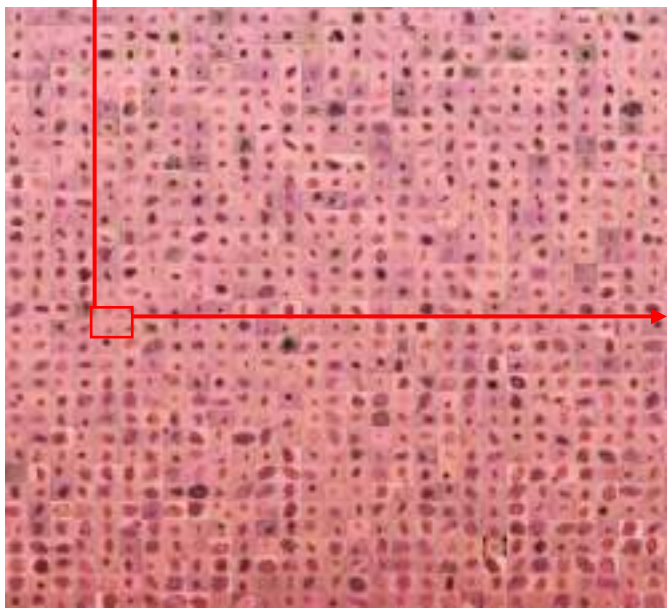


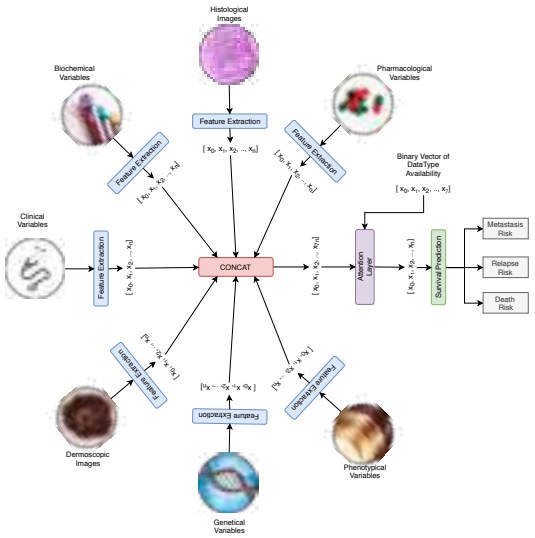

January
June

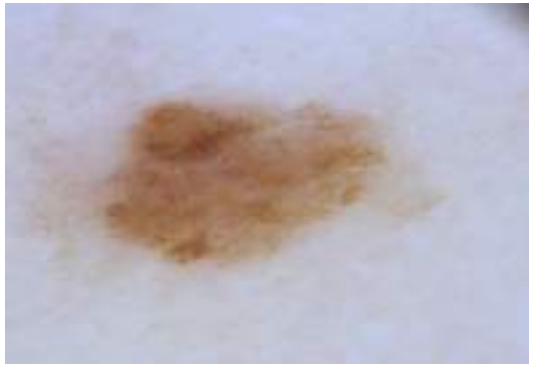




MELANOMA RISK SCORE: DEEP PHENOTYPING







Age, sex, ethnicity, geography
Skin UV damage
Skin type (spectrophotometry)

CLINICAL
Clinical background
Previous MM
Familial MM
Medications

GENETIC
CDKN2A G101w
MITF wt, POT-1 wt, TERT wt
MC1R wt
Polygenic risk score

DEEP IMAGING
Full body Dermoscopy

CLÍNIC BARCELONA Hospital Universitari

Apps and AI in skin cancer

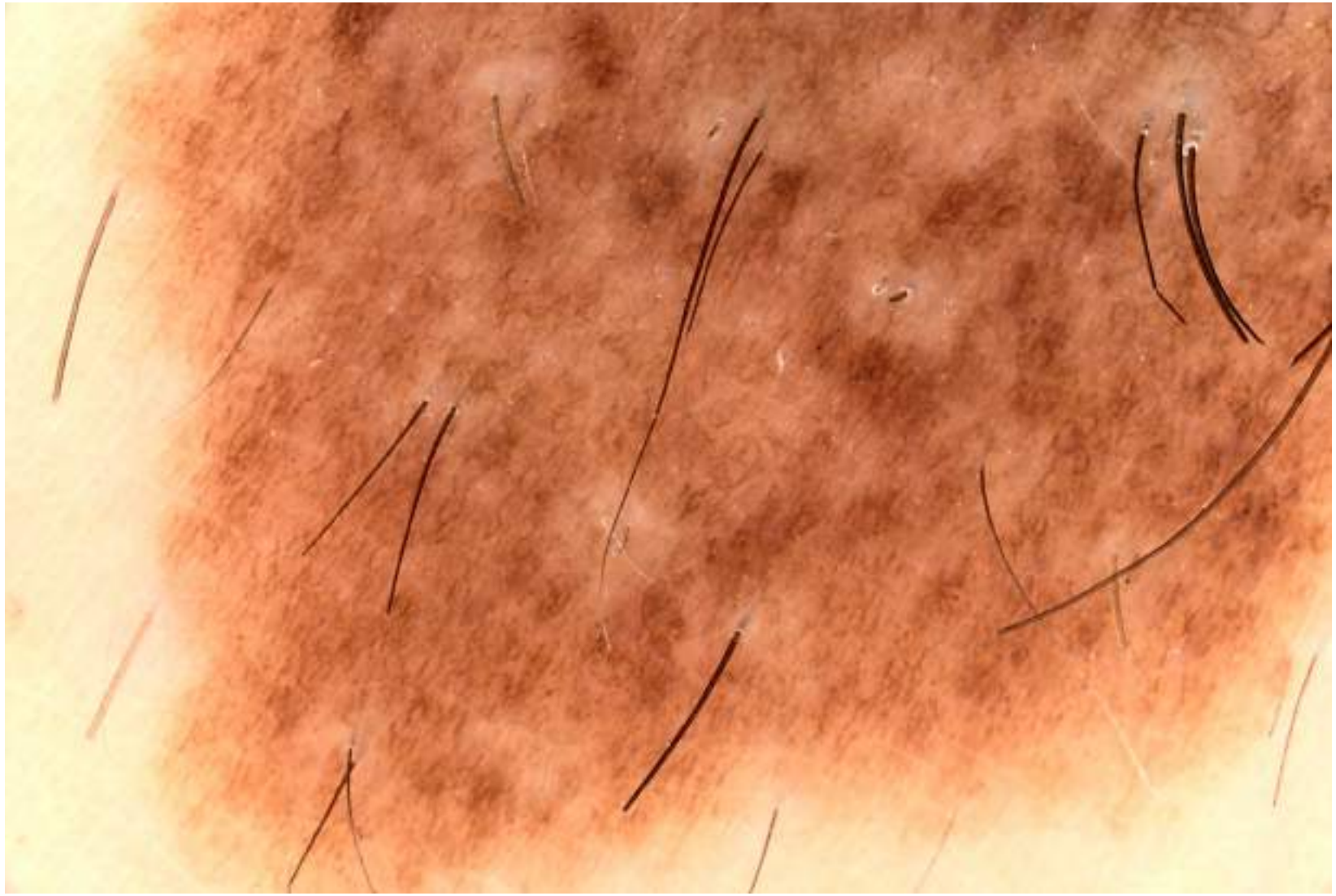
skin analytics

miiskin

TeleSkin

LEGIT.HEALTH


0 1 2 3 4 5 6 7



Accuracy of commercially available smartphone applications for the detection of melanoma.

British Journal of Dermatology (2022) 186, pp721–750
M.D. Sun, J.Kentley, P. Mehta, S.Dusza, A.C. Halpern, V. Rotemberg

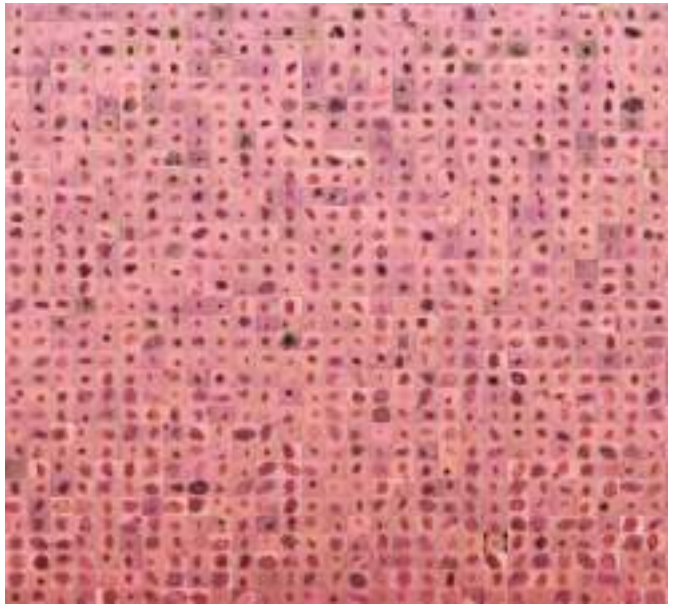
15 consecutive histologically proven invasive melanoma cases (pT1a–pT2b) and 15 histologically proven benign naevi, all in patients with lighter skin phototypes. Median age was 56 years (range 23–87), and 21 patients (60%) were female. Images were cropped to the lesion and are available at the International Skin Imaging Collaboration Archive (https://doi.org/10. 34970/401946). Local institutional review board approval was obtained.
Of 43 apps identified, 25 claimed to identify melanoma and were functional.

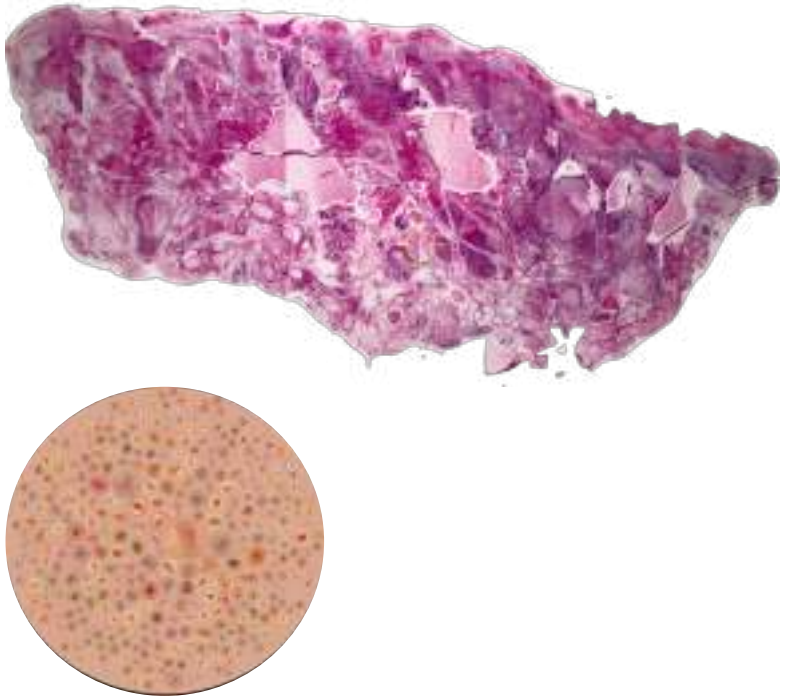
Fifteen of 25 apps returned diagnoses, 12 of 25 risk categories and two of 25 risk scores (Figure 1). Three apps gave >1 output type. Mean accuracy was 0,56, 0,60 and 0,64

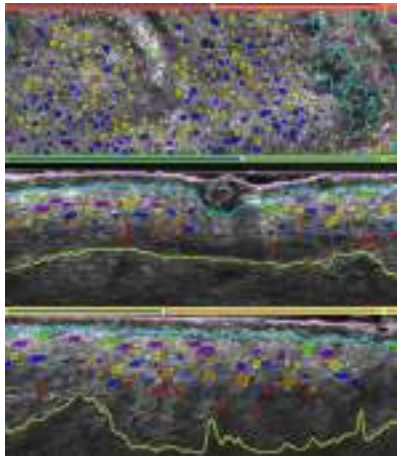

Checklist for image-based AI algorithm development in Dermatology

Data

1. Describe imaging modalities, confounding artifacts, and pre/post data processing
2. Describe the metadata on images used for AI development. Comment on potential biases
3. Carefully define image datasets (independent training, validation, test) used for AI algorithm development
4. Clearly describe how the test dataset relates to the proposed clinical setting, with special attention to statistical distributions, especially out-of-distribution (OOD) images and data







Checklist for image-based AI algorithm development in Dermatology

Application

10. Describe intended use cases and target conditions (inside distribution)
11. Discuss potential impacts on the healthcare team and patients

User

Lay-person self exam

Patient

Nurse

GP

General Dermatol

Expert dermatol

Intended use

Education, diagnostics, monitoring,

……

Apps in Dermatology using AI: Position statement of the EADV Artificial Intelligence Task Force

EADV 2023

Clínic Barcelona

Risks

Potential risks due to inaccuracy, limited reliability, especially when analyzing suspicious skin lesions for features of skin cancer.

Education

Lack of education and proper information for users on how to correctly select lesions that are suspicious of skin cancer.

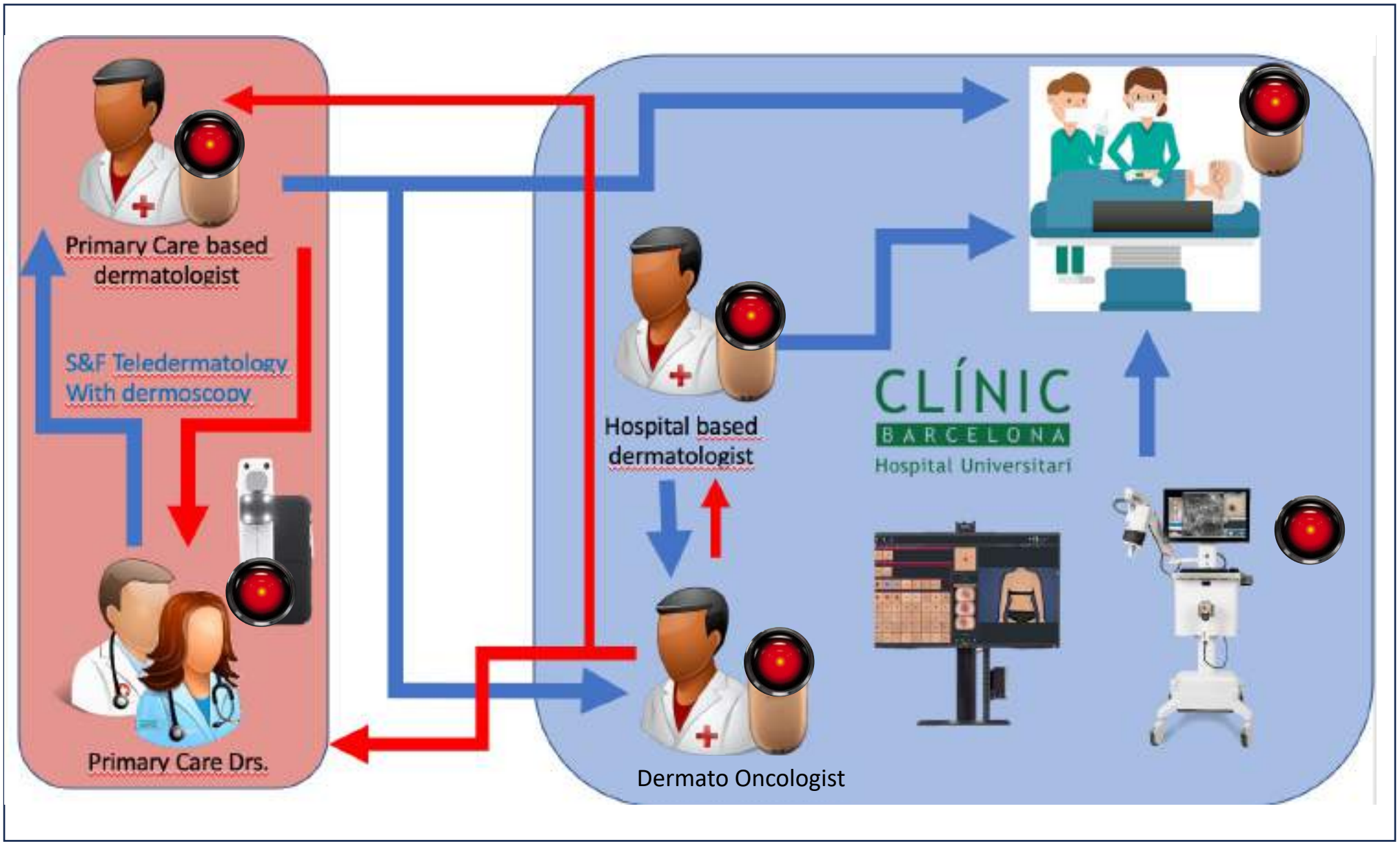
Regulation

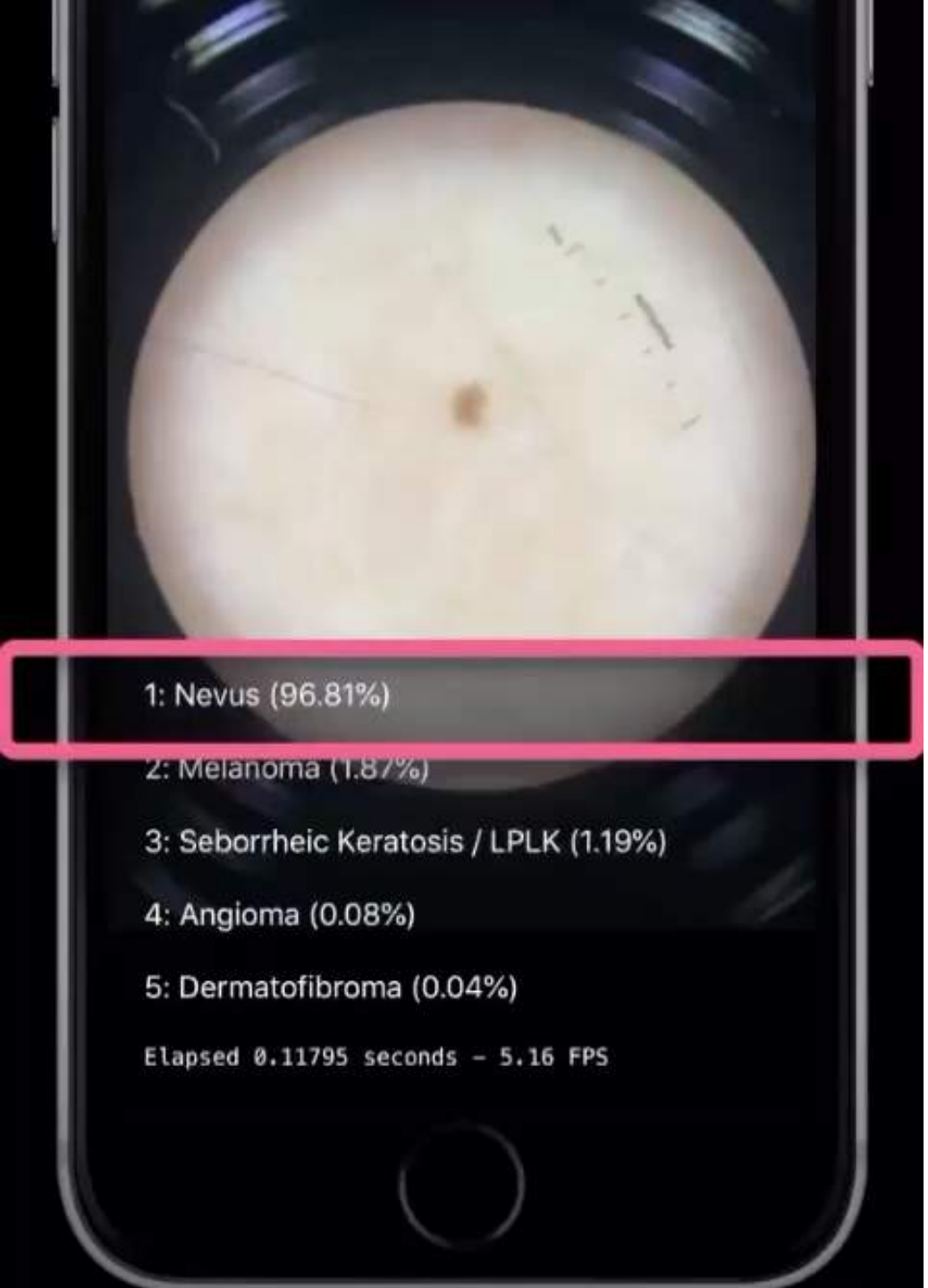
Lack of proper regulation is another significant concern related to dermatology smartphone apps.

Opportunity

Have the potential to become reliable screening tools. . These apps may provide increased access to dermatological care.

AI for education and triage and Dx assistance

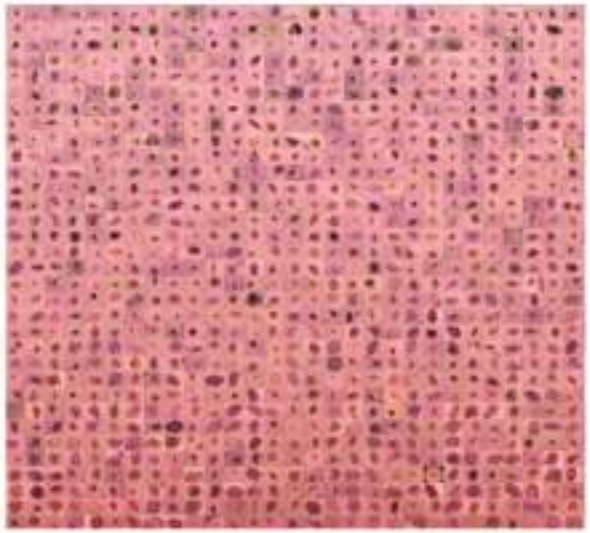


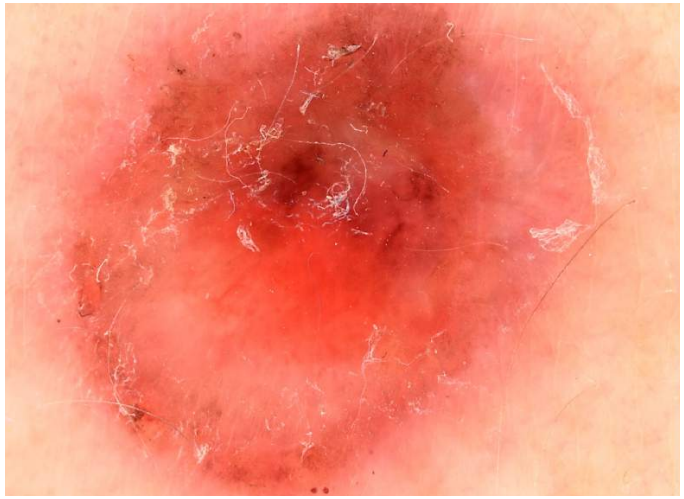


Courtesy of P.Tschanldt

Conclusions

- New dermatoscopes
- New Digital Dermoscopy and 2D and 3D TBP
- AI will be incorporated as a support tool





Me encanta mi dermatoscopio !

9º CURSO

FORMATO HÍBRIDO

Avanzado de Dermatoscopia

Curso teórico-práctico

Anar a la pàgina 2

Barcelona 21, 22 y 23 de Septiembre

PROGRAMA PRELIMINAR

Organizado por:

Directores del Curso:

Dr. Josep Malvehy
Dra. Susana Puig
Servicio de Dermatología
Hospital Clínic Barcelona